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TO: USAID-Nepal

FROM: I4 Insurance Innovation Initiative of the BASIS Assets & Market Access Innovation Lab

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SUBJECT: Next steps for agricultural insurance in Nepal

The government of Nepal has committed substantial resources to the promotion of an agricultural insurance market in an effort to reduce the risks that are understood to reduce productivity and well-being in Nepal's small farm-dominated agricultural sector. To date, progress has been slow and committed resources remain largely unspent (the appendix below summarizes the current state of agricultural insurance and insurance policy in Nepal). In this context, the I4 Index Insurance Innovation Initiative of the BASIS Assets and Market Access Innovation Lab undertook a study to see if cutting edge, remote sensing technology could break this log-jam by providing a relatively low cost, but high quality index insurance contract for Terrai rice production that might appeal equally to farmers and insurance providers. Unfortunately, as detailed in prior reports, technical difficulties—largely the result of extended periods of cloud coverage that is impenetrable to key satellite sensors—made it impossible to design an index contract based on remote sensing data that accurately predicted famer losses.

This failure raises the question about what should be done next given that these technical difficulties in no way obviate the need to find a risk transfer solution for agriculture in Nepal. In this memo, we detail our answer to this question:

Test the cost-effectiveness, demand for, and impact of, an area yield insurance contract.

An area yield contract is an index insurance contract based on a seasonal yield survey in which average yields realized by farmers are directly measured and used as the basis for insurance payouts. It is potentially the highest quality index insurance contract, but it is also the potentially the most expensive to administer in the absence of existing government surveys that provide the necessary yield data. Scaling up an area yield approach would only be worthwhile if its social and economic impacts are large enough to justify the costs.

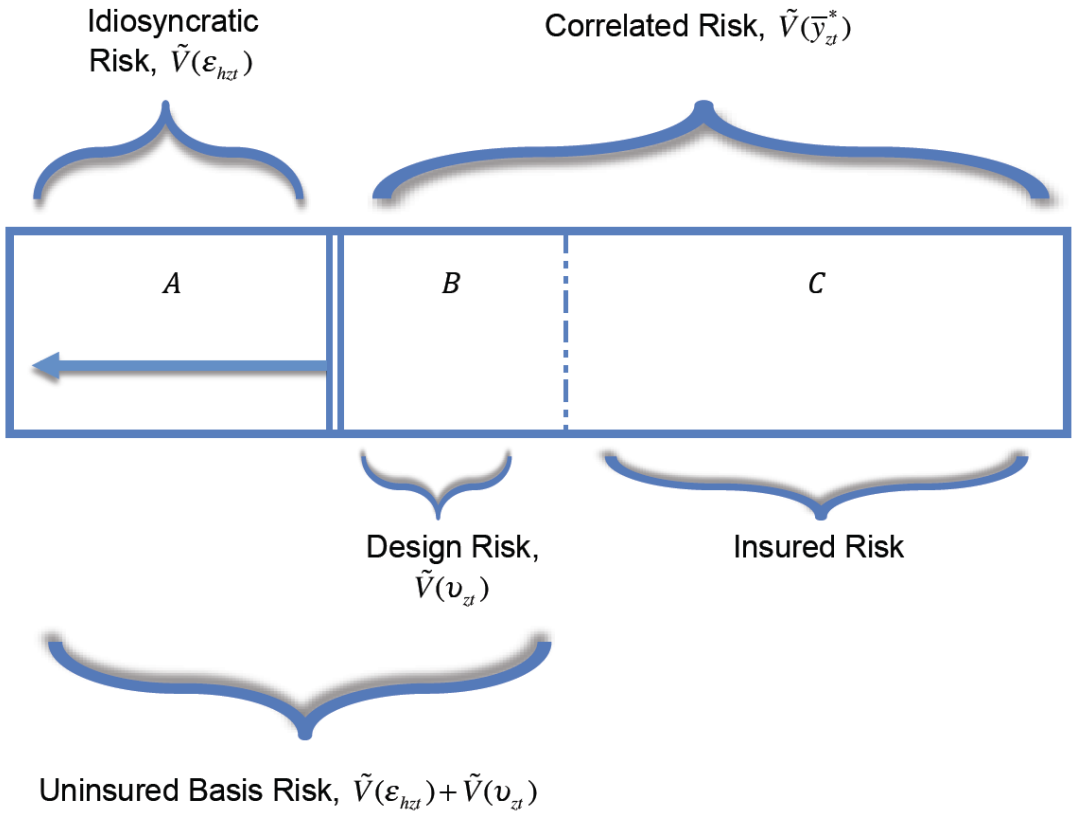
The remainder of this memo is divided into the following sections:

