



COIN-Re

Business plan

Cardano Development

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Executive Summary

Cardano Development and its partners are working on a very promising initiative. This business plan describes the viability of establishing a broker in drought insurance policies for agricultural communities in developing countries, with specific interest in Sub-Saharan African countries.

This community-insurance project aims to break the vicious cycle of poverty for subsistence smallholder farmers in developing countries with tough weather conditions. It does so by offering a workable and low-cost solution to drought-related risks, which facilitates the provision of micro-loans to the farming communities. With these loans farmers may make small but crucial investments to produce higher-yielding crop and work themselves out of the poverty trap. Ultimately, this will promote a cultural mind shift within the rural communities in developing countries, from autarkic self-reliance to the use of finance to manage risks and returns to achieve better, more lasting results.

The concept is founded on three key principles that are unique and that differentiate our initiative from the drought-mitigating concepts currently being tried out by others¹:

1. The insurance targets frequent occurrence events rather than rare incidents. This has the benefit of vastly reducing the cost of uncertainty and the acceptance of the product by the end user. Frequent payout improves the product's trustworthiness with the end-user and is more aligned with the investment horizon and risk perception. The high level of premium associated with a high payout ratio means that the insurance product must trigger productivity growth to remain affordable.
2. The primary aim is to keep the operational cost of the insurance brokerage to a minimum to allow maximum scalability. Strategically, this means use of index-based triggers based on satellite technology. The remaining basis risk between the possible occurrence of loss by the farmer and the index trigger must be absorbed by the individual farmer and/or an aggregator that benefits from some portfolio diversification effects. In our immediate plans, the microfinance institution should perform this role. Note that by relying on an objective index to determine pay out, potential moral hazard and corruption are brought down to a minimum.
3. In order to create scalability and economic sustainability, the solution will not include any permanent subsidies other than those provided to cover start-up costs of the broker and the network. Market-based solutions are key to achieving the end-goal.

The result is a highly cost-effective easily scalable product - that can be tailored to any locality on the globe and any specific crop - which serves as a basis for a commercial investment initiative to support smallholder farmers wishing to produce higher-yielding, but less resilient crops.

Cardano Development will set up a broker for such insurance and orchestrate the joint cooperation by strategic partners, including reinsurance companies, weather (satellite) data providers, agricultural specialists and microfinanciers to design a complete supply chain to agricultural end user communities.

The prerequisites are fulfilled by an unique partnerships with climate specialists, reinsurers and a network of development and microfinance institutions and an academically accredited and historically tested method of measuring drought and its consequences, leading to a transparent and tailor made solution in a generic framework.

The remainder of this document provides an overview of the (I) climate risk methodology, (II) pricing approach, (III) product design, (IV) target market, (V) the organisational structure of the brokerage, (VI) the financial plan and finally (VII) the next steps to bring the plan into execution. The first step is to test the set up in real life cases. The immediate aim is to have three pilot projects to be ready for the main planting season in 2012.

¹ Please find a more elaborate discussion of the various other initiatives in appendix B

Introduction

The Millennium Development Goals emphasize the importance of food security and complementary analysis confirms the risk of climate volatility, underinvestment and lack of productivity growth.

Climate volatility is expensive. Physical solutions to drought (e.g. irrigation) are often not economically viable for smallholders without access to finance.

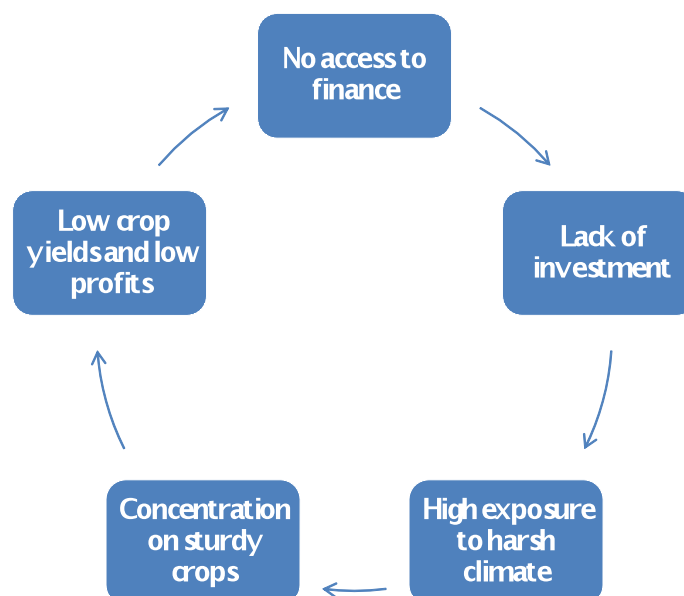
From the foreword of OECD-FAO *“Agricultural Outlook 2011-2020”*

“An important message from this report is the need for both shorter term measures to help manage and mitigate the risks associated with [climate] volatility and for further investment to enhance the productivity and resilience of the global food and agriculture system.”

Alliance for a Green Revolution in Africa:

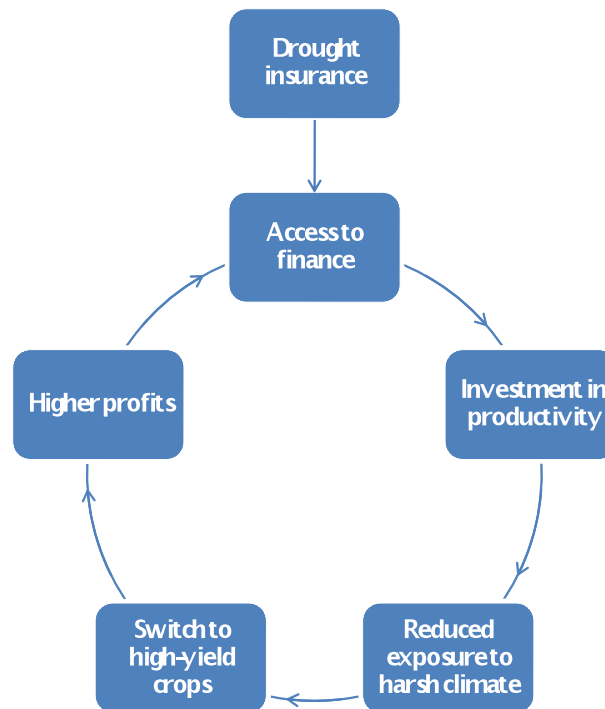
“...in many African countries, strong economic growth rates over the past decade left commercial banks awash with money. Even today, as the global financial crisis has tightened domestic markets, there is excess liquidity. However, less than 1% of the available domestic private sector financing typically goes into agriculture--a disturbing fact, since agriculture accounts for 70% of the labor force.”

The key question is thus how to make the farmer bankable for a Micro Finance Institution (MFI) such that the agriculture sector is supported in providing food security. The unmanageable factor preventing MFIs from providing finance to smallholders is the local climate. Investment plans remain unfeasible because the high level of uncertainty and the high impact of climate risk are too much to be borne by the farmer and / or the MFI. The key business rationale for COIN-Re is to tackle this existing poverty trap prevailing for farmers in rural communities in Africa and other developing countries:



- Smallholders balancing on the edge of survival have no access to finance.
- Without access to finance, smallholders cannot invest in climate-mitigating (irrigation) and/or yield-enhancing (better seeds and fertilizers) measures.
- As a result, the smallholders remain highly exposed to erratic climate conditions. In order to survive even in the driest of years, they stick to hardy, low-yielding crops. This leaves them without potential to generate profits in excess of bare subsistence levels.
- Lack of profitability leads back to lack of access to finance.

