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Research Report

Scaling Up Index-based Flood Insurance (IBFI) for Agricultural Resilience and Flood-proofing Livelihoods in Developing Countries

Giriraj Amarnath, R. P. S. Malik and Avinandan Taron

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Scaling Up Index-based Flood Insurance (IBFI) for Agricultural Resilience and Flood-proofing Livelihoods in Developing Countries

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IBFI Index-based Flood Insurance

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Contents

Acronyms and Abbreviations

ACRE	Agriculture and Climate Risk Enterprise
AICI	Agriculture Insurance Company of India Limited
BAAC	Bank for Agriculture and Agricultural Cooperatives
GIIF	Global Index Insurance Facility
GRM	Grupo de Risco Municipalizado
HARITA	Horn of Africa Risk Transfer for Adaptation
IBFI	Index-based Flood Insurance
IBLIP	Index-based Livestock Insurance Project
IFA	Insurance for Assets
IFW	Insurance for Work
INR	Indian Rupee
IWMI	International Water Management Institute
JBIC	Japan Bank for International Cooperation
KBSLAB	Krishna Bhima Samruddhi Local Area Bank
MFI	Microfinance Institution
MODIS	Moderate Resolution Imaging Spectroradiometer
MPCI	Multi-peril Crop Insurance
NAIS	National Agricultural Insurance Scheme
NASFAM	National Smallholder Farmers' Association of Malawi
NGO	Nongovernmental organization
ORDA	Organization for Rehabilitation and Development in Amhara
PACC	Programa de Atención a Contingencias Climatológicas
PMFBY	Pradhan Mantri Fasal Bhima Yojana
PPP	Public-private Partnership
PRF	Public Reinsurance Facility
PROAGRO	Programa de Garantia da Atividade Agropecuária
PROCERGS	Companhia de Processamento de Dados do Estado
PTTS	Programa Troca-Troca de Sementes
R4	R4 Rural Resilience Initiative
REST	Relief Society of Tigray
SAA	Secretaria de Agricultura e Abastecimento
THB	Thai Bhat
USD	United States Dollar
USGS	United States Geological Survey
WFP	World Food Programme
WIBCI	Weather Index-based Crop Insurance
WII	Weather-indexed Insurance
WRMS	Weather Risk Management Services

Summary

Protecting against floods and providing risk cover against losses due to floods has long been a concern of governments around the world. Although flood insurance has often been included in multi-peril crop insurance (MPCI) programs, it is not yet offered as a standalone insurance product for use within agriculture anywhere in the world. Weather index insurance is an innovative approach to manage weather and climate risks where payouts are made on the basis of a predetermined index such as rainfall or wind speed without the need for a damage assessment. Index insurance provides quick compensation and is easy to understand, transparent, and scalable to any region in contrast to the traditional damage assessment at an individual level, which is an expensive and time-consuming process. In recent years, index insurance has been used as a tool within comprehensive climate risk management and has been recognized by policy-makers and practitioners around the world.

Given recent successful experiences with designing and implementing index-based insurance products such as Weather Index-based Crop Insurance (WIBCI), an Index-based Flood Insurance (IBFI) product with similar features, would appear to be an appropriate approach for insuring crop losses due to floods. IBFI uses satellite images and flood modeling tools that combine inputs on satellite rainfall estimates, river characteristics, and digital elevation models to generate flood depth and flood duration to develop predetermined thresholds based on historical flood events and economic losses.

Extending the concept of WIBCI to flood insurance is not straightforward and requires suitable adaptation of the concept, consideration of the many challenging methodological complexities of product development, an effective means of marketing this specialized product, and carefully devised strategies to promote widespread adoption by those sectors of society for whom it is intended.

This report reviews evidence that can guide the development of IBFI and assess experience from innovation and scaling of agricultural insurance products, particularly those intended for smallholder farmers and marginalized groups. Following an analysis, we conclude with recommendations to support the development and implementation of IBFI.

In this report, we present a framework for a business model where insurance product development and marketing form two modules of the model. The product development side comprises activities, mechanisms, and relationships for providing a good or service or creating value. The market development side comprises the activities, mechanisms, and relationships for selling that good or service or capturing value. For a business to succeed, creating and capturing value are equally important. These two components of the business model must then provide continuous feedback on performance to support improvements in product design and market development.

Based on a review of the literature and experience implementing agricultural insurance products around the world, we envisage that a Public-private Partnership (PPP) is the most suitable approach for developing, marketing, and scaling up an IBFI product. A PPP could function on both sides of the business model for creating value (product development) and capturing value (product marketing). However, given the differing requirements of each, we anticipate that two somewhat different PPPs with differing sets of stakeholders and partnership arrangements would be needed to develop an effective business model for IBFI. However, marginalized sectors of society generally have a low ability to pay and suffer frequent flood losses. Their dispersed nature makes cost-effectively marketing a suitable micro-insurance product a challenge. Doing so requires the skills and expertise of the public and private sectors to be harnessed and harmonized.

For product development, collaboration is needed among various institutions and organizations in the public and private sectors such as government departments responsible for agricultural insurance, research institutes and scholars, weather information providers, disaster management authorities, space research organizations, insurance companies, reinsurers, and the farmers likely to be affected by floods. We envisage that the development of the necessary partnerships and collaborations will be stronger if supported by an organization that provides facilitation and a technical support unit. The International Water Management Institute (IWMI) is playing this role in the pilot development of IBFI in India.

On the product marketing side, selling a crop insurance product in large numbers to poor farmers spread across a wide geographic area will require a marketing strategy with contributions from a variety of stakeholders. Collaborative arrangements or partnerships will be needed among and between actors within the private and public sectors. These include grassroots organizations such as rural cooperatives and self-help groups, financial organizations including Microfinance Institutions (MFIs), and government agencies that can provide financial support and potentially oversee the implementation of an insurance program.

We suggest that a PPP involving insurance companies and government agencies with a mandate for agricultural insurance will be needed to efficiently and effectively market an IBFI product. While the contributions of both sectors will be vital, the superior efficiency of the private sector makes it the best choice for steering the partnership.

Despite the benefits of risk coverage provided by an agricultural insurance product, usually at a highly subsidized cost to the farmer, adoption rates for agricultural insurance have been low. The reasons are, however, little understood. A review of the literature shows that little effort has gone into systematically investigating the factors that affect the demand for and uptake of agricultural insurance by potential clients and the level of influence that each has. There is also little insight into whether a co-design process with targeted farmers was used. This lack of information means that a 'magic formula' for making agricultural insurance work at scale has yet to be found. However, the presumption is that innovative business models and proactive public policies have the potential to stimulate wider adoption.

The literature reveals that four broad groups of interrelated factors influence the uptake and scaling up of agricultural insurance. These are (i) behavioral factors that influence farmers' enthusiasm to invest in insurance; (ii) financial factors that stipulate governments' willingness to provide financial support; (iii) legal and regulatory factors, which set ground rules for fair business and govern their adherence by various stakeholders; and (iv) facilitating factors, including product design and development, business models, research and development, data availability, and awareness creation, which help ensure an efficient supply of insurance services. The existing research suggests the following actions could encourage more people to adopt agricultural insurance:

- Better dissemination of information in accessible formats about insurance schemes and their benefits to farmers, strengthening public awareness programs, and development of an efficient communication strategy.
- Greater transparency in insurance contracts, with improvements to procedures for estimating losses, calculating fair compensation, and making timely payouts.
- Strengthening grievance redressal mechanisms.
- Provision of financial support from governments, including subsidies to cover insurance premiums.

Scaling Up Index-based Flood Insurance (IBFI) for Agricultural Resilience and Flood-proofing Livelihoods in Developing Countries

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Introduction

Floods are a major source of risk for farmers. While heavy rain is the primary cause of flooding, river, flash, and coastal floods pose a threat to agriculture. River flooding occurs when a river system cannot contain the flow of water in the channel, prompting a breach that submerges surrounding low-lying land. Such floods are caused by rainfall or snowmelt, which may sometimes take place far from the affected location. Flash floods arise from intense, localized rainfall and can happen practically anywhere. A growing body of evidence suggests that climate change is increasing the intensity of rainstorms, thereby exacerbating flash flooding. Coastal zones are subject to flooding from storm surges, i.e., increased sea levels driven by tropical storms or cyclones arising from intense low-pressure systems offshore (IPCC 2018).

Floods can be characterized by the frequency with which they occur. The term 'normal' flood is applied to relatively minor events that happen almost every year, while a 'medium' flood is used to describe higher-impact events occurring once in five years. 'Severe' is used to denote major floods that generally occur on average once every 20 years. 'Catastrophic' floods or '100-year floods' is a term used to simplify the definition of a flood that statistically has a 1% chance of occurring in any given year. The magnitude of floods influences the level of economic damage they cause (Box 1).

Box 1. Levels of Magnitude of Flooding.

Normal floods (e.g., 1-year flood): Regular inundation of low-lying farmland is common in many countries. Such events occur almost every year, and farming practices, especially rice cultivation, are well adapted. Forecasts can be issued to give advice regarding cropping and sowing times to minimize losses.

Medium floods (e.g., 5-year flood): These less frequent floods cause some economic losses, but are not extensive or serious. They affect farmers and people living in low-lying areas and by rivers. Loss of life is unlikely, as people are usually prepared for these regular events.

Severe floods (e.g., 20-year flood): These floods occur when river levels continue to rise and affect large geographic areas. People living in urban areas, who are less accustomed to flooding, are often among the victims. Damage to the physical environment and losses to the economic sector are generally significant.

Catastrophic floods (e.g., 100-year flood): These extreme floods inundate extensive areas. They are highly devastating, with multiple impacts on lives, infrastructure, and economies.

Note: Floods may not occur at these exact intervals.
Source: Adapted from ADPC 2005.

Satellite remote sensing data (Moderate Resolution Imaging Spectroradiometer [MODIS] and Landsat) offer a bird's eye view of an event and can be used to determine the extent of flooding and to estimate the impact on population and crop losses (e.g., the extent over time and space of an inundation in the Ganges River Basin in India captured through the United States Geological Survey [USGS] Landsat data processed between 2007 and 2016) (Figures 1 and 2).

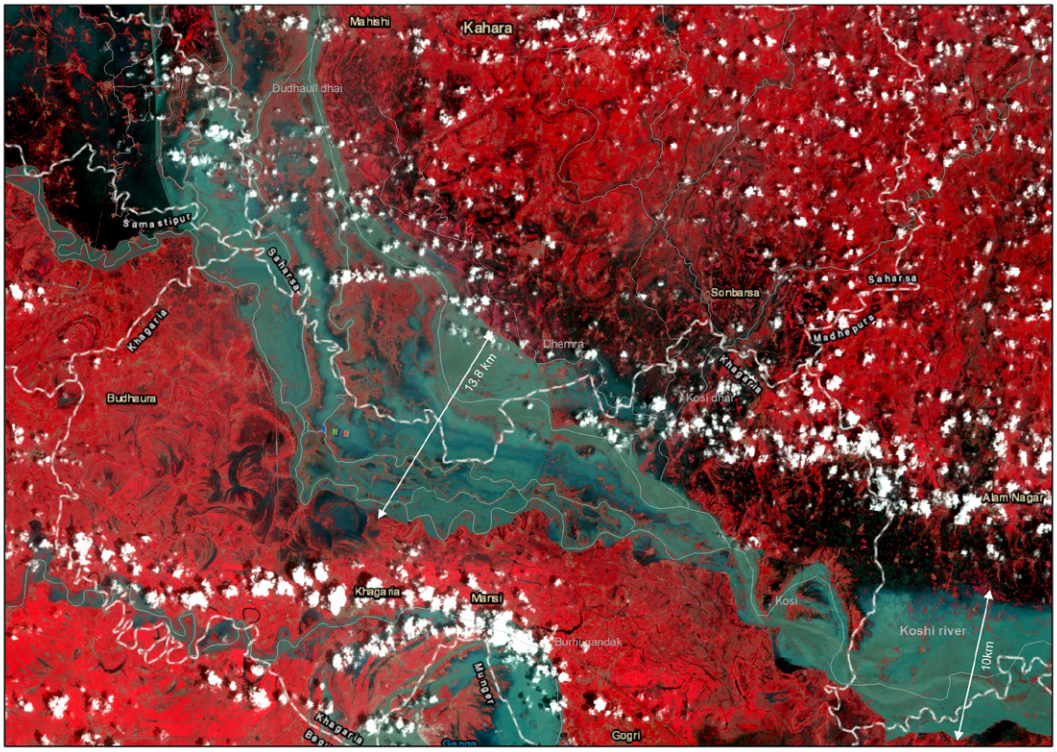

Figure 1. Flood extent along the Ganges River in Bihar.

Source: International Water Management Institute (IWMI).

Note: The map shows large-scale crop damage taken from the USGS Landsat 7 on August 26, 2017.

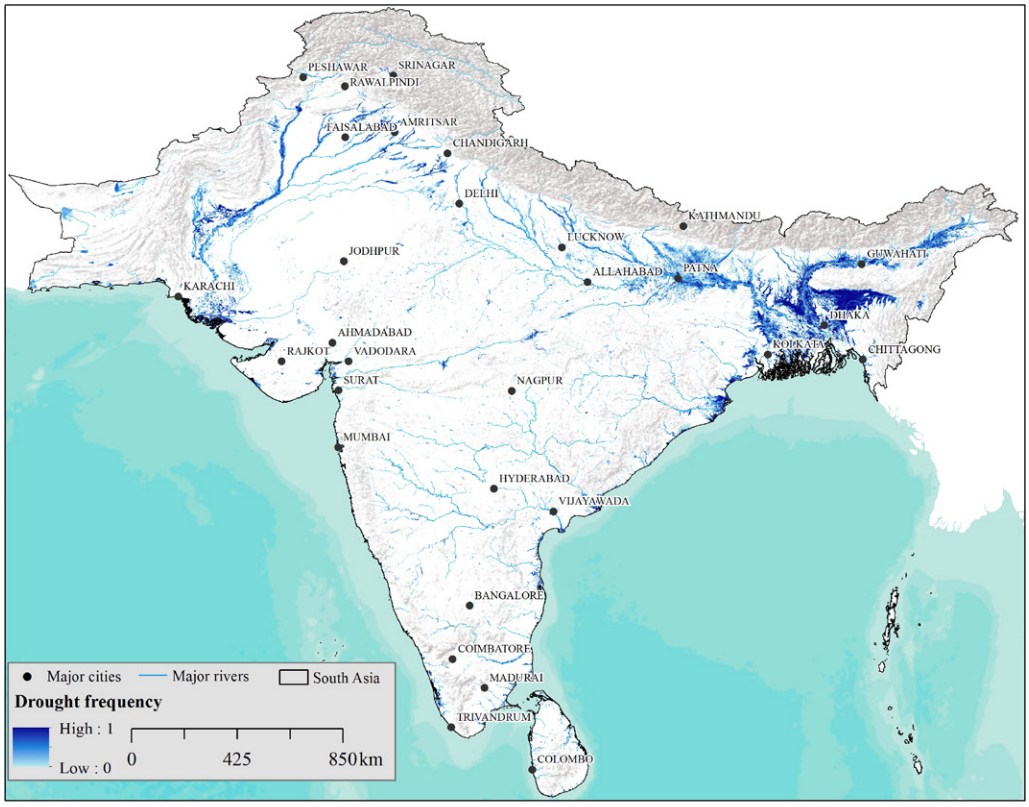

Figure 2. Flood frequency map generated using satellite data for South Asia.

Source: IWMI.

Note: Dark blue shows the severity of the floods. It is likely these areas have high population exposure and agricultural losses.

While accurate data on the number of people affected by floods and the losses caused are often not available, indicative data from South Asia show that floods cause widespread death and destruction (Table 1). Between 1980 and 2020, estimated damages due to floods in India were in the order of USD 84 billion.

Table 1. Flood events between 1950 and 2020 in South Asia.

Country	Flood events	Total deaths	Total affected population	Total damages ('000 USD)
Bangladesh	96	52,987	345,291,360	13,591,400
Bhutan	3	222	1,600	
India	304	75,557	895,975,504	84,744,168
Nepal	51	7,700	5,713,801	1,320,232
Pakistan	106	18,105	80,944,904	22,581,178
Sri Lanka	74	2,013	17,102,826	2,573,564
Total	634	156,584	1,345,029,995	124,810,542

Source: EM-DAT 2021.

Protecting citizens and property against floods and providing risk coverage against losses due to such events is a major concern for governments globally. Historically, authorities have invested in structural flood protection measures such as building dams and water storage facilities above and below the ground and constructing protective barriers. Concurrently, governments have also invested in non-structural measures to enable people most at risk to prepare themselves and minimize the potential damage. These measures include developing flood forecasting systems, undertaking capacity-building efforts, increasing resilience, strengthening financial preparedness, and enhancing emergency response capabilities.

Over the years, insurance has emerged as a pillar in any comprehensive strategy to provide protection from and assist with adaptation to natural hazards. Besides incentivizing farmers to engage with and invest in risk-mitigation measures, insurance reduces the pressure placed on the public purse for compensatory relief. Insurance can also help increase resilience against residual risks that cannot be prevented or mitigated. However, insuring against floods poses challenges to insurance providers, with insurance markets struggling to provide affordable flood insurance in high-risk areas (Cummins and Mahul 2009; Skees et al. 2007). Even in many developed markets, flooding remains an uninsurable risk in coastal areas or on floodplains. High-expected losses impair the commercial viability of flood insurance products, and many households at risk therefore do not have access to affordable insurance (White 2011).

According to Swiss Re (2012), "no other peril defies the basic principles of insurability to the same degree." When flood insurance is provided, it is common for the state to at least partially bear the cost of flood risk. State-backed insurance is common in developed countries with established private markets and is also available in some developing countries. Where insurance penetration is low, governments bear the cost of flood risk by providing aid following a flood event.

Status of Flood Insurance for Agriculture

Insuring against losses from floods, including ruined crops, has been a challenge for the insurance industry around the world. In the agriculture sector, flood insurance is often included in Multi-peril Crop Insurance (MPCI). In such insurance products, the combined impact of different perils is reflected in reduced crop yields, which form the basis for insurance payouts. Different countries have included different perils in MPCI. In India, flood is an insured peril under the National Agricultural Insurance Scheme (NAIS), the subsequent modified NAIS and the recently launched *Pradhan Mantri Fasal Bima Yojana* (PMFBY)[1] scheme (Prime Minister's Crop Insurance Scheme). Flood insurance is not yet offered as a standalone insurance product in the agriculture sector anywhere in the world.

Given the large agricultural losses and the recurring incidence of floods, there has been strong interest from both governments and the private sector to get involved in the development and promotion of specialized flood insurance products.

[1] https://pmfby.gov.in/ (accessed on July 10, 2021).

Given the experience with designing and implementing index-based insurance products such as Weather Index-based Crop Insurance (WIBCI), an Index-based Flood Insurance (IBFI) product appears to be the most realistic method of insuring crop losses due to floods. Extending the concept of WIBCI to flood insurance is not straightforward. It requires:

- suitable adaptation of the concept and its design,
- development of new methodologies,
- availability and access to data,
- advanced data-gathering technologies,
- capabilities to design flood indices, and
- determining trigger levels that would accurately predict crop losses with various degrees of inundation and timing of crop growth stages.

Unlike rainfall-related risks, flood events do not depend on a single parameter, and therefore defining and measuring flood-induced thresholds and crop losses is more complex and challenging. Of the various types of floods, the index approach is more suitable for inundation flooding around a river delta spread over a large area.

Developing a workable flood insurance product and then effectively marketing it to ensure that the intended audience adopts it is challenging. Some of the issues to be considered are modeling and quantifying the risk and the impact of floods, defining losses caused by flooding, determining flood-risk zones for calculating premiums and enrolling customers, operating the flood insurance scheme including loss adjustment and underwriting, and managing financial challenges related to risk transfer and reinsurance. In this report, we present a framework for a business model where insurance product development and marketing form two modules of the model. Definitions of some of the terms used in this report are given in Appendix 1.

A Business Model For Flood Insurance: Objectives And Scope

This report seeks to identify opportunities for improving the design and delivery of business models for agricultural insurance to increase their adoption, effectiveness, and efficiency. It aims to apply the experience and knowledge gained from implementing agricultural insurance in different parts of the world to support the development of a new product for insuring crop losses due to floods. Achieving this goal requires a clear understanding of the factors determining uptake and scaling up insurance products and exploration of the pricing levels, structures, institutions, partnerships and local context required to achieve scale and sustainability. We have sought to develop this model by studying existing business models to deliver multi-peril and named-peril agricultural insurance products to smallholder and marginal farmers in developing countries. The report describes the development of a business model for a generalized IBFI product. Its application at a specific location would then require suitable modifications to address underlying local conditions. We have used conditions prevailing in India to illustrate how context affects business model development.

Business Model Concept for Agricultural Insurance

Given the vast landscape across which agricultural activity extends (and which needs to be brought under insurance cover) and the large numbers of poor farmers who cultivate this diverse terrain (and who must be convinced to invest in insurance), agricultural insurance differs from other forms of cover such as health or life. It is not only the coverage of risk that is of concern but also the process by which the protection against such risk is structured and delivered. This calls for answers to important questions:

- What form of products and instruments will provide coverage against the named risks, and who will develop such products?
- Who will provide the insurance cover and how will the insurance products be promoted, marketed, and scaled up?
- How will the product be priced?
- Who will pay the insurance premiums?
- Who will assess the impact of the product and gather feedback?
- What are the financial and social costs and benefits of providing agricultural insurance?

These components make up a business model. A business model consists of a specific combination of product, distribution, supply chain, financing, pricing, subsidizing, payment and sales, and is often far more important in determining the success of a product than the product itself (Kubzansky 2012). From an organization's perspective, a business model describes the process of how an organization creates, delivers, and captures value. The business model concept is thus linked to business strategy (the process of business model design) and business operations (the implementation of a business model into organizational structures and systems (Vorley et al. 2008).

There are two main components to a business model, production and marketing. The production side comprises the set of activities, mechanisms, and relationships for providing a good or service or creating value. The market development side comprises the activities, mechanisms, and relationships for selling that product or service or capturing value (IIED 2010).

Osterwalder and Pigneur (2010) organized the constituent parts of a business model which create different costs and capture values within a generalized template (Figure 3). This template shows the importance of market differentiation (building a value proposition) and cost management to the success of any business model. The components listed on the left side of the canvas are those that form the cost structure of the business, while those on the right side provide the revenue-generating mechanism. Taken together, the nine elements reflect how an organization will create a business that matters to customers. Each component represents a crucial building block in constructing the model.

The two components of the business model continuously provide feedback on performance, thereby generating opportunities for improving product design and marketing and value-creation activities (Figure 4). The available literature on business models for agricultural insurance often does not explicitly differentiate the creating and capturing value components or they are subsumed into each other.

In what follows, we present a broad overview of the business models that have been used for providing agricultural insurance, discuss the need for innovations and modifications for developing and marketing an IBFI, and explain how such modifications may be carried out. We then discuss opportunities and interventions, including policy changes, for scaling up the IBFI model.

