IFPRI Discussion Paper 02316

December 2024

What's Holding Back Private Sector Agricultural Insurance?

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Abstract

Much of the recent literature on agricultural insurance focuses on ways to increase farmers' demand for insurance, but this paper revisits the supply side of the insurance market. To better understand the conditions under which private insurance has been successful or failed the paper draws on the available empirical and theoretical literature, on case studies, and interviews with selected insurers. While there are many examples of innovative solutions to some of the product design, marketing and delivery challenges facing agricultural insurance, our review suggests that private unsubsidized insurance can only play a limited role in terms of the overall risk management needs of agriculture. Fundamentally, agricultural insurance can only address certain types of risks, and these are often not the most important from the farmers' perspective. For most farmers insurance is best seen as part of a broader risk management approach, and its relevance for commercial farmers linked to value chains can be quite different from that for more subsistence-oriented smallholders. Commercial farmers generally have the most options for managing risk and may benefit most from specific types of indemnity or index-based products to protect specific agricultural investments and there are many examples of insurers meeting this need on an affordable and unsubsidized basis. On the other hand, subsistence-oriented farmers, especially poor and vulnerable ones, need insurance that can help protect their household income and consumption from negative shocks. This kind of insurance is expensive and difficult to supply without subsidies and requires strong public sector support. Even if targeted in this way, private unsubsidized insurance will only thrive given a supporting policy environment and, to keep costs down and improve the relevance and delivery of its products, insurers need to take full advantage of new and emerging digital and remote sensing innovations, and where possible, partner with intermediaries who can bundle their insurance with credit, farm inputs and other services.

Keywords: Agricultural insurance, farmer segmentation, private sector challenge, literature review, case studies

Acknowledgements

This work received financial support from the CGIAR Initiative on Climate Resilience (ClimBeR). We would like to thank all funders who supported this research through their contributions to the CGIAR Trust Fund: https://www.cgiar.org/funders/. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

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1. INTRODUCTION

Farming is a risky business and is becoming more so with climate change. Recognizing the negative impacts risk can have on farm incomes and food security, investment, and productivity, agricultural insurance has been embraced by many policymakers around the world as an important aid for farmers. Insurance is also now included in several international policy agendas as a possible climate risk management aid for helping highly exposed poor and vulnerable populations, especially in low- and middle-income countries (LMICs). But insuring farmers, especially smallholders, against agricultural risks faces many challenges and without public intervention it is rarely offered by the private sector at any scale. While public interventions have helped scale up agricultural insurance around the world (GTZ 2021), they have been costly in terms of the financial support needed. For example, total insurance subsidies around the world currently exceed $20 billion (Hazell & Varangis 2020; GIZ 2021). Moreover, poorly designed subsidies can also distort farmers' incentives leading to inappropriate land use patterns, environmental damage, and increased dependence on future subsidies (Hazell & Varangis 2020). In an ideal world, agricultural insurance would be offered by private insurers without the need for subsidies, as happens with insurance in many other sectors of an economy. So, what is holding back private sector agricultural insurance, and what can be done to promote it without the need for high levels of financial support?

Much of the recent literature focuses on the demand side of the insurance market and on ways of designing, pricing, and marketing insurance contracts to make them more attractive and relevant to farmers (see Ali et al 2020 and Kramer et al 2022 for recent reviews). This paper revisits the supply side of the insurance market and reviews the historical and contemporary experience with unsubsidized private agricultural insurance. To better understand the conditions under which private insurance has been successful or failed we draw on the available empirical and theoretical literature, on case study research, and interviews with selected insurers. The paper is structured as follows. Section 2 reviews the literature on the factors that are thought to impact on the availability of private agricultural insurance. Section 3 reviews the extent and structure of private agricultural insurance and provides an analysis of a set of case studies. Section 4 consolidates lessons from the case studies that add to the insights available from the literature review in section 2 and section 5 contains our conclusions.

2. FACTORS IMPACTING THE SUPPLY OF PRIVATE AGRICULTURAL INSURANCE

Table 1 lists factors that have been identified in the literature as impacting on the supply of private agricultural insurance and posits hypothetical signs for their direction of impact. They are organized into four clusters: characteristics of the risks impacting on farmers and their insurability; farmers' demand for insurance; the delivery systems available to insurers; and the institutional and policy context for private sector insurance.

Table 1: Factors Impacting the Development of Private Agricultural Insurance

Factors	Hypothesized direction of impact
1. Characteristics of the risks impacting on farmers and their insurability	
Availability of objective and affordable data about the risks to be insured	+
Exposure to moral hazard and adverse selection problems	-
Frequency and severity of covariate tail end risks	-
Frequency of idiosyncratic production risks	+
Level of diversity in farmers' exposure to risk and their inherent willingness to purchase insurance	-
Possibility of low-cost index products at scales with low basis risk	+
Impact of climate change on production risks and uncertainties about those risks	-
2. Farmer demand side issues	
Farmers perceptions about risk and their willingness to bear it	+/-
Value of potential losses relative to their own wealth	+
Availability of alternative risk management aids to farmers (e.g., diversification on and off farm, savings, credit, mutual groups, family support)	-
Farmers' knowledge about and trust in agricultural insurance	+
Seasonal liquidity constraints that make payment of an upfront premium difficult	-
3. The delivery systems available to insurers	
Availability of insurers' own delivery systems	+
Availability of intermediaries who can bundle insurance with other value adding propositions (e.g., credit, inputs)	+
Possibilities for insuring groups of farmers	+
Prevalence of mobile phones and e-banking to facilitate credit and insurance systems	+
4. The institutional and policy context	
Stage of development of nonagricultural insurance (e.g., life, motor, assets) to underpin the insurance sector	+
Enabling legislation and regulation of agricultural insurance	+
Scale and experience of agricultural insurers	+
Availability of suitable data systems for designing and monitoring insurance contracts	+
Availability of reinsurance or other risk pooling mechanisms	+

Factors	Hypothesized direction of impact
Government willingness to invest in educating farmers about insurance	+
Competition from any public agricultural insurance agency or poorly targeted disaster relief payments	-
Level and type of smart insurance subsidies	+
PPPs for risk layered approaches to insurance	+

Note: +/- means the impact could go either way.
Source: Authors construction.

2.1 Characteristics of the risks to be insured

Farmers face a variety of production and marketing risks, but many are difficult to insure. Insurance works best for pooling risks that are: a) independently distributed over many individuals; b) when the underlying probability distributions are stable; c) when objective data on the risks involved are available and affordable to insurers; d) when the insured cannot influence the insured losses that occur through neglectful or deliberate mismanagement (the so called "moral hazard" problem); and e) if significant diversity exists in the risk exposure of individuals, insurers can contain costs by identifying and classifying a grouping individuals into homogenous groups who can be offered the same basic contract (Ahsan, Ali and Kurian, 1982; Nelson & Loehman 1987). Life, medical and auto insurance typically meet these requirements and are widely available from private insurers. But apart from some specific perils like accidents or theft, most agricultural risks do not meet these requirements. Fluctuations in crop yields tend to be positively correlated across space and many farmers within the same region may suffer insured losses at the same time. Much the same can happen with livestock mortality in the event of a contagious disease outbreak or a severe drought in pastoral areas. The covariate nature of these risks exposes the insurer to potentially large payouts in any one season, and this exposure is highest in regions where the frequency of extreme losses is also high. Market risks pose a similar covariate problem, worsened by the fact that they are impacted by political and economic forces that are inherently difficult to predict for insurance purposes.

On the other hand, while the more idiosyncratic production risks that vary across farms ought to be more insurable, many are hard to objectively measure (e.g., plot or farm level yields), as are the insured losses when they occur. This makes it difficult and expensive to design and price contracts for individual farms or to control for moral hazard problems, both of which can lead to sustained losses for the insurer. The risk exposure of farms is also typically diverse adding to the challenges and cost of designing contracts for individual farmers and resolution typically requires that insurers sort farmers into groups that are sufficiently homogenous in the risks they face that they can be offered the same basic contract. However, in the absence of adequate farm level information it is difficult to achieve sufficient homogeneity within groups and failure to do so can lead to the "adverse selection" problem[1]. But even when farmers can be successfully

[1] This is the problem that arises when only those farmers facing average or higher than average levels of risk in a group will purchase the insurance while lower risk farmers will opt out. This then requires that the insurer raise the premium rate to reflect the higher average risk level within the remaining group members and which in turn can lead

sorted into homogenous groups in terms of their risk exposure, they also vary widely in their ability and willingness to purchase insurance, a reflection amongst other things of the alternative options they have for managing risk, their willingness to bear risk, their knowledge about and trust in insurance, and their financial ability to purchase insurance. Since most of these attributes are also unobserved, then even when contracts can be offered to homogenous groups in terms of their risk exposure, the insurer still faces uncertainty about the level of demand for the products. Climate change is adding to all these problems by increasing the frequency and severity of production losses for many farmers and in ways that are difficult to predict for insurance purposes.

To cope with these problems, agricultural insurers have developed in unique ways compared to most other forms of insurance, but there are limits to what can be done. For example, insurers can reduce their own risk exposure to spatially covariate risks by diversifying their insurance portfolio across crops and regions, by carrying sufficient liquid reserves, or by purchasing reinsurance. But these options can be expensive as well as difficult to implement when an insurer is starting up or when they are small and geographically focused. The difficulties and costs of assessing risks and losses at farm levels can also be reduced by limiting insurance to specific perils like hail or frost that are relatively easy to observe, or to indexed based products that are identical for all farmers within an insurance area. To cope with diversity amongst farmers in the risks they face and their readiness to purchase insurance, insurers can also segment the market and offer different products for different types of farms, for example, distinguish between smallholder farmers who most need to protect their incomes and commercial farmers who may be more interested in insuring specific agricultural investments. Insurers can also reduce their exposure to farmers' market risks by specifying fixed prices for valuing losses in their contracts. To cope with the increasing uncertainties about the risks involved due to climate change, insurers can also add an extra risk charge to the premium rate they charge to cover their own increased risk exposure.

As Table 1 suggests, the scope for private insurance is greater when risks are less spatially covariate and more idiosyncratic, when the risk of extreme losses is low, when the insured risks are less prone to moral hazard problems, and the lower the level of diversity in farmers' exposure to risk and their willingness to purchase insurance is lower. Unfortunately, climate change is exacerbating many of the problems facing insurers. It is increasing the frequency of crop losses at farm levels, and of extreme, covariate losses at regional levels (e.g., extreme droughts and floods). This is adding to the difficulties of assessing potential losses when calculating premium rates and making insurance more expensive. On the other hand, advances in remote sensing with sufficient granularity and crop modeling are enabling more sophisticated index products to be developed, which is increasing the options available to private insurers. Improvements in seasonal weather forecasting may also help improve the profitability of crop insurance (Cabrera et al., 2009).

2.2 Demand side issues

A fundamental constraint on agricultural insurance is that farmers' demand is generally low when the insurance is priced at its true cost. Goodwin and Smith (1995) review a 1980s debate in

more farmers to opt out of the insurance. The subsequent downward spiral eventually undermines the financial viability of the insurance.