If drought insurance can remove the main obstacle to finance, the vicious circle can be turned into a virtuous one:



- With access to microfinance, the smallholder can invest in measures to enhance productivity.
- With the additional feature of weather insurance, the smallholder can switch (partially) to higher-yielding, but less sturdy crops. The financial impact of crop failure as result of drought is mitigated by insurance proceeds.
- With higher-yielding crops and better productivity, the farmer makes a profit well in excess of total cost (inputs, funding and insurance). Reinvesting this profit allows the farmer to gradually work himself out of poverty.
- Wealthier farmers have better access to finance. A self-reinforcing circle is created.
- Crucially, in case of drought the farmer's obligations to the financier are borne by the insurance proceeds. His survival is assured until the next season, and renewed access to finance can help revive the cycle anew.

The issue is not the individual farmer. Rural communities in developing countries are often the predominant driver of domestic GDP, and strengthening the viability of the agricultural sector is vital to the overall development of these countries. Introducing stabilizing measures to the farmers through a combination of access to finance for investment to mitigate threats to productivity has a high development impact.

Strategy

About Cardano Development

Cardano Development was created to bring high-impact, sustainable financial risk management innovations to developing countries.

- High impact means that innovations must bring substantial benefits to solve immediate needs for end-users and be scalable.
- In order to be sustainable, the innovation solutions that Cardano Development creates must be practical and affordable.

Good examples of such financial risk management solutions are currency and commodity hedges, climate risk insurance, etc. The purpose is thus to give end-users access to the risk management tools they need to create a more sustainable base for their activities. Creating a more stable business reduces the hurdles to investment and leads to productivity improvements and capital accumulation.

Cardano Development may involve itself in any way required to deliver the product. In the case of The Currency Exchange Fund or TCX (www.tcxfund.com), Cardano Development's first success, it is the manager of a special vehicle. In the case of COIN-Re, this is more likely to be in the form of a broker.

Cardano Development does not have a profit maximising ambition but operates on a cost+ principle, reinvesting profits of existing activities in support of new innovations.

COIN-Re Mission statement

Facilitating agricultural development in rural communities by channelling climate-related risk to international reinsurers to optimise social and economic benefits.

Vision

Mitigating climate risk is key to unlocking (micro-) finance for subsistence farmers in developing countries. Access to finance will catalyse investment needed to achieve productivity growth and to break the vicious cycle keeping smallholders in a poverty trap. It is feasible, with current technology, to deliver risk-mitigating tools efficiently and securely on a global scale.

Ambition

- I. Create an effective and an efficient supply chain from reinsurers to rural communities by establishing an insurance broker operating on a cost+ basis.
- II. Create a network organisation with strategic partners delivering agricultural expertise, climate data, modelling, reinsurance, product design, training/education and finance.
- III. With these partners, create a financial loan product with embedded climate risk insurance to smallholder farmers in local communities based on index based climate risk insurance.
- IV. Provide farmers indirectly access to local currency loans including climate insurance to manage risk, facilitate investment and higher agricultural productivity / food security.
- V. Start with a pilot project in Africa in 2012.
- VI. Build a global insurance portfolio of at least USD 150 million of insured capital by 2018.
- VII. With scalability proven, build out the portfolio to full potential.

Climate risk & Methodology

OECD-FAO Agricultural Outlook 2011-2020

“Predicting agricultural production: many local and global ecological parameters are monitored using satellite-based data, contributing to predicting food production in many OECD and non-OECD countries as much as three to six months in advance.”

Climate data is available globally and, depending on the location, for (very) long time series. With the availability of a long history of reliable and objective data on climate, the analysis of climate risk becomes feasible. On the basis of this historical data it is possible to build a sound business case for agricultural investment by individual farmers, and quantify the weather risk. The case at hand focuses on drought risk in the most vulnerable areas in Sub-Saharan Africa. Drought risk is defined here as the risk that the harvest is hampered by rainfall of insufficient quality.

Rainfall can be monitored in two fundamental ways: by direct measurement of rainfall at weather stations (traditional method) and by satellites. The latter does not measure rainfall as such, but evaporation and plant transpiration, which is a measure of the moisture available to plants.² The satellite data can be obtained in a cost efficient way and is therefore a key driver in making the offering scalable. The use of satellite data has a number of key advantages over the traditional method:

- Standardised data is available on a global scale (with a 5x5 km grid) at a low cost.
- The quality of the traditional method is dependent on local management, and human interference with the results to get a desired result cannot be ruled out.
- Product development can be done without huge investments in local infrastructure.

Although the data series are well established (with 30 years of data), methodological and measurement errors in the historical series could still jeopardize the construction of a sustainable and adequate product. A validation of the models will be performed by COIN-Re when designing the product by local verification with end users. COIN-Re aims to enter into a strategic relationship with a partner to further enhance the modelling and understanding of climate risks.

² See United Nations, FAO Irrigation and drainage paper 56 *“Crop evapotranspiration, Guidelines for computing crop water requirements”*

EARS, *“FESA Micro-insurance: methodology, validation, contract design”*

Product design & pricing

Sustainability and scalability are key drivers for product development. Another important premise is that the solution should be viable without permanent subsidy. The all-in cost of the product to the end-user must be as low as possible and must be affordable relative to the highest expected income for the farmers resulting from obtaining an effective and efficient risk management tool and the resulting access to finance. This is a fundamentally different approach than just measuring the nominal cost of the insurance, without taking the funding and potential crop yield into full consideration.

In order to create trust and acceptance of the embedded insurance, the pricing in the value chain will be transparent.

The cost of insurance is a function of:

- Technical reserves / provisions
- Cost of capital to the reinsurer
- Administration and distribution

The product COIN-Re offers ensures an efficient risk/return profile to the reinsurer, the MFI and the farmer. In this chapter we discuss the strategic choices related to product design and intertwined pricing of the various components.

Risk coverage: tail or frequent occurring event?

The fundamental assumption for designing the product is that the expected payout occurs frequently, contrary to catastrophe risk insurance solutions. The main reasons for this important choice includes:

- I. The investment horizon and risk management perspective of the farmers are medium term.
- II. If there are too many years without a payout, the community (MFI) perceives no benefits.
- III. Only coverage of frequent occurring events improves materially and sufficiently the creditworthiness of the farmer and hence lowers the default risk.
- IV. Systemic credit risk is the main reason why farmers are not able to obtain financing from MFI's.

The affordability of the product resulting from the choice of insuring more likely events rather than limiting payout to infrequent catastrophic events is key for the farmer as well as for the reinsurer, as we show below.