Existing Business Models for Agricultural Insurance

Crop insurance has been an important part of risk management in many parts of the world, including India. Over the years, many products have been developed and marketed to provide cover for different individual and group perils. Specialized WIBCI products have successfully provided cover against specific weather-related perils. We briefly review in Appendix 2 the salient features of some of these index-based insurance products used in developing country settings.

While considerable experience exists in managing the numerous challenges faced when developing and marketing crop-related insurance products, the business of agricultural insurance continues to remain both complex and risky. Providing such insurance is a challenge for state and privately

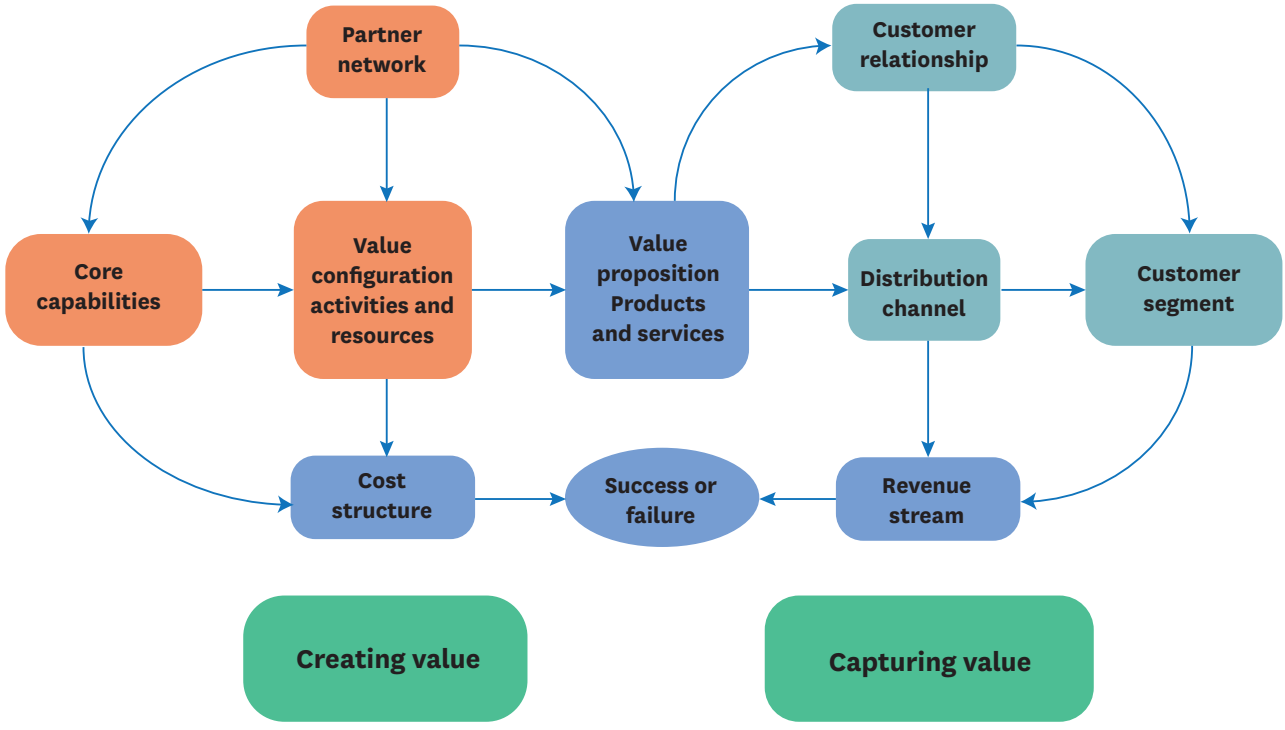

Figure 3. Canvas of a generic business model applied to the development of a flood insurance product.
Source: Adapted from Osterwalder and Pigneur 2010.

owned insurers, and for the governments whose interest it is to protect vulnerable farmers from the serious risks and large losses that can affect the agriculture sector.

Broadly speaking, there are three possible conduits through which agricultural insurance can be provided (Iturrioz 2009; Čolović and Mrvić Petrović 2014): (i) insurance companies under state control, (ii) insurance companies in a public-private partnership (PPP) mode, and (iii) private insurance companies (Figure 5).

1. Fully intervened systems or systems fully controlled by the government: In these systems, the state's role is key as it has full control over pricing, distribution, price setting, and settling claims. These systems are characterized by intensive government support of one unified insurance product.

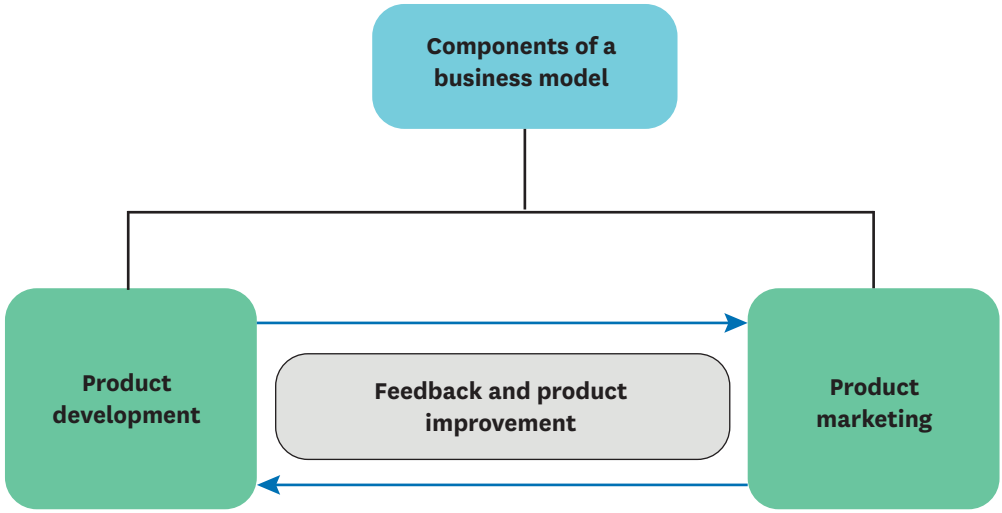

Figure 4. Links between the two components of a business model.

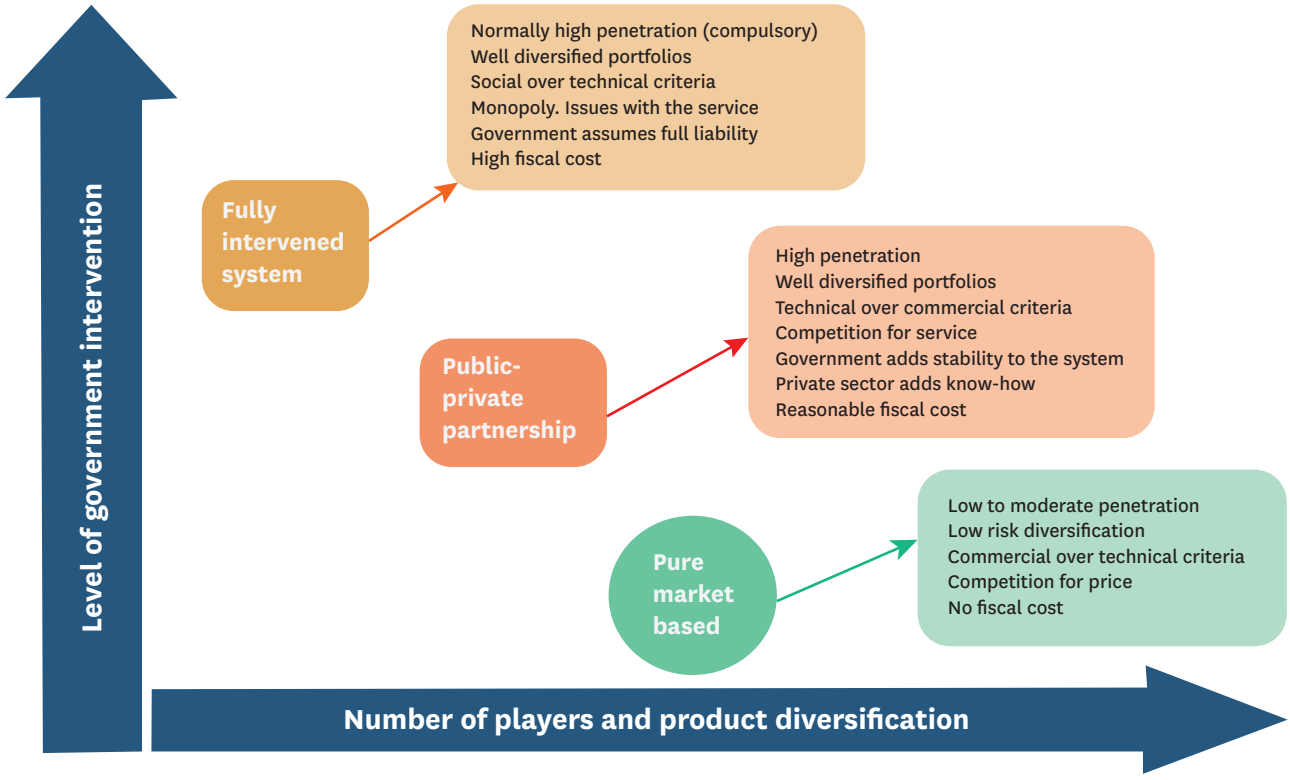

Figure 5. Existing business models of agricultural insurance.
Source: Iturrioz 2009.

The product is usually commercialized through a state-owned insurance company holding a monopolistic position. These systems have large market penetration, often because farmers are required to buy insurance, but incur high public costs to the government and frequently deliver poor service caused by lack of competition. The government assumes full responsibility for compensating crop losses incurred by farmers.

2. Public-private Partnerships (PPPs): An insurance-based PPP is essentially a contractual agreement between the public sector (represented by a ministry or local authority through a government program) and the private sector (represented by the insurance industry and its service providers and distribution partners). This arrangement combines business objectives with public policy goals in a cost-efficient and effective way. PPPs are motivated by a need to improve financial control over public budgets and deliver more efficient services to final beneficiaries. Collaboration between the public and private sectors can often reduce and manage risks ex-ante, as cover can be conditional on adaptation. Market and government failures and behavioral barriers are other reasons PPPs are often preferred (Solana 2015). PPPs have relatively higher penetration and a diversified portfolio. Technical criteria dominate over commercial concerns, there is competition in the provision of services, and the state helps underpin system stability. The private sector provides knowledge and technology, all with reasonable financial benefits. PPPs can take many forms, with governments designing a structure to suit their operational setup and ability to work with the insurance sector, taking into account the maturity and capacity of the local insurance industry and its aggregators. A typical PPP structure is presented in Figure 6.

3. Complete market systems: These are pure market-based systems with the private sector playing the lead role. These systems have low to moderate penetration and a low level of risk diversification. Commercial criteria dominate over technical concerns, and prices are competitive without fiscal expenses (Manić 2012, cited in Čolović and Mrvić Petrović 2014). In this model, insurers offer a range of products that provide greater profitability rather than products that cater to the needs of most farmers.

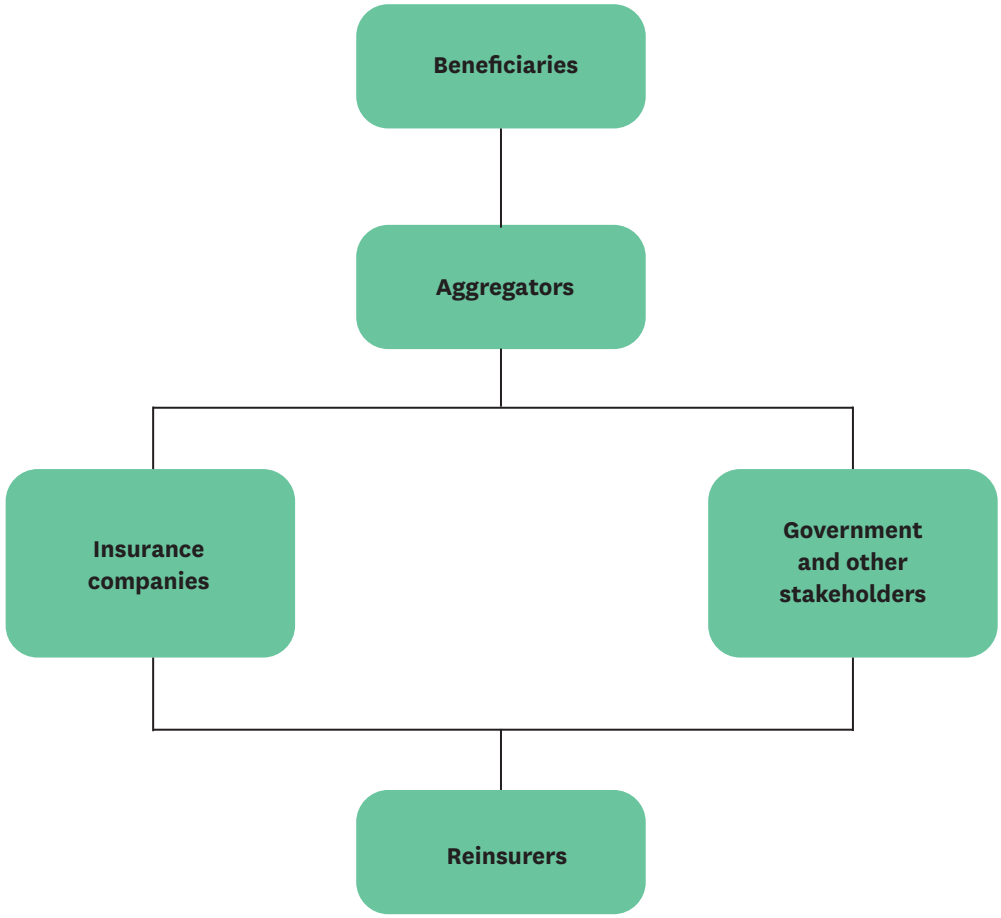

Figure 6. Illustration of a typical PPP structure for providing agricultural insurance.

While the private sector is increasingly recognizing an emerging business opportunity in designing or modifying business models for crop insurance, to date, this evolution has been patchy and ad hoc. Many innovative pilot initiatives have succeeded at a micro level but failed to achieve success at scale.

There are two broad organizational models of agricultural insurance common in India.

Full-service public model: This is roughly equivalent to the fully intervened system described above. All activities related to the provision of insurance, including designing the product, marketing, collecting premiums, and paying claims, are performed in-house by the insurance provider (Figure 7). Agriculture Insurance Company of India Limited (AICI) is such a provider.

Partner-agent model: This is a variant of the PPP model. The partner, usually a mainstream insurer, performs activities related to developing and pricing products and managing the risk exposure of the insurance portfolio and investment of reserves and annual premiums. The agents are generally nongovernmental organizations (NGOs) or microfinance institutions (MFIs), which are responsible for marketing, promotion, initial sale of products, and for collecting premiums and payment of claims (Figure 8). Bundling certified seeds with crop insurance in Kenya provides an excellent example of such a partnership (Bulte et al. 2020).

Figure 7. Full-service public model for providing agricultural insurance.

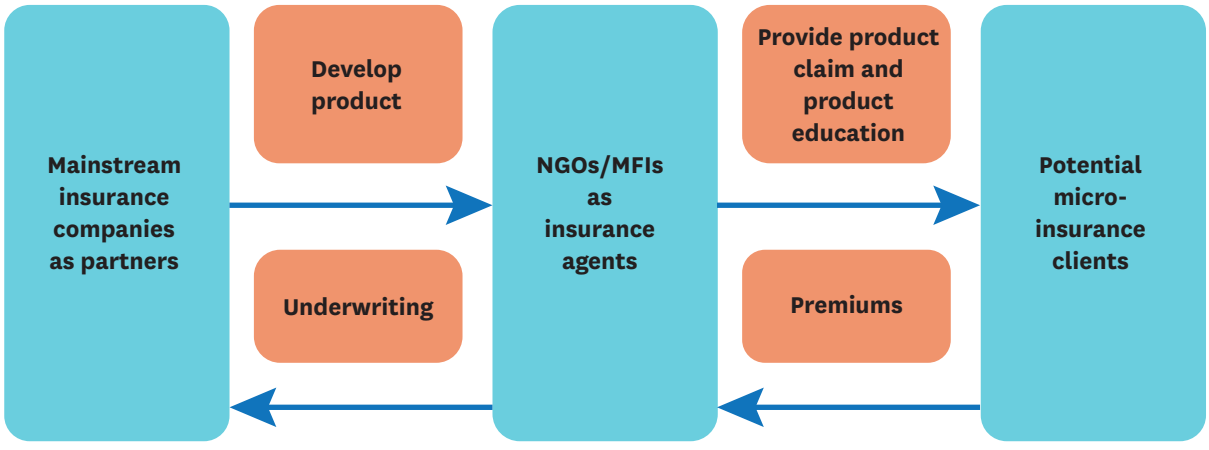

Figure 8. Partner-agent model for providing agricultural insurance.

A Business Model for Index-based Flood Insurance

In this section, we develop a potential business model for IBFI to provide insurance cover against crop losses from floods to vulnerable sectors of rural society. Given the specialized nature of the flood risk this product seeks to cover, its use is limited to agricultural regions or zones prone to floods.

Using the template of the typical business model in Figure 3 and the links between the two main components of the business model depicted in Figure 4, for a business to succeed, product development (creating value) is as important as product delivery to end-users (capturing value). Developing an insurance product specifically designed to provide cover to crop losses from floods is challenging both from the perspective of creating and capturing value.

Nature of the Business Model

Three categories of business models have frequently been employed for providing agricultural insurance. While all three models have their requirements, advantages, and disadvantages, a frequently asked question is: Which model represents the most efficient and wide-reaching way of organizing the business of agricultural insurance for a given type of product in a particular setting or country?

Unfortunately, there is no one answer to this question. The appropriateness of different models varies depending on the context. Variables include the nature of the insurance product, the status of market development, the cost of insurance, client characteristics, institutional arrangements for performing various activities, the financial resources available, the nature of government support, and the prevailing legal and regulatory environment.

A study by the World Bank on agricultural insurance around the world reported that more than half of the 104 countries surveyed offer some form of agricultural insurance (Mahul and Stutley 2010). The research included a more detailed survey on agricultural insurance programs in 65 of these countries, aimed at understanding the experience of providing public and private agricultural insurance in developed and developing economies, and examining the different ways governments support or do not support agricultural insurance. The results of the survey showed that, while the period 1950–1990 saw a major growth in public sector-led MPCI, particularly in Latin America and Asia, since the 1990s governments have favored promoting agricultural insurance through the commercial insurance sector, often through PPPs.

As of 2008, private insurance providers operated in 54% of the surveyed countries, and PPPs were implemented in 37%. The size of the private agricultural insurance sector within a country increases with the development level of that nation. Co-insurance pools, usually relying on PPPs, have been established mainly in middle-income countries to strengthen the supply of agricultural insurance. PPPs tend to improve the financial performance of government-sponsored agricultural insurance programs. Loss ratios, a simple measure of the financial performance of an insurance program, seem to be lower when programs are managed by the private sector, sometimes with government support through PPPs. This may be due to better implementation of insurance principles such as sound underwriting procedures and improved pricing of risk, lower administrative costs, and the greater financial discipline of private insurers (Mahul and Stutely 2010).

The results of other empirical assessments of agricultural insurance programs tend to agree with these findings. While the private commercial insurance sector is most successful at efficiently and effectively implementing agricultural insurance, scaled-up agricultural insurance programs typically require leadership and targeted support from governments. Examples include weather and area yield-based crop insurance programs in India, Mexico's weather-based crop insurance scheme, and the index-based livestock insurance scheme in Mongolia (World Bank 2013). Some evidence suggests that sustainable, scaled-up agricultural insurance programs should be based on an equal partnership between the public and private sectors. For example, evidence from some industrialized countries indicates that all successful and sustainable agricultural insurance systems have been based on PPPs. Purely private or purely state-organized systems have failed (World Bank 2013). By working collaboratively, both the public and private sectors gain, and so do the clients (Box 2).

Box 2. Advantages of PPPs to Governments and the Insurance Industry.

Advantages for governments

- Micro-insurance can bring a client-centered approach to product development. Beneficiaries of public programs can experience reduced payout times and improved benefits. The private sector may be able to deliver benefits more effectively and efficiently.
- Data on different risks can be developed over the long term to price and transfer risk in a more efficient way while contributing to greater public transparency.
- PPPs can create better budget management as insurance premiums can introduce more certainty around catastrophic events that have a severe impact on public finances.
- Insurance mechanisms can help incentivize governments to set up policies that reduce the exposure to risk of particular groups.

Advantages for the insurance industry

- Access to scaled-up programs can help reduce operational and premium costs. Efficiencies of scale can help to improve value for final beneficiaries.
- Collaboration with the government provides opportunities for improved data collection, which can lead to better pricing and beneficial competition.
- Insurance PPPs can increase the capacity of the industry to deal with more clients and premiums, while fostering national financial risk-transfer mechanisms.
- Working collaboratively with a government can help to change a population's exposure to risk, making insurance protection sustainable for both insurers and reinsurers.

Source: Solana 2015.

An insurance product for marginalized sectors of society that frequently suffer crop losses due to floods will need to be efficiently and cost-effectively marketed to overcome barriers resulting from the low ability of these groups to pay for insurance. Given the social and economic relevance of such insurance, the expertise and comparative advantages of both the public and private sectors will be needed in developing and marketing the product and to obtain the necessary regulatory approvals.

Based on lessons from successful PPP arrangements for agricultural insurance from around the world, we suggest a PPP is the most suitable model for developing, launching, marketing, and scaling up an IBFI product. India already has substantial experience with PPP models for agricultural insurance products. Based on this experience, the Government of India developed its PMFBY scheme using a PPP model. Introduced in 2016, PMFBY aims to provide insurance cover against multiple perils to farmers countrywide. Some of the main features of the scheme are presented in Box 3.

We suggest the PPP approach applies to both the creating value (product development) and capturing value (product marketing) components of the business model. Given the differing requirements of each, we envisage different PPP designs with differing sets of stakeholders and different types of partnership arrangements for each component of a business model for IBFI.

Creating Value: Issues in Product Development

Developing insurance products for covering flood risk in both urban and rural areas has been a challenge for the insurance industry in both developing and developed countries. While there have been longstanding efforts at developing flood insurance, this kind of insurance is currently not in commercial use anywhere in the world (World Bank 2009). Building on experiences of taking an index-based insurance approach to drought, the World Bank conducted research and concept-testing activities to investigate the potential for expanding the index approach from drought to floods (World Bank 2009). The main objective was to assess prerequisite conditions and identify practical and efficient methods for conceptualizing and potentially implementing index-based insurance for agricultural losses caused by floods. The work also assessed how modern technologies such as flood modeling and remote sensing, which are widely used to support flood-risk mapping and flood warning, detection, and control, could be harnessed to support the design of flood insurance programs for rural clients.

