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Africa Current Issues

Index Insurance for Agriculture in Africa: Emergent Direction or Dead End?

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1. Introduction

A farm, whether large or small, can be a risky business. Farmers face price, yield, and resource risks. Such risks tend to make their incomes unstable and unpredictable. Systemic[1] risks such as crop disease and extreme weather affect individual farmers, and the social networks and communities on which they rely. Drought or new pest outbreaks may destroy crops and/or livestock. Assets, revenue, and even lives may be lost due to extreme events such as hurricanes, fires and floods. Agricultural risks also vary by scope. Trends in local or world markets may push market prices down, or drive input costs up.

Contextual factors drive both the type and the severity of agricultural risks. These factors include farming methods, weather, geographic zones, national policy, and institutional capabilities. Such risks are particularly burdensome to small-scale farmers, especially in the absence of efficient credit and insurance markets. Many farmers adopt informal risk coping strategies to mitigate the impact of both systemic and idiosyncratic shocks. For example, individual farmers may diversify plantings, or invest in livestock. Collective networks such as farmer-based organizations (FBOs) may deploy risk sharing to help address idiosyncratic risks such as equipment breakdown or family illness.[2]

Unfortunately, informal risk coping practices are often costly and economically inefficient. Conventional crop insurance, even when available for a given crop and in a specific zone, may cost more than farmers are willing and able to pay. Verification of the actual loss makes up a large part of the costs of conventional crop insurance, leading insurers to seek other solutions. Index insurance compensates the insured based on the observed value of a specified "index" closely related to such losses. Often, rainfall provides a reasonable proxy for agricultural losses. [3] [4]

This note explores the innovative index approach to insuring the agricultural value chain, evaluates its potential to add value to stakeholders in African agriculture, and identifies potential business opportunities. Downstream business stakeholders include banks, out growers and other contract farmers, nucleus farms, warehousing firms, input dealers, processing firms, and other agricultural aggregators. On the upstream end, niche opportunities may emerge for weather and commodity market data providers, blockchain and other technology developers, and mobile payment providers.

Table 1: Types of risk faced by agricultural producers

Sources of Risk	Types of Risk
Climatic/Natural Disaster	Drought, fire, flood, frost, hail, pest infestation, snow, storm, wind, etc.
Environmental	Pollution, deforestation
Financial	Interest rates, economic downturns
Geological	Earthquakes, volcanic eruptions
Health	Illness, injury, disability, epidemic diseases
Operational	Inputs availability, equipment failure, technology incompatibility
Policy	Public subsidies, agricultural policy
Price	Commodity markets, inputs, exchange rates
Property	Fire, theft
Sanitation	Plagues, diseases

Source: Reyes, et al 2017.[5]

Coping with versus managing risk

Informal risk coping mechanisms may limit farm profitability and often impede the adoption of improved production technologies. For example, communal risk-sharing schemes such as rotating access to

group savings may help manage risks for individual farms during "normal times." These arrangements typically collapse when a widespread weather catastrophe adversely affects the incomes of all members of the group. Crop diversification generally offers very limited protection against catastrophic weather events; such events typically affect production across all crops. Investing in livestock is a poor hedge against the loss of income from widespread catastrophic weather events. Unfortunately, hard times motivate farmers to liquidate their herds to sustain their cash flow, which tends to profoundly depress sales prices.

African farmers face a broad range of risks (see Table 1).[6] Increasing agricultural productivity requires adoption and diffusion of improved methods and core technologies such as improved varieties, fertilizers, and irrigation.[7] However, most African farmers live near subsistence level, and are likely to be highly risk-averse. Poverty deters them from adopting new technology and farming practices, even when the results are likely to be beneficial.[8] Risk management is one such innovative farming practice that many African farmers have yet to adopt.

Why Index Insurance?