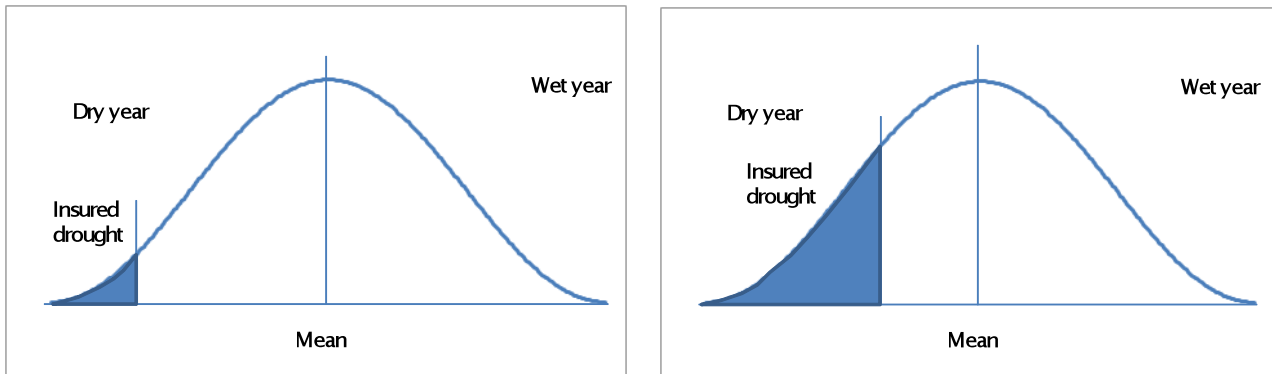
Key to the willingness of the farmers to pay an insurance premium is whether they see the insurance as a form of income smoothing and savings instrument instead of an out of pocket cost. The former is more likely if the farmer is expecting to buy the product each growing season. From the point of view of affordability, it is a condition that the insurance unlocks financing that substantially increases the farmer's expected income. High risk associated with high return (productivity growth) merits financial risk mitigation. Cost (insurance and funding) can only be judged when related to expected income.

The other side of the coin is that the reinsurer expects to payout frequently. Reinsurers hold technical reserves as a provision to cover the expected payout. For instance, to cover an event that is expected to occur once every 5 years, an annual amount equal to 20% of the insured interest must be provided for (not taking into account time value of money or unevenly distributed payouts).

However, the cost of modelling uncertainty is highly dependent on the probability and hence the distribution of payout. This cost component is the element charged by the insurer to cover the risks of flaws in the model, fat tail risk (i.e. freak occurrence) and the effects of climate change. As we show below, in relative terms this cost increases dramatically when targeting low payout probabilities (catastrophe risk). This is because the tail end of the probability curve is relatively more sensitive to these effects. By targeting higher probabilities of payout, the impact of this cost component is minimised. The investment horizon and risk management focus of farmers is assumingly more oriented to events once every 5 years on average.

Consider the probability density of rainfall in a particular location. Assume the distribution is close to normal. In the first instance a drought insurance is considered in the very infrequent events (e.g. 1 in

20 years event or worse), in the second it is selected at a more frequent occurrence (e.g. 1 in 5 years event).

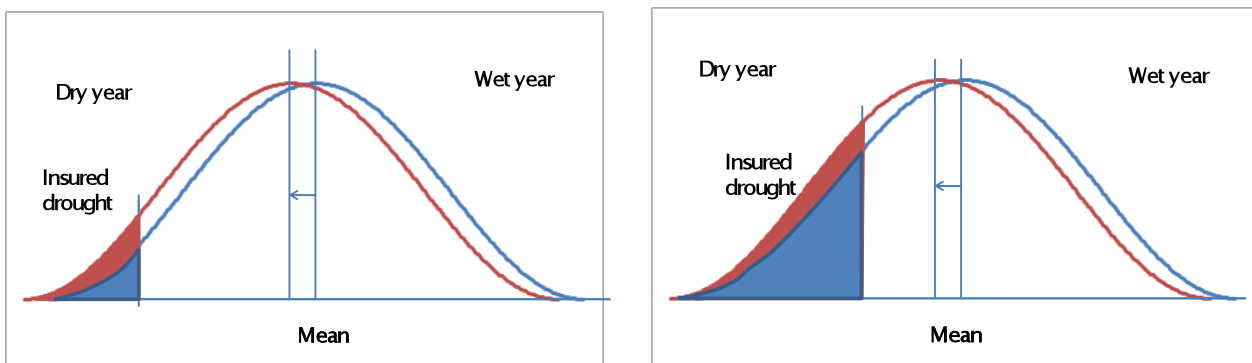


The filled-in area under the probability curve in the diagrams above is equal to the probability of the insured event occurring (i.e. for the left one, 5%, for the right one, 20%).

Insurers are aware that they may be underestimating the risks because of model flaws, unknown future distribution or unaccounted-for trends. Extra uncertainty is caused by:

- Lack of data / information / knowledge / experience
- Imperfect modelling
- Political risk

Insurers will therefore stress-test the model by assuming a slight shift in the probability curve to their disadvantage, i.e. to the left. The curves used for the stress test are shown below.



The cost of uncertainty is proportional to the increase in filled area in the curves. It is clear that this cost is proportionately higher in the 5% case (where the area has more than doubled) as compared to the 20% case. In other words, the more the insurance is targeting very infrequent events (tail risks), the more the product is prone to major modelling and estimation risk, leading to high uncertainty cost.

The conclusion here is that for both the reinsurer and the farmer a high pay off frequency is preferable.

Capital costs of the reinsurer

It is apparent that the global reinsurance industry is keen to absorb weather risks in developing countries due to the low correlation with many other risk types and geographic locations assumed. Also, reinsurers appear keen to assist in the creation of this risk class by devoting management time without immediate volume expectations. Placing these risks with these institutions is therefore deemed to be feasible. The capital cost to the reinsurer is determined by the regulators and the market. The regulatory capital is set to provide for the unexpected loss of the insurance policy. The model risk is an important factor in the unexpected loss estimation and therefore in order to keep the costs to the client as low as possible, this risk needs to be minimised. Besides the choice not to only insure the tails of the distribution as explained above, other uncertainties in the product definition should be avoided. Below we discuss a few of the choices made in the product definition.

Index- or indemnity based?

We have opted for index-based insurance because an indemnity-based insurance is in general slow in payouts (inspections) and very expensive to manage. Management costs also increase because of potential fraud in the control chain.

However, the choice for an index-based product introduces a material issue: there is a basis risk between the index triggers for pay out and the actual loss incurred by the farmers due to drought. If the crop is lost as a result of drought and the trigger was not hit and the insurance does not pay off, the farmer and/or the MFI will have problems. In appendix C we have included a more in depth discussion of the consequences and solutions to basis risk.

Satellite or weather station data

Weather station data is expensive to operate, prone to fraud and therefore not scalable. There are no quality issues with satellite data. Evapotranspiration data (evaporation and transpiration data) from satellites are validated and numerous, and the choice for evapotranspiration satellite data is methodologically supported by the FAO. Therefore the measurement error is small and the availability of consistent and high quality historical data increases the reliability of the modelling exercise. Interestingly, the use of satellite data was found acceptable to farmers in India in a study of micro insurance products.³

Insurable interest: loan or crop yield?

