Designing Agricultural Index Insurance in Developing Countries

A GlobalAgRisk Market Development Model Handbook for Policy and Decision Makers

GlobalAgRisk INC.

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ACRONYMS AND ABBREVIATIONS

AEP	Annual Exceedance Probability
AI	Avian Influenza
AICI	Agricultural Insurance Company of India
BASIX	Livelihood promotion and microfinance entity of Andhra Pradesh, India
BIP	Base Insurance Product
BSE	Bovine Spongiform Encephalitis
DX-HT	Dong Xuan-He Thu (Double rice-cropping system in the Mekong River Delta region)
DoI	Department of Insurance (Vietnam)
DRP	Disaster Response Product
ENSO	El Niño Southern Oscillation
FAO	Food and Agriculture Organization (United Nations)
FAPRACC	Fondo para Atender a la Población Rural Afectada por Contingencias Climatológicas (Mexico)
FMD	Food and Mouth Disease
FONDEN	Fondo de Desastres Naturales (Mexico)
GoV	Government of Vietnam
GDP	Gross Domestic Product
(HYV)	High-Yield Varieties (Rice)
ICICI Lombard	Private general insurance company in India
IMDE	Insurance Market Development Entity
IBLI	Index-based Livestock Insurance (Mongolia)
LIIP	Livestock Insurance Indemnity Pool
M&E	Monitoring and Evaluation
MNT	Mongolian Tugrik (1 USD=1,441 MNT)
MoF	Ministry of Finance
MPCI	Multiple Peril Crop Insurance
MRC	Mekong River Commission
MSI	Maximum Sum Insured
NASFAM	National Smallholder Farmers' Association of Malawi
NPV	Net Present Value

PDF	Probability Distribution Function
PML	Probable Maximum Loss
SIWRP	Southern Institute for Water Resources Planning (Vietnam)
SRHMC	Southern Region Hydro-Meteorological Center, Ho Chi Minh City, Vietnam
USD	United States Dollar
VBARD	Vietnam Bank for Agriculture and Rural Development
VND	Vietnam Dong (1 USD=17,820 VND)
WTO	World Trade Organization

INTRODUCTION

This GlobalAgRisk Market Development Model handbook offers a conceptual framework to guide policy makers and stakeholders for implementing and designing agricultural index insurance products in developing countries and uses the market development experience of GlobalAgRisk in Vietnam as its centerpiece example. Agricultural insurance is an important element of risk management that can contribute to dynamic and responsive rural financial markets. Before an appropriate and effective risk management policy or agricultural insurance program can be developed, a clear understanding of the risks that can be insured and the challenges to developing agricultural insurance is critical. Market development as an ongoing process, which requires assessing and evaluating the economic and social importance of agriculture in a country, its structure of agriculture, its exposure to natural disasters, and the existing institutional arrangements that may substitute for agricultural insurance, and then a careful monitoring and assessment of the results of decision making.

As with any product, understanding its demand and supply is the first step. Demand for agricultural insurance will be heavily influenced by existing rural lending and social policies. Some policies may reduce the demand for formal insurance. In Vietnam, for example, the rural lending policy implemented by the Vietnam Bank for Agriculture and Rural Development (VBARD) includes largely uniform, subsidized interest rates across Vietnam. Given their access to capital from the state, VBARD implements a liberal rescheduling policy when a natural disaster creates problems with repaying loans. These kinds of policies act as a form of insurance which undoubtedly reduces the demand for formal insurance. Nevertheless, use of informal credit channels during times of crises suggests there may be some scope for insurance demand in Vietnam.

The supply side of insurance market development, the delivery of insurance products, is similarly affected by existing polices, institutional arrangements, and demand conditions. Insurance companies will rightly recognize that existing arrangements can reduce the demand for agricultural insurance. If potential buyers have other arrangements, it becomes even less likely that they will pay the full cost of agricultural insurance. More fundamentally, providing agricultural insurance services in developing countries for smallholder farms is an expensive activity.