Crop insurance is an important risk management tool. The recent emergence of index insurance for agriculture promises to reduce transaction costs and mitigate systemic risks. Unlike conventional crop insurance, index insurance eliminates the cost of verifying individual claims, and simplifies provision of insurance products and services to rural communities. By refunding the costs of their inputs, weather-indexed insurance indemnifies farmers from reduced crop output due to poor weather and other risks. However, underwriting such policies requires reliable data and correlation between variance in the index and the loss suffered. When this relationship cannot be established, farmers may experience losses, yet not receive a payout.[9] In addition, the concept of an index is awkward to market. Smallholders need to understand the characteristics of the financial product they are purchasing and indexed products are complex. One major barrier is premium cost: the amount farmers are willing to pay may be less than the actuarially fair premium. This is the rate needed to ensure sustainability of the insurance scheme. These factors lead to low uptake of crop insurance by farmers, unless uptake is encouraged through subsidies.

Subsidies for crop insurance

Both developed and developing countries subsidize agricultural insurance, at an annual global cost exceeding $20 billion. Economic issues, such as market failures that constrain uptake of crop insurance, may motivate such subsidies. In other cases subsidies help meet political and social objectives, such as protecting agricultural lending institutions, reducing the need for disaster assistance, or simply supporting farm incomes. According to the World Bank, little is understood regarding whether the outcomes generated by crop insurance subsidies justify their costs.[10]

Section two below presents an overview of index insurance and its use in Africa. Section three discusses current limitations of index insurance, and provides evidence on the use of index insurance and its benefits to business stakeholders, followed by recommendations on future use by innovative businesses.

2. Index insurance

Conventional crop insurance pays policyholders based on the verification of losses in farm production. Verification is expensive, and often slow. This results in higher premiums and late payments to policyholders, resulting in low take-up for conventional crop insurance. Practitioners and researchers believe the "index insurance" approach has the potential to overcome the limitations that made this type of crop insurance unviable for Africa agriculture. An index is a simple and objectively observable variable (as is a stock market index) that correlates to a more complex phenomenon (as does the Dow

Jones index for economic activity). In insurance, a useful index is one that correlates to losses, can reliably be measured, yet cannot be influenced by actions of the insured. Rainfall is the most widely used index for agricultural insurance. Index crop insurance underwriting may also consider other weather-related indices such as temperature, satellite-measured vegetation indices, and proxy measures such as area-yields, river flood levels, and mortality rates.

How an index insurance policy works

Blockchain technology can register the location, amount, and parties involved in transactions as a linked chain of distributed files, or "blocks" identified by unique codes. This design protects against modification of related documents in the chain and creates trust among partners, as each user has a role in ensuring the integrity of the blockchain.

For example, if a blockchain were used to record and track a contract between a farmer and an insurance provider, both parties would have access to this particular chain of files. If the farmer assigned the payout from the policy to a lender, a block containing this information would be added to the chain. The insurer would be notified and both the farmer and the insurer would be requested to approve the change. This would trigger issuance of a new unique code. The unique code mechanism would prevent one party from modifying the contents of a block earlier in the chain without first receiving approval from other parties in this chain. Blockchain technology has other applications in the crop insurance sector, such as helping insurers balance risk by linking to re-insurance providers.

Smart Contract

An agreement between parties can be executed using software that runs on the blockchain platform, called a smart contract. The smart contract will trigger a payment to the assignee upon an external event that is highly correlated to losses by the insured, called an index. For example, if objectively measured rainfall were below the amount agreed by the insurer and the farmer, the insurer would initiate payment according to a schedule.

The design and successful implementation of an index insurance contract requires an agreement that meets multiple conditions, including the following: 1. weather events must correlate with losses; 2. the index must be a reliable proxy for losses, 3. events must be observable and easily and inexpensively measured; 4. a trusted third party should be involved in measurement; 5. the measurement and reporting system must be objective and transparent; and historic data must exist to enable pricing of the risk.

An index insurance program that uses rainfall volume to index agricultural losses typically has threshold and limit levels of rainfall, between which indemnification will be executed and the policyholder paid. The threshold is the accumulated rainfall volume that will trigger the payment of indemnity, and the limit is the minimum level that will lead to maximum payment. Once the threshold is reached, the indemnity payment begins. Payment will incrementally increase until the index reaches the limit set.