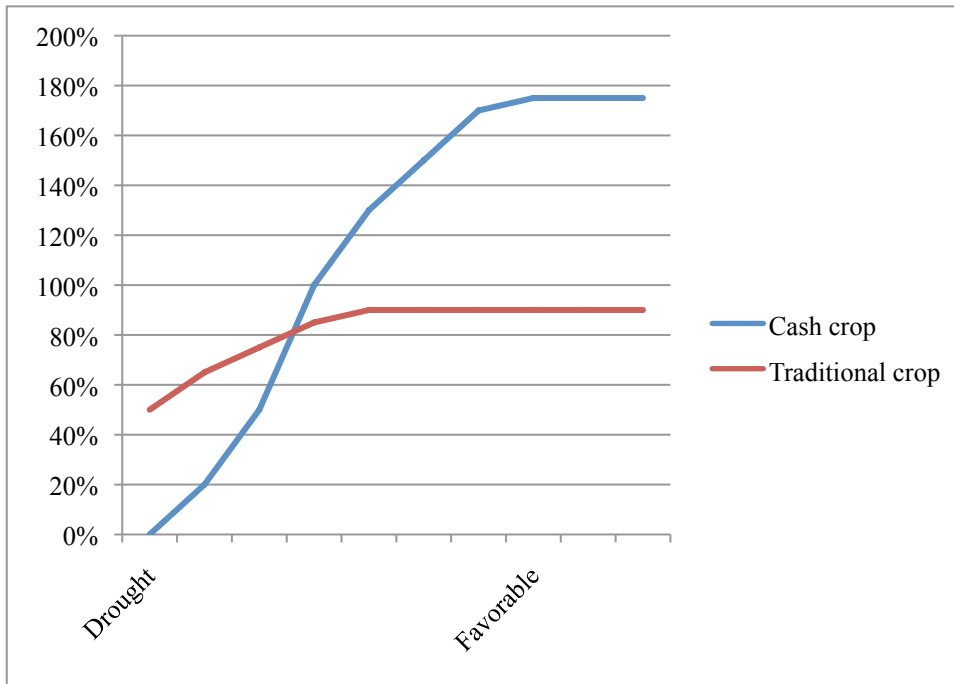
We propose to have the insurance cover the loan (including interest and cost of insurance) rather than the crop yield (i.e. the product is not designed to insure expected profits). Loans taken out for investment are a good proxy for capital to be insured. Not covering the crop yield, but the financing as the insurable interest avoids moral hazard, speculation and over/underinsurance. Adverse selection is mitigated by community policies for the complete portfolio of loans to farmers versus individual policies. The embedded insurance is effective and efficient.

This choice however also introduces basis risk to the farmer. However insuring the crop yield would overcomplicate the modelling of the risk and thereby increases the real cost of the product to unacceptable levels.

The potential productivity increase resulting from the access to finance is key to the business case of CoinRe. Without the prospect of capital accumulation and profitable investment, sustainable productivity growth and food security cannot be achieved. The crop yield should be above a minimum threshold to make it viable. A low return with high risk and/or high interest is not feasible and does not provide the basis to develop for the long term either.

As illustration the graph below shows two crops, one with low volatility but low average yields (a crop like sorghum), the other with higher average yield but larger loss in case of drought (a crop like maize/corn). The potential returns are of the two crops are shown in the graph below.

³ See Janice Angove & Nashelo Tande, ILO Microfinance paper no 11, July 2011, "A business case for microinsurance: An analysis of the profitability of microinsurance for five insurance companies"



In the two-crop example the sensitivities for expected return and volatility are clear and summarized in the table below.

Type crop	μ (mean)	σ (standard deviation)
Cash crop	115%	65%
Traditional crop	82%	13%

The standard deviation (as a measure of risk) for the cash crop ($\sigma = 65\%$) versus the standard deviation for traditional crop return ($\sigma = 13\%$) clarifies immediately why a microfinance institution cannot develop a portfolio of loans for cash crops. In the above example the probability of failure due to climate risk (defined as a return of less than 50% in 20% of the years) of the cash crop is xx% versus the traditional crop's xx%, highlighting the vulnerability of cash crops and thus the difficulty in providing finance. The application of drought insurance for the traditional crop is less than obvious. Is it not apparent that insured financing can improve the expected return.

Reinsurer or local insurer?

Given the appetite by global risk carriers and that these institutions can efficiently absorb these risks at minimal capital costs due to their diversified portfolios, it does not make much sense to create an competing local insurer vehicle to act as principal in the transactions. CoinRe will therefore logically not become principal but remain a broker, for reasons of cost of capital and cost efficiency.

We propose to broker the products directly to the microfinance institutions without the use of a local insurance company. There is no need for such additional chain for local distribution and we avoid the capital costs of the local insurer. Local capital for a local risk is not effective as result of the lack of diversification benefits, nor efficient from a cost perspective.

Distribution and administration cost

The cost of distribution and administration are direct costs to the end-user and should be kept as low as possible in order to achieve affordability without subsidies and scalability. This is a primary strategic driver for the COIN-Re concept.

The main strategic choice to reduce operational expenses is to target a distribution channel via the MFI's. The drought insurance will be embedded in a loan facility targeted at farmers with the aim to

support their use of a higher-yielding crop, based on the assurance that in case of crop failure due to drought they will not be required to pay back the loan. This solution has a number of major operational advantages:

- The farmer is not required to assess the viability of the insurance product on its separate merits, which requires a high level of financial literacy, trust and is potentially sensitive to cultural issues. The farmer can assess the total package.
- The farmer does not have the financial strength to absorb the basis risk between the yield of his produce and the trigger of an index-based insurance. It is proposed that the MFI's absorb some basis risk. Since the inclusion of the insurance lowers the probability of default on the loan a buffer exists for the MFI to provision for basis risk without increasing the cost of the funding to the farmer. Note that a 'waiver' of the loan has a social benefit in comparison with a default. This is discussed in more detail in appendix C.
- There is no need to administer the insurance policy individually for each farmer because it is embedded in the loan, which can be kept on a community / portfolio policy basis.
- Ensures that COIN-Re vision of unlocking finance through the provision of climate risk solutions is met.

A second strategic choice that reduces operational costs is to use index-based rather than indemnity based insurance (i.e. an insurance that pays out on actual loss by the farmer). The latter requires a cumbersome and expensive system of indemnity inspection policies and procedures carried out locally. This system is highly prone to fraud, causality analysis and therefore prohibitively expensive to manage properly.

A third choice to keep costs down is to work with relatively inexpensive satellite data rather than with weather stations. Satellite data can be acquired on a global scale from centralised and methodological sound sources as weather station data (although very reliable in many locations) are provided by national institutions at best and can be more easily interfered with, thus again requiring a more elaborate system of operational quality control. Satellite data has a sensitivity of 5 kilometres which is considered sufficient.

Target market

The criteria for the target region / market are:

- Climate risk must be a material reason why agricultural investments are not financed by MFI's.
- A professional partner MFI is present and able to participate in product development, marketing and sales of the product. The MFI must reach enough farmers within its existing capabilities to make the product worthwhile for it.
- The potential return on agricultural investments to be supported must be high enough to cover the costs of the product and yield a good profit to the farmer.
- No legal or political entry barriers.