1. Why Area Yield Insurance?
2. Design and Cost of an Area Yield Pilot Study

The first of these sections gives technical detail on area yield insurance and its potential in Nepal. The reader may skip over these details and go immediately to the second section (page 4 below) to see our specific proposal on next steps.

1. WHY AREA YIELD INSURANCE?

Index insurance is designed to protect farmers against significant sources of shared or "correlated risk"—such as volatile weather—while (i) keeping costs low (no insurance agents are needed to verify claims), (ii) avoiding moral hazard (an individual farmer cannot artificially increase the probability of an insurance payout by lowering her own production) and (iii) avoiding adverse selection (the likelihood of payout is not increased even if only the most risk-exposed farmers sign up for the insurance). It issues payouts based on the level of an index that either measures or is correlated with average farmer losses, such as measures of drought, vegetation density within an area or measures of average yields within an area.



The diagram above helps fix ideas. The total width of the boxes (*A+B+C*) measures the total risk faced by the farmer. Some of the risk is specific to the individual (*e.g.*, losses resulting from a pest problem specific to the individual's field) and is indicated by the width of box *A*. The remaining risk (*B+C*) is the shared of correlated risk that is due to forces that affect a number of people in the farmer's zone (*e.g,.* drought or flooding). Index insurance is

designed to only cover the shared risk, not the specific or idiosyncratic risk. This is shared or common risk (*B+C*) is the *potentially insurable risk* under an index insurance contract.

How much risk appears as idiosyncratic and how much as shared depends on the geographic scale of the insurance index. If a single index reading were to cover all the Western Terrai, then an insect or weather problem that only affected farmers in one or two wards would appear as idiosyncratic risk as it would not affect outcomes averaged across all farmers in the Western Terrai. On the other hand, if the scale of the insurance index were shrunk down to the level of the individual ward (such that each ward received its own index reading), then this more localized event would influence the index and appear as a shared, insurable event. In the extreme, if there was an index for each individual farmer, then idiosyncratic risk (*A*) would disappear, and all the risk faced by the farmer would become potentially insurable. However, an index at this scale—and maybe at the scale of the individual village or ward—would be prone to problems of moral hazard and adverse selection. As the geographic coverage or scale of the insurance shrinks, the double vertical line in the figure shifts left, indicating that more of the overall risk becomes potentially insurable correlated risk.

In addition to the index scale, the quality of an insurance index—in terms of how much risk it covers—is determined by how accurately the index measures the common risk. That is, how much of the potentially insurable common risk is actually picked up by the insurance index? Commonly used rainfall indices will accurately pick up less than half of the overall common risk. In the figure above, the fraction of common risk that the insurance index picks up is labeled as *C*, whereas the common, potentially insurable risk that index misses is labeled as *B*. This uncovered, but common risk, can be termed *design risk* because it results from an imperfect or incomplete index design.

In summary, under a given index scale and index measure, the width of box *C* indicates risks that are insured, whereas the combined widths of boxes *A+B* are the uncovered risks, typically referred to as *basis risk*. A contract that has too high basis risk does not protect the farmer and is a waste of either the farmer's money (should she pay the premium herself) or a waste of public money (if the insurance is subsidized).