Beyond the basic questions of demand and supply, certain risks are simply uninsurable. Many severe weather events occur too frequently to allow any insurance company the opportunity to sell what must be an expensive insurance product. Other risks have characteristics that render them uninsurable, such as flash flood risk. For uninsurable risks, public sector investments in risk mitigation, education, and disaster relief are likely to be a better investment of public resources. However, market goals must be clearly distinguished from motivations and structures for delivering social relief for disasters, otherwise social programs can quickly distort incentives in the creation of agricultural insurance markets. Even with social programs to provide relief for disasters, some significant care is in order. The very policies designed to provide relief can create more losses in the future and encourage increased agricultural activity in regions with a high frequency of natural disasters.

As the above considerations demonstrate, policy makers cannot decide to develop insurance markets without careful thinking about how and where these insurance markets can fit. This document is based on the assumption that policy makers want to create effective, sustainable programs that maximize social welfare while also demonstrating restraint in the use of a limited government budget. Given these policy goals, the focus of this handbook is on index-based weather insurance for agricultural insurance development. Traditional insurance approaches used in developed countries are far too difficult to implement in countries dominated by smallholder farms; the social costs of traditional insurance often outweigh the potential social benefits. For many countries as Vietnam, the priorities for initial insurance market development are aimed at establishing the foundations for a broader, more effective insurance market that can offer coverage for many of the most significant weather risks.

The handbook is organized as follows:

Chapter 1 *Challenges in Developing Agricultural Insurance Markets* examines the institutional setting that effects potential insurance demand and supply conditions and reviews the traditional approach to agricultural insurance programs. The economics of agricultural insurance and the specific problems associated with having a large number of smallholder farms lead to the conclusion that traditional approaches are not appropriate, especially for countries formal insurance markets are not available.

Chapter 2 *The Role of Risk Assessment in Setting Insurance Priorities and Policy* presents the process of a structured risk assessment, which is part of a systematic approach to insurance market development. Risk assessment identifies the specific risks upon which policy is developed. Index insurance is also introduced as a potentially feasible alternative for catastrophic risks.

Chapter 3 *Applications of Risk Assessment and Product Development* profiles the pilot project experience using the example of index insurance for risk aggregators against a specific type of flood risk in Vietnam, and draws specifically on the risk assessment strategies developed in Chapter 2. Chapter 3 also outlines current efforts to develop farm-level index-based insurance against drought risk.

Chapter 4 *A Policy Vision for Developing Agricultural Insurance* synthesizes the concepts and market development work presented in Chapters 1–3. Chapter 4 also presents an agricultural insurance policy framework for stakeholders with an example of a proposed action plan for Vietnam.

Two appendixes are included that relate to insuring livestock and GlobalAgRisk market development experience with the Index-based Livestock Insurance (IBLI) product in Mongolia, along with a reference list that offers further reading.

Chapter 1 Challenges in Developing Agricultural Insurance Markets

1.1 Introduction

In this chapter, we examine the role agricultural insurance can play in enabling greater resilience and opportunities for growth in the agricultural sector. The discussion of agricultural insurance presented in this handbook develops the rationale and the challenges associated with managing weather risks. While the focus is on weather risk for agriculture, many catastrophic weather events have large social and economic ramifications beyond the agricultural sector.[1] Thus, the approach for the market development process that emerges from this handbook has implications beyond agriculture.

In this chapter, we place the pursuit of agricultural weather insurance in a context that will aid policy makers and others stakeholders to understand the challenges and opportunities ahead. This chapter focuses on two primary considerations for successful agricultural insurance market development and the various factors that influence these two considerations: the *demand* for agricultural insurance and the ability to *supply* appropriate agricultural insurance products.

Markets for transferring catastrophic weather risk are nearly always lacking in developing economies. In countries that have agricultural insurance markets, large government subsidies are common, given the difficulties of establishing these markets. These subsidies are often expensive, inefficient, and lead to more production in vulnerable regions, making the future losses from catastrophic events even higher. Global experience demonstrates that concerns about government expenditures and economic efficiency associated with subsidized insurance is significant reason to proceed with extreme caution in taking the steps needed to develop agricultural insurance markets.

Assessing the demand for agricultural insurance is a first step, especially when demand for agricultural insurance products is somewhat unclear. For example, in Vietnam, demand appears to be highly price-sensitive, and there is evidence of educational shortcomings and misperceptions among potential users about the purpose of insurance and its role in an overall risk management strategy (FAO, 1999). In contrast, other work has found strong interest in insurance, particularly in cases where there is significant risk of loss of productive assets purchased with credit (Dufhues, Lemke, and Fischer, 2005).