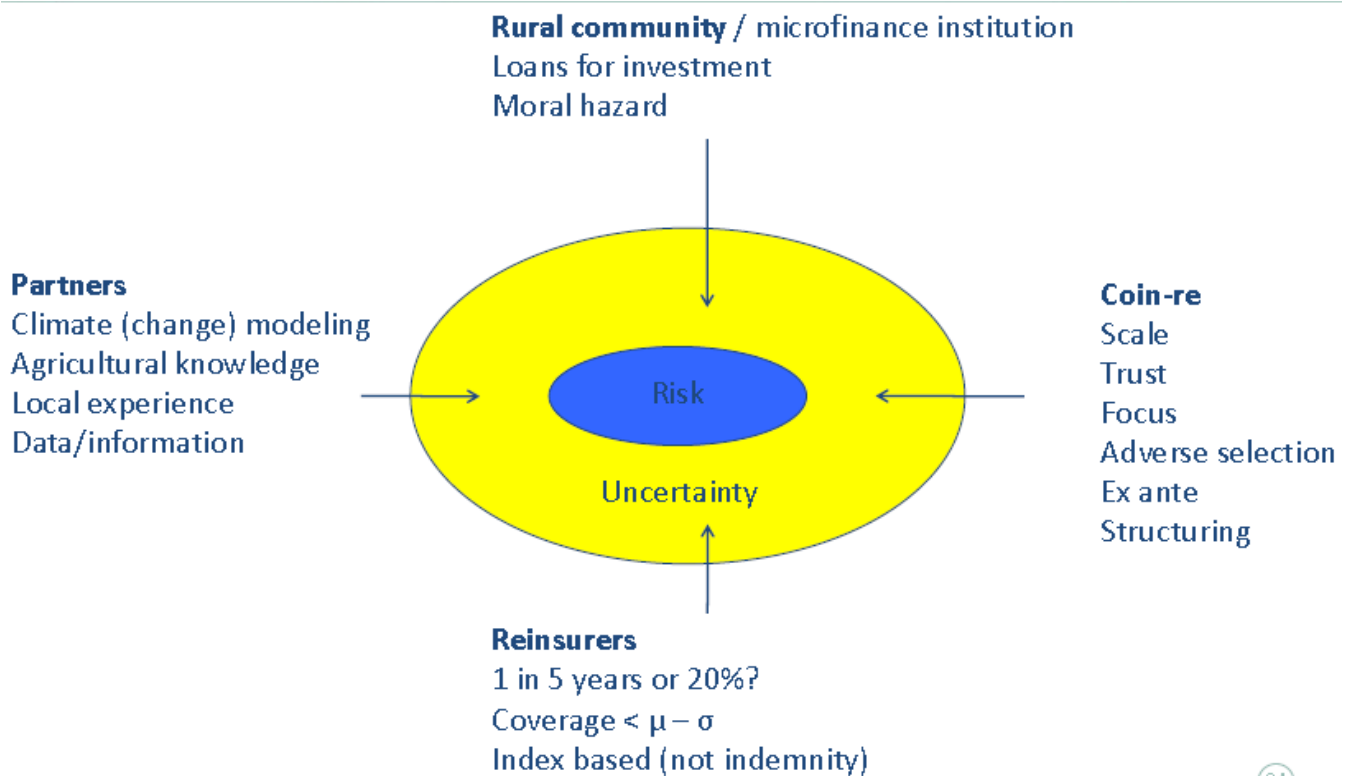
The initial target markets could be:

- Senegal
- Mali
- Burkina Faso
- Niger
- Chad
- Uganda
- Madagascar
- Ghana
- Nigeria

This is supported by some preliminary investigations financed by the Dutch Ministry of Foreign Affairs / GFDRR; and a Swiss Re study: Lovemore Forichi, Agricultural Insurance Specialist, and Reto J Schneider, Head Agriculture Europe and Africa, Swiss Re.

Business case

Conceptual rationale



(24)

The picture above outlines the roles & responsibilities of the stakeholders. It is necessary to reduce the amount of uncertainty as much as possible to make this concept economically viable. Coin-Re is the spider in the web, connecting the dots to facilitate pricing of the true technical risk and avoiding add-ons for all sorts of uncertainty.

The example below shows the role of the partners in the network, the responsibility of the participants in the distribution chain and the logic of the product design. All amounts are expressed in USD equivalents of local currency amounts.

The farmer

Suppose a farmer in a rural village in Africa sees an opportunity to grow a crop with a high potential return. The cash crop can generate a good return, but is vulnerable to climate conditions. Suppose that on average in four out of five years the yield is very good, but once every five years the return is zero.

The farmer compares the alternatives of growing the high return but vulnerable crop (vegetables, maize, corn) and growing the far more drought-resilient but lower yielding crop (e.g. sorghum). Maize will generate on average a higher return, but the return is too volatile for the farmer who does not have the financial resilience to survive the risk of one year of no returns.

The farmer in practice already attempts at present to diversify the crops he grows, in order to be less dependent on specific drought moments (different crops have different critical rainfall requirements) but cannot invest in improved conditions for lack of access to finance. To run the risk of crop failure plus the risk of not being able to pay back a loan is insurmountable.

Let's assume that each farmer has a need for finance of USD 1.000 until the end of the cycle, assumed to take one full calendar year, to invest in fertilizer, seeds and irrigation, with which he expects to generate an income of USD 2.500 within an annual cycle. Let's also assume that the crop is expected to fail once every 5 years due to drought, leading to no income at all in that year. On average therefore

the expected income is USD 2.500*4/5 or USD 2.000 per year. The revenue expectation (net of repayment of the loan) in a good year is therefore USD 1.500, but on average it is USD 1.000.

The insurance's payout probability is 20% of the insured value. The insured value will be the sum of the financed amount, the interest due and the cost of the insurance, in order to ensure zero financing (total input) costs in a drought year.

The insurance premium is therefore mainly not a cost, but a kind of savings product and can be interpreted as a smoothing of the (expected) income stream by creating a floor of zero.

The rural community

A rural community is very dependent on agriculture. There is a huge correlation between [the economic well-being of the] inhabitants of a village and the prevailing agricultural economical cycle. The risk of climate related crop failure therefore is not limited to just the farmers.

Assisting the farmers to escape the poverty trap thus has a direct impact on the economic wellbeing of the rural community as a whole. Traders, schools, health clinics, local public sector are all primarily dependent on the economic strength of the agricultural community.

We have assumed that the community includes 1.000 farmers of which 50% participate in the agricultural sector loan plus insurance program. The community can take out the insurance policy as embedded in the loan product for farmers.

The microfinance institution (MFI)

The MFI is active in the rural community and is presumed to wish to maximize its activity in the agricultural sector as this is the dominant local economic activity. Boosting the economic productivity of the agri sector will have positive spill-over effects to the rest of the community as stated above, benefiting the rest of the MFI's non-agri business.

The MFI will be concerned with a number of issues in order to manage its risks, one of which being managing a portfolio of farmer clients (whether on an individual basis or through collective borrowing schemes). Currently, the climate risks in a loan portfolio are managed by simply limiting the exposure to the agricultural sector.

In our model, the MFI is the focus point to create a bespoke product that is specifically designed around one or two high-yielding crops, based on the provision of specially parameterized weather insurance.

The MFI will determine the appropriate level of disclosure on the components to the farmers. It will have to explain in what circumstances the loan repayment obligations will be covered by the drought insurance and what level of basis risk remains with the farmer.

