



STEPS TO DETERMINE WHETHER INDEX-BASED AGRICULTURAL INSURANCE CAN BE AN EFFECTIVE TOOL FOR DEVELOPMENT

Index insurance is an innovative financial tool proven to affordably protect smallholder farmers when they lose crops to drought. Traditional indemnity-based insurance, which pays out for verified losses, does not work for small-scale agriculturalists due to its high costs. Index insurance avoids these costs by basing payouts on an index based on data from satellites or weather stations, or on estimates of average losses in an area.

If index-based insurance is implemented responsibly and can be effectively designed, it can have significant impacts on the target population, including:

- Reduced reliance on foreign aid in the case of disaster
- Preservation of assets in the case of disaster
- Avoidance of meal reduction of a coping mechanism in the case of disaster
- Increased on-farm productive investment in good years
- Increased access to finance for investment for low-collateral, or previously “high risk” borrowers

While index-based insurance for agriculture is a promising tool for development, it must be implemented responsibly to meet its potential. The implementation of low-quality products can make farmers worse-off than if there had been no intervention at all. It also damages the market for insurance, both now and in the future, compromising future high-quality interventions that could make a difference in the lives of farmers and the economies of target areas.

The following steps provide a pathway to understanding how and when index insurance is appropriate and has a true chance to achieve agricultural development impact.

BY TARA STEINMETZ



If index-based insurance is effectively designed and implemented responsibly, it can have significant development impacts.



STAGE I

Identify whether risk is a barrier to growth and/or contributor to poverty, and identify resources available for the intervention.

This first stage will help to determine the top candidate geographic regions and commodities for which this tool may be a good candidate. By the end of Stage 1, you should have identified top candidate regions and commodities for the proposed intervention, as well as have a list of all of the resources available.

Step I

- Identify whether agricultural risk keeps the target population from investing in growth opportunities, such as improved seeds or chemical fertilizer, and/or is a major factor that pushes families into poverty.
- Resources needed: high-level population data (including poverty rates, food insecurity data, what crops are grown in what areas, etc.), farm yield history for relevant agricultural systems and interviews with agricultural experts.

Key questions:

1. What agricultural sectors that are a key source of livelihood for the majority of a target population?

Many organizations have already identified populations that are highly vulnerable to poverty and food insecurity. Without a shared crop that is important to the majority of the target population, an index insurance intervention is unlikely to have significant development impacts.

For example, in Nepal's Terai region rice is the most important staple crop. It is significant both as a source of income for individual farmers and its broader role as a contributor for the food basket of the region. These factors mean that rice farmers in this region may make good candidates for an index insurance intervention.

2. What crops are vulnerable to climate volatility or other risks that affect large portions of the population at the same time?

For index-based insurance to be effective, a large portion of risk must be shared. If a disaster affects a handful of individual farmers but not their neighbors, index insurance might not be the best solution.

Without a shared crop that is important to the majority of the target population, an index insurance intervention is unlikely to have significant development impacts.

For example, Kenya's arid and semi-arid regions have experienced widespread droughts that affect all or most pastoralists in these regions. By contrast, in the mountains of Nepal, pastoralists living at the top and bottom of a hill may not have the experience with weather. Index-based insurance would likely be a good candidate for pastoralists in Kenya, but perhaps not for those in the mountains of Nepal.

3. Does risk contribute to poverty in the target population?

This is a somewhat subjective question that should be determined by experts and, if possible, by the farmers themselves. Farmers in high-risk environments are made poor by disasters, and kept poor by shying away from more costly but more productive investments.

If it appears that disasters push farmers into poverty or make them unable or unwilling to make productive investments, index insurance may unlock potential for this population. Data that consistently show descents into poverty after a disaster and remarks from farmers about their unwillingness to risk borrowing to buy productive investments like improved seeds, suggest that risk is a major constraint and a key contributor to poverty.