Index insurance can mitigate risks along the agricultural value chain[11]:

Micro-level index insurance covers individual farmers including smallholders. Meso level index insurance covers "risk aggregators" such as banks, microfinance institutions, agribusinesses, suppliers, national export companies, and cooperatives. Macro-level index insurance covers contingent liabilities that a Government or insurer might face in the event of a disaster or a weather-related catastrophe, often via reinsurance mechanisms.

Experience in Africa

Today, index insurance pilot programs have been implemented in more than 20 African countries with more pilot programs in the pipeline. Researchers and international agencies have undertaken extensive

index insurance research and market development activities in sub-Saharan Africa over the past two decades. These activities include: design and actuarial rating of index insurance contracts; determining the feasibility of market-based pricing (i.e., without subsidies); educating and fostering cooperation among farmers, lenders, insurers, government officials, and regulators regarding the potential benefits of index insurance; acquiring, validating, and analyzing weather and agricultural production data; assessing the adequacy of weather station network density, security, and real-time reporting capabilities; exploring the feasibility of alternative insurance indices; identifying and testing alternative ways to incorporate index insurance into farm, firm, and governmental risk management strategies; and improving the marketing and delivery mechanisms needed to distribute risk insurance.

Limitations of index insurance

Despite encouraging outcomes from pilot studies, the take up rate for index insurance pilot programs is low. Significant uptake of index insurance among smallholders occurred only when it was heavily subsidized or coupled with other benefits, such as low-interest loans. Developing a market for micro index insurance products requires substantial investment in training and education of farmers. Creating demand for these insurance products at the farm level requires educating farmers about the relative costs and benefits of insurance products, and training farmers to use them to manage their risks. Unlike traditional crop insurance, index insurance does not cover production losses from perils unrelated to the index, such as losses from pestilence and disease. Micro index insurance products offered on a wide scale will require investment in efficient delivery mechanisms, sales force training, and purchase channel and indemnity collection contact points. Mobile applications might reduce some of these costs.

Basis risk in index insurance arises when the index measurements do not match actual losses by the insured. A wide array of index insurance products, tailored to varied production practices and risk exposures, minimizes the basis risk associated with index insurance products. Geographical basis risk rises with the distance between the measurement instrument and the production site. Basis risk is reduced when the area the index covers is homogeneous in terms of weather and farming techniques. Thus, as the density of weather stations and satellite pixels is increased, basis risk is minimized.[12] Measurement based on a geographically dense network of weather stations or refined satellite observation grids also reduces basis risk. Virtually every pilot project study noted the need for investment in additional automated weather stations, rainfall gauges, or other measurement methods to ensure the effectiveness of index insurance contracts based on meteorological indices.

However, the costs to roll out a multiplicity of tailored weather insurance products and constructing, maintaining, and securing a broad network of weather observation stations can be substantial. This is an impediment to the expansion of index insurance programs, particularly micro insurance programs. Using satellite-based observations has the advantage that satellites can provide observations at very high levels of spatial resolution. However, satellite observations may provide less precise information than weather stations about actual conditions on the ground.

3. Opportunities for the private sector: recent empirical evidence

Pilot programs and studies undertaken in sub-Saharan Africa provide many valuable lessons. Recent studies reveal that adoption of index-based agricultural insurance by stakeholders is more likely with policies that align their interests along the value chain. For example, the terms and conditions for granting a loan to a farmer might include a provision that the farmer signs up for a crop insurance policy to which the loan provider has first rights. Using mobile technology to reduce the cost of administering the provision and repayment of loans significantly reduces overhead costs, thus allowing premiums to be more affordable. Governments, through programs that selectively subsidize index insurance to cover

losses in specific crops in areas of higher risk, can provide income security and keep farmers in business.

The benefits of index insurance on loan provision, and thereby on improved technology adoption, may be dramatically increased if the indemnity goes to the lender rather than to the farmer.[13] [14] A lender can curtail the incentives for strategic default by requiring all of its smallholder borrowers to purchase index insurance to obtain a loan, with the additional condition that any indemnity must first be awarded to the lender for repayment of an outstanding loan, with the residual passed to the smallholder. This substantially reduces the negative impacts on lenders of widespread loan defaults in the event of an adverse systemic weather event. The immediate benefits of index insurance (meso index as opposed to micro index insurance) contracts employed in this fashion are expected to be greater to an agricultural lender (or any other value chain participant that agglomerates risk) than to individual agricultural producers.