Let's assume that the MFI requires an interest rate of 30% per year, for a 12-month crop growth cycle, to be paid at the end of the loan. In case the crop cycle (growing season) is less (e.g. 5 months) the interest cost of the loan reduces.

The reinsurer

The reinsurer has the appetite and capital to absorb climate risk. It is actively interested to access exposure in this area for reasons of diversification benefits. It has in-house established modeling knowledge and has a long-term interest to grow the portfolio and support the Millennium Development Goals.

The agricultural sector can become viable and commercially interesting for reinsurers if they can find scalable underwriting opportunities. However it is apparent that reinsurers are OK to assume long lead times to achieving the scalability on the grounds of immediate PR benefits, if the scalability over time can be proven.

Reinsurers will be highly sensitive to reputational risks, such as corruption and incompetence. This is mitigated with the quality requirements of CoinRe's activities.

Modeling uncertainty is estimated to add 1% of the insured amount to the technical reserve (which is thus increased to 21%). No additional provision is taken to cover the reinsurer's other expenses (administration).

Let's assume the risk capital allocated to the business is 8% of the technical provision and required return on capital is 12% per annum. Thus, if the technical reserve is 21% of the insured amount, the per annum provision for return on capital is $21\% \times 8\% \times 12\%$ or 0,2% of the insured amount

COIN-Re

We are assuming that the broker in the chain between the MFI and the reinsurer adds 5% to the technical premium to organize the network and distribution, including administration.

Total annual operational expenses for the CoinRe operation are expected at USD 1.500.000, based on the following high-level assumptions:

- CoinRe personnel and office cost: the all in costs for a staff of 3 to 5 staff (CEO, COO & CCO) and office costs (lease, ICT and insurance) are estimated at USD 800.000.
- Satellite Data: for data delivery and product development support, COIN-Re will enter into a long-term contract with EARS and the annual fee plus tax is budgeted at USD 300.000.
- Distribution expenses: Distribution costs should cover marketing material, website development and maintenance, conferences, business trips and all other sales and marketing efforts, excluding man-hours. The budget could also cover distribution fees paid to third parties. The total budget for these costs is USD 250.000.
- Governance, Tax and Legal: COIN-Re will need tax and legal advice to perform its intermediary role fully to the partners in emerging markets. Furthermore, in this budget the audit fee and the costs of the Advisory Board are included. The amount budgeted for these cost is USD 150.000.

We assume that the estimated cost of USD 1,5 million will need to be covered on a break even basis by a insured portfolio of USD 150 million. This equates to 1% per annum over the insured amount or 5% over the insurance premium (equal to 20% of the insured amount if the payout ratio is 1 in 5).

We assume that CoinRe will have to operate at an operational loss in the build-up phase, until the portfolio reaches the USD 150 million break-even portfolio. If it takes 5 years to get there in a gradual growth scenario, capital coverage is required for approximately USD 3 to USD 5 million to cover start-up losses.

Overview

The table below summarizes the example in the business case above. The real cost of the insurance as measured by the difference between expected average return with or without insurance is low and affordable.

		One farmer	One policy
Number of farmers			500
Loan amount		1.000	500.000
Good year gross revenue		2.500	1.250.000
Average expected gross revenue		2.000	1.000.000
Interest	30%	300	150.000
Technical reserve coverage	21%	351	175.566
Insurance operational expenses	5%	18	8.778
Cost of capital of the reinsurer	0,96%	3	1.685
Capital to be insured		1.672	836.030
Total expenses		21	10.464
Total premium		372	186.030
Total premium / Loan amount		37%	37%
Total interest plus premium		672	336.030
Net good year revenue		828	413.970
Net average revenue		662	331.176
Total cost / total premium		5,6%	5,6%
Total cost / insured capital		1,3%	1,3%

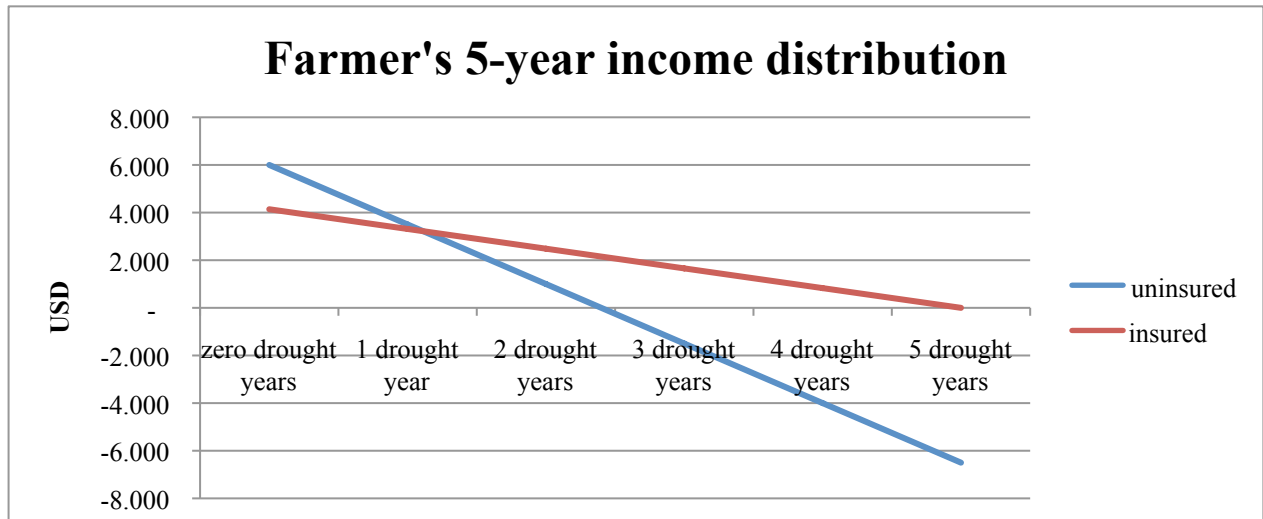
To show the effect of insurance in a simple scenario analysis, a full 5-year cycle is viewed with crop failure occurring with a probability of 20%, assuming full independency year-on-year (i.e. the probability of two consecutive years of drought is 20%*20%, etc).

Without insurance the farmer's gross revenue in a good year is USD 2.500. His costs being the loan (principal + interest) debt service of USD 1.300, he has net profit of USD 1.200. In a drought year the farmer has gross revenue of zero and a net loss of USD 1.300 (he still has to pay back the loan).

With insurance the farmer's costs increase, yielding a net income in a good year of USD 828. In a drought year the insurance covers all costs and the net income is zero.

On a cumulative basis this gives the following expectation of outcomes:

Scenario	Probability	Cumulative income over 5 years	
		Uninsured	Insured
Zero drought years	32,768%	6.000	4.140
1 drought year	40,960%	3.500	3.312
2 drought years	20,480%	1.000	2.484
3 drought years	5,120%	-1.500	1.656
4 drought years	0,640%	-4.000	828
5 drought years	0,032%	-6.500	0
Expected	100%	3.500	3.312



The scenario with insurance included clearly shows lower volatility and no negative outcomes. This example assumes the basis risk equals zero (i.e. that the farmer incurs a loss not covered by the insurance due to an inappropriate trigger).