Step 2

- **Determine the development opportunities available to farmers if the constraint of risk is removed, and whether financial access will be available.**
- **Resources needed: stakeholder interviews, discussions with ministry of agricultural and extension workers, agricultural production data and data on access to finance.**

Key questions:

1. Is the population of targeted farmers falling short of potential in terms of productivity and income?

One way to find out is to compare these measures between the targeted farmers and farmers in neighboring countries for the same activity or commodity. While many factors could influence differences realized by these farmers for the same commodity or activity, a large gap in yields may indicate that more could be achieved if farmers took advantage of available productive technologies like improved seeds.

2. Are farmers taking advantage of opportunities to increase investment and income?

Risk can keep farmers from spending on more expensive but more productive technologies. For example, when farm yields and chemical fertilizer adoption rates

Why Insurance for Development?

Decades of evidence around risk and development indicates that risk makes people poor by reducing incomes and destroying assets, and keeps people poor by discouraging investment and distorting patterns of asset accumulation.

When financial alternatives are limited, in the face of disaster, households typically turn to two coping strategies: reduction of assets to smooth consumption, or reduction of consumption to protect assets.

Both of these strategies can have costly long-term economic consequences. In addition, before a shock even occurs, households may try to further protect themselves by avoiding risky - but potentially profitable - opportunities for growth.

are far below regional averages, index insurance may provide the security farmers need to make or increase investments in higher productivity.

However, or if farmers have already met the full yield potential or no growth opportunities are available, insurance is unlikely to unlock additional growth. Alternatively, if outside investments can be made, for example in a side business, then managing risk in farming the target crop may still be useful.

3. Do farmers have access to finance to help them take advantage of investment opportunities?

Without finance available to help farmers overcome a lack of available cash or liquidity, insurance may not enable farmers to make investments in productivity. Assessing the reach of the financial market, which includes informal markets like savings and loan associations, will help to indicate the level of opportunity available.

Step 3

- **List data available to implement index insurance, including historical yield data at various levels of aggregation and weather data or satellite data on vegetation growth.**
- **Resources needed: bureau of statistics and other government ministries, public satellite data or in-country satellite partners, weather statistics.**

Key questions:

1. What data are available on yields?

This is an important piece of information for the design and calibration of a safe and effective index for agricultural insurance. Details should include how far back the data goes (at least 10 years is ideal) and at what level of aggregation (the smaller the better).

If the data is available only at a national or regional level, it will be difficult to calibrate the index. Especially in areas with high variation in topography and other environmental conditions, farmers within a region can have very different experiences. On the other hand, highly localized data, such as village-level yields, can help determine what populations share the same local environmental risks.

2. What weather data is available?

Weather data includes rainfall, satellite and a myriad of other sources. Most countries have basic, national-level data, which can be helpful to a point. In preparation to moving towards Stage 2, more nuanced and detailed data will be required.

The crop can make a difference

When developing an insurance product, it is also important to consider the market structure of the commodity. There is a tradeoff between staple crops, cash crops and livestock.

Focusing efforts on staple crops can be appropriate for 1) reaching a maximum number of households and 2) risk may be limiting how much farmers invest in productivity.

Farmers who produce a crop that performs well compared to neighboring countries may not be the best candidates for an index insurance intervention. There may be greater potential for farmers whose crops have consistently lower yields than those in other countries.

The most precise measurements at the smallest level of aggregation will help create the most effective index insurance. The availability, reliability, frequency, level of aggregation and resolution will all determine whether a reliable index for agricultural insurance can be created.

Step 4

- **Assess other resources available for an insurance intervention, including financial resources for evaluation, and government and political support.**
- **Resources needed: gathered primarily through stakeholder meetings.**

Key questions

1. Is the national government and its relevant insurance regulatory authority aware of or open to index insurance?

Most countries have a regulatory authority for insurance, though not all countries will consider index insurance in the same way as traditional claims-based insurance. To prepare for later stages, it will be useful to know whether these authorities will allow the establishment of an index insurance product.

2. Will insurance companies or other private sector partners in the country contribute expertise?

A listing and assessment of all potential partners will help move forward. Insurance companies that are willing to consider a partnership in an index insurance intervention will help future implementation move more smoothly.

3. Are financial resources available from the government or other partners?

The next stages will require some financial support for the required technical expertise, whether or not these costs are covered by the government or partners. Additional costs include software and labor for in-depth data analysis, the cost of implementing a survey for household-level data, travel, and the costs of educating farmers on index insurance.