Australia in which it was argued that private sector provision of multiple peril indemnity-based insurance, rainfall, or area-yield insurance is infeasible because few farmers are willing to pay the full cost when realistic levels of administration cost are added to the actuarial risk cost. Based on evidence from the US and Spain and several willing-to-pay (WTP) studies, Smith and Glauber (2012) also suggest substantial subsidies are needed (covering all administrative costs and about 40% of the actuarially fair premium) to achieve participation rates of about 50%. More recent studies of smallholders in developing countries find meager farmer demand at actuarially fair rates (e.g., Ceballos & Kramer 2019, Hill et al. 2016, Mobarak & Rosenzweig 2013), while other studies find inelastic price elasticities of between −0.33 and −0.65 (Bageant & Barrett 2017; Hill et al. 2016, 2019; Mobarak & Rosenzweig 2012). These findings are consistent with estimated demand elasticities for farmers in the US (see Goodwin and Smith, 1995, Table 5-1). Such results imply that insurance must either be heavily subsidized or else alternative ways of increasing demand must be found.

In the search for ways of increasing demand, several factors have been identified that contribute to low demand (for recent reviews see Platteau et al., 2017; Ali et al, 2020). Farmers are quite diverse in the ways they perceive risky outcomes and in their inherent willingness to bear risk, and this has an impact on their willingness to buy insurance (Binswanger, 1980). Demand for insurance is also affected by the level of a farmer's risk exposure - demand tends to be higher for farmers growing crops and livestock for which the risk of significant loss is high relative to their wealth. Demand is also affected by the availability of alternative risk management aids, some of which may be more accessible or less costly than insurance; for example, crop and income diversification strategies can reduce ex ante risk exposure and savings and credit can be used to cope with ex post losses when they occur. For many farmers, insurance is best seen as a tool for dealing with residual risks that cannot be avoided through alternative and more cost-effective measures. However, many residual risks are not insurable, or the available types of insurance do not address the main risk exposures of the farmer. For example, available crop yield insurance may be limited to specific crops and perils which may not be the most important ones facing a farmer.

Economic theory suggests that farmers should be more interested in protecting themselves from major shortfalls in their total farm or even household income, in which case for diversified farmers individual crop losses may be only weakly correlated with their total income, potentially reducing the value of any crop specific insurance. Theory also suggests that basis risk can reduce the demand by rational and risk averse farmers for index-based insurance (Clarke 2016). This is primarily because the farmer would still have to pay the insurance premium even when insured losses occur that are not compensated because of basis risk, making the farmer worse off than if she had not purchased the insurance.

The literature also draws important differences between the demand for insurance by commercial farmers verses subsistence-oriented smallholders, especially in the context of LMICs (e.g., Binswanger-Mkhize, 2012; Kramer et al, 2022). Commercial farmers are typically better placed to purchase insurance since they are better informed about how it works and they offer a better business proposition for the insurer given their scale and lower servicing costs, yet their higher wealth and easier access to alternative risk management aids often reduces their demand for insurance. On the other hand, smallholders typically have high risk exposure relative to their low wealth and have fewer options for managing risk, so they ought to benefit the most from insurance. Yet even when suitable insurance is available their demand is often constrained by its

high cost, by seasonal liquidity constraints that prevent upfront payment of the premium, and by their limited knowledge about and trust in insurance. Insurers also see smallholders as more difficult and expensive clients to insure unless they are organized for group contracts (e.g. an insurance mutual) or can be serviced through an intermediary like a marketing board, agro-dealer or financial institution. One consequence of this disparity between commercial and smallholder farms is that there may be limited scope for insurers to first develop a financially viable market based on commercial farms from which they can subsequently scale up and reach smallholders.

Recent research has explored several ways of enhancing smallholders' demand for insurance, often using randomized trials and pilot schemes to assess potential increases in demand. For example, Liu et al (2020) undertook an experiment in China to test whether a change in the timing of the premium payment—payment at the end of the insured period at the cost of an interest charge—can improve insurance demand. Their analysis shows that farmers were 10 percent more likely to purchase insurance under the delayed payment scheme than the conventional upfront payment scheme. Other studies have explored options such as designing contracts that offer a better value proposition to the farmer by bundling insurance with credit, seeds, and fertilizer (e.g., Mishra et al., 2020; Kramer et al 2021;Ndegwa et al, 2020;), providing training about insurance (Hill et al, 2013, 2019), offering more flexible weather index contracts to reduce basis risk (e.g., Hill & Robles 2011; Ceballos & Robles 2020), offering insurance through groups rather than individual farmers (e.g., Dercon et al 2014; Hill et al 2013), targeting women farmers (e.g., Akter et al 2016), offering new types of insurance products like picture based insurance (PBI) (Kramer et al 2017), and enabling farmers to learn about and access insurance through mobile phones (Kirshner & Musshoff 2023). Most studies show some increase in demand for insurance, and when bundled with credit and farm inputs there is usually also an increase in the demand for those inputs which can help increase farm productivity. Missing from this literature are multi-dimensional studies that combine different interventions to capture possible synergies between interventions that might lead to much larger increases in smallholder demand for insurance.

2.3 Available delivery systems

Even when a potential market exists for private insurance, it can be impeded by the lack of an adequate delivery system for writing and distributing contracts and settling claims at reasonable cost. Few insurers have widespread networks of their own in rural areas in LMICs and face challenges in trying to reach large numbers of disparate smallholders. As such, they have usually either tried to work with groups of farmers belonging to farmer-based organizations (FBOs) like insurance mutuals and coops or marketing boards, or through intermediaries like financial institutions and agro-dealers that have networks of their own. Working through farmer groups or trade organizations can lead to similar contracts for all members or even a single pooled contract for the entire group, which greatly simplifies and reduces the insurer's transactions costs. In some cases, the insurer can also rely on the intermediary to provide any oversight of farmers' practices needed to reduce moral hazard problems; for example, lenders also need to scrutinize farmers' practices to reduce possible loans defaults. Similarly, marketing agents or agro-processors that have contract farming arrangements with smallholders that include insurance oversee their farmers to ensure the quality of their production. As our subsequent case studies show, there are many successful examples of insurers working through farmer groups and intermediaries, and these models have also been widely adopted by many subsidized agricultural insurance programs.

The recent development of digital technologies is upending some of the difficulties of reaching smallholders. With the rapid spread of mobile phones, e-banking, and geo-referencing it is increasingly possible for farmers to remotely access index insurance products, and for that insurance to be bundled with credit and information services (Kirchner & Mussoff 2024; Raithatha and Priebe 2020). Picture based insurance also relies on these technologies (Kramer et al, 2017).

2.4 Institutional and policy context

Private agricultural insurance requires an enabling policy and regulatory environment. Several key factors have been identified in the literature. It helps if there is already a mature private insurance sector rooted in traditional life, motor, or business insurance as this reflects an effective legal and regulatory system for licensing and monitoring insurers to ensure their financial solvency and credibility. An already established insurance sector can also provide a base from which private insurers can venture into agricultural insurance. In some countries, special legislation may be needed to enable index-based products, especially if they are otherwise classified and restricted as lotteries. Policies that permit foreign insurers to enter the domestic market can also be important for promoting agricultural insurance, especially for smaller countries, and can facilitate access to international reinsurance arrangements.

More direct public interventions can also be important, especially in the early stages of development. Suitable data systems are crucial for successful agricultural insurance, and this requires public as well as private investment. Whether designing indemnity-based or index-based crop insurance products, time series data are needed on crop area, production and yields at individual farmer levels and for more aggregate spatial units (e.g., districts or parishes), as well as meteorological weather station data collected at sufficient sites to capture important spatial variation. These kinds of data are needed anyway for many other government purposes, so the payoff from such investments can be much broader than from insurance alone. Many forms of IBI also require access to spatially referenced remote sensing data which needs to be accessible to private insurers, either through government or partnerships with tech firms that collect such data.

Adequate public investment is also needed in educating farmers about insurance. There is a public goods aspect to this since in a competitive market private insurers will not be able to capture all the benefits from their investments in educating farmers, leading to less than socially optimal levels of investment. In more concentrated markets (e.g., monopolistic competition) insurers may find it worthwhile to invest in farmer education while also branding and promoting their products to increase sales if this leads to further segmentation of the market. But for more competitive markets insurers may either need to collude and undertake collective investments that benefit them all, or the government needs to make some investments of its own. Such public investment can be justified to the point where the marginal increase in demand for insurance is equal or greater than the marginal cost of educating additional farmers.

Governments also need to avoid public interventions that undercut private insurance. For example, government sponsored and heavily subsidized agricultural insurance programs (e.g., China, India, Brazil, Philippines, USA) can leave little room for private insurance. Poorly targeted disaster relief programs can have similar effects. One way to avoid this conflict is to

make a clear distinction between the risk management needs of commercial farmers verses smallholders and instead of one size fits all approaches, to target publicly subsidized insurance to smallholders and let the private sector insure the commercial farms (Kramer et al 2022), Another important role for government is removing some of the catastrophic risk from the market leaving private insurers to handle the more intermediate risk (ISF, 2022). Carter, Long and Boucher (2011) argue that this can be done in some cases through a risk layering approach in which the government and insurers share a common index-based insurance product.

Start-up problems may require some initial infant industry support beyond public investments in data systems and educating farmers (Hazell & Varangis,2020). There are few private insurance programs that were initiated entirely by the private sector, and typically governments, aid agencies, international insurers/reinsurers, or NGOs play important roles in the early stages (ISF 2018; Swiss Re 2022). This often leads to public-private-partnership (PPP) arrangements whereby the intervenor provides technical support and subsidies, especially for insurance targeted at smallholders, and the insurance is delivered through private insurers. This approach requires the smart use of subsidies if they are not to become entrenched for the longer term (Hazell & Varangis 2020). There are many examples of such partnerships as we shall see in the next section. The public sector may also need to play an initial role in providing some form of reinsurance until the industry has been able to build up financial reserves and access international reinsurance markets. Tax policies may also help – e.g., taxes on agricultural insurance premiums might be exempt during the early stages of development (Swiss Re 2016).

3. THE EXPERIENCE WITH PRIVATE AGRICULTURAL INSURANCE

3.1 Extent of Private Agricultural Insurance

Private agricultural insurance has a long history. Crop insurance against hail damage was offered by mutual insurance companies (formed by farmers) in Western Europe as early as the 17th Century, and by the late 19th and early 20th centuries hail insurance was available in the United States, Canada, and Argentina (NRAC 2012). Other forms of specific peril insurance (e.g., fire and frost) have also been around since at least the 19th century. Multiple-peril indemnity insurance, or Multi-Peril Crop Insurance (MPCI), has rarely succeeded on a private basis, and the few attempts made by private insurers in the US in the late 19th century all ended in failure. However, publicly subsidized MPCI became very popular in many countries around the mid 20th century and in LMICs was often tied to the lending programs of publicly owned Agricultural Development Banks (Hazell, Pomareda & Valdes 1986). However, a host of problems, including moral hazard, adverse selection, poor data, high costs, corruption and political interventions, undermined the effectiveness and financial viability of these programs, making them wasteful and expensive for governments (Hazell 1992). As a result, most countries had phased out or drastically reformed their MPCI programs by the late 1990s, which helped set the scene for the emergence of new types of index-based insurance (IBI) products, initially area-yield insurance (e.g., India) but subsequently broadening out to include weather station based indicators (e.g., rainfall and temperature), and then expanding into a range of remotely sensed indicators with the emergence of GPS and satellite information.