The World Bank (2009) findings drew on background feasibility studies carried out during 2006–2008 in three countries, Thailand (the Upper Pa Sak River Basin, Phetchabun Province), Vietnam (the Mekong Delta),

Box 3. Salient Features of the *Pradhan Mantri Fasal Bima Yojana* (PMFBY) scheme.

Coverage of farmers: All farmers, including sharecroppers and tenant farmers growing notified crops in notified areas, are eligible for coverage. Compulsory for all farmers taking out Seasonal Agricultural Operations loans from financial institutions (i.e., loanee farmers) for notified crops, and optional for non-loanee farmers.

Coverage of crops: Food crops (cereals, millets, and pulses), oilseeds, annual commercial, and horticultural crops.

Coverage of risks: For preventing sowing and planting risk and standing crops (sowing to harvesting), comprehensive risk insurance is provided to cover yield losses due to non-preventable risks, namely drought, dry spells, floods, inundation, pests and diseases, landslides, natural fire and lightning, storms, hailstorms, cyclones, typhoons, tempests, hurricanes and tornados, post-harvest losses, and localized calamities.

Levels of indemnity: Three levels of indemnity, 70%, 80% and 90%, corresponding to high, moderate and low risk levels are available for all crops.

Level of sum insured: Sum insured per hectare for both loanee and non-loanee farmers is the same and equal to the scale of finance decided by the District Level Technical Committee. Sum insured for irrigated and non-irrigated areas may be separate.

Premium rates: The actuarial premium rate to be charged by the implementing agency. The rate of insurance charges payable by the farmer are capped by the government.

Use of Area Approach: Scheme operates on the basis of the area approach, i.e., defined areas for each notified crop for widespread calamities. The insurance unit is the village or village *panchayat* (council) or any other equivalent unit for major crops. For other crops, it may be a unit above the village level.

Intermediary commission: Bank and other financial institutions are paid service charges at 4% of the premium collected from farmers. Rural agents are engaged in providing insurance-related services to farmers and are paid an appropriate commission as decided by the insurance company, subject to a cap prescribed under the Insurance Regulatory and Development Authority of India regulations.

Release of subsidy: Government to release 50% of the total estimated premium subsidy to impanelled insurance companies at the beginning of the crop season on the basis of business projections submitted by each insurance company.

Reinsurance: Insurance company to take all necessary steps to obtain appropriate reinsurance cover for their portfolio. In cases where the premium-to-claims ratio exceeds 1:3.5, or the percentage of claims to sum insured exceeds 35% (whichever is higher) at the national level in a crop season, then the government will provide protection to implementing agencies. The losses exceeding the above-mentioned level in the crop season would be met by equal contributions from the central government and relevant state governments. The liability of payment of all claims shall be of the concerned implementing agencies only. In the case of non-fulfilment of the above-mentioned condition, insurers shall be responsible for settling admissible claims in states where losses exceed the above ceiling.

Technology: Use of innovative technologies such as satellite imagery to rationalize crop cutting experiments.

Source: https://pmfby.gov.in/

and Bangladesh (country-wide flood-risk mapping). The studies were undertaken jointly with local research centers, agricultural banks, insurance companies, international experts, and centers of excellence in remote sensing and flood modeling. The findings from the three case studies provide insights into the complexities, opportunities, and challenges posed in developing IBFI under different types of flooding conditions such as river flooding inundation, flash floods, and coastal storm surge floods. The studies underline the feasibility and differences in approach and methodology that need to be developed regarding all the underlying parameters such as risk zoning and flood mapping, premium calculations, index designing, farmer enrolment, and loss assessment.

Table 2 summarizes the feasibility of index insurance at macro and micro levels under different types of floods (Lotsch et al. 2010).

Attempts are being made to overcome the constraints and challenges and to develop an IBFI product capable of speedily estimating crop losses due to floods that is easy to implement and meets the expectations of stakeholders (Amarnath et al. 2017).

Requirements of Product Development

The design of agricultural insurance products is often driven by insurers, even more often by reinsurers and, in an increasing number of cases, by ad hoc pilot projects driven by governments or donors. An important concern regarding product design has been that neither the insurance needs of the targeted population nor that of actors within the agricultural

Table 2. Feasibility of macro- and micro-level flood index insurance.

River flood/inundation	Flash flood	Coastal storm surge flood
	Macro level	
An indexed product for risk transfer by the aggregator to reinsurers based on river discharge data is feasible. However, objective flood measurement and loss payments based on remote sensing would require the risk aggregator to establish their own payout rules. This approach could allow the transfer of large-scale risk but the need for the aggregator to establish payout rules at the local level may make this product more suited to a government compensation scheme or for the holder of aggregated risk such as an agricultural bank.	An index product is not feasible and objective measurement is not feasible. However, the localized nature of flash floods may make conventional field assessment more appropriate, supporting a disaster payment system or conventional indemnity based flood insurance.	Indexing a product for a coastal flood is not considered feasible but objective flood measurement and a disaster payment system could be workable by using remote sensing. If a flood is highly correlated with a cyclone, then some form of risk transfer based on cyclone occurrence is potentially foreseeable, although with high basis risk to areas actually flooded. Engineering principles are applied to calculate the construction of coastal dikes at given return periods. Practical extension of this work to calibrate agricultural flood risk using flood modeling has not yet been undertaken. Risk transfer at the macro level to reinsurers for cyclone-induced coastal flood for agriculture has not yet been tested.
	Micro level	
Micro-level flood index insurance is highly challenging. A pure index product for flooding cannot be developed at the micro level. Objective and independent loss measurement using remote sensing and an agreed payout scale can bring the most important benefits of an index to flood insurance. Reinsurance of major risks could be carried out using a macro index based on river discharge, leaving some potential basis risk with the insurer.	An indexed product is not feasible. Objective measurement is not feasible due to rapid onset and dispersal of floodwater. However, the localized nature of flash floods may mean more conventional field assessment is practical, supporting a disaster payment system or by conventional indemnity insurance.	A pure index product for flooding cannot be developed at the micro level. Objective and independent loss measurement using remote sensing and an agreed payout scale can bring the most important benefits of indexing to flood insurance. However, there is no real basis for developing premium rates.

Source: Lotsch et al. 2010.

value chain have been ascertained during the development process and have therefore not usually been central to the design. As a result, uptake of many of the existing agricultural insurance products has been low (Bhushan et al. 2016).

Developing a dedicated flood insurance product is information intensive, methodologically challenging, and resource demanding. Extensive efforts are needed to collect large amounts of historical data on a number of variables, along with real-time data on a daily basis using advanced technological innovations. Information is required on:

i. the nature, source, frequency, and magnitude of floods;
ii. delineating those areas most at risk from flooding;
iii. flood characteristics (facilitating the classification of flood-prone areas into homogenous flood zones);
iv. timings, durations, and levels of inundation;
v. yield loss as a function of various flood characteristics;
vi. weather parameters; and
vii. cropping patterns, chemical use, and crop yields.

Once the data are in hand, skilled analysts are needed to draw inferences to build a financial product such as IBFI.

Meeting the data requirements for a multifaceted insurance product requires collaboration supported by facilitation. Collaborative working arrangements for data collection are needed among institutions and organizations in both the public and private sectors, such as government departments responsible for agricultural insurance, research institutes and scholars, weather information providers, disaster management authorities, space research organizations, insurance companies and reinsurers, and those farmers likely to be affected by floods. Figure 9 summarizes the tasks to be undertaken and the nature of institutional collaboration needed to develop a complicated product such as IBFI.

The need for a facilitator

The involvement of many institutions in product development brings with it a new set of challenges. While it may be possible to demarcate the roles that public and private sector actors can individually best perform, it is challenging to coordinate and harmonize. Figure 10 illustrates the possible roles that public and private sector actors can play. The sections that follow briefly describe some of these roles.

While each institution and actor may have the expertise for undertaking the task assigned, an institutional arrangement is needed to coordinate the activities, monitor ongoing work, and provide feedback and technical support. We recommend using a facilitator with the necessary technical competence and administrative and infrastructure facilities to perform this critical function.

IWMI initiated the concept of IBFI and has a large pool of technical expertise and administrative capabilities, and has all the competencies required of a facilitator to lead and guide product development. At this early stage of developing the IBFI product for field application and to demonstrate how a facilitation unit should work, IWMI has assumed the role of facilitator and is housing a technical support unit.

An IWMI team has been facilitating the process of developing an IBFI for India (Amarnath et al. 2017). This involved gathering data from various agencies and nurturing collaborative arrangements with government agencies, private insurers, reinsurers, financial institutions, research institutions and agricultural universities, and farmers to develop an IBFI for pilot testing. Once these collaborative arrangements are in place and a prototype of the product developed and pilot-tested, operational guidelines for putting the product into practice will be formulated. Product design will need to be adaptively managed to accommodate any concerns arising during the operational phase. We describe below some important concerns that need consideration during the operational phase.

The Role of the Government

Government support is vital at all stages of product development (Figure 10). Government agencies need to:

i. invest in data collection and make information available for use by stakeholders;
ii. promote and facilitate research;
iii. create development and training activities;
iv. facilitate a conducive policy and regulatory environment;
v. create product awareness;
vi. test, pilot, and approve products;
vii. undertake crop cutting experiments to estimate crop yields;
viii. review and monitor implementation and adjust premium rates accordingly; and
ix. benchmark products and evaluate performance, including that of the insurance companies.

The government also needs to encourage the adoption of advanced technological innovations such as the use of satellites and drones in gathering data and estimating crop losses. Often, national or international donors and experts may need to contribute to and complement these government efforts.

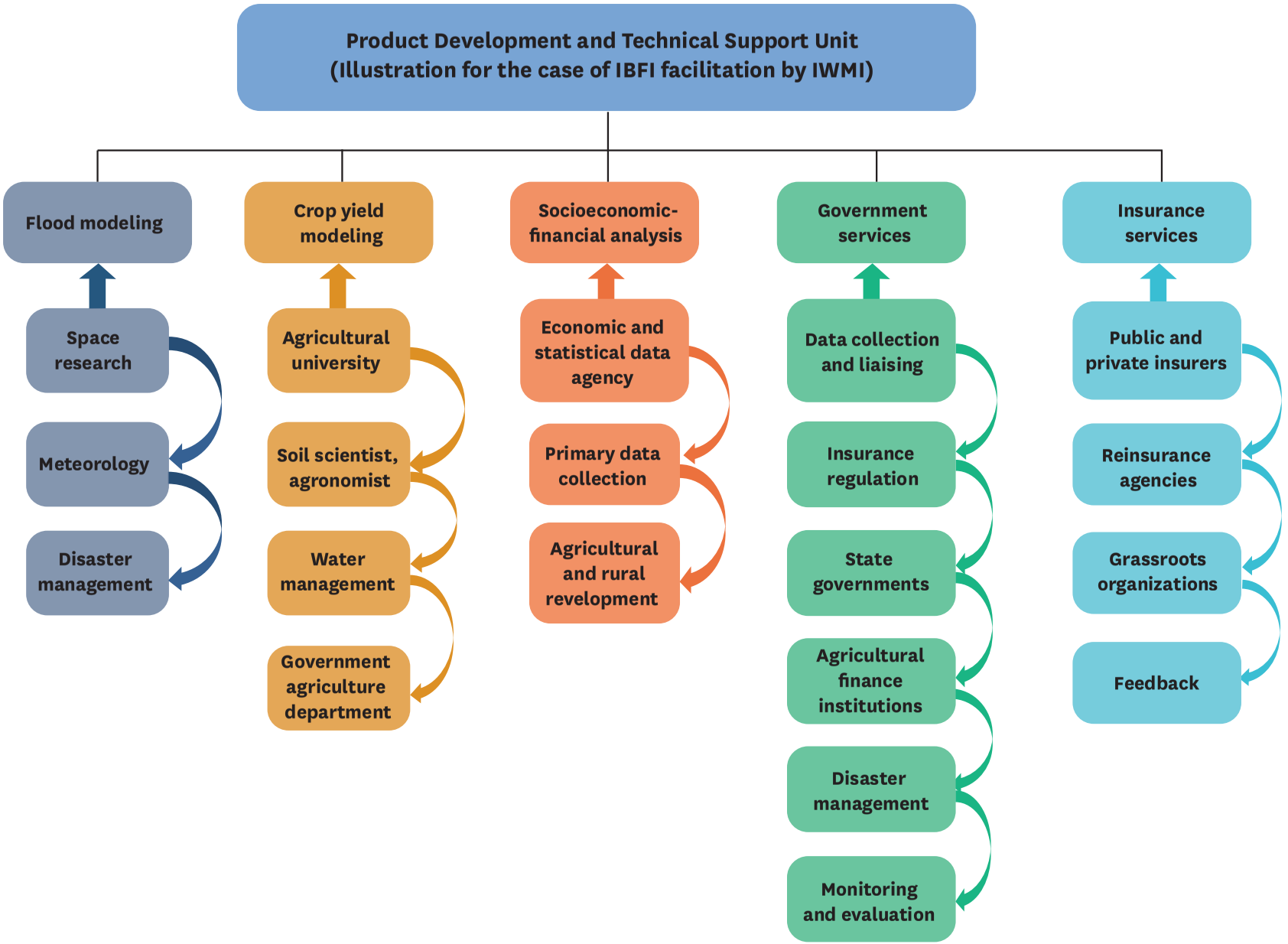

Figure 9. Collaborative partnership requirements for product development.

Two government roles are fundamental to the development and success of an agricultural insurance product. These are i) gathering data and making it available to stakeholders, and ii) acting as a regulator to gain the trust and confidence of insured parties. We briefly elaborate on these roles.

The role of the government in providing data

The large amounts of data required for development and implementation of an insurance product such as IBFI are generally unavailable or inaccessible, especially at the geographic level most suited to this kind of product.

Product development requires detailed data on many variables for many past years along with almost continuous present-day data. This includes data on meteorological conditions, land use, agricultural production, and vulnerability and risk exposure indicators. Often these data are not yet available and need to be built up over time. For example, the lack of weather stations at the local level limits the availability of data on important weather variables crucial for the development of IBFI. Recent technological advances in the availability and use of remote sensing data suitable for developing indices have a high potential to overcome the substantial data constraints faced by most parametric insurance projects.[2]

Meanwhile, the increasing availability of reasonably priced, small, automated weather stations for continuously recording local weather and the emergence of innovations such as drones offer immense opportunities for data gathering. However, besides requiring trained personnel, such data are expensive to collect, process, analyze, and store. Given the costs and related institutional and administrative needs in accessing such data, government support is critical.

Access to data: Making insurance more affordable

For agricultural insurance to be viable, contracts must have low failure rates, be affordable, and be appropriate for scaling up. One reason for high insurance prices is the uncertainty loading often applied by reinsurance companies due to sparse data in most developing countries. Local insurance companies rely on reinsurance to price the product and carry a substantial amount of the risk (over 90%). Faced with gaps in data, reinsurance companies build in a weighting for uncertainty, which elevates premiums.

While simple subsidies delivered by the public sector may be an appropriate policy response to the need for lower premium costs for poor farmers, Carter (2013) suggests a cost-effective alternative in the form of a Public Reinsurance Facility (PRF). This facility could function in an uncertainty-neutral fashion and suggest affordable premiums. Thus, the facility could insure farmers against the most catastrophic risks (e.g., at the left tail of the yield distribution) where there is more uncertainty loading, while the private sector would insure a relatively moderate risk. This could help create a unique PPP that would take into consideration the public good and the needs of private reinsurers to not provide below-cost unsustainable pricing.

Role of the government as an insurance regulator

The role of a regulator is important when introducing a new micro-insurance product. The primary function of an insurance regulator is to ensure consumer protection, not to drive innovation. Ensuring adequate financial stability of insurance providers is a key aspect. Insurance regulation is rarely the driving force behind the development of agricultural insurance but rather a promoter of product diversity and risk pooling in the market. An accommodating and robust regulatory environment is widely considered essential for scaling up agricultural insurance systems. However, in the initial phase of product development and piloting, regulation is often less important. During this phase, regulators need to focus on understanding the product and related issues and preparing a framework for the scaling-up phase.

The Role of the Private Sector

The government and the private sector should contribute equally to product development. Insurers and reinsurers help package the technical, social, and commercial considerations into a viable financial product (Figure 10). Insurers need to allocate responsibility for underwriting, assessing crop losses, devising procedures for processing and accepting levels of risk, working out methods for quickly settling claims to the satisfaction of farmers, providing feedback, and procuring reinsurance, often from international reinsurers. Insurers must also contribute to creating product awareness and scaling up the product.

Insurers need to work with stakeholders. Stakeholders will vary according to the requirements of the insurance product being developed and may include research institutes specializing in flood modeling and forecasting, agronomists with expertise in modeling crop yields against levels of inundation, social scientists and finance experts able to undertake socioeconomic profiling and economic analysis to determine willingness to pay and affordability of insurance to the farmers and analyze factors that could promote uptake of the insurance and suggest ways to improve cost efficiency.

[2] The use of satellite data for retail products is not without challenges. Farmers do not understand this technology and they tend to trust data from this source less than data collected from on-site weather stations. The possible failure of the satellite or the inability to access relevant data must also be factored in.

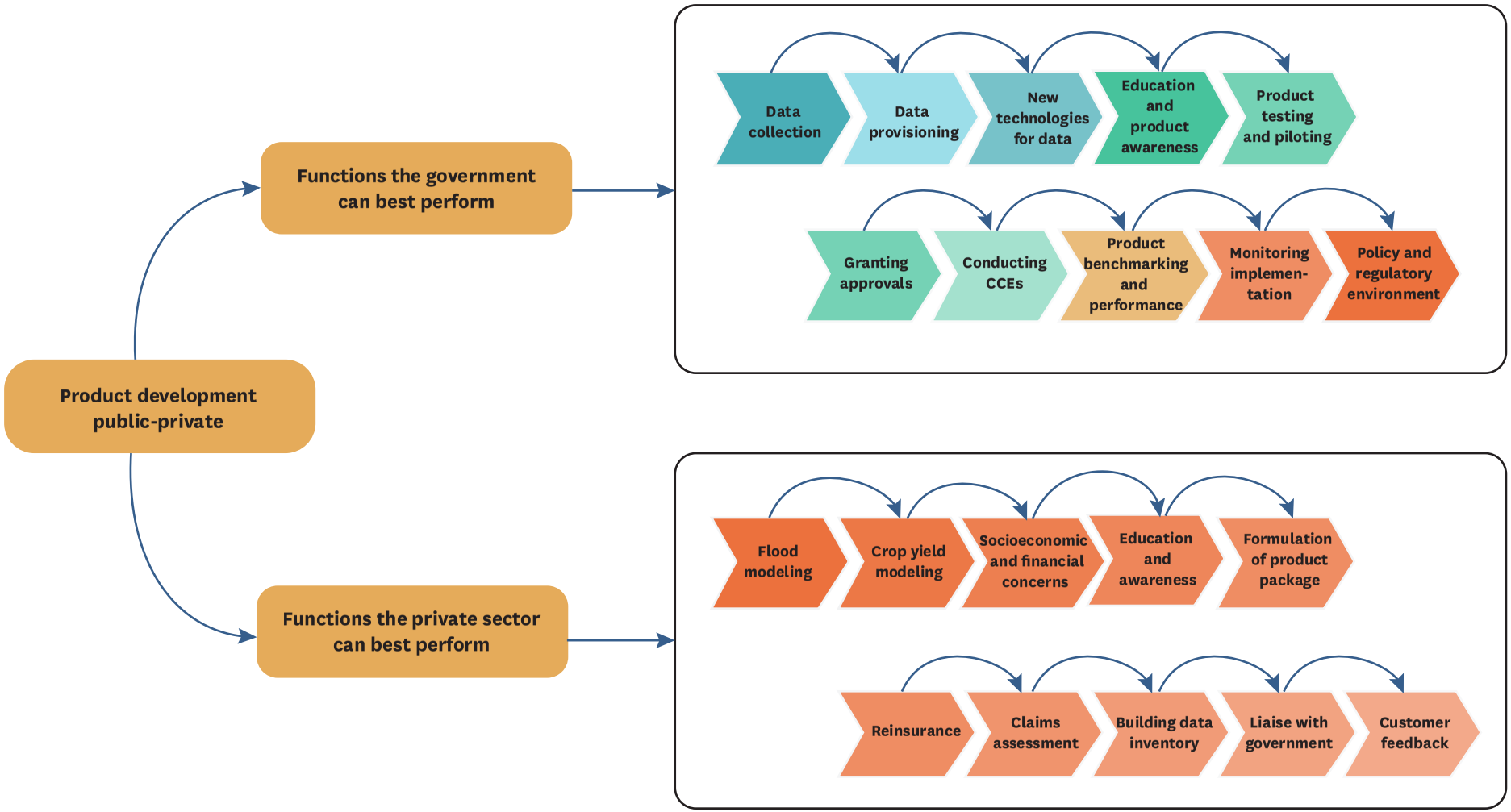

Figure 10. Indicative functions public and private sectors can best perform in product development.

Note: CCE - Crop cutting experiments.

Operational Issues Requiring Consideration Before Product Launch

Variability in the incidence of floods in flood-prone areas

Agricultural losses from inundation, and therefore insurance payouts, are linked to specific incidences of floods. An important consideration in product development, therefore, is how to demarcate the flood-prone areas into homogenous risk zones. Demarcation should be based on criteria such as the magnitude, incidence, frequency, and pattern of flooding across regions. The entire geographic area surrounding a river basin cannot be treated as one homogenous unit for the purpose of flood insurance. Creating homogenous zones is also important for determining premium rates. Demarcation into zones based on flood homogeneity and determination of premium rates based on differential risk exposure in each zone can, to a large extent, help deal with adverse selection (i.e., the tendency for those most at risk to obtain insurance).

Compulsory versus optional flood insurance

In India, agricultural insurance is generally compulsory for farmers taking crop loans from institutional sources and optional for those outside the formal credit system. Making insurance compulsory helps reduce adverse selection compared to optional selection. However, given that most small and marginal farmers do not or cannot access institutional credit facilities, making flood insurance optional carries the risk of excluding a large number of vulnerable people. A related issue is farmers' eligibility to enroll concurrently in other agricultural insurance schemes, such as PMFBY in India or a specific WIBCI program. What criteria should be permissible?

A concern in India is whether IBFI coverage should be extended to *rabi* crops (winter). Since floods are a major concern only during *kharif* crops (summer), IBFI is likely to be made available to provide risk cover for *kharif* crops only. What should happen regarding risk coverage for *rabi* crops? Could farmers invest in IBFI during the *kharif* season and buy a different insurance cover for the *rabi* season? And should those farmers who continue to buy the IBFI product year after year enjoy certain advantages and benefits not available to those farmers who intermittently opt in and out of the scheme?