In our prior work, we tried to use freely available satellite information that was very high resolution so that separate loss measures could be created at the level of each VDC or even ward, while exhibiting very little design risk. Unfortunately, we could not overcome the design risk problem and we could not craft an index that could reliably average farmer losses at the VDC and ward levels.

So why area yield insurance? Area yield insurance relies on systematic measurement of average yields within a particular area or insurance zones (*e.g.*, average yields within a VDC). Insurance payouts are then triggered whenever VDC yields fall below their long-term typical levels. For example, if on average farmers in a VDC produce 2 tons per-hectare of rice, an area yield would begin to issue payouts anytime those yields fell below this 2 ton level (or, say, 80% of this level), with payouts increasing as the magnitude of the losses increases. *The advantage of area yield insurance is that it has no design risk* because crop

losses are directly and accurately measured on the ground. The only uncovered risk is the idiosyncratic risk (some individual farmers may have low yields even when overall VDC yields are fine). Note that the magnitude of uncovered idiosyncratic risk can be reduced by shrinking the insurance zone down to the level of the individual village or ward.

While it is the highest quality index insurance available, *area yield insurance is also potentially the most costly*. A VDC index would require a yield survey every crop season to reliably measure average yields for each VDC. A ward level area yield index would require yield surveys for each and every ward. Note that there is a direct quality-cost tradeoff based on the geographic coverage of the index. A lower scale index offers better quality insurance coverage, but costs more. Even a relatively high scale index will still require significant operational expenses to administer (unless, as in the US, the government or other body is already measuring yields in a reliable, non-manipulable fashion for other purposes).

So can area yield insurance work for Terrai Rice Farmers? As part of our study of satellite-based insurance, we analyzed the yield data we collected and showed that at least 40% of the overall risk faced by farmers could be covered by a 'multi-ward' area yield index set at the level of several neighboring wards. Had this area yield contract existed in 2014, 66% of the famers who reported losses that year would have received an insurance payout. While this analysis reveals that idiosyncratic risk is relatively high in the Terrai, the level of risk coverage that would be offered by an area yield contract at this level would offer valuable insurance coverage to farmers.

In summary, area yield insurance shows modest potential for Terrai rice farmers. But such an insurance will be costly to implement. We turn now to consider how we might determine whether or not the benefit of this insurance would be worth its cost.

2. DESIGN AND COST OF AN AREA YIELD PILOT STUDY

If there is appetite for further exploration of the potential for agricultural index insurance, we would recommend the following:

- Design a multi-ward area yield contract in 100 VDCs selected at random from the 500 VDCs that constitute the Western Terrai.
- As each VDC contains around 9 wards, this will result in 2 to 3 multi-ward insurance zones in each VDC for a total of approximately 250 multi-ward zones in the 100 selected VDCs.
- After pricing the index insurance contract for each multi-ward zone (see below for more detail), select 125 zones for piloting of the insurance contract.
- Follow production results and food security measures in all 250 multi-ward zones for a season or 2 to determine impacts of the insurance (by comparing the 125 zones with insurance to the 125 zones without insurance).

- Based on this design, we would also be able to determine if an ultimately cheaper to implement VDC-level insurance contract could work.
- If the impact benefits warrant the costs (on which more below), consider scaling up the index insurance model using either the multi-ward or the VDC level contract.

There are two barriers to implementing this pilot project: pricing of the insurance contract and cost. We now talk briefly about each of these in turn.

In order to implement an area-yield insurance product, we need a database of historical yields at the multi-ward level in order to measure risk and price the area yield insurance contract. Nepal does not have a database of historical yield at this level. Indeed, the only source of yield data collected every year is at the multi-VDC district level. Production conditions vary too much inside each district to make it an effective geographical scale for an insurance index (*i.e,* as discussed above, idiosyncratic risk at this larger scale would grow to be unmanageably large).

In the absence yield data at the multi-ward insurance zone level, we can assume that all multi-ward units inside a same district all share the same distribution of yield. With this strong assumption, we can then use the survey data from the Agricultural census collected in 2011 to compute ward-level yield for this single year and compare it with the district data for this same year. Doing so, the normal yield for each district is set using the normal yield at the district level. And the probability that the ward yields fall below the ward normal value is estimated using the 2011 Agricultural census.