The 'cost' of insurance is the difference in expected income between the two scenarios. The insured case expected return after 5 years is USD 188 lower or 5% below that of the expected return of the scenario without insurance.

In a third comparative scenario, it is assumed that a farmer manages to enter into a financing agreement without insurance and thus defaults the moment a drought occurs, does not repay the loan (i.e. does not experience the negative cashflow) and as a result of the default, does not receive a new loan to try again thereafter.

- The farmer ceases to produce after a default.
- The expected aggregate 5-year cumulative income for the farmer is USD 3.227 hence 3% lower than the insured case, even after not paying back the last loan.
- The MFI remains with a portfolio of unpaid loans after a drought (67% default probability after 5 years).

Volatility in expected returns is reduced significantly in the scenarios with insurance. Higher utility, sustainable (micro-) finance, capital accumulation and productivity growth are the result.

Partnership strategy

COIN-Re is intending to actively use already existing expertise to create an efficient partnership and focus only on the coordination of the chain of partners to result in a cost-effective and innovation-driven distribution of product.

More specifically, the added value of COIN-Re is not to add another link in the chain, but the missing link between the reinsurer / capital market and the microfinance institution / farmer, by creating a platform for communication, product development, pricing and research.

As a typical network initiative there are several key players involved from different areas. The currently identified partners are:

1. *Risk capital climate insurance*

- Swiss Re (www.swissre.com)
- A second partner to be confirmed?
 - Munich Re (www.munichre.com)
 - Partner Re (www.partnerre.com)
 - Africa Re (www.africa-re.com)

2. *Microfinance financiers*

- Incofin (www.incofin.be)
- Grameen Crédit Agricole Microfinance Foundation (www.grameen-credit-agricole.org)
- Access Holding (www.accessholding.com)
- East African Development Bank (www.eadb.org)
- Oikocredit (www.oikocredit.nl)
- KfW (www.kfw.de)
- AfDB (www.afdb.org)
- To be confirmed
 - FMO (www.fmo.nl)
 - Rabobank Foundation (overons.rabobank.com)
 - Shell Foundation (www.shellfoundation.com)
 - DGIS (www.minbuza.nl)

3. *Microfinance Institutions*

- To be confirmed

4. *Knowledge Partners*

- EARS (evapotranspiration satellite data) (www.ears.nl)
- FAO (methodology) (www.fao.org)

Business processes & organisation

The COIN-Re initiative is a classical innovation in risk management. It is extremely solution-oriented, with the following edge:

- Extreme focus
- Not for profit orientation
- Low cost
- Scalability
- Cooperation / sharing (network partners add value through service level agreements)
- Technical expertise
- Lean & mean organisation structure (small balance sheet)
- Proper governance

The broker COIN-Re is a network organisation and therefore strives to be a small organisation, but maximizing impact by incorporating all key players of the business model in the governance of the company. As described in the previous chapters, COIN-Re will engage with already established strategic partners to leverage off existing capacity.

COIN-Re will fulfil the following roles:

- Product development
- Transparent pricing
- Advice & training
- Strategic marketing
- Distribution from reinsurances to local counterparties

In the first instance, COIN-Re expects to employ three to five staff to start the operations. Frank Gosselink will act as CEO of the company. Frank will be responsible for setting the profile of the company and managing the activities of COIN-Re. Other staff profiles will be determined during the implementation phase. Broadly, the two to four other staff members will respectively focus on sales & distribution and product development & administration.

Governance

COIN-Re will be incorporated under Dutch law and will be a full subsidiary of Cardano Development B.V (which is itself a full subsidiary of Cardano Holding B.V.) and a sister company of TCX Investment Management Company B.V.

Cardano will not provide any guarantee to COIN-Re. Cardano directors will perform the non-executive board responsibility for corporate oversight. COIN-Re will constitute an external Advisory Board. The role of this Advisory Board is strategic advice, governance of stakeholder interests and monitoring the performance of COIN-Re.

The Advisory Board will have five members:

- Independent Chair
- Representative of MFI community
- Representative of reinsurers
- Representative of the DFI community
- Representative of provider of start-up capital

A profile for all the members will be drafted during the implementation phase. The Advisory Board is expected to meet quarterly.

Regulatory, legal & compliance

COIN-Re will be an authorized insurance broker, legally allowed to underwrite policies on behalf of Re-insurance companies. Legal incorporation will be dependent on (insurance) tax, regulations, legal requirements and all other institutional barriers. If necessary, COIN-Re can formally operate offshore.

Formally the finance providers (MFI's and DFI's) are buying indemnity climate risk insurance from Re-insurance, which allow them to structure the loan covenants with an embedded insurance. End users (rural agriculture communities) are getting loans which will be (partially) cancellable if a pre-determined event takes place during the tenor of the loan. They do not buy separate or on an individual basis insurance policies. COIN-Re, the Re-insurance companies and the loan providers need to ensure compliance with legal & regulatory requirements in all relevant jurisdictions.

A high level risk analysis of the business model identifies five main risks. These risks cannot be completely mitigated and need to be managed.

Volume

As COIN-Re targets a new market, there is uncertainty about the size of the market. Although potential is proven conceptually, a new market always has a lead time. Product design, training and education are important elements to ensure end-users fully understand and accept the terms & conditions and thus have demand. For two or three years COIN-Re could maybe be subsidized by donor grants, but a clear growth path should be experienced to warrant successful implementation. One of the major tasks therefore of COIN-Re is the development of the market. The primary mitigation of this risk is the proposal of an initial pilot phase.

Product risk

The product, although developed in conjunction with key market players, might prove to be ineffective or inefficient. In case the product needs improvement, COIN-Re should be flexible and adaptive. This risk is managed by involving the whole chain in the initiative and by allowing for a flexible product definition.

Pricing risk

COIN-Re is aiming to bring transparency by clearly outlining the premiums and the costs of the insurance policy. Nevertheless, the product premium is material in terms of overall cost and might be considered as not feasible. Furthermore, insurers might take the stance that the product is not profitable enough to sustainably build a business.

Reputational risk

The reputation of COIN-Re is an important asset in selling the product and advising clients. Unexpected legal or basis risks for the customer might seriously taint the reputation of COIN-Re and damage the ability to act as an intermediary.

Political / legal / regulatory / tax risk

Since insurance offerings are a regulated business, changes in regulation or perceived regulatory arbitrage might hamper the business model of COIN-Re. Next to regulatory issues, a protectionist approach to an outsider entering the market is a threat. COIN-Re will actively engage with local parties to mitigate this risk and will not build a business case on specific rulings or exemptions.

Pilot

To test the business plan and to confirm the marketability of the product, a first step in the roll out of the COIN-Re concept is the execution of a few pilot cases.

The pilot cases should answer the following questions:

- Does the product offering appeal to local farmers?
- Is the operational set up sufficient and efficient?
- Is there a need for an additional partner (for example in local selling)?

Conditions for a pilot:

- Partner MFI who is ready, willing and able.
- All parties are in agreement on the modelling for this region.
- Contracts are signed between all parties.

Milestones

COIN-Re aims to start its first pilot in 2012 in time for the planting season. This will require a decision on a go-no-go at the latest in October 2011. To meet this time schedule the business plan of COIN-Re was approved by Cardano Development in principle beginning of July 2011. Cardano Development will set explicit conditions precedent to which the initiative can work on towards end of October 2011.