Demand may also be weak due to the institutional setting because current practices and policies replace some of the need for agricultural insurance among farmers. For example, practices of the government-sponsored rural bank, Vietnam Bank for Agriculture and Rural Development (VBARD) allow farmers with debt to restructure that debt with favorable terms after a disaster. Nonetheless, farmers still carry risks, and VBARD is changing policy to operate with more commercial principles. Results from focus groups suggest that farmers are concerned about losing their title to land should a major natural disaster cause them to be unable to pay loans. Thus, if the right products were available, farmers may be willing to purchase insurance. However, focus group results also demonstrate that farm households face many

[1] This handbook focuses on insuring weather events that create agricultural losses. Importantly, livestock disease problems are also common in Vietnam. Insurance is not a risk management policy response to livestock disease. Appendix A is included to provide the policy context for this conclusion.

different types of risk and so, in some cases, insurers may find it easier to develop products other than agricultural insurance that are also in higher demand among operators of farm households. For example, initially, life or health insurance may be far more important to the farm household than agricultural insurance.

From the supply side, we draw on international experience to examine the economic challenges in developing agricultural insurance products. World experience demonstrates that it would be very costly to introduce traditional forms of agricultural insurance when small farms dominate a country's landscape. Large subsidies would be needed. There are serious questions about the benefits and costs associated with such subsidies for agricultural insurance.

1.2 Experience with Agricultural Insurance in Vietnam: A Familiar Story

A familiar story in the developing world is that agricultural insurance has been previously tried with little success and agricultural insurance is practically nonexistent. Stakeholders can have a sophisticated understanding of the classic problems associated with agricultural insurance and lessons learned from the experiments in agricultural insurance[2] can be an important reference point for policy makers as they embark on the quest to develop agricultural insurance markets. In 1999, the United Nations Food and Agriculture Organization (FAO) provided a useful review of the Bao Viet experience with crop insurance that emphasizes the persistent problems with agricultural insurance: high transaction costs tied to monitoring in attempting to control adverse selection and moral hazard, and large financial exposure due to highly correlated risks. An FAO technical review of the program identified several key problems that contributed to the eventual failure of the insurance scheme (FAO, 1999, page 11):

- A general lack of knowledge of the operation of the agricultural class of business in respect to underwriting, claims, and loss adjustment;
- Non-acceptance or low voluntary uptake by farmers, hence a low premium base;

[2] Bao Viet, a state-owned finance/insurance group, offered rice-yield loss insurance coverage for 5 years from 1993 until the insurance was discontinued due to actuarial losses in excess of VND 5 billion and reflected in an aggregate loss ratio of 110 percent over that period. The product was offered in 12 provinces selected by the company and, while farmer participation was voluntary, these offerings were in provinces where the local Peoples Committee reacted favorably to the scheme. While the provinces selected were to be typical rice producing areas, the area insured was a fraction of the total area sown. It was later shown that, unsurprisingly, insurance participation came primarily from those areas subject to the greatest yield loss risk, creating a serious adverse selection problem for Bao Viet (FAO, 1999). The product itself covered multiple risks, though not specifically named, making it difficult for already inexperienced loss adjusters to separate management issues from peril-induced losses. Farm-level losses were determined relative to coverage that was established using estimates of area yields. In that case, farmers with expected yields less than the area average yield would be attracted to the insurance, while those with expected yields greater than the area average yield would chose not to participate. In 1997/1998, Bao Viet, by then directly under the authority of the MoF, made another attempt to offer agricultural insurance and signed a contract with ten provinces in the Red River and Mekong Delta to supply farmers with crop insurance, especially for rice production. This insurance scheme did not succeed and was terminated two years later in 2000 due to massive losses (Dufhues, Lemke, and Fischer, 2005). Bao Viet no longer has any meaningful level of activity in the agricultural insurance market.

- Those who did insure were generally in high-risk locations (the type of adverse selection that ultimately dooms any insurance program that only uses estimates of area yield), and a lack of underwriting skill resulted in an accumulation of insured crops;
- The benefits paid by government in the event of major natural disasters undermined any insurance initiatives; and
- Inadequate financial support from both reinsurance and directly through government subsidy.