The following three brief mini-cases capture the essence of recent findings from pilot studies of the marketing and use of index insurance in Africa:

Minicase 1: Ghana Agricultural Insurance Pool

New empirical evidence on the impact of meso index insurance for agriculture in Africa reveals strong links between the structure of index insurance policies and access to credit. Miranda et al (2017)[15] conducted a field experiment in northern Ghana to investigate this phenomenon among smallholder maize farmers. The researchers worked with The Ghana Agricultural Insurance Pool (GAIP), one of the main agricultural insurance providers in Ghana. Currently, GAIP offers drought insurance policies for maize and soy crops and is the only provider of agricultural index insurance in the country.

In the Miranda study, farmers were randomly assigned to one of three groups: those that were to be Microinsured were offered production loans coupled with index insurance that directs payouts to the borrower (the farmer). Farmers that were Mesoinsured were offered production loans coupled with index insurance that directed payouts to the lender for the express purpose of repaying the loan. Farmers in the Control group were offered loans without index insurance.

Preliminary results showed banks were 32% more likely to approve loans to farmers who applied for insurance-backed contingent loans that provided payouts to retire the loan (i.e., Meso index insurance).

Minicase 2: Using blockchain technology to provide capital investment opportunities

World Cover, an innovative agricultural insurance company that uses rainfall data as index to price its insurance products in Ghana, is pioneering the use of blockchain technologies to further reduce transaction costs associated with reinsurance to make index insurance more affordable to smallholder farmers. WorldCover has built a network of capital providers and investors, who accept the financial risk of paying for drought claims in return for participating in the premium income that WorldCover collects from customers. Using blockchain technology to ensure end-to-end security, they established a seamless exchange between capital providers, reinsurance companies, and policyholders in the region. Using blockchain technology to ensure end-to-end security, they established a digitally enabled exchange between capital providers, reinsurance companies, and policyholders in the region.

Minicase 3: Mobile money and app business development opportunities

Most Africans depend on agriculture as a source of livelihood. As index insurance becomes ubiquitous in agriculture, cost effective indemnity payment will become indispensable. Insurers will more and more rely on mobile money platforms to pay farmers. Once the rainfall is measured--either by satellite or by ground observations--a claim payment can be instantly sent via mobile money directly to a stakeholder's

wallet. This model promises to improve the efficiency of the existing mobile money system and adapt to it users' demands. In Kenya, Tanzania, and Rwanda, Agriculture and Climate Risk Enterprise Ltd. (ACRE) has led the use of mobile technologies to sell to and pay farmers who are insured under their policy. They sell weather insurance, Hybrid Index and Multi-Peril Crop Insurance, and livestock insurance to stakeholders along the agricultural value chain. As of 2018, ACRE insured over 1,700,000 farmers in Kenya, Tanzania and Rwanda and underwrote over 181 Million USD against a variety of weather-related risks.

Recent developments along the crop insurance value chain

As their climate vulnerability increases, farmers in the developing world need accessible and affordable crop insurance. Sadly, traditional insurance isn't working for many of them. In sub-Saharan Africa, only 3% of smallholder farmers have access to agricultural insurance coverage. Insurance can be expensive, and farmers whose crops have not done well need funds so they can replant for the next season, and cannot afford to wait for delayed insurance payouts. Index insurance, with its inherently lower cost business model and no need to verify actual losses, is a potential solution for many small farmers.

Suppliers seeking to make index insurance more effective can capture additional business opportunities. For example, Blockchain technologies can increase foreign investors' exposure to index insurance as secure tools to diversify their investment. World Cover pioneered the use of blockchain technologies to reduce transaction costs associated with reinsurance and make index insurance more affordable for smallholder farmers. The firm's network of capital providers and investors accept the financial risk of paying for drought claims, in return for participating in premium income collected by WorldCover.