Assessment of crop losses

With existing crop insurance schemes, crop losses are generally determined on the basis of historical crop yields and current yields inferred from crop cutting experiments. With flood insurance, it is difficult to estimate losses using these methods. Unless a simple, reliable, easy-to-understand and fair basis for calculating crop losses can be established, it will be difficult to convince farmers to buy an IBFI product. Remote sensing potentially offers the most reliable basis for assessing floods and calculating losses. However, issues of the availability of remote sensing images at an appropriate resolution and the cost of acquiring such images need to be resolved. In addition, farmers would need to be educated on the advantages and reliability of remote sensing technology. Unless clients are convinced about the methodology used to estimate losses and calculate payouts, it may be difficult to market a technology-based product.

Determining trigger values

There are often no historical data available at an appropriate scale that can shed light on the extent of losses due to past floods and climatic variability over the years. Some data on meteorological parameters and river discharge are usually available, and estimations of crop losses therefore need to be made on the basis of loss modeling. Collaborative efforts with regional agricultural universities or other experts can help identify crop damage threshold levels for paying compensation for different crops.

Establishing premium rates

Setting a premium price for IBFI is complicated and requires information on expected losses, risk margins, and administrative costs. The expected losses and risk margins would need to be estimated using flood-risk models and available historical data. The level of administrative costs needed to run the business, such as those incurred in acquiring data, office expenses, loss adjustment and so on, would depend on how efficiently the whole business is developed and run. Careful consideration of these issues in the absence of any data would need to be made when setting premium rates.

Risk transfer: Reinsurance

A review of major global flood events highlights the catastrophic nature of floods. Flood insurance will likely be characterized by years of no claims when weather is clement and years of multiple claims following a major event. An insurer operating nationally, especially during the initial phases of a new program, will have limited opportunity to spread risk, for example, between different regions of a country or varying zones within a broad region. In contrast, an international reinsurer is well placed to develop a suite of catastrophe schemes from different countries and achieve a balanced portfolio. Hence, developing a reinsurance program will be an important element of financial management for a domestic insurer offering flood insurance.

Capturing Value: Issues in Marketing Index-based Flood Insurance

Marketing the new product will be as important as developing it. However, marketing an agricultural insurance product is challenging. Given farmers' limited exposure to insurance and low willingness and ability to pay, insurers find it difficult to market such products. Therefore, they often have to first raise awareness to bring about behavior change and encourage farmers to embrace crop insurance. With high overhead costs and low margins, insurers face the difficult task of creating an insurance marketing landscape and selling the product to potential clients in large numbers. Insurers frequently find it useful to partner with other organizations with a presence at the grassroots level, such as self-help groups and farmer associations, even if these partners have no previous experience of selling insurance products. Governments can often provide a helping hand in forging these partnerships, creating awareness, nurturing a conducive policy and regulatory environment, and most important, providing financial support. The absence of partners with the requisite experience and the high cost of forming partnerships has led to impressive innovations in marketing insurance products in rural areas. We discuss below some issues that influence marketing agricultural insurance products in general and IBFI in particular.

Given the complexity of selling crop insurance products in large numbers to poor farmers dispersed over a wide geographic area, developing an appropriate marketing strategy requires contributions from many stakeholders. It requires collaborative arrangements or partnerships to be forged among grassroots organizations such as rural cooperatives and self-help groups, rural financial institutions including MFIs, and government agencies that can provide financial support and oversee implementation. We envisage that a PPP involving insurance companies in both the public and private sectors and government agencies with a mandate for agricultural insurance will be needed to efficiently and effectively market IBFI. We briefly describe the broad contours of such a relationship and the respective roles that the government and the private sector would play in marketing the product.

The Role of the Government

The government makes an important contribution to product marketing. It will need to actively assist with creating product awareness, building the capacity of stakeholders, selecting the insurance agency to partner with and provide contracting services for overseeing product marketing, resolve disputes, scale up adoption levels, secure reinsurance, and evaluate product performance. The government must also provide financial support to help cover the cost of providing the insurance and subsidizing insurance premiums.

The role of the government in providing financial support

When discussing the role of the government in an agricultural insurance PPP venture, the availability of financial support gets the highest attention. It is not uncommon for government finances to be used to subsidize upfront farmer premiums to make insurance more affordable, support program administration and operations, contribute to payouts, and purchase reinsurance.

A survey of 65 countries conducted by the World Bank in 2009 estimated the overall government cost of upfront premium subsidies to be 44% of original gross premiums in 2007 (Mahul and Stutley 2010). Including administrative and operating costs and claim subsidies, the total cost to governments of providing agricultural insurance was as high as 68% of the original gross premiums. The public cost of agricultural insurance subsidies represented 50%–300% of the premiums paid by farmers in most countries surveyed. Public support for agricultural insurance in many high-income countries (including Italy, Spain, and the USA) represented more than twice the premium paid by farmers. In contrast, in most middle- and low-income countries surveyed, public support to agricultural insurance represented 50%–150% of the premium paid.

Premium subsidies are the most common form of public intervention in agricultural insurance. The majority of countries that provide agricultural insurance, despite their development level, also provide insurance premium subsidies. Some countries provide fixed premium subsidies (as a percentage of the gross premium) while others provide variable premium subsidies. A few countries, such as India, cap premiums. Premium subsidy programs are offered mainly for MPCI or area-yield insurance. An exception is South Africa, which offers non-subsidized MPCI to individual farmers.

Concerns have been raised about the efficacy of premium subsidies in boosting the uptake of insurance by farmers and increasing food production. It has often been suggested that government costs in providing insurance subsidies could be reduced by restricting premium subsidies to the marginalized sectors of society. However, significant challenges exist in targeting subsidies to those sectors of rural society that deserve it the most. Some researchers have argued in favor of swapping upfront premium subsidies for smart subsidies, where governments spend money for the public good, such as by collecting and providing relevant datasets for wider use by stakeholders. Nonetheless, upfront premium subsidies continue to be considered essential for encouraging vulnerable sectors of rural societies to adopt micro-insurance. The common model for disbursing agricultural insurance subsidies in India is described in Figure 11. We recommend a similar model for paying out subsidies under IBFI.

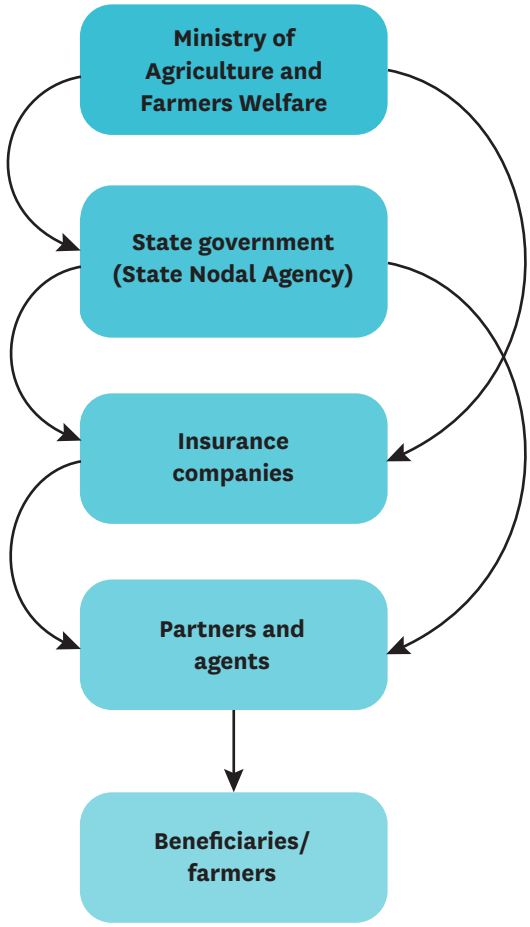

Figure 11. Model of subsidy flow in Indian agricultural insurance.

Other financial support provided by the government

Besides providing insurance premium subsidies, governments often also provide financial support for other operations related to the agricultural insurance business. A World Bank survey (Mahul and Stutley 2010) showed that governments provide support for public reinsurance in 32% of the surveyed countries, administrative and operational expenses in 16% of surveyed countries, and loss adjustment costs in 6% of surveyed countries. Public-sector support for reinsurance is higher in high-income economies than in middle-income economies. Support for reinsurance ranges from establishing national reinsurance companies to the formation of agreements under which governments act as excess-of-loss reinsurers. In such cases, the government charges no reinsurance premium.

In PPP arrangements, agricultural reinsurance is purchased mainly from private reinsurers. It is critical for domestic agricultural insurers to secure enough risk capital to cope with a major disaster causing catastrophic insurance losses. In two-thirds of the countries surveyed in the World Bank (2009) study, agricultural reinsurance was provided by private reinsurers. In 22% of the surveyed countries, agricultural reinsurance was provided by both public and private entities. Some countries rely only on public reinsurance (e.g., Costa Rica, Iran, Japan, and Kazakhstan). We suggest that insurance companies providing IBFI would procure reinsurance facilities from private reinsurers, supplemented by government support.

Role of the government in undertaking impact evaluation

With support from research institutions, the government can play a major role in collecting hard evidence to evaluate the performance of a new insurance product, assess any factors constraining its scaling up, explore avenues for improving efficiency and reducing premiums, and change product design and marketing. Such product evaluations help support agricultural insurance, including highlighting the positive effects of agricultural insurance on production and productivity, so the economic justification for supporting agricultural insurance does not remain theoretical. This is important in determining where agricultural insurance truly makes a contribution to food security and retaining high-level support for the sector.

The Role of the Private Sector

In a PPP endeavor, both the government and the private sector have to collaborate at all stages and contribute to the success of the venture. We see a major role for the private sector in raising product awareness, marketing, distribution, settling claims, and ensuring clients are satisfied with the product.

Distribution of IBFI

Distribution is one of the most important aspects of running an insurance business, and the same stipulation applies equally to the successful rollout of IBFI. To be cost-effective, an insurer should be able to sell the product and provide support across the entire value chain, including for product promotion and educating potential subscribers about the product, enrolment, premium collection, claims reporting, assessment and payment, and dispute resolution (Figure 12).

Handling the complexities and costs of product distribution alongside the administrative operation of agricultural insurance is a challenge for insurers. They generally find it more efficient and cost-effective to partner with one or more grassroots organizations for product distribution and other activities. Often, a single partner may not possess sufficient capabilities to undertake all the activities required to market an insurance product effectively. In such cases, distribution partners can be combined in creative ways to leverage their infrastructures, core strengths, and capabilities. While deciding on an appropriate distribution channel, the insurer needs to assess the strengths and weaknesses of each option in terms of:

- **Client understanding**: the ability to give advice and improve client understanding

  Product diversity: the willingness to offer a wider range of products

- **Scale**: the capacity to reach many potential clients

- **Brand and trust**: the popularity of the channel and trust of the people it commands

- **Costs**: the cost to the insurer

- **Partnership risks**: the stability of the partnership and the partners' willingness to engage in a long-term relationship

Developing partnerships and innovative distribution channels can also capture untapped opportunities within the fast-growing agricultural insurance segment. They can also be key to encouraging the insurer's business to grow, financially sustaining it, and achieving scale. Insurance companies are partnering with banks, MFIs, cooperatives, supermarkets, retailers, farmers' groups, and agricultural input suppliers to increase sales. Concurrent with using traditional channels for marketing, they are increasingly using more sophisticated technology-based approaches, such as social networking, telemarketing, and Internet sales to contact potential clients and market their products.[3, 4] The exact nature, form, and mix of distribution channels is likely to be shaped by underlying factors such as the development status of private insurance markets, demographics, literacy levels, plus cultural, infrastructural, and regulatory setups. Irrespective of the distribution channel chosen, face-to-face advice delivered by independent producers remains a vital component in the distribution mix, especially when it comes to meeting complex consumer needs with increasingly sophisticated products (DTTL 2010).

Insurers in the micro-insurance business have thus been working with a broad range of partner organizations in contact with low-income people and finding new ways to work with those organizations across the entire life of an insurance product, from design to paying claims. They are learning how to deliver value to those organizations and embed themselves in their core business. Nonetheless, the basic principle driving these innovations remains the same, a distribution partnership must deliver value to the insurer, to the distribution channel, and to the clients.

Distribution costs are and will continue to be a significant proportion of the cost of an insurance business. However, successful distribution of the insurance product is critical to the revenue stream of the insurer. Insurers must adopt a mindset that views distribution not as a cost burden but as a profit generator and a cornerstone of success. Efforts to develop innovative ways to distribute its products efficiently and cost-effectively must continue (DTTL 2010).

The available evidence suggests that in developed insurance markets, within high-income and upper-middle-income countries, insurance is traditionally marketed through agents employed by insurance companies or brokers. In low-income countries with underdeveloped insurance markets, agricultural insurance is mainly provided through cooperatives, MFIs, rural banks, agricultural input supply companies, and farmer groups in partnership with an existing development program. The comparative benefits and challenges of involving such institutions in distribution are given in Table 3. While almost 80% of agricultural insurance programs are offered voluntarily, agricultural insurance is often compulsory for borrowers of

[3] In drought-prone Gujarat State in India, more than 50,000 farmers enrolled in PMFBY for the 2016–2017 *kharif* season via the state portal on crop insurance. Taking a cue from Gujarat, the Karnataka government prepared its state portal for PMFBY.

[4] Some researchers think that because agricultural insurance is service-intensive, it is questionable whether alternative distribution approaches such as using the Internet and mobile phone networks will be successful (Herbold 2014).

agricultural loans in lower-middle and low-income countries (Mahul and Stutley 2010).

Role of Microfinance Institutions

India has set up an elaborate financial infrastructure for dispensing agricultural credit at concessional rates of interest to farmers. However, a large proportion of farmers either do not have access to this formal institutional arrangement or they have access but are not able to borrow (e.g., because they defaulted on an earlier loan). Those in the latter group have to depend on private money lenders or other informal sources. MFIs have emerged as an increasingly important source of lending and recipient for savings in rural areas in many low-income countries. They have often been unable to expand their agricultural lending portfolio significantly because agricultural-sector lending is seen as risky and prone to natural disasters and other calamities. Farmers living in areas frequented by such mishaps suffer significant losses that render them incapable of paying back their loans. This can lead to the destruction of risk capital, reduced access to liquidity, decreased lending, and sometimes insolvency of the MFI concerned.

To diversify spatially, expand their credit portfolios, and reduce the default risk on their agricultural lending portfolios, MFIs have tested offering weather index-based agricultural insurance products to their customers. An MFI's involvement might simply be a delivery channel to clients for the index-based insurance product, or sometimes the MFIs themselves become direct customers of insurance. In India, the MFI BASIX is both retailing a weather index-based rainfall insurance product and using an aggregate rainfall risk-transfer product to protect against default risk.

Farmers taking crop loans from institutional sources in India have to buy crop insurance. By bundling credit with insurance, MFIs can opt to sell index-based insurance to their customers on a mandatory or voluntary basis. Packaging credit with insurance has several advantages. Initially, a compulsory insurance may sometimes be the only viable way to sell agricultural micro-insurance because it helps generate the volumes needed to reduce the insurance premiums, reduce the cost of sales, and manage adverse selection, thereby ensuring that not only high-risk customers take the insurance product. Credit-bundling also offers a holistic solution to mitigate agriculture risks. Insurance products can be bundled with credit, agricultural advisory services, weather data, and access to quality inputs. By offering insurance as part of a broader risk-management framework, MFIs can significantly increase the value of insurance for farmers. Bundling insurance with credit can enable MFIs to charge lower interest rates to farmers by transferring the loan default risk to the insurance margins. A downside is that compulsory bundles do not accommodate the possibility that farmers may have other, non-insurance means to manage their risks. Bundling can potentially lead to customer protection issues if buyers are not aware that they are purchasing insurance or if they do not fully understand the product.

To protect themselves from the risk of default on their agricultural portfolio, MFIs can buy index-based insurance or portfolio insurance. Although this has not yet been tested on a large scale, it has been piloted in several countries. Portfolio insurance has the potential to benefit farmers both ex-post (via restructuring loans, loan write-offs, and the offer of emergency loans) and ex-ante through a larger supply of agriculture credit and reduced agricultural lending interest rates (Meyer et al. 2017).

MFIs offer good opportunities for insuring farmers who are uninsured. However, continued efforts must be made to identify those opportunities to improve microfinance business models to achieve greater effectiveness, efficiency, and scale.

Which Channel to Choose for Distributing IBFI?

Distribution is crucial to marketing micro-insurance products. Over the years, the challenge of distributing insurance to low-income clients in far-flung areas has given rise to a range of innovative channels. However, choosing the right distribution channel or a mix of distribution partners for a given product can be a difficult decision.

The maturity of the target market is an important consideration when choosing distribution channels. In markets where low-income people are not familiar with insurance, mandatory insurance for groups is usually most successful. Insurers look for a distribution channel, such as a financial institution, which already has a large client base and can facilitate mandatory enrolment. Clients will often require a greater level of interaction in such immature markets to understand and make use of the product. As markets progress, insurers can switch to voluntary products but will need to sell them to large established groups. At this stage, with the insurance culture still relatively weak, channels with an active sales approach are more likely to succeed in selling voluntary products. When clients are familiar with and value insurance, insurers can move on to the third, scaling-up stage, which is characterized by selling voluntary insurance to individuals. With a stronger insurance culture, more passive sales approaches may be possible, such as selling products off the shelf in a shop.

There is no one-size-fits-all distribution model. Tailored models are required for disseminating different types of insurance products and for distributing a specific insurance product in varied settings. Often, a multipronged approach that caters to the varied contexts

of different regions works better than a uniform approach. It is always helpful for insurers to work with an established organization with good existing networks because it will help accelerate growth.

An illustration of the relationship between public and private sectors in marketing an IBFI product is depicted in Figure 12, with the roles these sectors perform within the suggested PPP scenario depicted in Figure 13.

Table 3. Distribution channels for agricultural insurance: benefits and challenges.

Distribution model	Benefits	Challenges
Limited role of cooperatives, unions, MFIs, and banks	• Client trust is high due to the pre-existing relationship • When queries, concerns and claims are raised directly with the insurer such as through a local office, provision of quality information is more assured • The role of a financial institution as distribution channel facilitates the provision of pre-financing or co-payment, making the product more affordable before harvest season • In some schemes, operational costs are effectively shared between all stakeholders • Outreach	• The insurer may not be well positioned to get potential clients to see the need for coverage or prioritize its purchase • Incentives may be critical for distribution channel sales agents to spend time positioning the product and prioritizing sales • The insurer may incur high sales costs, particularly if they must invest in a local presence, such as opening an office • In some schemes, insurers and brokers often face an information blackout and have little information on sales numbers until they receive the final figures, particularly when the distribution channel does not have a robust information technology system
Comprehensive role of cooperatives, unions, MFIs, and banks	• Client trust is high due to the pre-existing relationship • Additional cost of distribution is low if using local staff • Costs are reduced where members take on some roles, such as inspection • Umbrella organizations, such as federations and leagues, offer an opportunity for these channels to more cost-effectively build awareness and undertake educational activities • Outreach	• Limited time to commit to micro-insurance (education and sales) activities, leading to sporadic, unsustained efforts • If the institution does not have local agents and is not cross-selling, costs of reaching villages will be high and the commission level may not be sufficient • Significant training needed to raise low understanding of weather-based insurance
Local development program staff	• Client trust is high due to the pre-existing relationship • Additional cost of distribution is low as staff are already in place	• Limited time to commit to micro-insurance education and sales activities • Low understanding of weather-based insurance • Quantifying costs and benefits is challenging, as micro-insurance work is overlaid with other field staff activities

Source: GAN 2017.

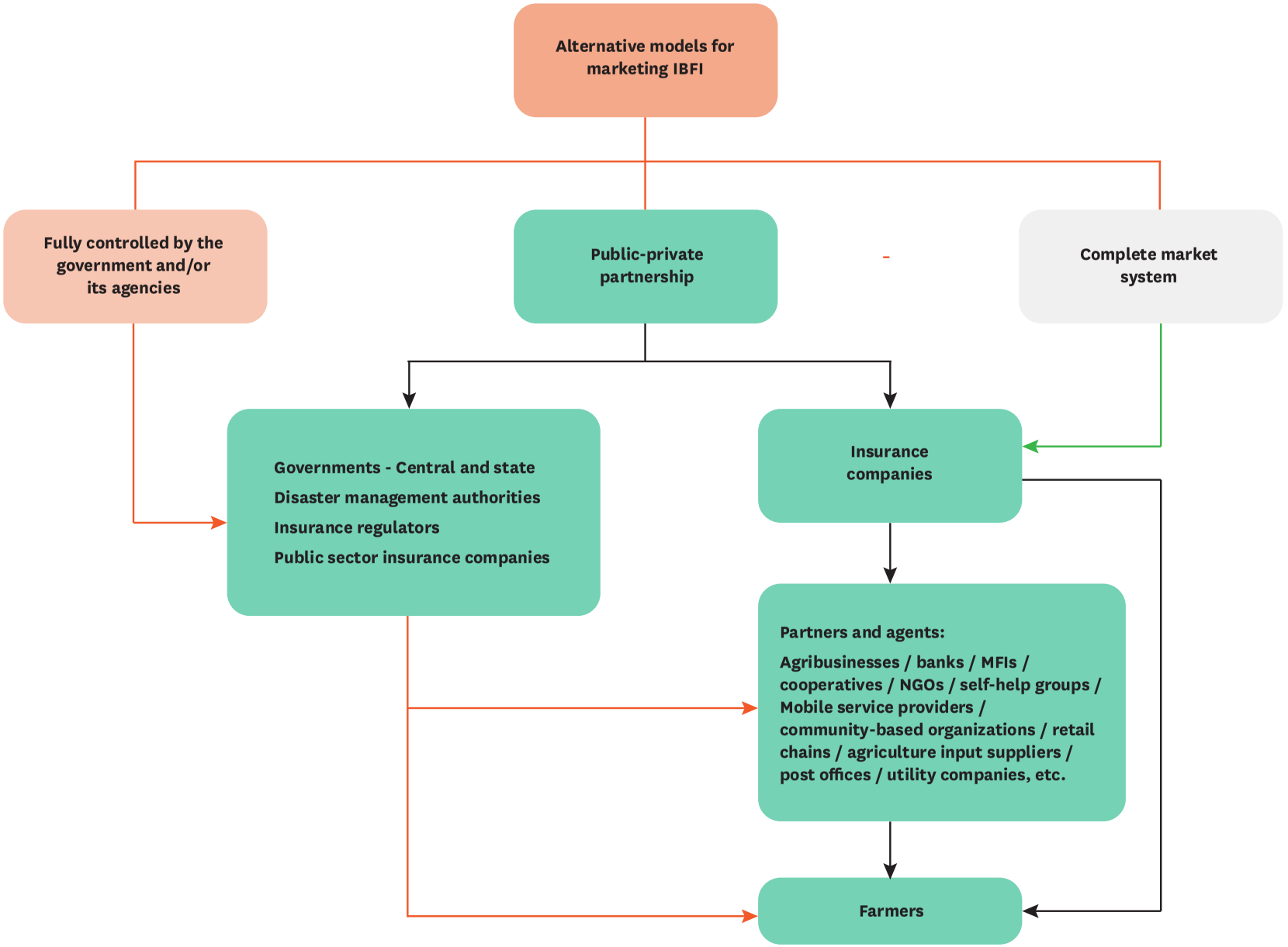

Figure 12. Marketing channels for IBFI under different partnership arrangements.