STAGE 2 Assess whether an index-based insurance product can be designed to effectively transfer risk for smallholder farmers.

Stage 2 considers “top candidates” from Stage 1 for further analysis. Some steps in Stage 2 may require external technical expertise, but all are essential to ensure any intervention is implemented responsibly. By the end of Stage 2, you should have identified the top candidate for a feasible intervention with high potential for development, or the “sweet spot,” if one exists. This top candidate will then be carried into stage three for contract and pilot study design.

Step 1

- Analyze yield data to determine how much risk is shared by a population of farmers and how much is unique to individual farmers within the population. This step will help to determine whether index insurance has the potential to transfer enough risk away from farmers to have a development impact.
- Resources needed: yield data, farmer surveys (if funding is available) and technical expertise.

Key questions:

1. Is there support available for household surveys?

This household-level data can be used to measure the degree to which sources of risk are shared by a population of farmers or unique to individual farmers (covariate vs. idiosyncratic). While this is not absolutely necessary, it is a prudent step that can help to identify the potential for impact prior to additional investments. If data is already available at the individual or household levels, additional surveys may not be necessary.

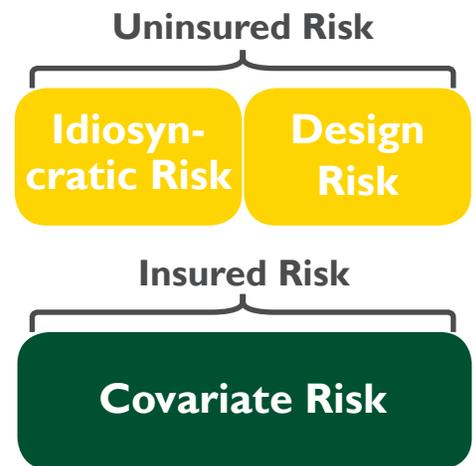
1. How much risk is shared (covariate), and how much is individual (idiosyncratic)?

Because index insurance can only effectively manage risks that affect large numbers of farmers simultaneously, covariate risk must be a significant share of overall risk for it to achieve development impact. To determine covariate/ idiosyncratic risk requires both technical expertise and data at the individual/ household and area levels.

An area yield-based insurance is a type of index insurance that is based on actual

Index insurance design

Index insurance is designed to protect farmers against risk while keeping costs low. Payouts are made on the predicted loss of the farmer, based on the index’s correlation with average losses in the area.



Index insurance covers the risk shared by the majority of farmers in a target population (covariate risk). Index insurance will be more successful and commercially sustainable where the majority of farmers share the same risk.

yield information rather than an outside indicator such as rainfall. It relies on the most accurate possible index. One way to assess how much risk for the targeted population of farmers is covariate vs. idiosyncratic is to build a theoretical index insurance model based on actual historical local area yields.

Comparing household-level data to area yields makes it possible to compare what a theoretical insurance product would have paid out to individual farmers in previous years. The result will show an upward limit of what an index-based insurance product can offer in terms of risk protection.

In Nepal, for example, this comparison showed that an area yield-based insurance contract would have paid out to farmers who experienced a loss 75 percent of the time. The remaining theoretical losses were due to idiosyncratic shocks experienced by individual farmers. The functioning of index insurance means that these individual farmers would not have received a payout despite their actual losses

This theoretical example from Nepal is a best-case scenario for an index-based insurance product, as area yield-based contracts are based on the most accurate possible index. It clearly shows that the majority of risk for these farmers was shared (covariate) rather than individual (idiosyncratic). This makes index insurance most likely to be an appropriate tool for agricultural development.

Step 2

- **Compare yield data to available index data to determine whether any available indices will be a strong predictor of yields, and estimate the probability that extreme losses will not trigger a payout (false negatives) or that payouts will trigger in the absence of extreme losses (false positives).**
- **Resources needed: for this step are yield data, other index data, and technical expertise.**

Key questions:

1. **Can the data available can produce an index that effectively predicts average yields?**

This is a critical step, because this determines the value of the product to farmers. If the index is only moderately able to measure insured shocks, and therefore does not trigger a payout every time the farmer experiences significant insured losses, then the farmer will continue to underinvest in productivity and pursue other risk-mitigation strategies.