1.3 Demand Assessment — Why Consider Agricultural Insurance?

Policy makers must have a strong reference point for why to consider agricultural insurance as they consider how to develop agricultural insurance. It is far too simplistic to pursue agricultural insurance markets in isolation. An active policy dialogue must be motivated by strong questions regarding why to consider agricultural insurance. How can insurance against the losses that occur from extreme weather risks help in poverty reduction and economic development? To what extent do many of the policies that are in place now compete against the potential demand for agricultural insurance? This section provides a framework for some of these important questions for policy makers.

As with most developing and transitional economies, a significant proportion of the population depends on agriculture and poverty is most acute in these rural agricultural areas. Limited education, lack of access to adequate financial markets, and inadequate property rights all contribute to poverty. Until poverty can be reduced, much of the human capital that can contribute to economic growth in these countries will not be fully utilized.

Natural disaster risks such as major typhoons, flooding, droughts, sea surges, and other natural disaster risks inflict significant hardships on many households, but particularly on agricultural households. Shocks from natural disasters also contribute to a cycle of poverty. Households that are just above the poverty line can quickly be thrust below the poverty line by natural disasters. In most developing and transition economies, financial markets for transferring natural disaster risks are largely absent or underdeveloped. Agricultural insurance can provide a means of transferring natural disaster risk out of local communities and even out of the country when global reinsurance is used. However, some natural disaster risks occur too frequently to allow for cost-effective insurance solutions. Other public policy interventions may be needed for these risks, including efforts to reduce the exposure of people via infrastructure mitigation systems or to scale back production if the risks are too great.

Government assistance to the agricultural sector is often focused on promoting rural development to create greater opportunities for higher standards of living for people in the countryside and may also focus on developing the institutional environment that enables agricultural to grow and operate more efficiently, including rural savings and lending, market information structures, regulation concerning input use and quality, etc. [3]

Improving financial markets aids and strengthens rural development. Financial markets generally involve savings, lending, and insurance. In many developing economies, the adoption of improved technologies that enhance productivity and efficiency is slowed due to low levels of lending. Lenders are often reluctant

[3] To read about the transition of Vietnam agricultural policy from taxation of the sector before 1996 to one of protection of the agriculture sector, see Orden et al., 2007.

to lend to farmers because of natural disaster risk and this reluctance can manifest itself in either limited access to loans or higher interest rates.

1.3.1 Effects of Weather Risk on Economic Development

Insurance markets that compensate for crop losses from natural disasters have long been promoted as being an important component to enable the resilience and recovery of farm households. Nonetheless, formal insurance markets in most developing economies are often limited in their product offerings and market penetration — usually only serving urban areas and relatively wealthier clients. Where there are no formal mechanisms in place to protect against large losses from extreme weather events, suboptimal risk coping strategies will be used, and household income and economic activities are likely to be depressed (Rosenzweig and Binswanger, 1993; Carter and Barrett, 2006; Dercon, 2005; Pollner, 1999). This section describes the direct and indirect consequences of exposure to weather risk in the absence of formal risk transfer mechanisms.

Beyond the immediate effects of a disaster, the exposure to a potentially disastrous event also influences household behavior and economic activity (Barnett, Barrett, and Skees, 2008). To avoid or minimize exposure to weather risk:

- Agricultural households will choose low-risk, low-return activities;
- Financial institutions may restrict lending to farm households; and
- Investment in the rural sector may be deterred.

While these strategies can be effective at reducing the consequence of risk exposure to some extent, they also limit opportunities for growth. The uncertainty surrounding the timing of weather risks and severity of events can limit investment and growth. Individuals and enterprises may be unwilling to invest their limited resources in opportunities that promise higher-expected returns if there is also a risk of substantial loss. Recognizing the potential for losses from weather events beyond their control, households that are highly vulnerable to shocks often manage risk by engaging in activities characterized by low risk but also low-expected return. While low-risk strategies such as crop diversification and supplemental off-farm employment may have less income variability, the prospects for economic growth are also much lower than would be the case if the household were investing in more profitable activities. Livelihood strategies that focus on higher-expected return would involve investments in productive assets—such as farm improvements, intensification, new technology, and education — in addition to start-up costs associated with new endeavors. These higher-return strategies are risky because limited resources are invested in activities that often have a lower return, or at least a more uncertain return, in the presence of natural disaster risk.