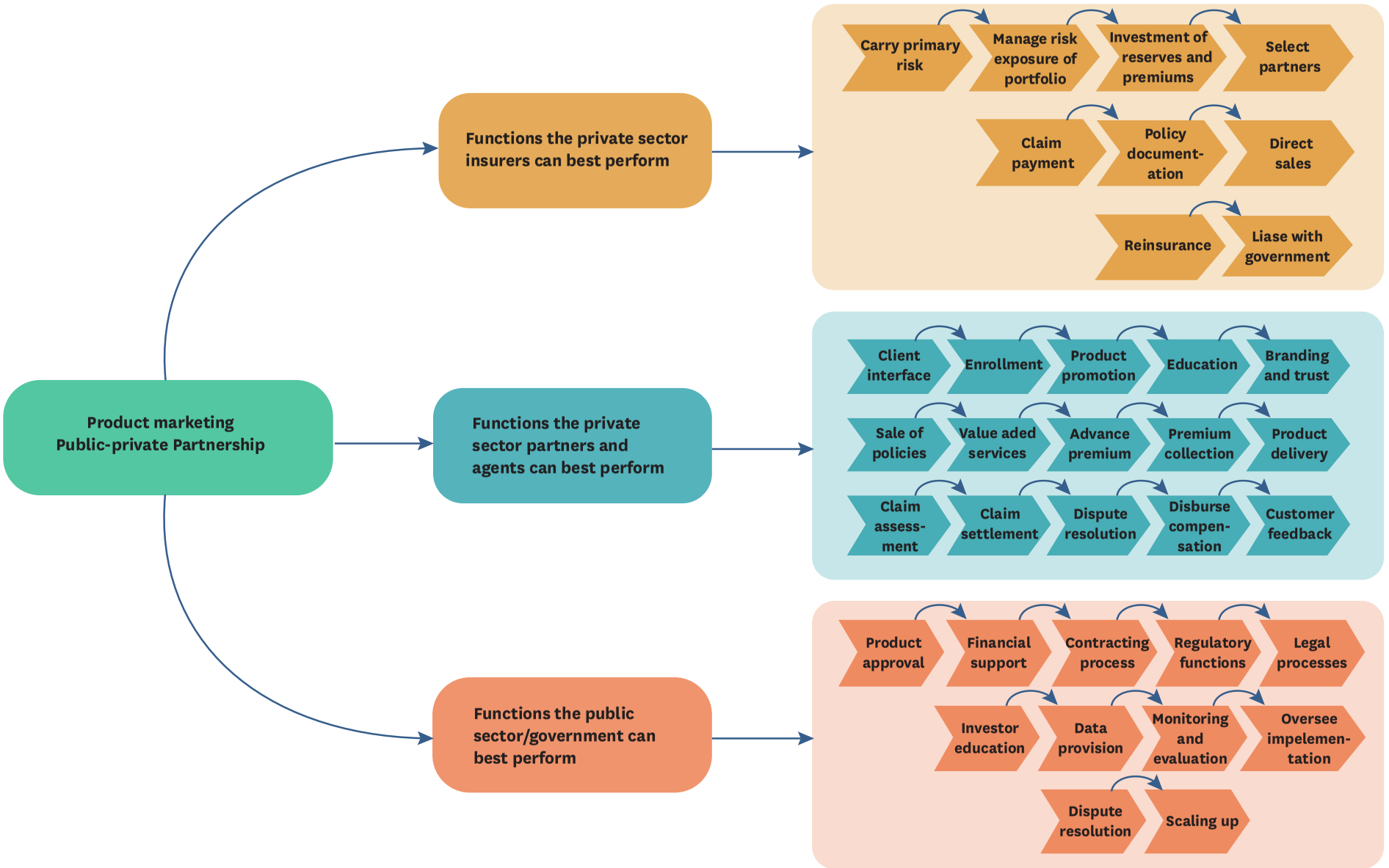

Figure 13. Functions best performed by different actors in a PPP marketing arrangement for IBFI.

Issues in Uptake and Scaling

The goal of scaling up is to reach as many people as possible. Given the level of risk cover provided by an agricultural insurance product, usually at a highly subsidized cost to the farmer, the reasons for observed low penetration rates of agricultural insurance have always been unclear. Innovative business models and proactive public policies have the potential to stimulate greater adoption and contribute to scaling up.

How to devise appropriate insurance strategies for risk management in agriculture has long been debated by policy-makers, practitioners, and researchers around the world. Only limited systematic efforts have been made to understand the role different factors play in influencing the uptake of agricultural insurance by potential clients. A clear understanding of what influences demand for agricultural insurance is vital for designing and developing appropriate insurance products, enhancing their effectiveness, increasing participation rates, and framing public policies relating to the provision of financial subsidies. The lack of historical data on relevant variables along with the complex interplay of influencing factors has frequently hampered empirical analysis and prevented researchers from finding a prescription for making agricultural insurance work at scale.

Based on the literature, we can categorize the factors influencing uptake and scaling up of agricultural insurance into four groups:

- Behavioral factors that influence farmers' enthusiasm to invest in insurance.
- Financial factors that stipulate governments' willingness to provide financial support.
- Legal and regulatory factors which set ground rules for fair business and govern their adherence by various stakeholders.
- Facilitating factors including product design and development, business models, research and development, data availability and awareness creation, which help ensure an efficient supply of insurance services.

Figure 14 provides a generalized overview of the interactions between these groups. We elaborate briefly on each.

Behavioral Factors

The farmer's decision to buy insurance is influenced by multiple interacting behavioral factors. These include:

- the type of farmer and crops grown;
- the nature of risks encountered in the past and foreseen for the future;
- awareness about the availability of insurance and understanding of the associated conditions governing insurance;
- the farmer's perception of the likelihood and frequency of the peril that the insurance product covers;
- perceptions about the utility of the insurance and the nature and level of coverage provided;
- affordability, willingness, and ability of the farmer to pay the premium;
- the availability of government subsidies on the premium and the ease with which these monies can be accessed;
- myopic thinking (the desire for immediate returns on insurance);
- the fairness of the trigger level at which payouts are activated;
- the process, ease, and speed with which claims are settled, and the fairness of the settlement process;
- ease of buying an insurance policy;
- any requirement by law to compulsorily buy an insurance policy;
- buying insurance as a precondition for obtaining institutional credit for crop production;
- the presence of an effective dispute-resolution mechanism;
- the availability of government compensation to cover post-disaster losses; and
- access to other avenues for risk coverage such as personal savings.

Financial Factors

Increasing losses from disasters and the associated burden on government budgets to provide relief to

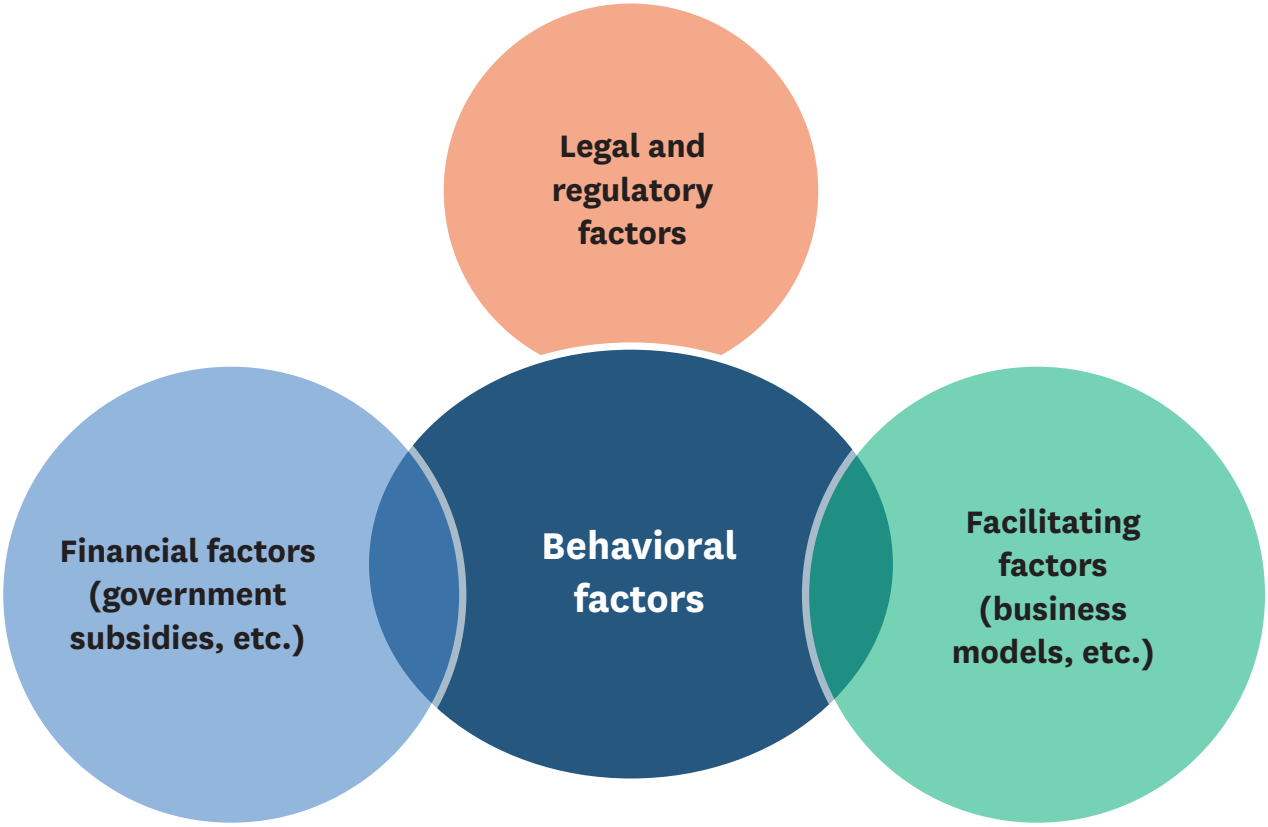

Figure 14. Factors influencing uptake and scaling of crop insurance.

those affected has been the clear driver of insurance against natural disasters in most countries. Government compensation to farmers for crop loss is provided either after the event as a lump-sum payment or in advance through facilitating the purchase of crop insurance. Based on the assumption that without financial support farmers may not buy insurance, many governments that offer it also provide extensive financial support. This includes subsidies on insurance premiums, contributions towards the administrative and operational costs incurred by private companies in delivering the insurance program, and the government's share of underwriting gains and losses. An important but unanswered question posed from a policy-maker's perspective is: Are public subsidies necessary to incentivize farmers to buy agricultural insurance? Despite rising subsidy budgets, insurance adoption rates have remained low, especially in developing countries. This raises many questions.

- What impact does the availability of subsidies have?
- What difference can it make in scaling up the adoption of agricultural insurance?
- Should governments continue to provide insurance subsidies year after year?
- If so, what level of subsidy should be provided, and does the level of premium subsidies affect insurance uptake?
- What is the price elasticity of demand for insurance, and how much premium subsidy is required to achieve a certain level of coverage?
- How does the demand for insurance change with the level of coverage provided and the nature of the insurance products?

There is a fundamental dilemma regarding subsidies for crop insurance: there is no objective rationale for the current matrix of premium subsidy rates on offer, either in total or by product and coverage level. Rather, the matrix of subsidy rates is a political equilibrium based on what society will pay. The lack of an objective basis for setting rates is not an issue until a program becomes problematic. Failure to satisfactorily address the issue of objective measurement can lead to cuts and the potential elimination of a program (Zulauf 2016).

A related financial issue that has also remained unresolved and that critically influences insurance uptake is: should the government provide ex-ante subsidies in the form of

premium subsidies or provide ex-post reimbursements to compensate for the loss due to damage? Which is more efficient and more effective, and what are the trade-offs?

Legal and Regulatory Factors

Legal and regulatory factors define the rules of the game, ensure that implementation is impartial, and safeguard the interests of stakeholders. Some factors that influence the uptake of insurance are direct, while others are less so. The direct factors include:

- the compulsory purchase of agricultural insurance by all farmers,
- a targeted group of farmers such as those in a specific zone or agro-climatic region,
- the compulsory purchase of insurance for multiple perils or a named peril such as weather and floods,
- the availability of dispute-resolution mechanisms,
- the speedy and impartial delivery of justice,
- the financial soundness of the insurance companies and other institutions involved in the selling process, and
- arrangements for underwriting financial losses through a link-up with a reinsurance company.

Indirect factors include an obligation to purchase insurance as a pre-condition to access certain facilities, such as concessional crop loans from institutional sources.

Facilitating Factors

Facilitating factors ensure the smooth conduct of the insurance business, promoting wider adoption and growth. These factors include:

- appropriate and differentiated product development aligned to the needs of farmers;
- research and development support to facilitate the creation of such products; and
- access to historical data on various aspects of product development, including local weather data or satellite imagery and access to time-series data on agricultural variables such as crop yields.

Facilitating factors include:

- creating awareness of the salient features of the insurance products through an appropriately designed communication strategy,
- the availability of efficient business models for sales and delivery of insurance products,
- fair and timely settlement of claims and a channel for conflict resolution, and
- a wide network of coordinated partners to ensure the availability of insurance products and services across a wide area.

Careful consideration of the influences of groups of factors, both in isolation and combined include:

- acknowledging that insurance is a complex financial undertaking,
- understanding the demand for insurance,
- developing appropriate insurance products,
- understanding impact pathways and methods for increasing product penetration,
- evaluating the soundness and profitability of insurance programs, and
- securing public support.

The use of analytical tools and incorporating notable features of different groups of factors within a cohesive modeling framework provide a basis for understanding the interplay between these factors and drawing more meaningful inferences about demand and uptake. Excluding such metrics from modeling frameworks may introduce non-trivial impacts and result in program-wide demand elasticity being underestimated.

To date, little systematic research has been undertaken to incorporate interacting sets of factors in a comprehensive analytical framework, possibly because of the complexity involved and the lack of long-time-series data. Limited context-specific empirical information is available in the literature on how some of the these factors affect insurance uptake but mostly analyzed in isolation. Recognizing that it is not wise to generalize on the basis of such results, we present a summary of evidence from the literature on the impacts of certain important factors influencing demand and uptake of agricultural insurance.

Empirical Evidence: Impact of Different Factors in Determining Insurance Uptake

Lack of empirical data on the uptake of insurance by farmers under varying underlying conditions has hampered a systematic analysis of factors that accelerate or constrain uptake of insurance. Most of the literature

has focussed on a single underlying factor on which some information could be obtained to draw conclusions about its significance in influencing uptake. In reality, several factors in isolation and in various combinations influence insurance uptake. In what follows, we give a brief summary of results obtained from some of the exercises undertaken to explain uptake.

Awareness about the Insurance Product and Clarity on the Conditions of an Insurance Contract

Lack of awareness about the range of risk-mitigation interventions and products available and those that best match farmers' needs constrains adoption levels. Based on a survey of 600 farmers in the Indian state of Tamil Nadu, Kumar et al. (2011) showed that, while almost 65% of the farmers knew about government agricultural risk-mitigation measures, only around half were aware of crop insurance schemes and products.

Failure of agricultural insurance markets to scale up can be caused on both supply and demand sides. On the supply side, the most studied issues are asymmetric and incomplete information with the resulting problems of adverse selection, moral hazard, and systemic risk. (Chambers 1989; Miranda 1991; Mahul 1999; Just et al. 1999; Bourgeon and Chambers 2003), On the demand side, the inability of farmers to precisely assess the benefits they might derive from agricultural insurance is often cited as a reason for limited demand.

Insurers or agents are sometimes unable to clearly communicate the terms and conditions of the policy to the client or, in a bid to sell an insurance product, may deliberately exaggerate the potential benefits. This can lead to a mismatch between farmers' expectations and any payout received in the event of a claim. This has a negative impact on farmers' trust and they are less likely to buy an insurance product. The Prabhakar et al. (2013) study on the effectiveness of agricultural insurance in the Philippines, Vietnam, and Malaysia identified a mismatch between compensation, insurance payouts, and farmers' expectations. Most farmers were not sure about the damage-assessment procedures adopted by the insurance companies and were overwhelmed by the claim procedures. These findings highlight the need to strengthen public awareness programs before enrolling farmers in insurance schemes. In another study, Garrido and Zilberman (2008) reported that although insurance did help farmers recover in areas where they had insurance, the claimants felt the payouts did not completely compensate for their losses.

Concurrent with the lack of clear understanding of the terms and conditions governing insurance contracts, farmers sometimes find they either have nowhere to go to resolve disputes or that available dispute-resolution channels are unsatisfactory. For example, farmers with access to agricultural insurance in the Philippines reported that although grievance-redressal mechanisms were present, the outcomes from using these mechanisms were mixed. Most rated them as unsatisfactory.

Role of Social and Economic Factors

The empirical evidence on the impact of social and economic factors suggests that they can have a significant impact on insurance uptake and scaling up. Kumar et al. (2011) reported that variables such as the gross cropped area, income from sources other than agriculture, the presence of risk in farming, the number of workers in the farm family, plus affordability and satisfaction with the premium rate significantly and positively influence the adoption of insurance. In one of the best systematic attempts to measure the determinants of crop insurance purchases undertaken in France and Italy, Enjolras et al. (2012) showed that purely agricultural indicators such as farm size and diversification were key factors for insurance purchase decisions in both countries.

A recent study by Farrin et al. (2016) set out to understand the role that factors relating to money and time played in influencing the insurance purchases of different groups of farmers in the USA. The authors found that relatively wealthier farmers spent less on insurance, choosing instead to self-insure through savings, while limited-resource farmers with low farm incomes used savings to increase insurance coverage. The longer the time a farmer factored into the decision-making process when comparing insurance versus savings for risk management, for example, considering many crop seasons rather than deciding on just one, the less important insurance became.

Another explanation for the limited interest in insurance, particularly MPCI, is that the organizational structure of farming means farmers can use other private instruments to manage risk, including product diversification, credit, and financial markets. Therefore, the potential demand for crop insurance could be lower than commonly believed (Wright and Hewitt 1994).

Premiums and Financial Subsidies

Many factors influence a potential buyer's decision to purchase an insurance product. While premium prices do influence purchase rates, their strength in swaying investment is often limited. Lower premium rates per se may not necessarily increase the purchase rate, although affordability issues may have some influence. Some studies show that individuals employ intuitive thinking rather than systematic consideration of cost versus future claims when choosing to forego insurance. They are guided by:

- simplistic decision-making rules, such as the likelihood of a disaster being lower than their threshold of concern,

- a desire for immediate returns on insurance, and
- viewing insurance as an investment rather than a protective measure.

It is difficult to convince individuals that the best return on investing in protection is no return at all. Generally, people voluntarily purchase insurance after a disaster event rather than before and often cancel their policy several years later if they have not suffered losses.

In a European study, Enjolras et al. (2012) concluded that if the potential benefits delivered by insurance overcame the cost of buying the policy, an insured farmer remained insured, even if the cover was costly.

A preliminary assessment of farmers' willingness to pay for drought insurance in China, Turvey and Kong (2010) showed that while there is a significant demand for insurance, price can be an issue. The results indicated that many farm households would transition from a no-demand state to a demand state as the price of insurance fell. This suggests that widespread adoption of insurance may require government intervention.

To understand the impact of subsidized insurance premiums and how much subsidy is required to attain a particular level of participation, geographic coverage, or total premium volume, subsidy providers need sound estimates of insurance demand elasticities that appropriately model subsidies and related effects. Despite the extensive literature on insurance demand, recent direct evaluations of aggregate demand responses to subsidization in crop insurance are surprisingly scarce. Three sets of empirical studies exist querying the impact of subsidies on the uptake of insurance. The first set shows that the availability of subsidies has a positive impact on insurance uptake, a second set draws the opposite conclusions, and a third set presents a mixed picture.

In a study on the effectiveness of agricultural insurance in the Philippines, Vietnam, and Malaysia (Prabhakar et al. 2013), it was reported that the cost of insurance appeared to be the single most important determinant of buying a policy. Most respondents, whether currently participating in insurance or not, preferred fully subsidized insurance. In Vietnam, a high proportion of enrolled beneficiaries preferred full subsidization of insurance compared to non-beneficiaries.

In crop insurance programs, policies are deliberately priced below the actuarially fair value. Glauber (2004) found that introducing heavily subsidized crop insurance policies significantly increases participation in the program. Coble and Barnett (2012) examined how subsidies and participation have changed over time in the USA. They found that while both have increased, it was not possible to attribute the increase in acres[5] insured solely to higher subsidy percentages. Nevertheless, it seemed clear that higher premium subsidies had contributed greatly to increased participation. Enjolras et al. (2012) reviewed the available literature on the subject and showed the consistent failure of private markets to operate comprehensive, multi-peril agricultural insurance sustainably in the absence of public intervention. Even with strong public support, insurance demand was not often as high as might be expected.

In contrast, in a survey of 65 countries based on agricultural insurance practices and their performance, Mahul and Stutley (2010) concluded that subsidies were not always a precondition for high adoption. High levels of agricultural insurance uptake could be found, not only for programs carrying high premium subsidy levels such as MPCI in Canada, India, and the USA, but also in countries with strong traditions of agricultural insurance through unsubsidized named-peril crop insurance and livestock insurance such as Argentina, Australia, and Germany. These survey results did not support the argument that premium subsidies are a precondition for farmers and herders to purchase agricultural insurance.

Similarly, a recent report commissioned from the United States Government Accountability Office based on elasticity estimates in the literature strongly concluded that subsidization in the Federal Crop Insurance Program could be cut substantially without significantly affecting program participation (GAO 2014).

In reviewing the impact of subsidies on insurance uptake, Woodard (2015) showed that the majority of studies have historically found inelastic demand responses or inelastic responses to expenditure on services related to the same under insurance (Goodwin 1993; Goodwin et al. 2004; Coble et al. 1996; O'Donoghue 2014; Shaik et al. 2008). Realization of the bulk of econometric results regarding high program uptake despite findings of inelastic demand have continued to puzzle researchers and policy-makers. Such conclusions can be counterintuitive on casual inspection of some programs when evaluating uptake in response to an increase in subsidization. Nevertheless, findings of inelastic demand at first glance may suggest that such programs for subsidizing insurance accomplish little (Woodard 2015). In developing countries, however, where farmers have little ability to pay insurance premiums, some of the evidence shows that subsidized insurance, in the short to medium term, does provide a stimulus for uptake of crop insurance.

[5] 1 acre = 0.40 hectares.

Conclusions and Way Forward

Weather index insurance, of which IBFI is a type, is an important risk-transfer innovation that can minimize the long-term impacts of floods faced by smallholder farmers in flood-prone areas. This report offers a framework to understand the challenges of a business model for IBFI, with a focus on insurance product development and market development. The product development side focuses on the set of activities, mechanisms, and relationships for the development and provision of the product to create value. The market development aspect focuses on the activities, mechanisms, and relationships that enable effective uptake of a product to capture its value. With a focus on these two aspects of IBFI, the report makes use of case studies to analyze and examine the challenges in the provision and uptake of IBFI among small-scale and marginal farmers.