1. **For years with available data, which index is most highly correlated with farmer outcomes?**

This requires analysis of historical yield data against indices available. It is most

likely that indices that measure area yields or observe outcomes by satellite will be more highly correlated with the actual experiences of farmers than measures that only capture one or a few factors that contribute to yields, such as rainfall.

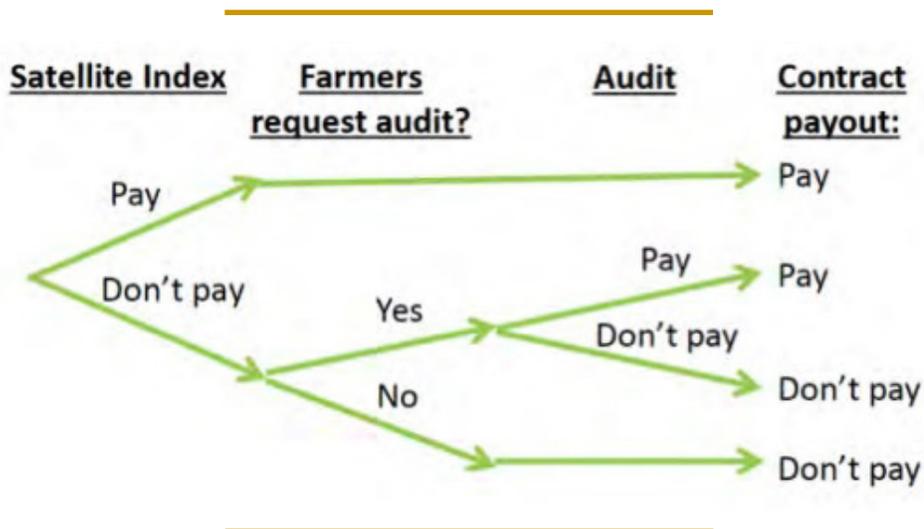
1. For the best available index, what is the probability that a payout would not have triggered when an insurable event occurred?

Even the best possible index may fail to trigger payouts. If this likelihood is high, an “audit rule” or other back-up mechanism can trigger a procedure that provides a back-stop to the index.

An audit rule is a stipulation in an index insurance contract gives policy holders the right to petition their insurance company to have an agronomist measure average village yields in the event that the index fails to trigger. An audit rule must be pre-planned, and its costs should be included in the cost of an index insurance product.

In Tanzania and Mozambique, researchers found that the primary index for an insurance product would fail 13 percent of the time in the event of actual losses. As a result, the company is implementing an audit that will triggered when a pre-determined number of farmers petition for a crop audit.

Satellite index with “fail safe” audit contract clause



STAGE 3 Move from the design phase to the field to assess how an index-based insurance product might be delivered in the field.

By the end of Stage 3, you should be able to propose a pilot study to generate concrete, rigorous evidence about whether the intervention works as intended and is achieving development impact.

Step 1

While this step is not absolutely necessary to implement an insurance intervention, it will be incredibly useful to demonstrate that a market exists for the proposed product; one of the greatest barriers to getting participation from the private insurance sector is the perception that there is no market for such a product.

- **Conduct surveys to assess the potential market and farmer preferences for product design to assess the available market and potential development impact.**
- **Resources needed: local survey companies, insurance companies, funding**

Key questions:

1. Is the product designed and explained in a way that farmers can understand?

The successful launch of an index insurance will rely on farmers understanding how it works and how it might benefit them, including the conditions by which insurance will and will not pay out. However, index insurance can also be a challenge to explain.

Using experimental games can be used to explain the product through simulated contracts. These games also provide an opportunity to ensure that the insurance product can be explained so farmers truly understand how it works, which is necessary to induce the desired development impacts.