The private sector has been actively engaged in supplying these new forms of IBI. It also continues to provide specific peril insurance of various kinds to commercial farms in many countries. Gudger (1990) claimed “private insurance was available for cereals, pulses, forage

crops, fruits, aquaculture, tropical beverages, flowers, forest products, tree crops, vegetables and some highly specialized agricultural activities such as mushrooms, snails, crocodiles and parmesan cheese ageing. The perils insured against ranged from the ordinary flood, freeze, fire, hurricane, and drought to the exotic such as foraging elephants, snakes, parrots and kangaroos, maritime algae blooms, and deer stampedes due to passing aircraft". A World Bank survey in 2008 of 65 insurance programs around the world found that on average a little over half were private, unsubsidized programs, with the highest shares in Oceana (100%), Europe (62%) and Latin America and the Caribbean (LAC) (70%) and lowest shares in Africa and Asia (25%) (Mahul & Stutley 2010, Table 3.3). Nearly all the unsubsidized private schemes were named peril insurance, such as hail and livestock insurance. Private insurance is still active today. Of the 54 agricultural insurance programs in LMICs surveyed in 2020 by GIZ, more than 60 per cent were private (GIZ 2021) and again nearly all were named peril or indexed based schemes. However, despite the prevalence of unsubsidized private insurance, programs are typically small and their total coverage, total premium collected, and number of farms reached is miniscule compared to that provided by publicly supported insurance programs. For example, the GIZ survey of 2020 found private unsubsidized insurance programs reached only about half as many policyholders on average compared to all other programs when the massive programs in China and India are excluded. Private insurers rarely insure farmers against market and price risks, leaving this to futures markets or to government supported insurance programs in which government can afford to take the exceptional risks involved.

Private insurers also participate in subsidized insurance programs through various types of public-private partnerships (PPPs) with government or non-profit agencies (e.g., bilateral donors, foundations, and NGOs). Mahul & Stutley (2010, Table 3.3) report that 37% of the 65 insurance programs they surveyed in 2008 were PPPs, with about 50% in Africa and Asia but only 25% in LAC. One reason for PPPs is that many of the non-profits promoting and financially supporting insurance are not licensed to sell insurance and must partner with private insurers to implement and underwrite the insurance contracts. Another reason is that many governments prefer to rely on private insurers to provide subsidized insurance under contractual arrangements rather than having a public insurance agency of their own. Since these arrangements invariably involve subsidies of one kind or another, we do not review them in this paper, except in cases where subsidies were limited to an initial startup phase.

The institutional arrangements for delivering private agricultural insurance vary considerably across countries. Within LMICs key players are:

- National and regional insurance firms

- International reinsurers who have an interest in developing insurance programs within countries, often offering technical advice as well as reinsurance (e.g., Swiss Re, Allianz)

- Other technical advisory and support service firms and NGOs who promote agricultural insurance and help design, organize, and pilot initial programs, often with financial support from development agencies and foundations.

- Intermediaries like FSPs and agri-businesses

- Farmers themselves and farmer-based organizations like coops, mutuals and marketing boards

- Governments who play a key role in providing the legal and regulatory environment and sometimes help educate farmers about the value of insurance. Many governments also subsidize insurance to help scale it up and reach specific target groups.

- International private insurers who sell insurance products directly to farmers or through intermediaries (e.g., World Cover, OKO).

Farm cooperatives and mutuals played key roles in early experiences with agricultural insurance in the USA in the late 19th and early 20th centuries. They also play key roles in LAC today, accounting for 9% of the total premium written in the region in 2015 and for much higher shares in Argentina, Uruguay, Paraguay and Mexico (Swiss Re 2016). The region also benefits from strong national insurance firms, many operating at a regional scale (e.g., Brazil's Aliança do Brasil, Mexico's Protección Agropecuaria (ProAgro), and Argentina-based Sancor). Several leading foreign agricultural insurers are also active in the region, such as Mapfre (a Spanish firm), Allianz, Swiss Re's Corporate Solutions, Zurich, Sompo and Liberty (Swiss Re 2016).

In Africa, other than in a few countries (e.g., South Africa, Kenya) national and regional insurance companies are generally weaker and play modest roles in initiating private agricultural insurance. Bigger roles are played by farmer organizations and intermediaries like financial services providers and agro-dealers, typically assisted by technical advisory and support service firms (e.g., ACRE), research organizations, and NGOs with financial support from development agencies and foundations.

According to an FAO study of the Asian insurance market in 2010 (FAO 2011), Thailand and Viet Nam had insurance markets prior to 2010 that were purely market based, but they proved financially unsustainable and had very limited penetration (see Win (2016) and Nguyenand Pongthanapanch (2016) for further details). Bangladesh, India and Nepal also had small-scale informal private livestock-credit insurance programs that were implemented either by community-based organizations (Nepal and India) or by NGOs/MFIs (Bangladesh). In both India and the Philippines, the private commercial insurers had introduced new market-based crop weather index insurance programs, which initially received no premium subsidies and were commercially reinsured either by international reinsurers (Philippines) or by a combination of a national local reinsurer and international reinsurers (India). In other countries agricultural insurance was provided mainly by government subsidized programs and this is even more so today with massive programs in China and India. In 2020, government supported insurance programs in China and India together accounted for about 250 million contracts, or 95% of the total contracts issued within LMICs in the entire Asia region (GIZ 2020, Table 2).

3.2 Case Studies

To better understand the factors that hold back private agricultural insurance, we selected some case studies that capture different eras, policy contexts, and types of agricultural insurance in terms of the risks covered and institutional arrangements. Our selection was based on cases for which sufficient and credible information could be obtained from available literature and the

internet, and was restricted to cases that did not involve any sustained subsidies provided by governments, NGOs or donors. We did include some cases where value chain players like agro-dealers and financial institutions covered part of the insurance premiums themselves because of benefits they received from insuring farmers, and where subsidies were limited to an initial start-up phase. For each case we examined success or failure in terms of duration of the program, the number of farmers reached, and where available, their financial outcomes, and we examined any innovative features and lessons learnt, though our ability to fulfill this was often constrained by available evidence. Table 2 provides a summary of the selected cases. Our case studies draw on early experiences in the US prior to the emergence of the Federal Crop Insurance Corporation (FCIC) in 1938, and on early and current experiences in the LMICs.

Table 2: Case Studies of Private Unsubsidized Agricultural Insurance

	Program	***Country/ region***	***Type insurance***	***Crop***	***What is insured***	***Time period***	***Type insurance arrangement***
Early Experiences in the USA							
1	Hail insurance	Initially in Connecticut and Minnesota but then replicated in many other states	Hail	Initially tobacco but extended to other crops	Crop damage from hail	1880-still ongoing in 1923	Insurer sold directly to farmers
2	Hartford Fire Insurance Company	Pacific Coast region, the South, Central belt states, and Eastern states.	Multiple-peril indemnity	Initially major crops but eventually limited to fruits and vegetables	Production costs against most weather and pest risks except hail	1921-22 for major crops, 1923-? For fruits and vegetables	Insurer sold directly to farmers
3	Georgia Peach growers	Georgia	Most natural hazards	Peaches	Difference between value of the crop after loss and actual production costs	Early 1920s	Insurance sold through Georgia Peach Grower Exchange
4	Florida Citrus growers	Florida	Frost	Citrus	Crop damage due to frost	1920- still ongoing in 1924	Insurance sold through Citrus growers' association on a "meso" basis
Experiences in LMICs							
5	Mauritius Sugar Insurance Fund Board	Mauritius	Cyclones, drought, excessive rainfall, or fire	Sugar	Production costs and profits foregone, but with a 5% deductible	1946 - present.	Compulsory insurance and Sugar Insurance Fund Board insures farmers who

	Program	*Country/ region*	*Type insurance*	*Crop*	*What is insured*	*Time period*	*Type insurance arrangement*
							are charged a levy
6	Consorcio Nacional de Seguros (CNS)	Chile	Frost, hail, excess rain, drought	Cereals and fruit for export	Up to 66% of insured yield	1981/82 – Late 1980s	Insurer sold directly to farmers
7	Index-based Livestock Insurance (IBLI)	Kenya	Drought	Camels, cattle, sheep & goats	Up to replacement value of animal	2010-present	Insurer sells directly to pastoralists
8	NWK Agri-services	Zambia	Weather index	Cotton	Input credit	2013/14-2016/17	Insurance sold through NWK AgriServices
9	Cotton ginners	Tanzania, Kwimba	Index for dry periods and untimely rain	Cotton	Input credit	2013/14 season only	Insurance sold through cotton ginner engaged in contract farming
10	Kilimo Salama	Kenya	Index for. Drought and excess rain	Maize and wheat	Input credit	2009 - present	Insurance sold through agri-dealers
11	AbonoSegurado	Philippines, North Luzon	Index for typhoons	Rice	Fertilizer cost	2013-2015	Insurance sold through Security Farm Supply (SFS), fertilizer supplier
12	PepsiCo	India	Index for weather conditions inducive to late season blight. Also frost	Potatoes	Costs of production	2007-?	Insurance sold through PepsiCo as part contract farming
13	La Positiva Insurance Company	Peru	Named perils including drought, untimely rains, flooding, wind and fire	Any crop for which a loan was obtained	Up to 50% of value of expected yield	2013-2019/20	Insurance sold through financial institutions
14	Café Seguro scheme in Colombia	Colombia	Index	Coffee	Production	2018-	Insurance sold through Nespresso?
15	Community run livestock insurance	India, Andhra Pradesh	Named perils	Dairy cows	Value of cow	2015-	Community organizations
17	World Cover	Africa	Various indices	Multiple crops	Various	2016-2019	Insurance sold directly to farmers

Private Agricultural Insurance in the US

Hail insurance has been the most successful private agricultural insurance in the US. In 1880 a group of tobacco farmers in Connecticut formed a mutual company to write hail insurance. It was followed in 1883 by the St. Paul Fire and Marine Insurance Company offering hail insurance in Minnesota. By 1900 there were 37 mutuals and one joint stock company offering hail insurance in the US with a total premium collected of around $20 million. There was rapid growth thereafter in both the insurance coverage and number of companies and several state governments also started offering hail insurance of their own. The insurance peaked in 1919 when the total premium collected exceeded $30 million (worth over $540 million in 2024 prices) for an insured coverage of $560 million (worth about $10 billion in 2024 prices). About one-half of the total risk was carried by 43 joint-stock fire insurance companies, one-fourth by 41 mutual hail insurance companies, and one fourth by State hail insurance departments in North Dakota, South Dakota, Nebraska, and Montana. Premium rates varied regionally between 3 and 10 percent, averaging about 6 percent. However, by 1923 the total premium collected was down to $18.5 million of which about $12.5 was collected by joint stock companies, $1.5 millions by mutuals, and $5 millions by state agencies (Valgren 1922; Hoffman 1925; Wallace 1923). The total premium collected for hail insurance by joint stock companies over 1920-22 amounted to $108.8 millions in nominal prices, while total payments were $69.7 million, giving an average loss ratio of 0.64 (Valgren 1923). This does not include the transactions of mutuals or state hail insurance departments but does show that the insurance was financially viable for private companies over an extended period.