While the potential benefits of IBFI are great, uptake and its implementation are challenging. The following recommendations are offered for the development and dissemination of IBFI products.

1. Improve data quality and availability

Accurate and timely weather data are key to successful index insurance products. The relatively high cost of private weather data services constrains the potential for scaling up insurance purchases. Infrastructure and multiple services for data must be provided.

2. Increase client awareness on index insurance

Smallholder and marginal farmers often do not understand the benefits of insurance, and even when they do often cannot afford it. Therefore, index-based insurance programs should include awareness raising, initial training, and an overall, continuous approach to capacity development. When farmers understand the use of index-based insurance as a risk-reducing investment, they are better positioned to know when and how to make a claim and have more realistic expectations.

3. Capacity development

It is crucial to support technical assistance initiatives and build capacity among regulators, insurers, farmer's associations, financial service providers, and clients. This training and awareness-building should start early in the pilot stage and continue throughout product launch and evaluation.

4. Monitor and evaluate the products to promote

Thorough monitoring and evaluation exercises need to be undertaken regularly to ensure effective learning and adaption. All products require ongoing review and development to continuously adapt to new risks posed by climate change, advances in technology, consumer needs, the availability of better data and information, and methods for keeping the product simple for consumers.

5. Engaging the private sector

Even when farmers can afford an IBFI product, insurers are not always prepared to offer them. For nearly all cases examined, private insurers were not the first to offer index-based insurance. The public sector, multilateral agencies, and NGOs appear to have taken the lead. This is perhaps because private insurers are constrained by the 'first mover' problem.[6] A key highlight of this study is that a strong PPP is needed to manage and scale up an IBFI product among farmers. Therefore, engaging the private sector from the beginning plays an important role in scaling up any product.

6. Facilitating the insurance scheme

The many hurdles indicate that a facilitating role played by NGOs, donors, and others is required to make index insurance accessible. For scaling up, governments and donors will need to intervene more actively as enablers and facilitators to support sector development.

7. Promote an enabling legal and regulatory framework

There are many hurdles in establishing index-based insurance programs that make spontaneous, market-driven development difficult. In nearly all cases, the initial challenges of missing public goods and resources and inadequate insurance laws and regulations pose a problem. Having local stakeholders in the lead is critical, especially to overcome the initial challenges and build client capacity.

8. Operational challenges of reaching the end-users

One important innovation in scaling up IBFI is bundling it with other products and services to reduce costs and align incentives. When insurance is tied to credit or farm inputs, the credibility of the supply system affects the perception of the entire package. Therefore, it is important to involve private actors to scale up adoption effectively.

9. Access to risk-transfer markets

Reinsurance support is critical for many meaningful index-based insurance developments, and it is a crucial condition for scaling up. It can be a business driver as reinsurers are ready to take on a significant amount of risk. This practice will allow insurers to earn commissions without tying up capital, unlike in typical insurance where reinsurers require a retention level of at least 15% of the risk to avoid moral hazard.

[6] Firms who are the first to enter a market with a new product (i.e., first-movers) can gain substantial market share due to lack of competition, sometimes their efforts fail.

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Appendix 1. Glossary.

Actuarial premium rate: An estimate of the expected value of future losses, generally based on historical loss data.

Adaptation: Adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate potential damage or to benefit from opportunities associated with climate change.

Crop cutting experiments: An assessment method employed by governments and agricultural bodies to estimate the yield of a crop or region during a cultivation cycle for randomly selected plots of land.

Index insurance: Payout benefits are triggered by a predetermined index (like rainfall) for agricultural production losses due to weather and catastrophic events. Possible indices include rainfall, yields, or vegetation levels measured by satellites.

Micro-insurance: Micro-insurance products offer coverage to low-income households and individuals with little savings. It is tailored specifically for lower valued assets and compensation for losses.

Microfinance institutions: Microfinance institutions provide loans to low-income clients, including micro-companies and the self-employed, who traditionally lack access to mainstream sources of finance from banking institutions.

Multi-peril crop insurance: Protects against crop yield losses by allowing participating producers to insure a certain percentage of historical crop production. A single policy protects crops against all natural perils including adverse weather, fire, insects, disease, wildlife, earthquake, volcanic eruption, and failure of irrigation water.

Premium: The cost of an insurance policy.

Reinsurance: Insurance taken out by an insurer who is unwilling or unable to carry all the risk.

Risk transfer: Shifting the burden of financial loss to another party through insurance, reinsurance, legislation, or other means.

Appendix 2. Case Studies of Agricultural Insurance Programs.

In this Appendix, we present a brief review of experiences with some existing index-based insurance products applied in different parts of the world, notably in developing country settings. The choice of these case studies was in part influenced by the inherent nature of the underlying business model. Broadly speaking, the ten case studies reviewed can be classified according to the type of the business model considered.

Micro-model studies that directly cater to farmers and where farmers directly obtain insurance through any channel which might be based on credit from the bank or any input from the suppliers. The bank, NGO, and MFI input suppliers make no insurance contract on behalf of the farmer.

Meso-model studies where intermediaries are required to help pool the risk of a group of farmers. Intermediaries like banks, NGOs, and MFIs obtain an insurance contract from the insurance provider.

Macro-model studies where risk pooling occurs at a much larger scale and is usually taken up through government interventions.

Table A2.1 lists the ten case studies reviewed classified according to the nature of the business model considered. Of the ten case studies, four are based on micro models, three on meso models and three on macro models. The case studies are drawn from Asia, Africa, and Latin America.

Table A2.1. Case studies reviewed.

Study number	Case study and country	Type	Selection criteria
C1	PepsiCo's contract farming program for potato growers in India	Micro model	This case was reviewed since there is involvement of private parties in the micro-model setting.
C2	Harnessing mobile technology to deliver insurance in Kenya, Rwanda, and Tanzania	Micro model	This variant of the micro model includes the use of mobile technology for insurance delivery, which is particularly useful for farmers not dependent on institutional credit and can be linked to insurance through the purchases of inputs such as fertilizers.
C3	Drought weather insurance to safeguard crops in Malawi (e.g., groundnuts, maize, and tobacco)	Micro model	This micro model is another variant of directly linking farmers to insurance through the purchase of inputs such as high-quality seeds. The operationality of the model requires intermediaries such as Farmers' Clubs.
C4	Insurance for climate shocks in Ethiopia, Malawi, Senegal, and Zambia	Micro model	Another innovative variant of the micro model where farmers can pay for insurance through an insurance for assets (IFA) scheme that engages them in risk reduction activities. IFA schemes are built into government safety net programs or World Food Programme (WFP) Food Assistance for Assets initiatives.
C5	Satellite and weather station-based insurance in Rwanda	Meso model	This model includes the use of both satellite data and weather station data for developing indexed insurance. The model was reviewed since IBFI includes integrating satellite data with meteorological data for developing index-based insurance.
C6	Index-based insurance for rainfall in India	Meso model	This is a successful indexed insurance scheme in India through a private insurance company and an NGO.

Continued

Table A2.1. Case studies reviewed. (Continued)

Study number	Case study and country	Type	Selection criteria
C7	Weather-based insurance for drought management in Thailand	Meso model	This case study involves a meso model where banks provide loans to farmers and loanee farmers get access to loans. The bank makes the insurance contract on behalf of the farmers.
C8	Index-based insurance in Brazil	Macro model	This model covers all extreme weather events for a specific crop (maize).
C9	Index-based insurance for rainfall in Mexico	Macro model	This is a more complex model covering all extreme weather events for different crops.
C10	Index-based livestock insurance in Mongolia	Macro model	This case study was reviewed to understand the workings of the model and how the government can pool risk and provide insurance for allied agricultural activities (livestock rearing) in Mongolia.

C1: PepsiCo's Contract Farming Program for Potato Growers in India.

To secure a supply of potatoes for potato chips, PepsiCo started a contract farming program in India in 1995. By 2008, it was contracting approximately 10,000 potato farmers in Punjab, Uttar Pradesh, Bihar, West Bengal, Himachal Pradesh, Maharashtra, Tamil Nadu, and Karnataka. The volume of potatoes sourced from this program increased to account for 60% of PepsiCo's total demand.

Under its contract farming arrangement, PepsiCo requires contracted potato farmers to use a specific variety of high-quality potato seed but offers an extensive package of services. It distributes fertilizer, provides access to pesticides, and sells the seed to farmers at cost. It also gives farmers technical advice on production practices through a network of agronomists, extension workers, and local facilitators.

As part of wider efforts to establish long-term relationships with farmers, PepsiCo added index-based insurance to its contract farming package. This was aimed at limiting the risk to farmers and reducing the risk in its supply chain posed by late blight disease. Index-based insurance was appealing to the company because the national area-yield insurance was not considered sufficiently transparent, and its record in India had been poor.

PepsiCo worked in partnership with Weather Risk Management Services (WRMS) and ICICI Lombard General Insurance Company to develop the product. It was designed to cover severe potato crop losses caused by late blight disease. Minor losses could be avoided through better farming practices. Late blight disease can spread easily under conditions of high moisture levels from rain, dew, irrigation, or humidity greater than 85%, coupled with moderate temperatures (night temperatures of 10-15 ˚C and day temperatures of 15-21 ˚C). Consequently, the insurance program is based on a disease index, incorporating both humidity and temperature levels.

Roughly 95% of the contracted farmers who elected to purchase insurance in 2008 were driven by price and the requirement to be loanee farmers to buy insurance. Approximately 50% of those insured by the program were smallholders owning less than five acres of land. In Punjab, where relatively few farmers need to take out loans for production costs and have no requirement to purchase insurance, about 75% of farmers still chose to buy. In Maharashtra, where index-based insurance is compulsory for loanee farmers, 1,500 farmers purchased it. Of the 1,500 PepsiCo farmers in Karnataka, about 75% chose to purchase insurance.

Operational setup

As an integral part of the PepsiCo contract farming program, WRMS installed weather stations to gather data and manage the insurance aspect of the program. It charges PepsiCo a commission of 5% of the premiums. The locations of the weather stations were carefully chosen to minimize basis risk. WRMS bore the costs of installing the new infrastructure, recovering this investment through the revenue generated by the insurance program and the sale of services to other companies and commercial farmers. WRMS has so far installed 250 weather stations in India and is planning to add more.

The premium for index insurance in the PepsiCo program is INR 1,500/acre (USD 30/acre), approximately 3%–5% of the sum insured (INR 25,000–30,000/acre or USD 500–600/acre). The product is structured to cover losses above 40% of yield, with farmers covering losses up to this point through various risk-coping mechanisms. The maximum payout is equal to the cost of production plus a little extra to include family farm wages and opportunity costs.

Payouts for late blight disease are triggered if crops experience consecutive days of average relative humidity greater than 90% and an average temperature of 10–20 ˚C. A frost index was subsequently added, which triggers payouts when the temperature falls below 1–2 ˚C. The program has been effective in settling claims quickly, lowering the settlement time from an average of six to eight months to a maximum of two months from the end of the covered period.

Business model: PepsiCo's contract farming scheme in India.

Partners	Activities	Value propositions	Customer relationships	Customer segments
• PepsiCo • ICICI Lombard General Insurance Company • Weather Risk Management Services	• Setting up weather stations • Data generation through the weather stations • Designing the index through proxy weather parameters • Marketing • Buy-back incentive	• PepsiCo offers farmers a base buy-back price and additional price on insurance purchases (INR 0.15/kg) • Higher yields of 11–14 tons/acre through improved inputs from PepsiCo • Sustainable supply of potatoes for PepsiCo • Revenue generation to WRMS (5% on premium) and data services sold to newspapers, Reuters news service, and television channels	• Personal assistance	• Farmers
	Resources • Generation of meteorological data • Human resources • Documentation of farmers		**Channels** • Direct sales	

Cost structure	Revenue streams
• Premium cost to a farmer is USD 30/acre • Establishing and maintaining weather stations • Training and educating farmers by PepsiCo • Underwriting costs	• Buy-back incentive • Generation of weather data • Maintenance of supply chains for PepsiCo

Social costs	Social benefits
• Basis risk calculations need to be more specific, otherwise insurance companies will have a high loss ratio	• Sustainable livelihoods • Use of good agricultural practices

C2: Harnessing Mobile Technology to Deliver Insurance in Kenya, Rwanda, and Tanzania.

In Kenya and Rwanda, over 96% of agricultural land is rainfed and vulnerable to erratic rain and drought. Mitigating weather-related risks for small farmers is, therefore, an important tool for unlocking credit. *Kilimo Salama*, meaning Safe Agriculture, was the first agricultural insurance program worldwide to reach smallholders using mobile technologies. It was launched in 2009 in Kenya, Rwanda, and Tanzania, through a partnership between Syngenta Foundation for Sustainable Agriculture, Switzerland, and telecoms operator Safaricom, Kenya.

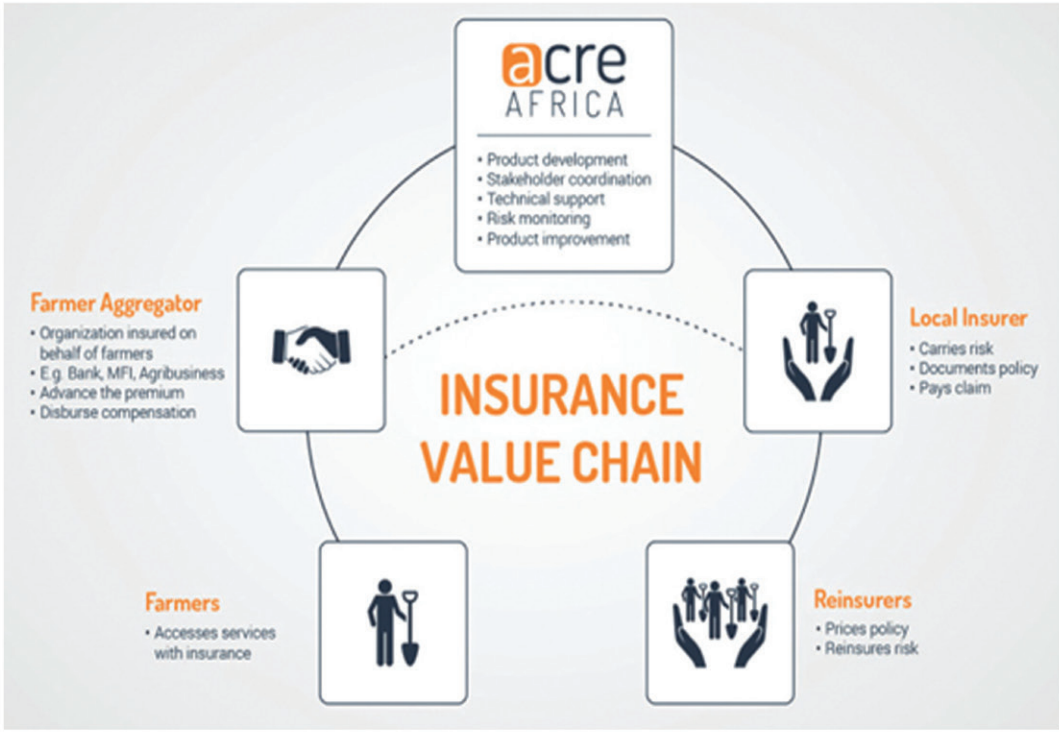
By 2013, 187,467 farmers were covered under the insurance program (67,607 in Kenya, 115,550 in Rwanda, and 4,310 in Tanzania). The total insurance portfolio stood at USD 2.3 million, with insurance payments of USD 370,405. In 2014, the Syngenta Foundation established the Agriculture and Climate Risk Enterprise (ACRE), a for-profit company that evolved from *Kilimo Salama*. Working with local insurers and other stakeholders in the agricultural insurance value chain, the aim was that ACRE would advise on protection for African smallholders and continue to reduce the burden of weather and other risks for them.

Operational setup

As a for-profit company, ACRE acts to link farmers to insurance products so they can confidently invest in their farms (Figure A2.1). Using its actuarial and product development expertise, it helps local insurance companies add index-based products to their portfolios. These products are tailored to suit specific markets through collaboration with local agricultural organizations. ACRE's main insurance products are based on weather, area yield, and satellite indices. Crops insured include maize, sorghum, coffee, sunflowers, wheat, and potatoes, with coverage provided against drought, excess rain, and storms.

Farmers can trial insurance by insuring as little as one bag of seed. Insuring one acre of maize against drought costs a farmer USD 37 or 10% of the harvest value. Any payout is transferred to the farmer's mobile phone wallet at the end of the season. The program has increased access to finance and resulted in higher investments by farmers. A 2012 impact study reported that insured farmers invested 19% more and earned 16% more than their neighboring uninsured counterparts. The study noted that 97% of the farmers insured by ACRE received loans linked to their insurance; 177,782 farmers received USD 8.4 million in financing due to the agricultural insurance.

(a)



(b)

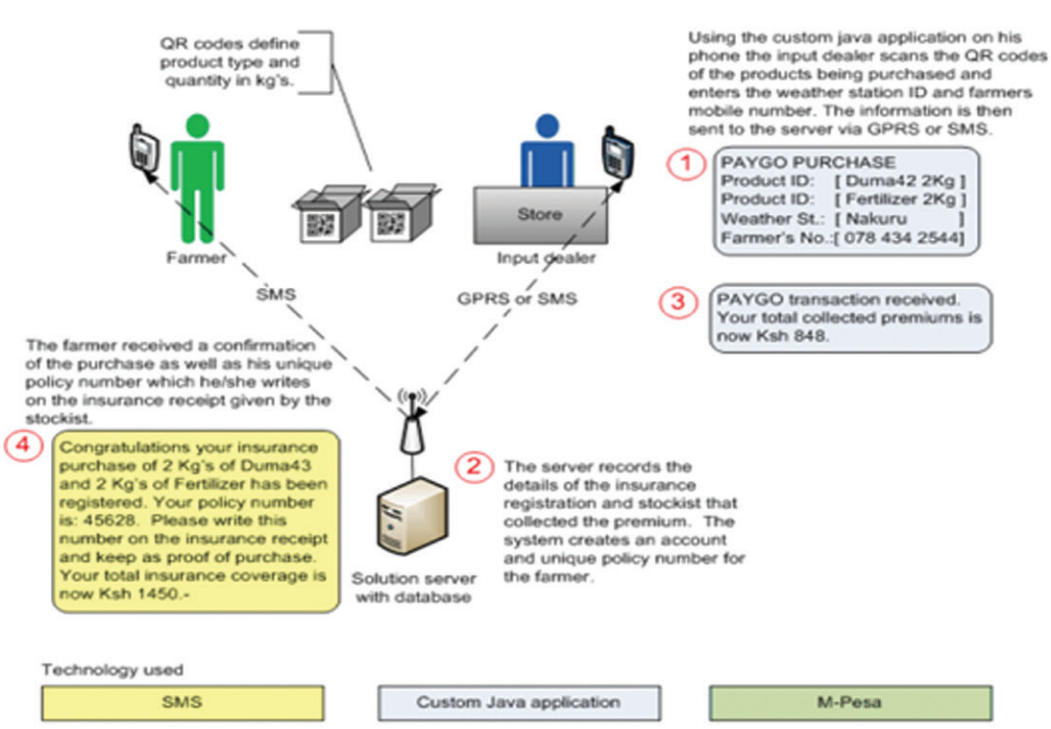


Figure A2.1. ACRE links between farmers and insurance products.

Sources: (a) ACRE, Africa; and (b) Syngenta Foundation for Sustainable Agriculture, Switzerland.

Business model: Insuring farmers against weather risks in Kenya, Rwanda and Tanzania.

Partners

- Syngenta Foundation for Sustainable Agriculture
- Global Index Insurance Facility (GIIF)

Insurers:
- UAP Insurance (Kenya), APA Insurance (Kenya), SORAS Insurance (Rwanda), Century UAP (Tanzania)

Reinsurers:
Swiss Re, Africa

Channel partners:
Seed distribution linked to a mobile network operator's location service; agribusinesses with out-growers or contracted farmers; lending institutions and savings and credit cooperatives providing input loans, and medium-scale professional farmers

Activities

- Data generated from weather stations
- Satellite-based meteorological data

Resources
- Generation of meteorological data and its procurement by the insurance company
- Human resources
- Communication channels through which farmers can be educated
- Documentation

Value propositions

- Low average cost of insurance; 5–25% of value of insured inputs or harvest
- More investments by farmers in agricultural and allied activities (increased by 19%)
- Increase in income for farmers (about 16%)
- Increase in opportunities for access to credit
- Reduced risk to microfinance agencies and lenders of agricultural credit

Customer relationships
- Personal

Channels
- Indirect through input purchases by the farmers
- Contracting
- Lending institutions and credit cooperatives

Customer segments
- Farmers

Cost structure
- Cost incurred for maintaining the database on the weather contracts
- Commission costs put forward to the agro-dealers
- Costs incurred due to payouts

Revenue streams
- Premiums paid through the purchase of inputs

Social costs
- Farmers who do not purchase inputs from authorized agents are not included in the insurance program

Social benefits
- For farmers, better access to credit, better access to inputs, and better livelihoods
- For agro-dealers, market expansion
- For insurance companies, increased market share in the rural economy
- The government has had to invest less in establishing a safety net for its vulnerable populations

C3: Drought Weather Insurance to Safeguard Crops in Malawi (e.g., Groundnuts, Maize, and Tobacco).

In 2004, the National Smallholder Farmers' Association of Malawi (NASFAM) wanted to expand its operations and develop Malawi's groundnut market domestically and for export. It was perceived that farmers would achieve a higher-value output by using costlier but good-quality groundnut seeds. To realize these potential benefits, farmers needed financing and a way to reduce crop risk from drought. However, financial institutions were not ready to provide loans because of the high risk to their businesses posed by drought. A major drought in 2004 and 2005 meant lenders could recover only 50–70% of loans, and one major bank lost USD 110,000 to smallholder farmers. Two other MFIs stopped lending to agriculture because of the losses they incurred.

The Commodity Risk Management Group of the World Bank, in close collaboration with NASFAM, developed an index-based crop insurance plan to increase access to credit facilities and protect both farmers and loan providers from weather risks. In 2005, the insurance was offered to farmers as a pilot program in Kasungu, Lilongwe North, and Chitedze. The insurance was initiated for groundnut and later extended to include maize. From 2007 onwards, the focus shifted to insuring cash crops such as tobacco (Table A2.2). In 2012, 1,100 farmers were insured. The highest loss ratio (the proportionate relationship of incurred losses to earned premiums expressed as a percentage) so far has been 14%. However, in the event of a catastrophe, the loss ratio is anticipated to go up.

Table A2.2. Expansion of Malawi's drought-linked weather insurance.