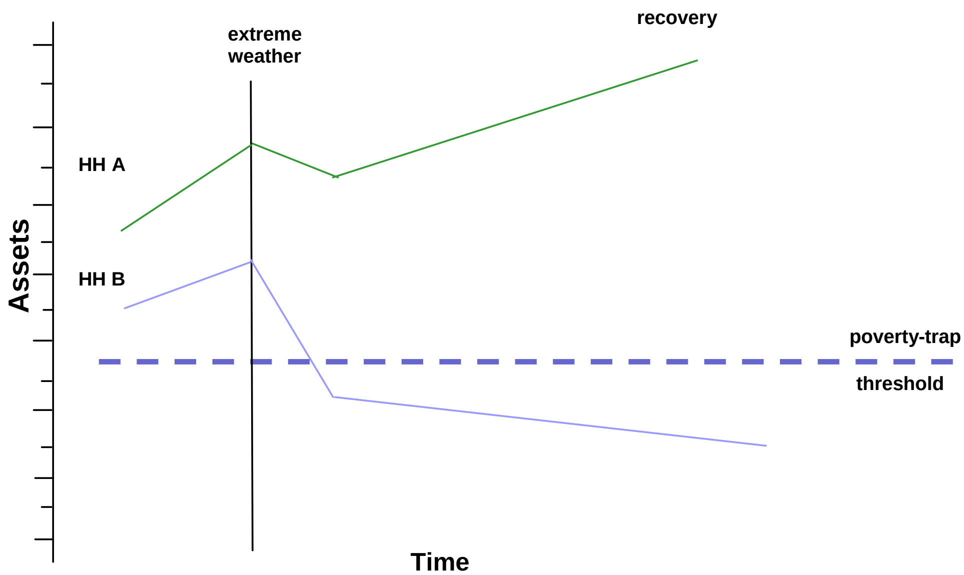
1.3.2 The Relationship between Risk and Poverty

Weather-related disasters can quickly destroy sources of current income such as existing crops. Importantly, natural disaster can also destroy household assets — often accumulated over years of savings and investment — that are needed to generate future income. This scenario can push some households into a cycle of poverty. Households that are just above the poverty line can quickly be thrust below the poverty line by a major weather event.

For example, Figure 1.1 shows the asset positions for two hypothetical households A and B (HH A and HH B). Initially, both households are experiencing upward growth in their asset level and income, though HH B is still close to the poverty line. If a catastrophic weather event occurs, both households may experience an immediate decline in their asset and income level due to loss or damage or to the cost of recovery. Wealthier HH A is also better able to protect its asset base relative to a poorer household.

Therefore, HH A retains more productive assets and is able to recover more quickly. For a poorer household that is disproportionally affected by the loss event, represented by HH B, the depletion of assets may push the household below the poverty line. Once the asset position of a household falls below the poverty line, its recovery may be slow or due to the lack of existing assets, it may be unable to generate sufficient new income to rise above the poverty level and regain its previous economic position. This situation is referred to as a poverty trap because once households on the margin slip into poverty, they are often unable to recover or recover only slowly (Carter et al., 2005). Weather insurance that targets poorer rural and farm households could help households avoid poverty traps by compensating for weather-induced losses and enabling lost productive assets to be replaced, thus stimulating faster recovery.

Figure 1.1 Economic Impact of a Natural Disaster on Households with Different Asset Positions



Source: Carter et al., 2005

1.3.3 Effects of Weather Risk on Rural Financial Markets

Savings, credit, and insurance are all important tools for managing risk and dealing with economic shocks. Savings and credit can also enable greater investment in improved technologies that can enhance productivity and efficiency in the rural sector. For these reasons, access to financial markets is increasingly acknowledged as a means to help alleviate the persistence of poverty traps in developing economies. However, the rural poor often cannot utilize these services due to the absence or inaccessibility of formal financial services.

Microfinance markets have experienced rapid growth and provide a channel for the poor to access financial services, although the penetration of finance in rural areas has been substantially less than in urban areas. The rural poor often lack access to formal credit due to lack of collateral, lack of land title, or lack of a credit history. Additionally, financial institutions (microfinance included) are often reluctant to lend to smallholder farmers because of their exposure to natural disaster risk. This reluctance can manifest itself in either limited access to loans or higher interest rates. Though there is growth potential for financial markets in rural areas and the agricultural sector, the potential for widespread economic loss in these areas is an inhibiting factor (Skees and Barnett, 1999; Skees and Barnett, 2006; Skees et al., 2006).