This strategy is only temporary and would hopefully suffice to get the contract off the ground. *There is some chance that insurance or reinsurance companies would not accept this risk estimation strategy.*

Once implemented, yields have to be measured in order to compute indemnity payments;. As these data accumulate over time, we can slowly improve the statistical basis for pricing the multi-ward insurance contracts.

So how expensive would it be to carry out yield surveys at the multi-ward insurance zone level? The sample size required to accurately estimate multi-ward average yields depends on the differences in yields between farmers inside a given insurance zone. If all the farmers inside the zone have the exact same yield (the variance is zero), surveying one single farmer would be enough. However, if every farmer has a slightly different yield value, it is necessary to survey several farmers. The sample size required increases when the differences between farmers increase (i.e. when we can find a farmer with extremely bad yields and another with extremely good yields inside the same ward the same year).

We already have some evidence that variability amongst farmers within a multi-ward area is relatively high. While we need to investigate this statistical question further, we tentatively calculate that we could obtain an acceptably accurate estimate of average yields within a multi-ward insurance zone by surveying ~40 'witness' farmers per zone.

Assembling this information, the annual cost of the area yield pilot can be estimated as follows:

- At planting time, the 40 'witness' farmers in each zone would be visited and their area planted in rice would be measured.
- These same farmers would be visited at harvest time to solicit the quantity of rice produced.
- Each of these visits would be quite brief, requiring only a few minutes to implement.
- We guesstimate that each interview would cost $US 8, implying an annual cost of $16 per-interview farmer or a total of $80,000 (=16x40x125) across the full pilot area of 125 insured multi-ward zones.
- It may be possible to reduce this cost substantially by using phone survey or other IT-based methods. These methods could be piloted as part of the pilot effort, but it would be wise to start with on-the-ground yield measurement.
- We assume that already available government funds could be used to partially subsidize the insurance so that there would be no further cost to encourage insurance up-take.
- Additional surveys in both treatment and control zones would be needed to determine the effectiveness of the insurance (if that was desired) and would cost approximately an $100,000 annually.

We hope that this brief note clearly explains what we see as the best way forward given what we have learned so far. We look forward to discussing these issues further with you.

Appendix: Current Agricultural Insurance and Government Policy in Nepal

The Government of Nepal is currently engaging insurance and risk management in a number of key ways:

- In 2013, the government introduced crop and livestock insurance directives.
- Since 2013, offered a 50% (increased to 75%) subsidy on the premium paid for insurance of crop and livestock.
- Government structure allows for other insurance-like risk management tools to be offered to farmers without the regulations & requirements that apply to insurance companies.
- The Government offers matching and/or subsidies to these other risk-management structures.

Insurance companies primarily offer livestock insurance, with little or no support for vegetables or other crops. The subsidies have increased, but uptake of insurance remains limited, and the subsidy is set to end after five years; insurance will have to reach sustainability by that time. The other risk management schemes are so highly subsidized by the government that it is unlikely that private insurance companies will be able to offer comparable value-for-money. Some of these programs strongly depend on public funds and might bias farmers' perception of the cost of risk.

Insurance Directives

In January 2013, The Government of Nepal (through the Insurance Board) introduced crop and livestock insurance directives to encourage insurance companies to develop commercial agricultural insurance. The directive introduces the obligation for non-life insurance companies to offer agricultural insurance, but the authorities have not aggressively enforced this obligation in order to let insurance companies adapt and learn.

Indeed, while 17 out of 19 non-life insurance companies have offered agricultural insurance in 2013-2014, they typically only offer coverage for livestock producers, but do not offer coverage for cereal crops, fruits or vegetables. Livestock is often seen as more valuable and easier to monitor than crops. An initial visit by a veterinarian to verify the animal's health, and a follow-up if the farmer fills an indemnity claim is enough to verify if indemnities are due or not. In the case of crops, it is harder to determine that losses are due to factors outside of the farmer's control and that the farmer did his best to get a good harvest (with use of quality inputs like seeds and appropriate timing of planting, etc.), so insurance companies have difficulties evaluating the risk attached to crop production.