One of the earliest recorded examples of multiple-peril indemnity insurance being offered by a private company in the US was that of the Realty Revenue Guarantee Company of Minneapolis in 1899. The insurance was essentially a revenue insurance that guaranteed farmers a return of $5/acre regardless of price or yield disruptions. In the event both weather and market conspired against the insurer and the scheme was discontinued after just one year (Hoffman 1925). A similar scheme was launched in 1917 by the Bankers' Insurance Company in Montana that covered most causes of yield loss and valued those losses at pre-determined and overly optimistic prices. This proved disastrous for the company because of a major drought that year and because many contracts were written too late into the growing season when the likelihood of serious losses was becoming apparent. Similar schemes were offered that year by joint-stock fire insurance companies in North and South Dakota, and which failed for the same reasons. The companies either defaulted on many of their payments or repaid the premium they had collected (Valgren 1922).

Another multiple-peril indemnity scheme was launched by the **Hartford Fire Insurance Company** in 1920. They offered insurance to cover the production costs incurred by a farmer against most weather and pest risks except hail for a wide range of crops. The production costs were specified in the contract, so the farmer was not insured against any cost increases. Compensation was based on the difference between the value of the crop realized and the agreed production costs. In the event of a total crop loss, only production costs incurred up to the date of loss were covered. The insurer diversified its risk spatially by selling the insurance in the Pacific Coast region, the South, Central belt states, and small amounts in the Eastern states. The insurer received $0.8 million in premiums in 1920 but had to pay out $2.5 millions, leading to a loss of $1.7 millions, mainly because of a large drop in crop prices. The company changed its policy in 1921 to exclude price risk by valuing crops at their previous 5-year price averages. On this basis

they sold only small amounts of insurance in 1921 and 1922, and at a loss. They discontinued the program for major crops the following year but did continue to insure small amounts of fruits and vegetables (Hoffman 1925).

Other examples of multiple-peril indemnity insurance of fruits and vegetables were linked to credit sold through lenders such as banks and input dealers. A good example was a policy sold to members of the **Georgia Peach Grower Exchange** by the Automobile Insurance Company of Hartford in the early 1920s. This covered most natural hazards, and compensation was based on the difference between the value of the crop after loss and actual production costs. The insurer was clearly exposed to some price risk, but this was curtailed by limiting the maximum compensation to a fixed and conservative amount per tree. The program was a success and enabled many growers to obtain credit (Hoffman 1925). There were several other successful examples of credit insurance for fruit growers where insurance was sold through intermediaries like input suppliers and banks along with credit. The insurance typically covered weather and pest damage, and the maximum compensation paid when a loss occurred was the value of the loan. To reduce exposure, insurers restricted the amount of credit that could be insured for any one farmer based on past yields and prices.

There are also examples of mutual insurance, whereby a growers organization takes out insurance on behalf of all its members and distributes the coverage amongst its members based on expected harvests. This approach has the advantage of reducing administration costs for the insurer and helps reduce adverse selection. A good example was a **citrus growers association in Florida** that took out insurance against frost damage beginning in 1920. The insurance was still ongoing in 1924 (Hoffman 1925).

By the early1920s, hail insurance was the only crop insurance sold at any scale in the US, and private insurers were very reluctant to engage in insuring more general crop losses. This gap was eventually filled in 1938 through the establishment by the US Government of the Federal Crop Insurance Corporation (FCIC) and its subsequent evolution into the large-scale and heavily subsidized program that exists today (Glauber 2012; Smith and Glauber 2012). The FCIC plus frequent provision of disaster assistance to farmers by Congress leaves little room for private and unsubsidized agricultural insurance except for some specialty crops. However, private crop insurance companies in the US thrive today because they deliver the government supported insurance, benefiting from both direct and indirect subsidies. However, they do have to share part of the underwriting losses (Glauber 2004).

Private Insurance in the LMICs

Early experiences with private agricultural insurance in today's LMICs include the insurance offered to estates and satellite smallholders growing export crops such as rubber, tea and oil palm during the colonial era. A good example is the **Mauritius Sugar Insurance Fund Board (SIFB)**. This insurance was started in 1946 to insure sugar growers and mills against cyclone damage following a catastrophic hurricane in 1945. The SIFB was initiated by the government as the Cyclone and Drought Insurance Fund through Ordinance No 53. The insurance is compulsory for all sugar growers and millers and includes many smallholder growers as well as estates[2]. It is funded by a levy (premium) on production and is operated by the not-for-profit

[2] As of 2012, 18,315 small planters (less 10 ha) produced 22% of national sugar production.

Sugar Insurance Fund Board. The premium for this insurance was initially set at 4.5% of the value of the average quantity of sugar harvested over three years, and the compensation provided is meant to cover both production costs and profits foregone, but with a 5% deductible. The scheme was reorganized in 1974 with the passing of the Sugar Insurance Fund Act, which also expanded the scheme to insure additional risks, including fire and losses from excessive rain and yellow spot disease. SIFB is unsubsidized and has remained financially sound. Over 2003-22 the average loss ratio was about 0.68 (Mahul & Stutley 2010; SIFB Annual Report 2022-23, Notes to Financial Statements).

An innovative feature of the scheme is that it provides coverage for millers as well as sugar growers within a well-organized processing and marketing system for sugar, offering an early example of "value chain" insurance. Another innovative feature is that it recognizes and rewards growers with histories of low claims by reducing the premium rates they pay and increasing the payments they receive when losses occur. Key reasons for success of the program include enabling legal acts by the government, well defined fire and cyclone risks for an important and high value export crop, a compulsory levy on all growers and millers, and a scheme managed by an independent not-for-profit board[3]. It also helped that there were no major losses after the scheme's start in 1946 until 1960 and this allowed the fund to build up a generous reserve (Roberts & Dick 1991).

Another example of private insurance for export crops arose in Chile in the 1980s (Roberts and Dick 1991). The **Consorcio Nacional de Seguros (CNS),** a private insurer, launched an insurance program covering named perils for large commercial farms growing cereals and fruit for the export market. The named perils for fruit included frost, hail, wind, and excessive or untimely rains that caused fungal diseases, and for cereals they included frost, hail, wind, floods and drought. Coverage was limited to 70% of estimated yields established at an underwriting inspection conducted by an agronomist. Yield losses were valued at one of several price options that the farmer selected when purchasing the insurance, and which was reflected in the premium rate he paid. Indemnities were paid when actual yields fell 70% or more below estimated yields and the loss could be attributed to one of the named perils.

The insurer incurred a large loss in the first year (1981/82) for both cereals and fruit but quickly adjusted the scheme by reducing the compensation to 66% of estimated yield (increasing the farmers' deductible), by requiring more rigorous damage inspection by agronomists to ascertain that yield losses were actually caused by an insured hazard and were not just coincidental, and by dropping some of the more exposed regions and farmers. With these adjustments, and perhaps a little luck, the scheme returned an average loss ratio of 0.35 for cereals, 0.54 for fruit, and 0.42 in total over the subsequent four years1982/83 to 1985/86 (Roberts & Dick, 1991, Table 1).

Contributing to the success of the program was the fact that CNS was a large and established national insurer and although they had no prior experience with agricultural insurance, they were able to take advantage of their existing administrative personnel and procedures and marketing channels to help keep costs down, and they had adequate reserves and access to international reinsurance to absorb any large losses. The loss assessments were also outsourced to agronomy

[3] For more detailed information about the SIFB and its insurance program, see the official website of the Sugar Insurance Fund Board (https://www.sifb.mu) or consult the Sugar Insurance Fund Act 1974 for the legislative details (https://www.sifb.mu/pdf/sifb_act.pdf).

experts on an honorarium basis, which were paid directly by farmers when making claims instead of having these costs added to the premium rates. CNS also responded quickly to an initial large loss and made effective adjustments to the design and operation of its insurance program. Another helpful factor was that the insurance was spread between cereals and fruits and severe losses for these two groups were negatively correlated, adding some stability to the aggregate losses for the insurer. Although the insurance continued successfully for a few more years, it did not reach any smallholders and the government subsequently stepped in to provide subsidized agricultural insurance more generally, effectively displacing the unsubsidized CNS insurance.

The **Index-based Livestock Insurance (IBLI)** is a good example of a commercial insurance scheme designed and piloted by a research team in collaboration with private insurers that proved sufficiently impactful that it was scaled up in subsidized form by the Kenyan government. IBLI originated in 2007 as a research collaboration between the International Livestock Research Institute (ILRI), Cornell University and the University of California at Davis (Jensen et al 2024). The objective was to develop an indexed based product to insure pastoralists against drought related livestock losses in Northern Kenya's arid and semiarid lands (ASALs). After a three-year research and design period, the insurance was piloted beginning in 2010 in a single county (Marsabit) on a commercial basis. The insurance was sold directly to farmers by private insurers (UAP Insurance and the Equity Insurance Agency) and reinsured by Swiss Re and the Equity Bank. The insurance was voluntary and based on an index that estimated average livestock mortality rates for spatially disaggregated Unit Areas of Insurance (UAIs). Payments were triggered by satellite-based observations of the NDVI (Normalized Difference Vegetation Index) which had been shown during the research phase to be highly correlated with livestock losses in drought years. The insurance was sold for two seasons each year, the short rainy season which occurs during April to late May, and the long rainy season which extends from end of October to December. The insurance was basically an asset insurance and provided coverage up to market value for camels, cattle, sheep and goats. The premium rate was not subsidized for most buyers[4], though the research costs and some of the insurers' initial operating and development costs were covered by donor resources. The average premium rate ranged from 7.5 to 11 percent of the estimated value of an animal.

The pilot showed promise but did not achieve scale. On average, only 508 contracts were issued per season during 2010-14 providing coverage worth about US$10,000 per year but insuring less than 0.01% of the livestock population (Jensen et al 2024, Figure 21; CTA 2018). The pilot program was carefully monitored by the ILRI led research team using a panel survey of some 920 households and the studies showed that purchase of IBLI was effective in protecting livestock assets, led to smaller herd sizes and better veterinary care, resulting in higher animal productivity (Jensen, Barrett and Mude 2017). By 2015, IBLI had provided coverage worth USD 26,160 (Taye, 2017). These results were sufficiently good that ILRI was encouraged by its donors and implementing partners to expand the scheme into Isiolo and Wajir counties. A Sharia compliant form of IBLI, called the Index Based Livestock Takaful (IBLT) was developed and offered in Wajir county to meet the needs of the region's sizable Muslim population. Four additional Kenyan counties were added by 2016 plus the Borana Zone of Ethiopia. This expansion was aided by the design of a more flexible index that tracked local forage availability

[4] A sample of households were initially given discount coupons as part of an experiment to estimate their demand at different premium rates.

as a predicter of livestock mortality that only required remotely sensed satellite data for each UAI. However, sales in each location remained low. For example, the average number of contracts sold per season over 2013-14 was 93 in Isiolo and 164 in Wajir. Sales were particularly low amongst the poorest and most vulnerable pastoralists who had no prior knowledge of insurance and could least afford the unsubsidized premium rates. Basis risk also emerged as an important problem, as well as supply side problems in the marketing, distributing and servicing of contracts for mobile pastoralists in remote rangeland areas with limited infrastructure.