2. Are farmers willing to pay for the proposed index-based insurance product?

These games can also be used to assess whether farmers are willing to pay the market price for the product, which is required to make it commercially feasible. Research has shown that by and large, farmers are willing to pay above the market

Explaining index insurance through financial education games



Recent efforts to implement index insurance have struggled with making it easily comprehensible. In an effort to create informed understanding of this contract, AMA Innovation Lab researchers designed an experimental economics game that duplicates the precise structure of an index insurance contract. By playing multiple rounds of the game, participants could begin to understand the impact of insurance on herd size and stability.

price for index insurance.

Step 2

While public support may be required to establish proof-of-concept, engaging appropriate partners in the public and private during early stages of this process will increase the probability that the intervention will become independently sustainable.

- **Identify potential partners for the design, marketing, sales, and payouts of an insurance product.**
- **Resources needed: list of non-life insurance companies, micro-finance institutions (MFIs), and NGOs working in the target areas; stakeholder meetings; mobile phone penetration rates and capabilities**

Key questions:

1. **Are private insurance companies willing to offer an index-based insurance product?**

While insurance companies may hesitate to enter a new market in this way, once proof-of-concept demonstrates that there is a market for the product they may be willing. By engaging private sector insurance partners early in the process, the intervention is designed to be sustainable.

2. **What related partners are established in the target geographic areas?**

If, for example, a proposed insurance product would force an insurance partner to incur the high costs of entering new geographic areas, then a partnership with a microfinance institution (MFI) that has existing networks in the area could make possible education, marketing, and sales. Creative thinking may be needed to reduce the costs of distribution and to leverage existing networks and infrastructure.

3. **Are there NGOs already doing financial literacy or other related work in this area?**

Insurance is a difficult concept that is unfamiliar in many contexts, and extensive education will be needed to ensure that it is sold responsibly to a target population that really understands how it works. NGOs already working in these areas may be able to assist with education around insurance and how it works, and both its strengths and limitations.

4. **What is the reach and capability of mobile phone networks?**

MOVING FORWARD

If the rate of mobile phone penetration is high, phones may be a viable option for the marketing and sale of insurance. It is also important to know the proportion of feature phones vs. smart phones, as each has different limitations. High mobile phone penetration is not necessary as a condition for success, but could be helpful to maximize efficiency and reach of the intervention.

Step 3

- **Work with government partners – especially regulatory agencies – to ensure the index-based product is well-understood, effectively implemented, and to avoid products that don't meet safe minimum standards.**
- **Resources needed: AMA Innovation Lab work on safe minimum standards, index insurance toolkit, stakeholder meetings.**

Key questions:

1. Can the provider of the insurance explain their pricing?

Insurance companies offer index insurance products at premiums that are higher than expected average payouts, and this is the cost to doing business. However, the process of pricing the product can be opaque, and has led to markups of up to 200 percent. Given the public support of the intervention, it must be understood that the pricing has been fairly done, and not marked up so dramatically that it becomes prohibitively expensive for the target population.

2. What are the expected average payouts over time, and how does that compare to premiums?

If annual premiums are \$10 and average payouts over ten years is predicted to be \$20, this may not be a good investment for farmers. In fact, they may be worse off than if they had not invested in insurance at all.

By nature, insurance moves money into the future, but in the case above it may be more reasonable for a farmer if the expected average payout over 10 years was \$70 or \$80 dollars. The benefits of risk management and predictability are worth the money in this scenario.

If all of the steps above indicate a high potential for a high-quality, responsibly implemented index-based agricultural insurance product with appropriate support, then this may be an appropriate tool for development impact. Additional materials are available on all of the above examples, and we would be happy to provide more information upon request.

We would also welcome any feedback on these steps and methods to help us refine our outreach and dissemination materials to create strong resources for USAID missions and partners.

For more, visit basis.ucdavis.edu or email basis@ucdavis.edu.

ABOUT THE FEED THE FUTURE INNOVATION LAB FOR ASSETS & MARKET ACCESS

The AMA Innovation Lab at UC Davis conducts and supports research on policies and programs designed to help poor and smallholder farmers worldwide to manage risk, adopt productive technologies and take an active part in economic growth.

With core funding from the USAID Bureau for Food Security to support the U.S. government's global hunger and food security initiative, our research agenda focuses on:

- Financial innovations and risk management
- Adoption of more productive agricultural technologies
- Synergies possible by bundling financial and technological innovations

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