	2005–2006	2006–2007	2007–2008	2008–2009	2009–2010
Insured crops	Groundnuts	Groundnuts and maize	Tobacco	Tobacco	Tobacco
Number of weather stations	4	5	2	3	2
Number of insured farmers	892	1,716	605	2,606	706
Sum insured (USD)	40,000	110,000	308,000	2,543,345	712,521
Premium rates	5–7%	5–14% (Maize high)	5%	5%	5%

Operational setup

The insurance program was based on data collected over 30 years from 21 weather stations operated by Malawi Meteorological Office. It was assumed that all farmers within a 20–30 km radius would be similarly affected. The insurance contract was bundled with a loan to farmers that covered the cost of high-quality seeds. The sum insured is the loan amount and the interest payable. Payouts are automatically made to the bank at the end of the contract if the index hits the specified drought threshold (Figure A2.2).

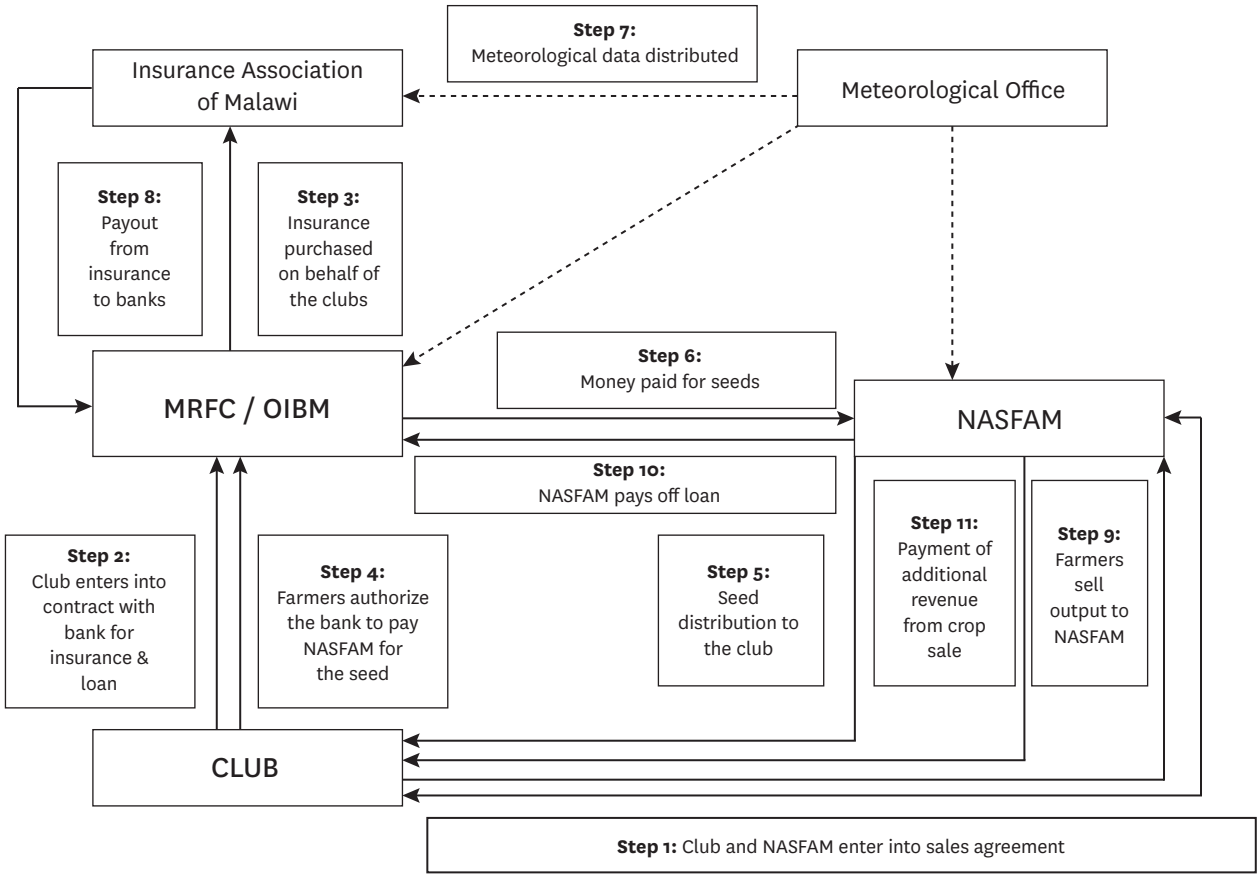


Figure A2.2. Operational setup of Malawi's drought-linked weather insurance.

Notes: MRFC – Malawi Rural Finance Company; OIBM – Opportunity International Bank of Malawi; NASFAM – National Smallholder Farmers' Association of Malawi.

Business model: Drought-linked weather insurance in Malawi.

Partners	Activities	Value propositions	Customer relationships	Customer segments
• Commodity Risk Management Group of World Bank • Insurance Association of Malawi • Malawi Rural Finance Company (MRFC) • Opportunity International Bank of Malawi (OIBM) • National Smallholder Farmers' Association of Malawi • Department of Climate Change and Meteorological Services	• Data generated from the meteorological office in the production area • Banks provide loans to pay for insurance • Calculation of the sum insured linked to three crop growth periods **Resources** • Generation of meteorological data • Human resources • Communication channels with farmers • Marketing channels for produce	• In the case of drought, farmers receive loan relief • Reduced risk to farmers through investments in high-value crops • Insurance Association of Malawi receives the cost of the insurance from the loan proceeds • Risk of default on bank loans reduced	• Personal **Channels** • Direct	• Farmer groups • Members of the clubs

Cost structure	Revenue streams
• Administrative costs, operational costs • Payouts during failures	• Revenue generation of the intermediaries (MRFC/OIBM) through commissions received from insurers • Revenue of the insurer through the sale of insurance and collection of premiums

Social costs	Social benefits
• Increase in transaction costs for farmers in the short-term	• For farmers, better access to credit and inputs • For banks, secured lending and expansion of their portfolios

C4: Insurance for Climate Shocks in Ethiopia, Malawi, Senegal, and Zambia.

Research suggests that 1.3 billion people live on less than a dollar a day, depending on agriculture for their livelihoods. Vulnerability to climate-related shocks is a constant threat to their food security and well-being. As climate change increases the frequency and intensity of shocks, the challenges faced by food-insecure farmers also rise.

In 2009, Oxfam America, Relief Society of Tigray (REST), Swiss Re Group, and partners developed a holistic risk-management framework to enable poor farmers in Ethiopia's drought-prone northern state of Tigray to strengthen their food and income security through community climate-resilience projects. A pilot project was initiated as the Horn of Africa Risk Transfer for Adaptation (HARITA) project.

In 2011, WFP and Oxfam America launched the R4 Rural Resilience Initiative (R4), building on the initial success of HARITA. The aim was to transfer lessons learned in Ethiopia to other countries. The program grew from 200 Ethiopian farmers in the original 2009 HARITA pilot to over 24,000 participants in Ethiopia and 2,000 in Senegal in R4 in 2014. Implementation of R4 in Malawi and Zambia started in 2015. Across these countries, it now reaches over 32,000 vulnerable farmers and their families (Table A2.3).

Operational setup

R4 is provided as a bundled risk-management product where index-based insurance is used to transfer risk. Other components include the development of individual or group reserve savings, the creation of climate-resilient assets, and the creation of credit channels to boost livelihoods. The risk transfer component of R4 enables the poorest farmers to purchase agricultural insurance. It has been one of the most successful efforts to scale up weather index-based insurance based on a rainfall index highly correlated to local yields.

Satellite rainfall indices are used to calculate losses from extreme weather for crops including teff, beans, maize, wheat, barley, sorghum, and millet. Payouts are triggered when limits defined in the index are breached rather than based on actual yields, thereby eliminating the need for assessments on the ground. Receiving compensation for weather-related losses means farmers can avoid selling productive assets and recover faster from droughts. Having a predictable income reduces the use of negative coping strategies and encourages rural households to invest in activities and technologies with higher rates of return. The insurance also serves as collateral to obtain credit at better rates.

Table A2.3. Expansion of the HARITA/R4 Rural Resilience Initiative, 2009–2016.

	Year								
	2009	2010	2011	2012	2013	2014	2015	2016	2017
Payouts			17,000	320,000	24,000	38,000	445,000	74,000	1.5 million
Value of premiums	2,500	27,000	215,000	275,000	283,000	306,000	370,000	781,000	1.1 million
Total sum insured	10,200	73,000	940,000	1.3 million	1.2 million	1.5 million	2.2 million	5.1 million	6.6 million
Farmers insured	200	1,300	13,000	18,000	20,000	26,000	32,000	42,000	57,000
Country	Ethiopia	Ethiopia	Ethiopia	Ethiopia Senegal	Ethiopia Senegal	Ethiopia Senegal	Ethiopia Senegal Malawi Zambia	Ethiopia Senegal Malawi Zambia	Ethiopia Senegal Malawi Zambia

The R4 Initiative attributes its success in part to the strength of its institutional partnerships. The project directly engaged organizations at all stages of the process, including farmer groups, governments, banks, MFIs, local insurers, research institutions, and international reinsurers. R4 targets poor smallholder farmers who were previously considered uninsurable due to poverty, lack of education, data limitations, and remoteness. To overcome the liquidity constraint, poor farmers have the option of paying premiums in cash or through insurance for work (IFW) programs. In Ethiopia, the IFW scheme is built into the government's Productive Safety Net Programme. In other countries, it is built into the WFP Food Assistance for Assets initiatives.

Business model: R4 Rural Resilience Initiative in Ethiopia, Malawi, Senegal, and Zambia.

Partners	Activities	Value propositions	Customer relationships	Customer segments
• Oxfam America • Swiss Re • World Food Programme • Local partners in each country (includes MFIs, farmer organizations such as REST and Organization for Rehabilitation and Development in Amhara [ORDA], credit cooperatives, ministries of agriculture, meteorological departments, insurance companies, and regulators)	• Strong networking of MFIs, farmer organizations, and credit cooperatives • Training and education **Resources** • Generation of meteorological data and procurement by the insurance company • Human resources • Farmer groups, microfinance organizations at grassroots level • Maintaining records of labor for insurance	• Asset creation (risk reduction) • Insurance (risk transfer) • Livelihoods diversification and microcredit (prudent risk-taking) • Savings (risk reserves)	• Personal assistance **Channels** • Direct sales	• Farmers

Cost structure	Revenue streams
• High transaction costs in maintaining the network of institutions • Administrative and operational costs	• Income generation through premiums paid

Social costs	Social benefits
• Increase in transaction costs for farmers in the short term	• Along with insurance benefits, there is a bundled approach toward access to credit and resilience (with extra savings) • Safeguarding and generation of livelihoods and incomes • Creation of social assets which increase environmental resilience

C5: Satellite and Weather Station-based Insurance in Rwanda.

Agriculture is the main economic activity in Rwanda, with 90% of the labor force engaged in the sector. The sector meets 90% of national food needs and generates over 70% of the country's export revenues. However, much of the agricultural land is rainfed, with little or no irrigation available. Over 68% of Rwandan land is on hillsides with a slope greater than 16%. Most agricultural activities are by non-commercial smallholders. These farmers are subject to crop damage from a variety of adverse weather conditions and, as a result, are largely excluded from access to finance. With minimal investment possible, they suffer from reduced yields and ongoing food insecurity.

In November 2010, the International Finance Corporation's Global Index Insurance Facility (GIIF) provided a grant to MicroEnsure to incentivize it to design new and affordable indexed-based insurance products, develop an effective distribution network to extend outreach to low-income farmers, and scale up agricultural index-based insurance into a commercially viable and sustainable product. MicroEnsure launched its operations in Rwanda in 2010. The total number of clients served as of 2013 amounted to 35,134, with an insurance portfolio worth USD 1.4 million and insurance payments of USD 15,396.

MicroEnsure designed insurance products to cover Irish potatoes, maize, rice, and cotton crops against dry spells and excess rainfall. Some products were designed to provide coverage against flooding by indexing drainage basins. It designed satellite-based and weather station-based insurance products. In Rwanda, MicroEnsure operates two main weather index-based insurance products, a weather station-based product and a satellite-based product. Both insure against dry spells and excess rain.

Operational setup

With the weather-station based product, cumulative rainfall is measured daily over a predetermined period (typically between 30 and 45 days) to insure against the effects of dry spells. If the cumulative rainfall is below a set threshold for the period, a payout is made. Rainfall is measured daily for the insured period. If the cumulative rainfall for a set period (typically three days) is below the predetermined threshold, a payout is made. With the satellite-based product, cumulative rainfall is measured over several consecutive decades (typically three for dry spells and one for excess rainfall). If rainfall is below or above the normal level for the period, a payout is made.

The weather station-based products measure rainfall at a single location, and farmers are eligible to be insured provided their farms are within a set radius of that location. Satellite-based products estimate rainfall within a given area, which typically gives a better average than weather station-based products. For both weather and satellite products, payouts increase according to the severity of the weather event, typically providing an additional percentage payout of the sum insured for every percentage point of rainfall below or above the threshold.

The weather index insurance scheme enabled the Kenya Commercial Bank to increase its agricultural portfolio in Rwanda from 1,600 farmers in 2012 to 6,400 in 2013, with the lending amount increasing from USD 108,000 to USD 233,000. Kenya Commercial Bank has made weather-indexed insurance (WII) a compulsory requirement for all agricultural lending. WII has also encouraged a change in investment behavior whereby investment in Irish potatoes by insured farmers generally provides returns higher than maize and rice. The sum insured for this crop increased from USD 16,000 in 2012 to USD 254,000 in 2013. MicroEnsure extended the scheme to Zambia in 2013.

Business model: MicroEnsure's WII scheme in Rwanda and Zambia.

Partners	Activities	Value propositions	Customer relationships	Customer segments
• MicroEnsure Insurers • SORAS Assurances Generales Ltd. (Rwanda), SONARWA • Focus Insurance (Zambia) Re-insurers • Swiss Re, Prima Re, Zam Re Delivery Channels • Banks, MFIs, agribusinesses such as Kenya Commercial Bank • Farmer Federations and Urwego Opportunity Bank Ministries • Rwandan Ministry of Agriculture and Animal Resources • Rwandan Meteorology Agency	• Generating data from weather stations • Generating satellite-based estimates of rainfall • Deriving the index for the insurance • Maintaining a strong network with rural banks and MFIs for the delivery channel **Resources** • Historical data for index design • Existing delivery channels maintained through rural banks and MFIs • Introduction of satellite-based products	• Increased agricultural bank portfolios • Increased investment and changed investment behavior	• Personal assistance **Channels** • Direct sales	• Farmers

Cost structure	Revenue streams
• Average cost is 9%–14% of the sum insured • Operation costs for the agency	• Higher value crops such as Irish potatoes and coffee have the potential to increase the total sum insured per farmer • Farmers take out larger loans and more insurance, improving the profitability threshold for creating a sustainable market

Social costs	Social benefits
• Higher transaction costs for organizations • Generation of meteorological data	• Commercial banks and MFIs are using weather indexed insurance as a tool to reduce their portfolio risk when lending to smallholders. This enables rural investment to increase, which provides higher agricultural outputs leading to higher incomes • Weather indexed insurance provides a safety net against the effects of adverse weather

C6: Index-based Insurance for Rainfall in India.

Indian company Bhartiya Samruddhi Investments and Consulting Services Ltd. (BASIX) provides financial and knowledge services. Between 1999 and 2001, BASIX carried out research and undertook small pilot projects to test an in-house crop insurance scheme. It had identified that risk management, particularly for rainfed agriculture, was an important 'credit-plus' service it could offer its customers.

Operational Setup

Krishna Bhima Samruddhi Local Area Bank (KBSLAB), a bank set up by BASIX, partnered with ICICI Lombard General Insurance Company in 2003 to pilot the sale of rainfall-indexed insurance contracts to smallholder farmers in Andhra Pradesh, India. The Commodity Risk Management Group of the World Bank provided technical support, and the project became the first weather insurance initiative in India and the first farmer-level weather index-based insurance in the developing world.

The first pilot of the rainfall insurance was carried out in 2003 in the district of Mahabubnagar. It covered 140 farmers cultivating 115 acres of land, with crops including groundnuts and castor. The following year the scheme was extended to two more districts in the same state. In contrast to the first year, where data from only one weather station was available to design the index, the second year included data from five weather stations. In the third and fourth years, the number of weather stations increased to 36 and 50, and the scheme was extended to seven states. Generic weather insurance products were launched, and the customer base expanded from 6,689 to 11,716. In 2008, three other state governments, Rajasthan, Chhattisgarh, and Madhya Pradesh, permitted the launch of crop-specific weather insurance covering paddy, gram, wheat, and soya bean crops. By 2009, 34,186 clients were covered, and USD 136,555 had been collected in premiums. Some 5,046 (15%) claims had been settled, with payouts totalling USD 88,826. Figure A2.3 shows the product value chain and operational setup of BASIX insurance.

Product value chain						
Product development	Underwriting	Policy issuance and administration	Claims facilitation and claim remittance	Marketing	Sales	Investment and asset management
BASIX AND INSURER				BASIX		INSURER

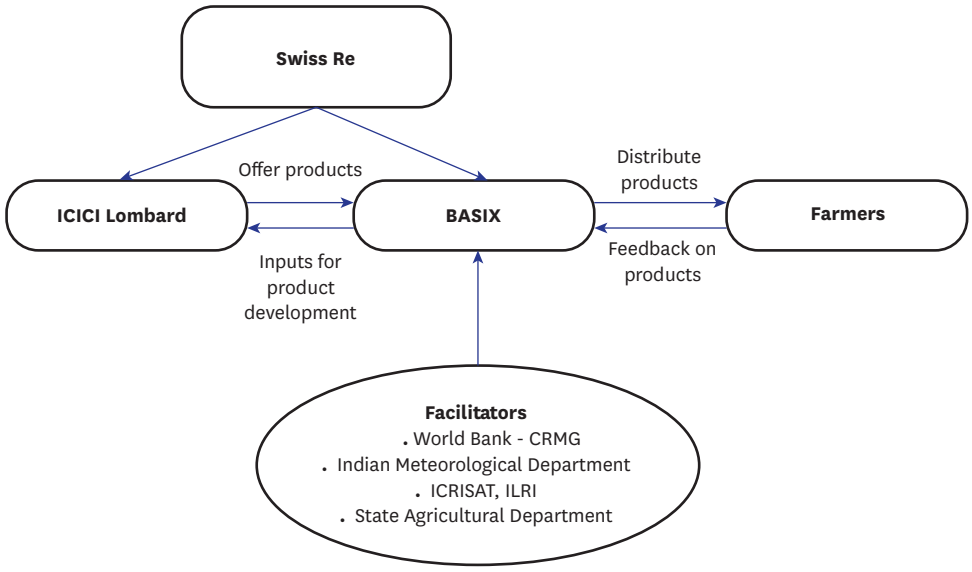


Figure A2.3. BASIX insurance product value chain and operational setup.

Notes: CRMG – Commodity Risk Management Group; ICRISAT – International Crops Research Institute for the Semi-Arid Tropics; ILRI – International Livestock Research Institute.

Business model: Index-based rainfall insurance in India.

Partners

- Krishna Bhima Samruddhi Local Area Bank (KBSLAB-BASIX)
- ICICI Lombard General Insurance Company
- Swiss Re
- Commodity Risk Management Group
- World Bank

Activities

- Rainfall data from India Meteorological Department maintained by ICICI Lombard General Insurance Company
- Training and capacity building for farmers by BASIX
- KBSLAB-BASIX provides loans to farmers to cover the premiums
- Calculation of the sum insured linked to three growing periods

Resources

- Meteorological data
- Human resources
- Communication channels through which farmers can be educated
- Documentation

Value propositions

- In case of low rainfall, farmers are given loan relief
- Farmers' risk reduced
- ICICI Lombard General Insurance Company receives its cost of insurance from the loan proceeds
- Reduced risk of default on bank loans to MFIs

Customer relationships

- Personal

Channels

- Indirect through BASIX

Customer segments

- Farmers

Cost structure

- Cost incurred by ICICI Lombard General Insurance Company in maintaining the meteorological data
- Major cost of ICICI Lombard General Insurance Company is in underwriting weather contracts
- Cost incurred by BASIX for the marketing and distribution channels

Revenue streams

- Maximum 15% income stream for the MFI
- Loss ratio of ICICI Lombard General Insurance Company is reported to be 37%

Social costs

- Increase in transaction costs for farmers in the short term
- Marketing channels

Social benefits

- For farmers, better access to credit, better access to inputs and better livelihoods
- For banks, secured lending and expansion of their portfolios
- For insurance companies, market share in the rural economy
- For BASIX, an MFI helped it to bundle the weather insurance with other insurance schemes such as for livestock
- The government has had to invest less in establishing a safety net for its vulnerable populations

C7: Weather-based Insurance for Drought Management in Thailand.

Rice paddy covers 48.7% of the total cultivable land in Thailand. However, yields are low compared with other countries due to natural disasters. Over the years, Thailand has had several crop insurance programs. Between 1978 and 1990, an MPCI program was implemented, covering cotton, maize and soybean, but was closed due to high administrative costs and loss adjustments. Subsequently, efforts were made by the government and public and private organizations to establish crop insurance for farmers facing risks from floods, heavy rains, droughts, storms, typhoons, cold weather, frost, hailstorms, and fires.

A weather index-based insurance pilot was first initiated with support from the World Bank in 2006. In 2008, Thailand's Bank for Agriculture and Agricultural Cooperatives (BAAC) signed an agreement with the Japan Bank for International Cooperation (JBIC) to develop weather indexed insurance products. The main objectives were to reduce the impacts of natural disasters on farmers and generate income by securing farms and farm products. In 2009, the scheme was pilot tested by Sompo Japan Nipponkoa in the drought-prone northeastern region. It was expanded further in 2010, with both organizations agreeing to develop the program for rice using rainfall deficits as payment thresholds.

Presently, the insurance program is working in 17 provinces of Thailand, covering farmers against early drought, drought, and severe drought (Table 2.4). Farmers who take a loan from BAAC receive the insurance. The premium is based on the amount of the loan. Farmers pay THB 1,200–12,000 of their loan for the insurance premium.

Table A2.4. Expansion of Thailand's Weather Indexed Insurance Scheme between 2009 and 2014.

Insurer	Sompo Japan Insurance (Thailand) Company Ltd.					
Year	2009 (pilot)	2010	2011	2012	2013	2014
Premium rate	4.64% of the insured premium					
Indemnity rate	40% of insured amount in case of severe drought and 15% in case of drought			5% for early drought (July 1–31) and 40% for drought and severe drought (August 1–September 30)		
Operation areas	5 districts in Khon Kaen Province	All 25 districts of Khon Kaen	Expanded to additional 4 provinces	Expanded to additional 4 provinces	9 provinces	Expanded to additional 8 provinces for a total of 17 provinces
Number of weather stations	5	34	140	235	235	388
Insured	276	1,158	6,173	849	2,863	4,320
Sum insured (USD)	287,158	466,320	2,074,950	291,450	955,550	1,640,820
Area insured (ha)	917.28	1,286.4	5,724	840	2,636	4,526.4
Premium (USD)	--	21,637.25	96,277.68	13,523.28	44,337.52	76,134.05
Indemnity (USD)	Pilot test, no payment	3,436.50	4,089.00	Early drought 12,412.00 359 farmers	Early drought 6,003.00 206 farmers	Early drought 49,445.00 1,322 farmers
				Drought 7,395.00 168 farmers	Drought 3,958.50 91 farmers	Drought 12,963.00 192 farmers

Continued

Table A2.4. Expansion of Thailand's Weather Indexed Insurance Scheme between 2009 and 2014.(Continued)

Insurer	Sompo Japan Insurance (Thailand) Company Ltd.					
Year	2009 (pilot)	2010	2011	2012	2013	2014
				Severe drought 26,100.00 207 farmers		Severe drought 14,369.50 125 farmers
Total indemnity (USD)				45,907.00 734 farmers	9,961.50 297 farmers	76,777.50 1,369 farmers
Loss ratio		15.88%	4.24%	339.47%	22.47%	100.85%

Source: Sinha and Tripathi 2016.