Data on the financial performance of IBLI are scarce, but CTA (2018, Tables 2 and 3) reports some useful figures for Marsabit county over the five-year period 2010-2014. During that time IBLI sold animal coverage totaling US$81,317 and made payouts totaling US$26,948. Given premium rates of between 7.5% and 11% then the total premium collected would have been between US$6,098 and US$8,945, leading to an average loss ratio of between 301% and 442%. This was clearly not financially viable, but it may be unfair to judge IBLI's financial sustainability over such a short period in a single county given that 94% of the payouts were made in a single drought season in 2011, and the program was still in a learning and adapting phase.

Noting IBLI's potential but poor scale, the Kenyan government added it to its social protection program in 2015 by launching a macro-level insurance scheme called the Kenya Livestock Insurance Program (KLIP) that provides fully subsidized insurance for up to 5 Tropical Livestock Units (TLUs) for targeted households. The insurance design is modelled on IBLI and pays out against the same NDVI trigger measured within individual UAIs. It is a macro insurance in which the government is the sole policy holder, but it is administered under contract by private insurance companies who also distribute the indemnities through mobile money or banks to targeted households when a drought occurs. KLIP was launched in 2015 in Wajir and Turkana counties for 5,000 vulnerable pastoralists, and by 2019 this had increased to 18,000 pastoralists in 8 counties with an annual total sum insured of USD 12.6 million (Fava et al. 2021). The insurance companies contracted to implement KLIP were also required to offer IBLI on a voluntary and unsubsidized basis to households who wish to top-up their insurance to insure more than 5 TLUs, as well as to non-KLIP beneficiaries. By 2019, about 33,000 pastoralist households (approximately 200,000 people) were insured under all IBLI programs combined in Kenya and Ethiopia with a total coverage worth USD 734,750

The IBLI program illustrates many of the problems of trying to introduce an insurance into regions with poor infrastructure and limited supply channels, worsened in this case by the mobile nature of the pastoralists, their lack of prior knowledge of insurance, and the limited availability of internet and remote servicing and e-banking (Fava et al 2921). It seems highly unlikely that private insurers would have been willing to initiate the insurance without the backing of the research team and access to funds to help cover their set-up costs. Even then, there were issues in the early years with the private insurers involved, including missed sales seasons, poorly trained agents, and some churning amongst the insurance companies willing to participate. There is little evidence to suggest that IBLI had a sustainable loss ratio and as with many other promising initiatives the fact that scale was only achieved once the program was subsidized suggests it is not financially sustainable on a purely commercial basis. However, it does continue in unsubsidized form for households who wish to top-up their KLIP insurance to cover more than 5 TLUs, as well as to non-KLIP beneficiaries.

Bundled insurance

There are many examples, particularly in Africa, of index insurance being sold through agribusinesses who bundle it with farm inputs and credit. Many schemes were initiated or supported by a third party, such as MicroEnsure or the Agriculture and Climate Risk Enterprise (ACRE), often with start-up funding from donors, research organizations, development banks or foundations. Unless subsidized, these schemes have rarely lasted more than a brief period, though some have served as models that were subsequently scaled up as part of larger subsidized insurance programs. We limit our review to cases in which the insurance costs for farmers were not subsidized, unless by an agribusinesses or financial organization because they perceive benefits from the insurance for themselves (e.g., attracting or retaining farmer clients).

One example is the insurance initiated by **NWK AgriServices in Zambia.** NWK is an agri-processing firm that has contract farming arrangements with cotton growers and purchases, gins, and markets cotton. NWK provides key inputs on credit at the beginning of each season, the repayment of which is deducted from the cotton proceeds when farmers deliver their cotton to NWK. Insurance is offered with the input credit on a voluntary basis and after harvest insured farmers receive payment for their cotton minus their loan repayment and insurance premium, or if an insured loss occurs, the loan is forgiven but not the insurance premium. The insurance is a weather index product that covers losses due to drought conditions, late onset of rains, dry spells and excessive rainfall during flowering phase. Data is provided by TAMSAT satellite data. The premium rate is 8% of the sum insured. The product is insured by Focus General Insurance and reinsured by Prima Re and Zam Re.

The insurance was piloted by NWK amongst their contract farmers in 2013/14 and 2014/15 in Southern Province. In 2013-14, approximately 7,000 farmers purchased the insurance covering 7,600 ha of cotton, but this fell to approximately 3,000 farmers and 3,700 ha of cotton in 2014/15. Due to severe droughts in some areas the insurance had high loss ratios in the first two years, averaging about 250%, yet in 2015/16 NWK scaled up the insurance to include the Southern, Central and Eastern provinces. In 2015/16 the insurance was purchased by 52,000 farmers out of a possible 70,000 farmers who were offered the insurance (an enrollment rate of 74%), but in 2016/17 only 4,338 farmers out of 46,346 purchased the insurance (an enrollment rate of about 10%). The decline in the enrollment rate that year was attributed to a low cotton price at planting time leading many farmers to switch to alternative crops like soybeans and other legumes (McCarthy et al, 2020). According to their website, NWK Agri-Services currently works with over 100,000 farmers and still offers the insurance, but more recent performance data are not accessible.

Despite the initial high loss ratios, NWK values the insurance because it helps retain farmers under their contract farming arrangements and has contributed to higher levels of loan recovery and deliveries and lower side-selling to other cotton processors[5]. Factors contributing to the successful establishment of the insurance include:

- Early support from the government through both the Ministry of Finance and the Ministry of Agriculture. Although no direct subsidies were involved, the value added tax

[5] Based on Arce (2016), GIZ (2016), and evidence provided by Agrotosh Mookerjee of Risk Shield Consultants Ltd for the GIZ (2021) study.

rate on the premium rate for agricultural insurance was reduced from 15% to only 3% for all insurance products targeting small scale farmers.
- There was also strong interest by other agro-processors, and the Cotton Board encouraged cotton ginners to participate in such schemes.
- To promote the insurance at the pilot stage, NWK included life insurance with the credit insurance. They also initially subsidized 75% of the premium for those farmers who had worked with NWK for many years and were categorized as Gold Club farmers.
- The triggers for both drought and excess rainfall have been recalibrated over time to reflect loss experiences.

When judged from an insurers perspective it is not clear that the NWK scheme is successful, although we do not have more recent data on its financial performance. However, NWK benefits from the insurance because it helps attract and maintain contract farmers, improves loan recover rates, and reduces side-selling by farmers to other cotton processors. These benefits seem strong enough that NWK is willing to cover part of the insurance premiums themselves.

An interesting but less successful case was the insurance offered to **cotton ginners in the Kwimba region of Tanzania**[6]. It was an index-based insurance designed to reduce the risk experienced by cotton ginners in providing credit for inputs to out-growers under contract farming arrangements. The main risks insured against were dry periods during the growing season and excess rain near harvest, using a satellite sourced rainfall index (TAMSAT). The insurance was piloted on a small scale in 2012 and implemented for the 2013/14 season. The insurance was initiated by an intermediary (MicroEnsure) who helped train staff and set up the program, with funding from the Gatsby Charitable Foundation. The insurance was underwritten by APA Insurance, a Kenyan company, and Africa Re provided reinsurance. It was hoped that the insurance would initially be adopted by five ginners and benefit around 10,000 farmers, but in practice only one ginner, Afrisian, participated, and only 337 farmers were insured for the 2013/14 season. Although the insurance was intended to be bundled with the farm loans, in practice Afrisian did not inform the farmers about their insurance, and the insurance was effectively implemented as a meso-insurance product that underwrote part of the loan portfolio of the ginner. The insurance did not perform well; 337 farms were insured at a total premium of $360, claim payments amounted to $460, and the insurer had a loss ratio of 1.28. The project failed in part because the ginners had problems obtaining farm inputs for the 2013/14 season and farmers had to buy their inputs independently, paying in cash. Moreover, the ginners were also concerned about other risks beyond rainfall, like side selling cotton, fake seeds, and the untimely availability of inputs, none of which were covered by the insurance. The ginners were also unwilling to service farmers with whom they did not have established and trusting relationships and who might side sell their cotton or default on their loans. The insurance did not continue beyond the 2013/14 season. The scheme illustrates some of the pitfalls of a third party trying to introduce crop credit insurance into a poorly functioning value chain in which crop production risks are just one of several important risks facing agribusinesses and farmers.

The Kilimo Salama project was an early pioneer of the use of rainfall-based indices and mobile banking to provide credit insurance for smallholders buying farm inputs (mainly fertilizer and seeds) from local agri-dealers. The original project insured maize and wheat farmers against

[6] Based on Arce (2016) and evidence provided by Agrotosh Mookerjee of Risk Shield Consultants Ltd for the GIZ (2021) study.

losses from drought and excess rain using an index based on rainfall measured at local weather stations. Crop models were used to establish the relationship between the index triggers and crop yields. The project was initially piloted in 2009 in Laikipia district in Kenya by the Syngenta Foundation for Sustainable Agriculture in collaboration with Safaricom, the largest mobile network operator in Kenya, and UAP insurance with reinsurance from ZEP-RE (IFC no date). The average premium rate was about 10% and which was heavily subsidized in the first year by the Syngenta Foundation, but thereafter the premium was split equally between the farmers and the agri-dealers who reaped their own benefits from increased sales (Wordpress 2016). The use of mobile banking was innovative at the time, enabling farmers to purchase insurance electronically at their local agri-dealer with immediate confirmation from the insurer and to automatically receive payments into their bank accounts when their local index was triggered. To introduce farmers to the insurance product it was marketed over the radio and at group training sessions, and farmers were able to try it out by purchasing insurance for as little as a single bag of fertilizer or seeds. The project also set up a help line through which farmers could obtain answers to insurance questions from trained agents. Farmers could also receive tailored extension messages using information from their local weather station to help them make best use of the rains.

In 2009 the pilot insured 200 farmers within two weather station areas, but in the following season it expanded to insure 12,000 farmers within 25 additional weather station areas (IFC no date). By 2013, Kilimo Salama had grown significantly which led to its transformation to ACRE Africa. ACRE Africa has leveraged on mobile technology, automated weather stations and satellite data, and partnerships with input providers and mobile network operators to develop and distribute tailored micro-insurance products to smallholder farmers. Today ACRE Africa has a diversified portfolio including multi-peril crop insurance, weather index insurance, area yield index insurance, and hybrid crop insurance. As of 2020, ACRE had facilitated more than 1.7 million insurance contracts worth USD 181 million to 8.5 million beneficiaries across Africa. ACRE has also partnered with financial institutions to provide agricultural loans services to insured smallholder farmers and included a range of other services such capacity building through technical training and extension services. In 2022, ZEP-RE acquired a major stake and control over ACRE Africa which enhanced the inclusion of livestock insurance products to pastoralist farmers in the Horn of Africa and scaling to new regions like Zambia where it has been involved in implementing index-based insurance for farmers under the government-supported Farmer Input Support Program (FISP). ACRE Africa continues to provide purely commercial and non-subsidized agricultural insurance products by partnering with private seed companies and financial institutions, including Seed Co, Kenya Seed Scheme, Apollo, and Digifarm [7]. However, a key factor underlying ACRE's broader success has been the availability of premium subsidies from Global Index Insurance Facility (GIIF), governments, and other development agencies that support its work. In 2016, for example, these subsidies amounted to 40% of the total premium collected by ACRE facilitated schemes (GIZ, 2016). It is not clear if the agri-dealers are still sharing part of the premium cost with farmers or whether external subsidies have replaced their contributions. Nor is there accessible information about the loss ratio for the insurance.