In Kenya, Tanzania, and Rwanda, Agriculture and Climate Risk Enterprise Ltd (ACRE) leads in the use of mobile technologies to sell and pay farmers who they insure. They currently sell several index products: weather insurance, Hybrid Index and Multi-Peril Crop Insurance, and livestock insurance. The main elements of such services are: 1. an insurance service; 2. a data provider; 3. a user interface; and 4. an application layer to link insurance policies to a blockchain. Several firms are involved in these projects[16]:

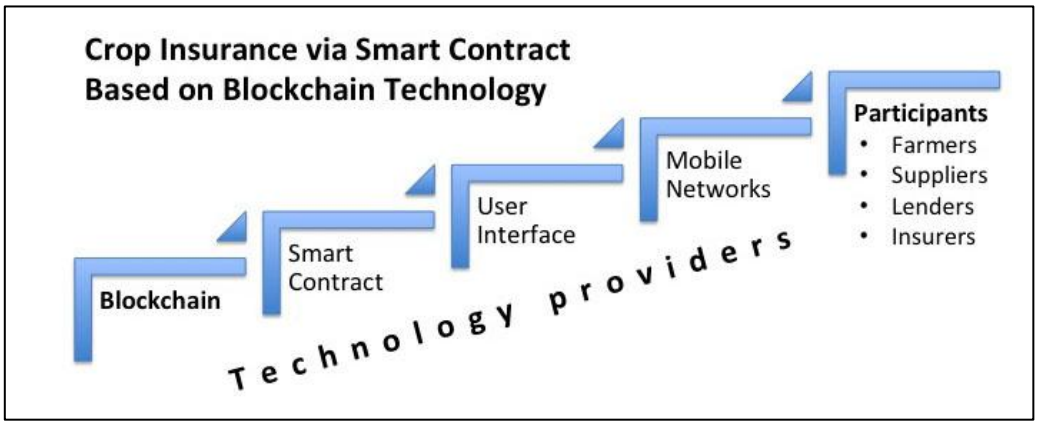
Insurance service and data provider ACRE Africa designs the insurance product, processes premium payments, and manages customer care. ACRE also collects and manages the weather data, which is used for the creation of a risk model and the verification of the occurrence of extreme weather events.

The user interface, designed and managed by Sprout Insure, registers insurance policies as smart contracts on a private blockchain. This reduces transaction costs by integrating policy information with payment processing, and farmer data.

The application layer developed by Etherisc provides the smart contract infrastructure as a layer in the blockchain that interacts with the user interface.

Mobile money provider, M-Pesa, will enable financial transactions between the end-users and the index-insurance product provider.

Figure 1: The role of blockchain technology in crop insurance



Source: author

The result promises to be a system that provides benefit to all parties involved: the insurance company obtains access to a wider market, through being able to offer lower premiums. The lender receives a guaranteed payout in the event of a loss due to unfavorable weather conditions. The farmer pays less for coverage, and receives the net payout (after repaying the lender) in time to prepare for the next planting.

4. Conclusion: charting a course forward

Clearly, the way forward is to use index insurance to strategically manage portfolio risks borne by lenders, processors, and others along the value chain. Such innovations can fully realize the basis-risk reduction benefits promised by meso index insurance products. Index insurance has the potential to simultaneously reduce loan defaults (or losses from such defaults) across many farmers in the event of widespread drought, flood, or other natural disaster. Thus, if properly integrated into portfolio risk management and loan practices, index insurance could dramatically reduce lender exposure to catastrophic risk and promote the expansion of credit supply to subsistence farmers at lower interest rates, which in turn should spur increased adoption of higher-yielding agricultural technologies.

However, effective use of index insurance by lenders to manage risk requires a deeper understanding of the cash-flow risks faced by lenders and their debt restructuring policies. Lenders are more sophisticated than farmers and in theory more able to implement complex risk management practices. However, many rural lenders in developing countries lack an active risk management culture that correctly deploys insurance, reinsurance, and derivative products. Their operational cash-flow models and risk management practices tend to be intricate and to vary from one lender to the next. Motivating lenders to incorporate index insurance into their risk management portfolios encounter difficulties unless lenders are willing to openly discuss alternative cash-flow management practices with index insurance specialists. Governments must accept the reality that well-managed crop insurance subsidies are investments that provide farmers with income stability and protect all stakeholders.

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