Insurance Subsidy

To support the adoption of insurance, the Ministry of Agricultural Development introduced a subsidy on the premium paid for insurance of crop and livestock in June 2013. Originally, the government provided a 50 percent subsidy on insurance premiums paid by individual farmers, farmers' groups and farmer cooperatives. In 2013-2014, however, only Rs.135 million of subsidies on insurance premiums have been allocated (corresponding to less

than 20% of the budgeted amount). In response to this low disbursement level, the subsidy was increased to 75% in the following year, and the overall budget for subsidies was to be cut in half.

This subsidy scheme is scheduled to stop after 5 years; insurance policies will have to reach sustainability by that time. In the meantime, farmers are often not aware of the government scheme for crops and livestock, and the scheme proposed by the government might seem overwhelmingly complicated to Nepalese farmers.

Other Available Mechanisms for Risk Management

Nepalese farmers (mostly livestock farmers) already benefit from other risk management schemes that are highly subsidized by the government, so that private insurance companies cannot offer a comparable value-for-money. Other entities are allowed to offer insurance-like products to farmers, but because they are not insurance companies, they do not have to comply with rules that apply to insurance companies (licensing by the Insurance Board, minimum capital, solvency requirements, etc.). These programs, led by the Deposit and Credit Guarantee Corporation (DCGC) and the Agricultural Development Bank (public owned financial institutions), also benefit from a 50% subsidy from the government. This subsidy program is separate from the insurance companies' subsidy scheme and is not scheduled to stop anytime soon.

Deposit and Credit Guarantee Corporation (DCGC)

The DCGC is a public institution held by the Government (90%) and the Central Bank (10%). Its primary role is to insure credits and deposits for banks and other financial institutions. Its role in the agricultural sector is mainly to cover loans, but it can also insure individual livestock farmers directly if they own more than 10 cows. DCGC does not offer crop insurance, considering it too risky because of input supply issues and weather variability.

DCGC's main activity is to offer coverage for the financial sector (MFIs). MFIs often offer non-collateralized loans to farmers but rely on group mutual insurance to reduce risk. When a farmer is unable to repay his loan, other group members repay the farmer's loan to the MFI on behalf of the farmer in order to prevent default. DCGC offers MFIs portfolio insurance for a very low premium set at 1% (0.5% paid by the MFI and 0.5% paid by the government). This insurance product covers loans, not the value of the animal. When the loan is repaid, the insurance contract stops. The high cost of administration of the scheme (the need for expert assessments at each step) generates a negative balance for this program.

Agricultural Development Bank / Sana Kisan Bikas Bank (Small Farmer Cooperative model)

The Sana Kisan Bank and the Agricultural Development Bank provide credit to small farmers (through the cooperatives). This insurance program is restricted to farmers who are part of a SFG. An insurance committee is formed inside each VDC, and is in charge of

claim verification. This program is now also available to vegetable farmers through the Agricultural Development Bank. Other crops often remain excluded from the insurance market.

Participating farmers must be members of a group and they pool the premiums collected on a group account. In the case of livestock, premiums are set at 10% (5% paid by the farmer, 5% paid by the government); in the case of vegetables, the premium is set at 15% (7.5% paid by the farmer, and 7.5% paid by the government). Indemnities cover 80% of the insured value of the losses. However, because indemnities are paid by the premiums collected inside the group (combined with the government subsidy), if all the farmers inside one group experience a shock altogether (epidemic disease or hail storm), the premiums collected are insufficient to cover an 80% indemnity for every farmer. Instead, they will split their indemnities, reducing the coverage level and the value of this insurance scheme for farmers. Further, when no catastrophe happens, the premiums paid by the farmers are transferred to a saving account so that the group can decide to reinvest it next year in insurance or any other asset.