[7] DigiFarm, a subsidiary of Safaricom, offers Kenyan smallholder farmers access to agricultural insurance as part of its integrated mobile platform. The insurance is bundled with other services such as inputs, credit, and farmer advisory services. This insurance is often included as a mandatory component when farmers take out Safaricom loans for farm inputs, ensuring that farmers are protected against potential losses

Private insurance schemes working through intermediaries can also be found in Asia and LAC.

An Asian example is **AbonoSegurado in the Philippines**. This insurance was offered by Security Farm Supply (SFS), a farm input supplier, to cover the cost of fertilizer purchased by rice farmers in North Luzon. The insurance reimbursed the farmer the cost of fertilizer up to a maximum of Php 200 per bag in the event of a typhoon, which was measured using an index based on windspeed data from satellite sources and ground weather stations. Claim payments take the form of a discount on fertilizer purchases in the season following the loss. As a sweetener at the pilot phase, accidental death cover was also included with an insured value of Php 2,000 per bag. An unnamed intermediary was heavily involved in setting up the insurance, training staff, and initial marketing during a pilot phase in 2013-14. It is unclear who paid for the intermediary. The insurance was provided by the Bankers Assurance Corporation, a subsidiary of the Malaysian Group of Insurance Companies, and reinsured by Liberty (a Lloyds syndicate) in 2013, then by Swiss Re from 2014 onwards.

The premium rate was set at 12%. The insurance was initially sold on a voluntary basis, but initial demand was low leading SFS to embed the insurance premium into the price of fertilizer for all sales in the following seasons. This led to significant scale up of the program, from about 450 farmers in 2013 to about 7,800 farmers in 2014. However, for farmers who did not want the insurance, this exposed SFS to competition from competing dealers who did not add insurance to their fertilizer prices. Moreover, for practical marketing reasons, the price per bag of fertilizer, which included the insurance premium, needed to be the same for all farmers. To accommodate differences in risk levels, the trigger levels also had to be adjusted for different areas. Unfortunately, this required setting triggers too high in some areas leading to significant basis risk problems. The problem was so bad in some areas in 2013 that some ex-gratia payouts had to be made to save the program.

The financial performance over 2013 to 2014 was encouraging[8]. The total premium collected was $65,826 and total claim payments were $6,129, giving a loss ratio of 9.3%. Despite high initial costs - brokerage fees and administration costs over 2013-2014 amounted to $43,995, the scheme returned a net gain of $37,169, or 56% of the total premium collected. While attractive to the insurers the high premium rate (10-12%), low loss ratio, and high triggers meant that the insurance was not a particularly good value proposition for many farmers. The insurance was only sustainable if the cost could be embedded in the price of fertilizer, but this was difficult in the face of competition from other fertilizer distributors who did not embed insurance in their fertilizer prices. It is not clear how long the insurance scheme lasted, but it seems to have been displaced by more general and publicly supported crop insurance programs for rice farmers.

PepsiCo index insurance in India[9]. PepsiCo contracts with farmer in several states in India to grow potatoes of the right type and quality for processing into chips. As part of the contract package, PepsiCo distributes fertilizer, provides access to pesticides, and requires contracted growers to use a specific variety of high-quality potato seed, which it sells to farmers at cost. PepsiCo offers farmers technical advice on production practices and starting in 2007, contracted farmers were also given the opportunity to purchase an insurance product to protect their

[8] Based on evidence provided by Agrotosh Mookerjee of Risk Shield Consultants Ltd for the GIZ (2021) study.
[9] Based on Hazell et al (2010) and ILO (2017).

investment against losses from late blight disease. The insurance is an index product that is based on measurement of temperature and humidity at local weather stations during critical stages of the growing season. The insurance is sold through ICICI Lombard General Insurance Company and managed by Weather Risk Management Services (WRMS), a private consultancy firm that designed the product, installed weather stations and manages the insurance aspect of the program, charging PepsiCo a commission of 5 per cent of the premium. PepsiCo has systematically educated farmers about this product, conducting numerous training sessions and meetings for the various actors involved. PepsiCo also provides farmers with weather forecasts about rain and frost conditions that are unfavorable for the potato crop. The premium for the insurance was set at US$30/acre, approximately 3-5 per cent of the sum insured of US$500-600/acre, and the product is structured to cover losses above 40 per cent of yield. The maximum payout is designed to be equal to the cost of production plus a bit more to include family farm wages and opportunity costs. The premium is paid up front by PepsiCo but deducted from the farmers' receipts when they deliver their potatoes. Although initially limited to late blight disease, the insurance was subsequently extended to include a frost damage index. Farmers do not need to lodge claims as the insurance company monitors the policy and calculates claims based on certified data from third-party weather stations.

About 4000 farmers purchased the insurance in the 2007 and 2008 Kharif season (about 80% of those eligible) and about 500 in the two Rabi seasons (about 50% of those eligible). The average loss ratio over the first three seasons was 76% (Hazell et al., 2010, Table 7). The relatively high uptake rate can be attributed to several factors:

- PepsiCo gave the farmers an additional Rs.0.15/ Kg on their potatoes which covered approximately 50% of insurance premium - an implicit subsidy suggesting that the insurance provides benefits to PepsiCo as well as the farmers.
- Inclusion of the insurance premium in the loan for farm inputs, essentially deferring payment until after harvest.
- Trust in the actors involved.
- Demonstration of timely payouts in the first season.
- A perceived need to mitigate the risk of losing the significant upfront production costs of US$500-600/acre.
- Dissatisfaction with the government area-yield insurance program.

Basis risk was a problem at the beginning for some farmers because there were too few weather stations to adequately capture local variation in key weather parameters, but this problem was reduced over time as WRMS invested in additional weather stations. The program was seemingly still ongoing in 2017, but more recent data is not accessible.

La Positiva Insurance Company in Peru successfully offered multi-peril indemnity-based crop insurance to small, commercially oriented farms on an unsubsidized basis from 2013/14 to 2019/20[10]. The insurance was available to farmers who were trusted borrowers from financial institutions associated with the insurance company. The insurance was available for any crop for which a loan was made, and covered a range of named perils including drought, excess and untimely rain, flood, landslides, strong wind and fire. The insurer relied on the lenders to monitor crop performance and assess damage. Claim payments were limited to 50 per cent of the value of a farmer's expected crop yield as determined by the lender at the time of issuing a loan.

[10] Based on evidence provided by Miguel Robles for the GIZ (2021) study

Indemnity payments were paid directly to the financial institutions who used them to offset farmers' loans. Any surplus payment beyond the value of a loan went to the farmer for her own use. To simplify its marketing strategy, the insurer charged an identical premium rate of 3.3% for all crops and regions. The insurance program was launched in 2013 with about 12,700 farmers and averaged about 14,600 farmers per year over 2013/14 to 2019/20. The scheme proved financially viable without any subsidies with an average loss ratio of 0.65 between 2013/14 and 2019/20. Inspired by this success, and with the hope of encouraging more private insurance companies to enter the market to scale up the number of insured farmers, the Government of Peru began offering a 50 per cent premium subsidy for this and similar schemes in the 2020–21 crop season.

Factors contributing to the success of the program include:

- The commercial alliance between the insurance company and a group of FSPs that provided farmers with agricultural credit. These included banks, microfinance institutions, and farmer cooperatives. Through this alliance the insurance company had access to key on-the-ground information about each farmer that facilitated the tasks of issuing contracts and assessing claims, helped keep costs down and contained moral hazard problems despite the multi-peril nature of the insurance coverage.
- The fixed premium rate for all crops and regions simplified the marketing of the insurance through the lenders, though it must have led to some cross-subsidization from low-risk crops and regions to high-risk crops and regions. Adverse selection problems were likely contained because the insurance was tied to credit which offered an important value adding proposition for farmers.
- Another factor contributing to success was that the insurance was only offered to trusted borrowers by the financial institutions, though this also acted as a constraint on scaling up the program to reach larger numbers of farmers.

The **Café Seguro scheme in Colombia**[11] is a good example of an insurance that was initiated and piloted by an NGO working with a large agribusiness and a technical support group and which the government subsequently decided to help scale up with the aid of subsidies. After an initial two-year design phase undertaken by AgriLogic Consulting and the IRI team of Columbia University with support from Blue Marble Microinsurance, Café Seguro was launched in July 2018 as a pilot for Nespresso's smallholders in the Caldas region. The insurance was underwritten locally by Seguros Bolivar and with international reinsurance provided by Blue Marble's owner companies. Café Seguro is an index-based product that protects coffee growers against two main weather risks, excessive rain during the flowering phase and lack of rain during the grain filling phase. The first pilot period from July 2018 to September 2019 spanned two annual harvest periods (Mitaca and Principal) and insured 1,858 farmers. The premium was paid by coffee cooperatives on behalf of their members using Fairtrade funds. All the farmers received payouts during the pilot period and while this helped build farmers' confidence in the scheme, it is not reported how this impacted on the financial sustainability of the insurance. The pilot's success attracted significant premium subsidies from the Government and starting in July 2019 the insurance reached 3,275 farmers and by July 2020, had reached over 9,000 smallholders and 22,000 hectares of coffee.

[11] Based on Nespresso (nd) and GIZ (2021).

A very different kind of private insurance was a **community-run livestock insurance in Andhra Pradesh State, India**[12]. This insurance protected smallholder dairy farmers (mostly women) against loss of dairy cow due to accident, named diseases subject to vaccination, surgical operations, and strikes, riots and civil commotion. The insurance was initiated in 2005 as a mutual insurance scheme owned and administered by community organizations at village, block and district levels. The insurance was voluntary and had an initial annual premium rate of 4%, plus a small entry fee. The value of the animal was estimated by a veterinarian and the coverage value decreased with the age of the animal. Losses were verified and claims settled by the community organizations. The insurance operated successfully from 2005/06 to 2006/07 as a self-financed mutual insurance scheme with no reinsurance protection and incurred an overall loss ratio of about 50 percent. As the communities undertook the administrative, supervision, and claim assessments themselves, operating costs were kept to a low 12% of the total premium income, and local supervision also helped minimize false claims. The number of animals insured increased from around 3,500 in 2005/06 to 25,500 in 2007/08 and the total premium collected increased from US$3.7 million to US$8 million. Based on this initial success, the Tata AIG Insurance Company entered into a three-year insurance agreement with the scheme administrators with a premium rate of 2 percent. The community organizations continued to be wholly responsible for implementing the scheme. The insurance model was subsequently replicated in other states in India with financial assistance from the World Bank, but which may now have been superseded by a national and subsidized livestock insurance scheme.

Experience of International Private Firms Promoting Index Insurance

Recent developments with remote sensing and digital technologies and the ability to geo-reference farms and fields has enabled the development of sophisticated weather index insurance products that can be remotely delivered to farmers and serviced through e-banking using their mobile phones. Payments can also be made automatically whenever warranted by an index, eliminating the need for farmers to file for claims. In effect, some insurance products can now be offered that do not require any physical contact between the insurer and farmers or any inspection of the crops and livestock they wish to insure. These opportunities have not only been seized by insurers within countries, but several fin-tech firms operating internationally have also entered the market, such as WorldCover and OKO.