Activities

In order to make a decision on the initial investment and the start of the project in October 2011 the following needs to be achieved:

- Clear roles within the COIN-Re set up and preliminary division of labour.
- Funding plan for initial phase.
- Positive intentions from both reinsurer(s) and MFI(s). Signed MOU's.
- Worked out legal set up of the company.
- Product definition and term sheet.
- Draft contract with EARS.

Planning

The draft business plan is approved as of July 2011 by Cardano management. Together with this business plan, clear milestones are agreed for further work out, including more detailed conditions precedent for definitive pilot project for 2012.

A seminar in October will be held to discuss the concept with the intended partners.

Literature, studies and other sources

- Olivier Mahul & Charles J. Stutley *“Government support to agricultural insurance; Challenges and options for developing countries”*
- Harold Alderman & Trina Hague *“Insurance against covariate shocks; the role of index-based insurance in social protection in low-income countries in Africa”*
- J. David Cummins & Olivier Mahul *“Catastrophe risk financing in developing countries; Principles for public intervention”*
- E. Morelli, Georgio Amsicora Onnis, W.J. Ammann & C. Sutter *“Micro-insurance; An innovative tool for risk and disaster management”*
- SwissRe, Sigma, 2010 *“Microinsurance - risk protection for 4 billion people”*
- EARS, *“FESA Micro-insurance: methodology, validation, contract design”*
- United Nations, Projet MH/PNUD/DADSG-SEN/87/006, 1994 *“Bilan-diagnostic des ressources en eau du Sénégal”*
- Joachim Herbold, Rural 21 – 04/2010, *“Crop insurance in developing economies; the insurers’ and reinsurers’ perspective”*
- United Nations, FAO Irrigation and drainage paper 56 *“Crop evapotranspiration, Guidelines for computing crop water requirements”*
- United Nations, OECD-FAO *“Agricultural Outlook 2011-2020”*
- Hans de Kruijk, 2010, *“Poverty Dynamics; the case of the Maldives”*
- Janice Angove & Nashelo Tande, ILO Microfinance paper no 11, July 2011, *“A business case for microinsurance: An analysis of the profitability of microinsurance for five insurance companies”*

A. Appendix COIN-Re

Initiators:

- Cardano Development (www.cardano.com), focused on innovative risk management solutions for emerging markets, owner of TCX Investment Management Company, subsidiary of Cardano Holding B.V.
- Frank Gosselink (f.gosselink@gmail.com, mobile + 31. (0)6. 51 79 70 88), fully committed to and assigned to COIN-Re realization as project manager, former director of risk management at FMO, member TCX RiskCo and former chairman of supervisory board at TCX Investment Management Company, former manager actuarial department and risk manager at AEGON and four years in West-Africa for the United Nations.
- Bart Bos (b.bos@cardano.com), director of Cardano Development, formerly CRO of Cardano Risk Management and Risk Manager of TCX. Background in banking, pensions and investment.
- Herman Bril (h.bril@cardano.com), managing director of Cardano Development, CFO of Cardano Group and COO of Cardano UK.
- Joost Zuidberg (j.zuidberg@tcxfund.com), managing director and CEO of TCX Investment Management Company and project advisor of COIN-RE.

B. Appendix Other initiatives

There are multiple initiatives in the agricultural microinsurance. In building the business case, we have taken the lessons learned from these other initiatives and, to our own opinion, aim to solve these issues.

Kilimo Salama (Syngenta Foundation)

The project provides insurance against too little and too much rain. The pilot is successfully concluded however the project is not yet self-financing. The project is innovative in the distribution channel, namely via the seller's of seed and fertilizer. Furthermore, the use of mobile banking is employed in collecting the premium and disbursing the claim. The COIN-Re initiative differs from this project in the use of satellite data versus weather stations. Furthermore, COIN-Re would also be applicable in more capital intensive agriculture, as it also provides financing. COIN-Re therewith aims to improve on the basis risk and targets a different market. The distribution channel could however be an interesting alternative or addition to the proposed route via MFI.

Cotton index Mali (ILO)

[Insert 1 sentence here explaining the project or the study]. It seems from the feasibility study that there remains quite some basis risk. The satellite data alternative is not considered because of the complexity. By including EARS in the network of partners, the clients of COIN-Re can profit from the experience of this specialist partner in developing the right product. Index insurance is the way forward, rainfall data without further refinement is not appropriate because of too high basis risk.

A BUSINESS CASE FOR MICROINSURANCE: AN ANALYSIS OF THE PROFITABILITY OF MICROINSURANCE FOR FIVE INSURANCE COMPANIES (ILO)

Two of the insurance companies analysed offer agricultural index insurance. The study shows the need for such insurance and the growth potential. The profitability is depending on reinsurance, which means that pricing of the product is still a challenge. COIN-Re will employ the same distribution strategy, but will take the lessons learned from the pricing issue, by lowering the model risk by offering a product insuring higher frequency events.

C. Appendix Basis Risk

The choice for an index-based product introduces a material issue: basis risk between the index trigger for payout and the actual loss incurred by the farmers due to drought. If the crop is lost as a result of drought and the trigger was not hit and the insurance does not pay off, the farmer will not have the finances to repay the MFI.

These problems are foremost of a financial nature, but are also problems of reduced trust and reversed productivity gains.

The basis risk can be assumed by the farmer if he is sufficiently aware of the issue and can take a considered decision. If not (which is more likely), he will lose all faith in the product the first moment the basis risk occurs and his loss is not covered. Note that there are also other risks that can lead to a bad harvest (such as insects or crop diseases), but these are less systemic on a regional basis and could probably only be covered by indemnity insurance.

Note that basis risk is not the same as foretelling the quality of the harvest. Basis risk for the embedded insurance has only implications for the quality (level) of the trigger and the chosen methodology (evapotranspiration as measured by a satellite). The farmer and the MFI are made aware of the terms of the index insurance in order to have them accept the risk.

The best-placed entity to absorb some of the basis risk seems the MFI. The social implications of a default are detrimental to the development of the agriculture sector. A logical way forward is to use the proceeds of a lower default probability of the farmers and hence the improved portfolio of agricultural loans to fund a provision to deal with the basis risk or other unforeseeable issues related to the portfolio of agricultural loans.

COIN-Re aims to minimize the basis risk in the product design in several ways:

- Instead of tail risk (catastrophes) the expected pay out frequency is much higher and on the safe side. This is as discussed earlier a very (cost) effective way of reducing the basis risk (maybe some payout when not necessary), but as yields are a more continuous function of lack of water, this is only smoothing the distribution of returns and not expensive.
- A quantile or value at risk of 20% is much more robust than a quantile in the tail of the distribution of 3%. The next observation (new year data) will probably not move the 20% quantile, but can move the 3% trigger considerably in a set with 30 years of observations. The 20% quantile is more robust vis-à-vis trends, climate change and uncertainty in general.
- A yearly (per growing season) renewable product reduces the basis risk not only for the farmer, but also for the risk carrier / reinsurer. Uncertainty materializing in new research or observations can easily be addressed in next year's premium and needs not to be addressed in advance by adding uncertainty margins. COIN-Re needs the knowledge partners to be at the forefront of developments to reduce uncertainty.