Operational setup

BAAC acts as a bridge between farmers and insurers. As soon as a farmer takes a loan from BAAC, a contract is issued providing insurance based on the amount of the loan. Weather-indexed insurance makes an insurance payout equivalent to 15–40% of the financing to which the insurance is subject should accumulated precipitation fall below a predetermined value for the period from July to September. The predetermined value is measured against the Thai Meteorological Department accumulated rainfall index. Sompo Japan Nipponkoa pays indemnities to BAAC, which in turn pays the requisite amount to the farmers (Figure A2.4).

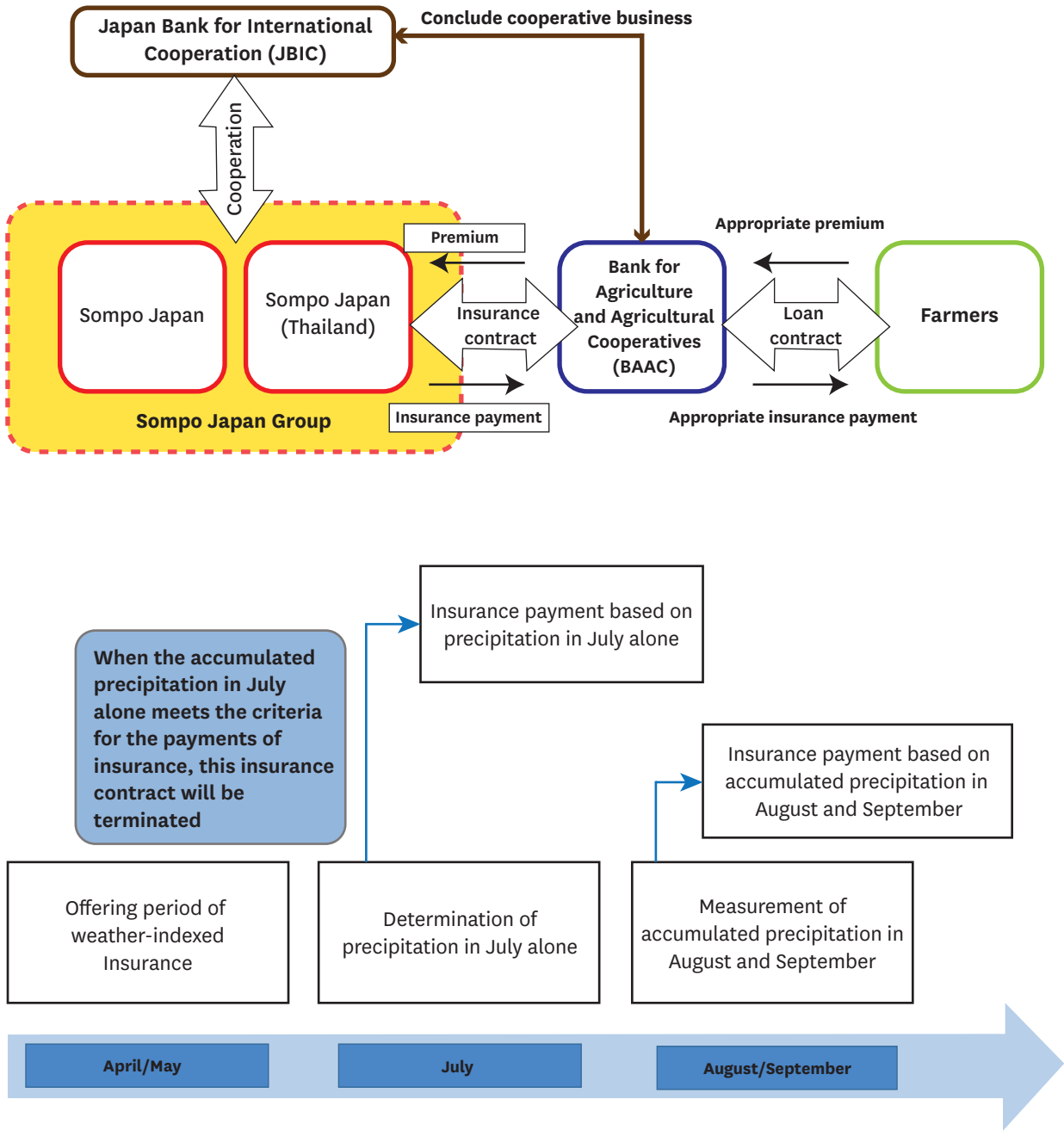


Figure A2.4. Weather-indexed insurance organization structure.

Business model: Rice weather index insurance scheme in Thailand.

Partners	Activities	Value propositions	Customer relationships	Customer segments
Policyholder · Bank for Agriculture and Agricultural Cooperatives (BAAC) Insurer · Sompo Japan Nipponkoa (Thailand) Co., Ltd.	· Deriving the loan contract and the premium · Deriving the index for the insurance · Generation of meteorological data · Premium payout if a trigger is activated	· Farmers can hedge the risk of drought conditions · Better access to loans in subsequent years	· Personal assistance	· Farmers
	Resources · Historical meteorological data		**Channels** · Direct sales	
Thai Meteorological Department Japan Bank for International Cooperation				

Cost structure	Revenue streams
· Premium: 4.64% of the insured premium (ranges from THB 1,200 –12,000) · Cost of procuring meteorological data	· Revenue stream for the insurer with a lower loss ratio

Social costs	Social benefits
· Expansion in weather data collection · Marketing channels	· Attaining a better yield to target food security

C8: Index-based Insurance in Brazil.

The State of Rio Grande do Sul in southern Brazil borders Argentina and Uruguay. It is the fourth largest state in Brazil in both area and Gross Domestic Product. However, Rio Grande do Sul suffers from weather risks, such as drought, flooding, and hail, which are exacerbated by the El Niño and its sister effect, La Niña. In South America, El Niño's high volume and intensity of precipitation cause flooding. La Niña causes insufficient rainfall resulting in extensive dry spells and drought. Both events can prompt loss of soil moisture and erosion. Farming is vulnerable to these risks, especially as almost one-fifth of Brazil's population lives in rural areas.

Since 1973, smallholders have been participating in the national subsidized *Programa de Garantia da Atividade Agropecuária* (PROAGRO) or Programme to Guarantee Agricultural Activities. Offered by Banco do Brasil and administered by Central Bank of Brazil, it is a compulsory all-risk subsidized insurance plan that exclusively covers payments for loans taken out by farmers. Besides federal agricultural programs, poor rural smallholders can take advantage of state-funded insurance.

Since 1989, the state government has implemented *Programa Troca-Troca de Sementes* (PTTS), a risk-management seed-swapping program. It is aimed at smallholder, low-income family farms of below 80 ha that derive at least 70% of total family income from agriculture. The program supplies farmers with certified seeds for maize, the main crop in the state. Payment for seed is collected at the end of the harvest, with a minimum guaranteed price set by the federal government at the beginning of the season. Extreme weather events threatened the continuation of the PTTS, and this led the state government to implement an area-yield-indexed insurance that would protect its investment in the program.

The *Grupo de Risco Municipalizado* (GRM) or Municipalized Risk Group was developed for Rio Grande do Sul in 2001. GRM is an index-based area-yield insurance product that protects the insured farmer against drought, flooding or hail causing a drop in the average municipal yield, in comparison to the historical crop yield of the area. The insurance is exclusive to PTTS farmers whose families subsist by raising poultry, swine, and cattle on maize from the PTTS program. It was launched by the state government in collaboration with AgroBrasil Seguros. AgroBrasil is a private risk-management agency supporting insurance and reinsurance markets to develop and implement agro-rural risk-management solutions in Brazil.

Between 2001 and 2008, 194,100 maize-growing families were insured (27.8% of PTTS families). More than INR 18.2 million (USD 9.1 million) in indemnities were paid to 57,778 families or 1.1% of the state's total value of maize production. The average insured area represented 4.1% of the sowed maize area, with a high point of 6.8% in 2005–2006. The total area insured was 390,095 ha. The number of families insured grew after a year with heavy claims. During these seven years of operation, GRM covered an average of 27,728 farmers per year (16.3% of the PTTS families) on an average of 55,727 ha per year.

Operational setup

A partnership was formed with the state's *Secretaria de Agricultura e Abastecimento* (SAA) or Department of Agriculture and Supply, the State Bank of Rio Grande do Sul (Banrisul), and *Companhia de Processamento de Dados do Estado* (PROCERGS), the state data-processing company. The primary objective was to design a product within the scope of PROAGRO that would protect family growers in southern Brazil. AgroBrasil used the established PTTS distribution channels to disseminate its insurance product to farmers. The insurance and reinsurance partners were selected each year based on three criteria of simplicity, comprehensiveness, and low cost.

To improve sales, AgroBrasil and SAA developed the AgroNet software program. Installed at all seed distribution points, the application cross-checked information on farmers' seed requests against insurance data for the municipality, such as the sum insured and the area-yield index of that municipality.

Through the AgroNet system, AgroBrasil exchanges information with SAA at the time of purchase. SAA then centralizes information on each municipality and submits a validated electronic report to AgroBrasil. This report is issued daily and made available on the Internet. It is accessed by technical partners, such as the ground sales team and insurers and reinsurers, who use the report to issue policies and provide financial guarantees to reinsure the risk.

Business model: Index-based area yield insurance in Brazil.

Partners

- Secretaria de Agricultura e Abastecimento (SAA)
- Companhia de Processamento de Dados do Estado (PROCERGS)
- State Bank of Rio Grande do Sul (Banrisul)
- AgroBrasil Seguros
- Brazilian Institute of Geography and Statistics
- Insurer: private actors
- Re-insurers: private actors
- PROAGRO

Activities

- Uses AgroNet software to update and validate farmers' requests for payments
- Deriving the area yield index

Resources

- Generation of yield data at municipal level and its procurement by the insurance company
- Development of the AgroNet software program
- Human resources
- Documentation of farmers

Value propositions

- Risk management of smallholders in terms of extreme weather conditions with a low premium
- Lower risk to the government of having to provide aid in case of extreme weather conditions, the cost of which is much higher than the 90% subsidy towards each premium
- Merging with the PTTS lowered the marketing and sales costs of AgroBrasil

Customer relationships

- Personal assistance

Channels

- Direct sales

Customer segments

- Farmers

Cost structure

- Premium cost to a farmer is 11–17% of the sum insured
- Marketing and sales cost of the insurance
- Costs for generating the yield data

Revenue streams

- Mainly for the farmers to insure their maize yield

Social costs

- This private insurance can be achieved only if a 90% subsidy is provided by the government. This level of financial support can be difficult to sustain

Social benefits

- Private insurers can offer coverage to low-income farmers

C9: Index-based Insurance for Rainfall in Mexico.

Mexico is highly vulnerable to catastrophic weather events causing excess rainfall and drought. These are further aggravated by the El Niño phenomenon and cyclones. Over the last 30 years, there have been over 119 natural disasters in Latin America and the Caribbean and the trend is upwards.

The agriculture sector accounts for 21% of the workforce. Traditionally, smallholder farmers have relied on informal mechanisms such as crop diversification and rotation or emergency borrowing from friends and family to manage their risks. This trapped them in a vicious cycle of poverty and limited sustainable growth. Before 2003, the majority of the poor rural population had no access to agricultural insurance. If a natural disaster occurred, they received funds from the Ministry of Agriculture's *Programa de Atención a Contingencias Climatológicas* (PACC), i.e., the Climate Contingencies Programme, a subsidiary of the National Disaster Fund.

A small-scale pilot project was carried out in 2002 which insured 75,000 ha of maize and sorghum against drought in regions of Guanajuato State. Based on a rainfall index drawing data from five weather stations, the insurance was designed and implemented by the government-owned national insurance institution AGROASEMEX. Later, some regions from Puebla State were also incorporated, and coverage was extended to barley. The insured area, the number of weather stations, and the sum insured increased. By 2008, approximately 800,000 low-income farmers were benefitting from the program.

AGROASEMEX still manages the program by marketing the insurance and transferring risk to the international reinsurance market. The weather index-based insurance now covers risks from drought and excess rainfall to a wider range of crops, including corn, beans, sorghum, and barley. Trigger levels differ according to the crop, region, and crop-growth stage (sowing, flowering, and harvesting).

Operational setup

This example is a macro-level model, where the entire value chain of the weather index-based insurance is regulated by government agencies. The product was developed using data from the National Water Commission (CONAGUA). This public entity manages the country's weather stations and granted access to its historical weather database and produces a weekly electronic report with rain value updates. The federal and state governments purchase the insurance product through the PACC program.

The premium depends on the degree of marginalization of the municipalities included in the portfolio. It is reported that 57% of the farmers have a monthly income of less than USD 74 and the rest earn between USD 75 and USD 222. The federal government subsidizes 90% of the premiums for highly marginalized municipalities and 70% for those with a low-to-medium level of marginalization. The remaining percentage of both is funded by the relevant state government. Before any indemnities are paid, CONAGUA is required to certify the weather data, which are sent to the international reinsurers.

PACC operational guidelines state that the minimum payout is USD 82/ha and the maximum is USD 455. Payouts are allocated according to the type of crop grown. In the case of an extreme weather event, compensation is given for up to 5 ha of land per farmer. This results in a maximum potential payout of USD 410 for smallholder farmers growing annual and perennial crops and USD 2,275 for those growing high-value crops such as fruits, coffee, and nopal (prickly pear cactus). Payouts are fixed at this rate, and the government retains any extra indemnities received.

The state governments have a list of low-income farmers eligible to receive a payout from PACC and they distribute the indemnities directly to farmers. These governments aim to deliver compensation within three months. On average, farmers reinvest 70% of payouts they receive on restarting production by purchasing agricultural supplies or enhancing their outputs through improving their facilities.

Business model: AGROASEMEX in Mexico.

Partners

- AGROASEMEX National insurance institution for the Federal Government of Mexico
- National Water Commission (CONAGUA) weather data provider
- National Insurance Commission (CNSF) regulating body
- Federal and state governments in Mexico

Activities

- Data generated from meteorological department required by the re-insurer and AGROASEMEX
- Determination of premiums under PACC program and payouts
- Purchase of insurance products by the government
- Listing of smallholder farmers by the state governments

Key resources

- Generation of meteorological data and its procurement by the insurance company
- Human resources
- Documentation of farmers

Value propositions

- In the case of low or excess rainfall, farmers are given indemnities for which they pay low premiums
- Reduced risk for farmers
- Opportunities to reinvest indemnities in agriculture in the case of a disaster

Customer relationships

- Personal assistance

Channels

- Indirect through state governments

Customer segments

- Farmers

Cost structure

- Premium cost to farmers is 10–30% of the premium depending on marginalization level
- Cost incurred by CONAGUA in maintaining the meteorological data
- Major cost of state governments in drawing up a list of smallholders
- Subsidies provided by the federal and state governments
- Average operational costs are in the range of 1.3% of the sum insured

Revenue streams

- Revenue streams for farmers from higher farm income or through the realization of payouts from insurance
- Viable for the government to buy insurance (through subsidies) and transfer risk, rather than provide disaster assistance

Social costs

- Higher investments in weather stations to be made such that basis risk is reduced. This needs to be borne by the state-owned insurance agency

Social benefits

- Financial viability is high. It has been cheaper for governments to purchase and operate insurance than to pay disaster assistance funds directly to farmers

C10: Index-based Livestock Insurance in Mongolia.

Mongolian pastoralists have been affected by several challenges in recent decades, including the country's transition from communism in 1990 to a free market economy. The collapse of communism created a complex dynamic between politics, culture, resource access, risk management, and institutional change, which has resulted in rapidly increasing inequality among pastoralists. The number of livestock roughly doubled between 1979 and 1999, with herds becoming increasingly privatized. The withdrawal of state-sponsored insurance and pastoral support services transferred the risk from the government to individual pastoralists. Urban unemployment is on the rise.

The most important climate-related shock affecting Mongolian pastoralists is the *dzud*, extreme winter weather conditions that result in high livestock mortality. This hazard occurs once every 5–8 years. Those most affected are pastoralists with herds of 100–500 animals (about 57%) and smallholder herders with less than 100 animals (28%). These herders often lack the financial resources to migrate, leaving them much more vulnerable to weather risk. They try to compensate for financial losses by working as hired laborers for wealthier herders, a strategy that usually fails. The possibility of a *dzud* winter appears to be a barrier to farmers investing in their herds and improving animal quality.

Between 1999 to 2002, there were three consecutive *dzud* years, which led to the loss of 11 million animals from over 10,000 households, representing a financial loss of USD 200 million. It raised poverty levels from 30% in 2000 to over 40% in 2004 and imposed budgetary pressure on the Mongolian government. The losses from these extreme weather events were so severe that the small agricultural indemnity insurance industry went bankrupt trying to compensate farmers and herders. The private insurance system also collapsed, destroying the risk-management systems in place. The nomadic nature of many farmers meant that high administrative costs were involved, and it was difficult to monitor individual behavior.

The Mongolian Index-based Livestock Insurance Project (IBLIP) was developed by the Government of Mongolia in 2005 with support from the World Bank. An index-based mortality livestock insurance product, it is 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 increase their resilience to extreme weather events. The number of herders insured increased from fewer than 5,000 in 2006 to around 20,000 in 2013, after which there was a decline to 10,000 in 2015. The drop in sales was mainly because of awareness when the program was scaled up in other provinces and the long travel distances required for agents to sell insurance.

Operational setup

The index used in IBLIP is the livestock mortality rate at the local level. The coverage period is from January to May when over 80% of livestock losses occur. The sales season is from April to June in the preceding year. Each June, the National Statistical Office conducts a mid-year survey and compares its findings 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.

IBLIP is unique in its formal layering approach. When livestock mortality is less than 6%, farmers are encouraged to self-insure, although support is provided through livelihood enhancement schemes. When livestock mortality is 6–30%, herders receive a payout from the Livestock Risk Insurance, formally known as the Base Insurance Product, supported by the Livestock Insurance Indemnity Pool. Livestock Risk Insurance is sold to farmers at actuarial premium rates. Usually, herders insure about 30% of the value of their herd. Reserves within the Livestock Insurance Indemnity Pool, from premiums and an insurer participation fee, are used to pay herders. Livestock losses that exceed 30% are covered by the Government of Mongolia's Catastrophic Coverage, previously known as the Disaster Response Product.

Business model: Mongolia's Index-based Livestock Insurance Project.

Partners

- Government of Mongolia
- World Bank
- National Statistical Office

Activities

- Data generated from livestock census to determine livestock mortality
- Insuring herders
- Strong monitoring and evaluation

Resources

- Generation of livestock census each year
- Human resources
- Communication channels through which herders can be educated
- Documentation
- Maintenance of Livestock Insurance Indemnity Pool & Government of Mongolia's Catastrophic Coverage

Value propositions

- Increase in the herd size of an individual herder who has insured
- Appropriate mix of species in the herd (goats and sheep are less vulnerable than cattle and horses)
- Farmers invest in their herds if they have sufficient insurance cover
- Insured households more likely to purchase productive breeds, increasing household revenue from livestock rearing
- Better income increases access to loans

Customer relationships

- Personal

Channels

- Direct

Customer segments

- Mongolian herder households

Cost structure

- Average cost of insurance was 30% of the herd value along with an insurer participation fee
- Cost incurred by the Government of Mongolia for maintaining the livestock census each year

Revenue streams

- Mainly for the farmers to reduce the livestock losses from extreme weather events
- Revenue of the insurer through the sale of insurance and collection of premiums

Social costs

- Middle-income and wealthy herd owners are likely to purchase insurance and hence increase inequality
- Where strong links exist between the local government and herder organizations, insurance coverage will likely be wider

Social benefits

- For farmers, better access to credit, better access to productive breeds, and better livelihoods

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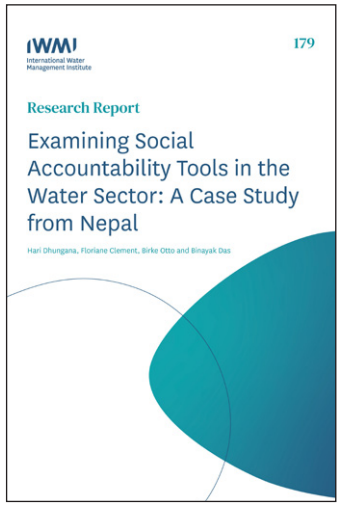

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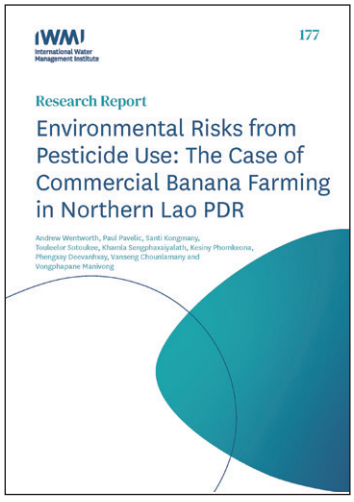

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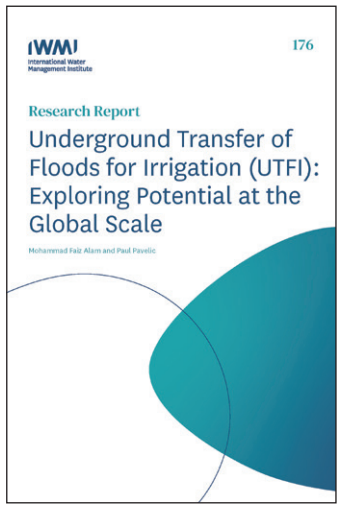

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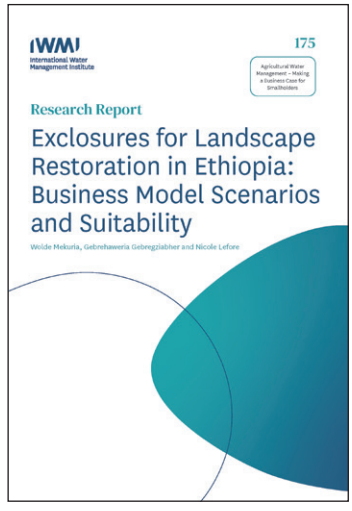

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