WorldCover is a private firm funded through venture capital that set out to sell IBI products to smallholders in Africa using remote sensing technology and electronic payments systems[13]. Starting in 2016, they launched programs in Ghana, Togo, Benin, Kenya and Uganda using local sales agents to promote and market the initial contracts. By late 2019 they were selling insurance policies to a total of 30,000 farmers, many of whom were repeat buyers. But to make the insurance financially viable they had a target of 1 million farmers and failure to achieve this led to a changed strategy. They terminated their in-country agents, and now work through intermediary organizations like cooperatives, agribusinesses and private insurance agencies. These in turn are insuring larger commercial farms rather than smallholders. They have also diversified away from Africa to include commercial farmers in Europe and the US, as well as large farms in Zimbabwe and South Africa. A typical client today has 100s of hectares, and many grow high value crops. One of their intermediaries is the One-Acre fund.

[12] Based on Annex II in World Bank (2008)
[13] Based on an interview with Melanie Bacou of WorldCover on September 14, 2020

Several problems held back their expansion with smallholders.

- It is hard to achieve scale with smallholders without any premium subsidies. In their experience, farmers are not willing to pay more than a 3-7% premium, even large commercial farmers. To reduce premium rates, they have offered flexibility on the level of coverage farmers can choose. The more popular contracts cover part or all of farm input costs like seed and fertilizer rather than the value of the crop.
- They have not run into complaints about basis risk, but this may be because their technology enables them to write contracts at spatial scales of 4 X 4 kms or less. Working through aggregators like coops or agribusinesses also helps reduce basis risk.
- The regulatory environment for parametric insurance is a problem in Africa. Their shift from direct sales to working through intermediaries means they are no longer regulated as insurers themselves, but their partners must comply.
- At a time when many African governments are contemplating launching agricultural insurance programs, a lot of uncertainty remains about the types of programs that will be launched. Since subsidized government insurance programs can crowd out their own sales, they need more certainty about if, what, and when governments plan to intervene.
- Not enough farmers have suitable mobile phones for their digital technology and payment systems.
- The cost of international reinsurance is very high and WorldCover has limited capacity to pool risks within its own portfolio.

OKO has a similar working model and offers index insurance in seven African countries but has only insured 27,958 farmers to date and paid $482,000 in claims (https://www.oko.finance).

3.3 Insights from Recent CGIAR Research Projects

A number of recent research studies have been undertaken in direct partnerships between researchers and private insurers, FSPs and agro-dealers to rigorously test innovative new approaches in the design and implementation of insurance products for smallholders. These studies have typically involved rigorously monitored pilot projects that are primarily geared towards assessing impacts on farmers' demand for insurance, and on farm input use and productivity, but they also provide useful insights about how insurers and intermediaries view new opportunities for providing insurance for smallholders. Our review draws on CGIAR research projects as these provide insights from the suppliers' perspective that are not to be found in most published research papers.

Recent pilots have evaluated various innovations and partnerships that could potentially encourage the private financial sector to adopt and sustainably serve the smallholder farmers on a commercial basis. For instance, picture-based insurance (PBI) leverages on smartphone technologies and farmer-generated data to generate evidence of crop loss based on farm-level images. This eliminates the need for costly in-person assessments and reduces the frequency of fraudulent claims thereby reducing transaction costs and operational expenses for insurance companies. The use of automated image processing also increases efficiency in claim verification further reducing operation costs (Ceballos, Kramer & Robles 2019). CGIAR has also developed a Climate-Credit Scoring Tool that integrates climate data —such as seasonal climate forecasts, satellite-derived weather information—into conventional credit scoring algorithms, to

create a more holistic evaluation of smallholders' ability to manage climate risks. By integrating multiple indicators this tool significantly bridges data gaps, providing financial institutions with a more nuanced understanding of borrowers' risk profiles, and their ability to make more efficient and accurate lending decisions. This will in theory lead to a reduction in information asymmetry and potential loan defaults (Benami et al. 2021). A stakeholder engagement with microfinance institutions in Zambia indicated that the tool has led to increased credit uptake by smallholder farmers, particularly by those previously underserved by conventional credit mechanisms. CGIAR has also tested the effectiveness of bundling insurance with other financial products or agricultural inputs as a strategy to increase market penetration and volumes. For instance, CGIAR researchers have worked with local microfinance institutions in Kenya, Ethiopia and India to design and test insurance and credit product bundles. The findings from the pilots have shown that the uptake of the bundled product is better compared to standalone products, Similarly, research in Kenya involving partnerships with input suppliers showed that linking insurance to specific inputs like seeds or fertilizers can increase effective demand for these technologies incentivizing the private sector to participate in these markets. Using advanced one-stop mobile innovations such as DigiFarm that connects farmers to financing, agro-dealers and output markets have also shown promising results in aggregating farmers and reducing spatial fragmentation. In Zambia, the CGIAR is currently finalizing an agreement to test a blended finance module that enables pooling and layering of resources from diverse stakeholders including development organization, and private and public investment. In the proposed module, the government and other public entities will offer concessional funding in the form of credit guarantees while the private sector focuses on scaling and commercial sustainability.

Although these innovations have successfully stimulated demand, reduced costs, and improved efficiency, they have yet to provide sufficient incentives for the private sector to sustainably serve smallholder farmers on a commercial basis. Stakeholder engagement with partners revealed that the innovations have fallen short of addressing farmer demand to levels that would ensure profitability, and they have not yet created a sustainable business model to encourage long-term private sector involvement in serving smallholder farmers. The challenges of market fragmentation and high transaction costs also continue to impede the development of a commercially viable approach to serving this demographic, suggesting that additional interventions or policy support may be necessary to achieve sustainable, large-scale private sector engagement in this market segment.

4. Lessons from the Case Studies

Several lessons emerge from the case studies that add to findings from the literature review in section 2.

4.1 Product Design

Selecting the risks to insure

In principle, multi-peril indemnity insurance ought to be attractive to farmers, but as the early private attempts to offer it in the US demonstrate, it can be a quick path to financial ruin for insurers because of its high cost, demanding data requirements, and moral hazard and adverse selection problems. Instead, private and unsubsidized insurance is nearly always restricted to

specific peril contracts or index-based products. Good examples are insurance programs that were initiated to address very specific and catastrophic risks, such as the hail insurance programs in the US and the Mauritius sugar insurance after a major cyclone in 1946. They were not only significant risks for farmers, but also risks and associated losses that could be easily and objectively measured. In contrast, the poor experience with a rainfall index insurance sold through the cotton ginners in Tanzania illustrates the pitfalls of ignoring poorly functioning farm input markets and of addressing only one of several major risks facing farmers and ginners.

Despite their success, programs that focus on specific perils or indices fail to address the broader insurance needs of many farmers. The case studies provide some encouraging examples for how to broaden the risks that can be privately insured. One approach is to insure communities or farmer organizations rather than individual farmers through single meso-insurance contracts. Insurance groups can tap into their ability to reduce moral hazard problems amongst their members, reinforced as needed by adjusting the premium rate for the group over time to reflect their loss experiences. Good examples are the peach and citrus grower cases in the US in the 1920s where the insurance was channeled through producer marketing organizations, and the Café Seguro scheme in Colombia where the insurance is sold through coffee cooperatives. A more complete example is the community-based livestock insurance scheme in India where community organizations are empowered to manage the insurance and undertake their own loss assessments.

When individual farmers are to be insured, moral hazard can be reduced by incorporating deductibles into the insurance contracts, and these can be adjusted upwards if claims are higher than expected, as with the CNS program in Chile. Moral hazard problems can also be reduced by bundling insurance with credit if the lending institution can be relied upon to provide careful monitoring of crop growth and damage as part of its oversight to avoid loan defaults. A good example is the La Positiva insurance in Peru which relied on trusted lenders to establish expected yields for each farmer and to monitor their crop management practices.

The CNS program in Chile offers an innovative approach for reducing moral hazard and false claims and that is to have farmers pay directly for damage assessments by designated and independent experts when making a claim rather than including that cost in the average premium rate. Not only does this discourage farmers from making false claims, but it also reduces the effective cost of the insurance for farmers who make lower claims over time.
Advances in IT and mobile phones are providing new opportunities for monitoring and assessing crop growth and damage at plot levels, such as can be done with Picture Based Insurance (PBI). While still at an exploratory stage in CGIAR research (see section 3.3), PBI and similar technologies may yet provide new opportunities for insuring a wider range of risks on a private basis.

Minimizing price risks

Incorporating price risks into insurance contracts has proved problematic for several private insurance schemes. For example, some of the earliest private insurance schemes in the US failed because they valued losses at the market prices prevailing when the loss occurred. Since variation in market prices is often inversely related to variation in aggregate production, the insurer can be exposed to a double hit when a systemic, regional losses occur, having to compensate farmers for their low yields while valued at the increased market price. Solutions found in our case studies include writing contracts that specify averages of past prices when

valuing losses or restricting claim payments to some share of estimated production costs rather than estimated yield losses. Some schemes have also imposed caps on the payments that will be paid per insured unit (e.g., per acre or animal). If farmers want greater price coverage, then as with CNS in Chile, farmers can be offered several price options in their contracts for valuing losses, each charged at an appropriate premium rate.

4.2 Demand for Insurance

Low farmer demand for insurance remains a major challenge, and our case studies confirm the large body of evidence showing few farmers are willing to pay the full cost of insurance. This is not just a startup problem but persists even with established insurance programs. Our case studies illustrate several approaches for addressing this problem.

Reducing the costs of insurance

The full cost of insurance comprises its pure risk cost plus administration costs plus risk loading costs. There is little scope for reducing the pure risk cost of insurance without subsidies hence insurers need to focus on products that are of high value to farmers. That often means targeting insurance at crops or livestock that have a high capital investment relative to a farmer's wealth, or insurance that is bundled with credit and farm inputs that together make a good value adding proposition for the farmer. The pure risk cost can also be contained by periodically adjusting insurance contracts to reflect any lower claims than expected. For example, the Mauritius sugar fund recognizes low claim farmers by increasing the payments they receive when losses occur, and NWK in Zambia recognizes lower claim farmers as "Gold Club" members who are charged a lower premium rate for their insurance.

In situations where farms have several plots with some spatial variation in risk exposure then, as in the early US experience, crop insurance is better written at the farm rather than plot level as this can help reduce crop loss claims and help keep premium rates down. Providing farmers with timely weather forecasts can also help them adjust their farming practices to the peculiarities of each growing season, reducing loss claims and enabling premium rates to be lowered over time (e.g., the PepsiCo scheme in India).

There is greater scope for reducing administration costs. Specific peril and index-based insurance products are considerably less costly to administer than multiperil indemnity-based products and can often be serviced using mobile phones and e-banking. Kilimo Salama (now ACRE Africa) is a good example of how these technologies can help reach large numbers of smallholders. However, World Cover's experience with similar technologies but without any subsidies suggests that on their own the new technologies are still insufficient to achieve scale. Bundling insurance with credit and farm inputs can save costs by taking advantage of the existing administrative systems of the intermediaries. Insuring groups rather than individual farmers is another cost-effective way of insuring lots of smallholders.

The CNS program in Chile illustrates the value of having farmers pay directly for inspections and loss assessments by designated experts rather than adding these costs to the average premium rate, and the costs saved by channeling agricultural insurance through an established insurer that is already marketing other types of insurance products in rural areas (e.g., life and motor insurance).

Risk loading costs can be reduced if insurers diversify their portfolio across crops and regions. A good example is the strong negative correlation between claim payments for cereals and fruit which helped stabilize the aggregate losses in any one year for CNS in Chile. The CNS case also demonstrates the value of an established insurer that is already diversified into a nonagricultural portfolio.

Knowledge and trust

Many farmers, especially smallholder farmers and pastoralists, have little knowledge or experience of agricultural insurance and efforts to increase awareness and financial literacy can help increase demand. In a highly competitive insurance market, individual insurers will have limited incentive to invest in such efforts because they cannot capture the full benefits of their investment. However, most markets for agricultural insurance in LMICs are far from competitive, and insurers may find it worthwhile to invest in farmer education along with branding and promoting their own products. A good example is PepsiCo scheme in India which provides lots of training for farmers, but it is done within the context of contract farming and hence a very segmented market. Bundling the insurance with credit and farm inputs may also help if the intermediaries are already established and trusted. Allowing the farmer to experiment with insurance at a small scale can also help. For example, the Kilimo Salama project permitted farmers to insure as little as a single bag of fertilizer or seeds to gain experience with their insurance product. They also established a phone help line through which farmers could obtain answers to their questions from trained agents.

Another way to attract farmers is to defer premium charges until after harvest to ease potential cash flow constraints. Examples are NWK in Zambia and PepsiCo in India. It can also help if insurance is designed to recognize differences in the needs of farmers. One approach is to offer a range of contracts, not just one, from which farmers can choose. For example, CNS in Chile offers farmers several price options for valuing losses which are reflected in the premium rates charged. Adding life or accident insurance to the agricultural insurance as an initial sweetener for first time buyers can also help, as illustrated by NWK in Zambia.

Compulsory insurance

Some programs seek to side-step the demand problem by making insurance compulsory. One example is the Mauritius sugar insurance which is compulsory by government decree for all sugar farmers and mills. In the absence of such enforcement power, insurers must work with less watertight approaches. Some financial service providers require borrowers to purchase credit insurance with their loans, but this adds to the cost of the loan and can discourage borrowing. A novel approach is to embed the cost of insurance into the price of an input like fertilizer which all farmers must pay regardless of whether they want insurance. This approach was tried by AbonoSegurado in the Philippines, but they found that in a competitive input market farmers who do not want the insurance can go to alternative suppliers who do not include insurance in their prices.

Cost sharing

Public subsidies are a powerful instrument for scaling up insurance, especially amongst smallholders, but even when such funds are not available there may sometimes be scope for cost sharing between farmers and other players in the value chain who also benefit from the insurance. A good example is the Mauritius sugar insurance where the sugar mills are also required to contribute to the cost of the insurance. In Zambia, the cotton insurance scheme

operated by NWK AgriServices helps the firm attract and retain cotton farmers under contract arrangements, improves loan recover rates and reduces side selling to other ginners, benefits that are of sufficient value to the firm that it offers a 75% premium subsidy for its Gold Club member farmers. Similarly, PepsiCo in India benefits from the insurance it sells to its contract potato farmers, and this is reflected in a price premium (equivalent to a 50% insurance premium subsidy) paid to potatoes farmers who purchase the insurance. Ago-dealers also shared the premium cost on a 50:50 basis with farmers in the early years of the Kilimo Salama project in Kenya, again because of perceived benefits from increased sales to farmers.

4.3 Delivery Systems

Working through intermediaries

Some of the more successful schemes sold their insurance through farmer organizations or marketing boards as intermediaries (e.g., the Georgia peach growers, Florida citrus growers, and the Mauritius sugar fund). This enables them to reach more farmers, keep administration costs down, and reduce adverse selection problems. Many other successful programs have sold their insurance through intermediaries like financial service providers and agro-businesses who can bundle the insurance with credit and farm inputs. But there are risks to this approach. Some schemes in the US were undermined because the intermediaries had incentive to keep selling their own products (e.g., seeds and fertilizer) along with the associated insurance until too late into the growing season. This enabled farmers to assess emerging weather conditions and likely crop losses and adjust their demand for insurance to the particulars of the coming season. Insurers soon learned to impose a firm closing date for the sale of any insurance contracts. Another risk is that insured farmers will default on their debts or, in contract farming arrangements, side sell to other buyers. This risk is even greater if the premium for the insurance is also advanced as part of a loan. One way that intermediaries can deal with this problem is by only offering insurance to trusted borrowers (e.g., La Positiva Insurance Company in Peru), though this also reduces the scope for scaling up to reach larger numbers of farmers. Another solution is for the insurance claims to be paid in the form of discounts on future input purchases, as with AbonoSecurado in the Philippines. More direct solutions are for the insurance claims to be paid directly to the intermediary rather than the farmer, or for the insurance to be written as a single meso-insurance contract with the intermediary. This has been done in several cases when the insurance was channeled through a farmer organization (e.g., the Mauritius Sugar Insurance Fund Board and the Georgia Peach Growers Exchange).

4.4 Policy Support

A striking feature about the case studies is that private insurers rarely initiated the programs but were drawn into it by intermediaries such as lenders, agro-businesses, and marketing/processing firms who saw the insurance as a way to expand their own businesses. In other cases, farmer organizations, NGOs, researchers, and donors played important catalytic roles in initiating new programs. This suggests there are significant entry level challenges and costs for insurers wishing to expand into the agricultural sector, particularly if they have no prior experience.

All our cases were undertaken in countries that had enabling legislation and regulations for agricultural insurance. Some governments also actively supported the development of the insurance programs. For example, in Mauritius the government was proactive in passing

enabling legislation for setting up the insurance scheme. In Zambia, the ministries of agriculture and finance supported NWK in establishing its insurance program and even reduced the value added tax from 15% to 3% for insurance premiums paid by small scale farmers. In several cases governments and/or development agencies were sufficiently impressed with privately run insurance schemes that they later scaled them up with subsidies to reach much larger numbers of smallholders (e.g., La Positiva insurance in Peru, Café Seguro in Colombia, IBLI, and Kilimo Salama (now ACRE Africa) in Kenya, and the community run livestock insurance in India).

Suitable data systems were also available in most of the case study countries. Some of the early insurance initiatives in the US were constrained by an absence of crop yield data below state or county levels, and this is still a problem in most LMICs. Index based insurance that relies primarily on remotely sensed data is less dependent on farm level data, though it is required at the product design stage. Weather station data is also limited in many countries and additional investments are often needed to reduce basis risk. For example, the PepsiCo insurance in India – had to invest in additional weather stations of its own to supplement the available government stations, as did the Kilimo Salama project. Otherwise, data does not appear to have been an important constraint in most of the case studies, but that may well reflect a selection bias in our sample of case studies, since private initiatives are less likely to arise in countries without suitable data or government support.

The case studies also show that private insurance emerges best where it does not have to compete with subsidized public programs, either because it found niche risks to insure or because public programs did not exist. In fact, rather than competing with public programs, several of the case studies led to viable and impactful insurance models that government subsequently decided to scale up with subsidies to reach larger numbers of smallholders. This typically led to the assimilation or demise of the original unsubsidized program.

5. CONCLUSION

It is hard to avoid the conclusion that private unsubsidized insurance will always play a limited role in terms of the overall risk management needs of agriculture. It can only address certain types of risks, and these are often not the most important from the farmers' perspective. Agricultural insurance is, at best, only one of the tools farm households can use for managing risk, and the design and development of insurance products needs to be better integrated within a broader and more holistic risk management perspective. To this end Kramer et al (2022) have proposed that more attention should be paid to market and risk segmentation when designing insurance programs and products (see Box 1). For many smallholders, insurance is best seen as part of an income support approach, while commercial farmers have more options for managing risk and may benefit more from specific types of indemnity or IBI products to protect specific agricultural investments. The rationale for premium subsidies should also be different for commercial versus smallholder farmers. Subsidies for the latter may be essential and for those below or near the poverty line subsidies might best be formally linked to safety net and public relief programs. But for commercial farmers, subsidies should be directed at correcting failures and externalities in insurance markets. Subsidies might also be targeted according to the type of risk to be insured. For example, if subsidies were targeted at the more catastrophic risks that are too expensive for most farmers to insure, then there may be more scope for private insurers to offer more affordable insurance for more intermediate risks.

Within this framework, private unsubsidized insurance seems most likely to be financially viable for underwriting intermediate level risks for farmers who are commercially linked to value chains (the green cell in Box 1). Even if targeted in this way, private unsubsidized insurance will only thrive given a supporting policy environment and, to keep costs down and improve the relevance and delivery of its products, insurers should take full advantage of new and emerging digital and remote sensing innovations, and where possible, partner with intermediaries who can bundle their insurance with credit, farm inputs and other services.

Box 1: Role of risk management strategies and insurance by type of farm household and type of risk

Type risk		Type household			
		Chronically poor	*Nonpoor, subsistence oriented small farms*	*Commercially oriented small farms*	*Medium and large commercial farms*
		Capacity to manage risk increases from left to right			
Idiosyncratic	Severity of losses increase from top to bottom	Income diversification and regular social protection transfers	Self-insurance (e.g., on-farm and off-farm diversification, credit and savings, membership in a local risk pooling group) plus asset and personal insurance		
Intermediate		As above plus some forms of heavily subsidized insurance	As above plus climate smart farming. Agricultural and credit insurance might help but may have to be subsidized from high to low across groups		
Catastrophic		As above plus disaster assistance	As above plus disaster assistance and/or catastrophe insurance Catastrophe insurance may have to be subsidized from high to low across groups		

Idiosyncratic risks comprise frequent but typically low impact losses, such as modest yield and production losses at farm or plot level. ***Intermediate risks*** involve less frequent but larger losses that may be correlated within groups of households, such as frost, hail, or flood damage. ***Catastrophic risks*** are tail-end risks that are infrequent but have high, systemic impacts, such as a severe flood or drought, affecting many households within a region.

Chronically poor households are generally the most vulnerable to risk with limited options for avoiding and coping with losses. Their primary challenge is to protect household consumption of food and other basics, and they are a major target group for social protection programs. If insurance has a role for this group, it is probably to protect specific assets like livestock or savings and would need to be heavily subsidized. ***Nonpoor, subsidence-oriented farms*** have sufficient resources to avoid chronic poverty, but repeated losses can push them into poverty. Subsidized insurance against intermediate risks may be helpful for protecting their incomes and assets and may enable them to invest more in their farms and transition to commercial farming. ***Commercially-oriented small farms*** might also benefit from insurance against intermediate risks but more to protect against loss of specific investments in agriculture than to stabilize household income or consumption. Because of their links to value chains, these farms may have access to insurance through intermediaries that is bundled with services such as credit and modern inputs. ***Medium and large commercial farms*** face the highest levels of

production and market risk but also have the greatest capacity to self-manage risk. This group is the most viable clientele for private insurers either directly or through value chain intermediaries and may need little if any premium subsidy. In addition to the subsidies indicated above they may also be relevant for small-scale meso insurance schemes that underwrite some of the covariate risks facing local savings and risk pooling groups. They may also be justified if insurance is to tackle some of the more catastrophic risks at affordable premium rates and reduce the need for disaster assistance payments.

Source: Adapted from Kramer et al (2022)

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