Restricting the amount of investment in the agricultural sector is one way for a bank or other enterprise to reduce exposure to these risks.

Rural households, particularly those on the margins of poverty may have difficulty repaying their loans if production has been disrupted or destroyed by extreme weather. Given that many natural disaster events are widespread, the correlated losses of the individuals have the potential to result in a significant level of defaults on the portfolio of rural lenders. For example, in the northern regions of Peru, El Niño events, such as the one that occurred in 1998, can cause major flooding. Following the last such event, the rate of loans in default increased from a rate of 8 percent to nearly 18 percent in one of the most severely affected regions (Skees et al., 2006).

In short, correlated risks from weather events can be a major constraint to financial services. The banking systems of most countries are not designed to absorb catastrophic risks. Financial institutions can pool certain types of risk by organizing a diverse portfolio of loans. However, correlated risks that affect many in the portfolio at the same time cannot be pooled. Natural disaster risk must be transferred into a global market to be diversified into a global portfolio of insurance risks. An important concept to understand is that without insurance markets to transfer the risk, society is paying a price for this risk exposure via higher interest rates, credit rationing, and lost opportunities for increasing productivity and income.

Governments and taxpayers also bear the cost of weather risk when they use public funds for disaster assistance or to forgive loans where farmers are unable to pay when there is a disaster. Implementing agricultural insurance would likely be a more efficient and less costly alternative. Insurance allows for transfer of risk *ex ante* (i.e., before a loss occurs), and the price of the risk is paid by those exposed to it (via insurance premium). Thus, insurance can provide improved incentives throughout the agricultural systems.

Crop failure, lost assets, and other major distributions that accompany catastrophic weather events create cash flow problems and repayment problems for agricultural loans. In many cases, these problems ultimately result in a default on the loan. Interest rates on loans must increase as the primary means to pay for default risk. Ray (1998, pp. 544–545) provides a simple model of how default risk is loaded into interest rates. The model reduces to a relatively simple equation when markets for lending are competitive:

$$i = \frac{1+r}{p} - 1$$

where p is an exogenous probability of non-default ($1 - p$ is the probability of default) that is constant across all loans, i is an interest rate charged to borrowers, r is the lender's opportunity cost of funds used for loans. Using this model, we can demonstrate how sensitive market interest rates are to default rates. Assume that the opportunity cost of funds r is 10%. If the probability of default is zero ($p = 1.00$), the equation shows that market interest rates will equal the opportunity cost of funds — 10%. If the probability of default is 0.10 ($p = 0.90$), the market interest rate would more than double to 22%.

Of course, this illustration is simplistic as this example assumes the default rate is the same every year. With a natural disaster risk that creates defaults, the lender may see defaults increase dramatically with some correspondence to the frequency of the natural disaster. Nonetheless, the example illustrates that defaults due to natural disasters will cause interest rates to increase for commercial lenders. If agricultural insurance were in place to aid borrowers in repayment of debt when natural disasters occur, interest rates should not increase.

If credit markets are not competitive and subject to significant government intervention in the name of equity, while this social goal is important, such a blunt instrument of social justice distorts the incentives of all agricultural producers, contributing to some of the problems that can be addressed by agricultural insurance. In particular, social policies that pass the cost of risk onto the government rather than the farmer will cause production of risky crops in high-risk regions. As banking policies in developing countries become more commercial, agricultural insurance will be more important. Given that agricultural insurance must reflect local risk conditions, this price of agricultural insurance along with banking policies will cause farmers to change farming systems so that less risky crops are grown in high-risk regions.

1.3.4 Benefits of Insurance for Catastrophic Weather Risk

Strong financial services are a condition for robust economic growth. Developing, strengthening, and deepening formal rural financial markets are key ingredients to rural economic vitality and the ability of the rural poor to climb out of poverty. Insurance and risk transfer are components of strong rural financial services. Using weather insurance to manage the risk of catastrophic weather events can help stimulate economic development by improving stability and opportunities for growth in the agricultural and financial sectors. A number of positive benefits of managing weather risk include the following:

- Protecting rural livelihoods, thereby reducing poverty;
- Protecting the productive capacity of rural enterprises and farm households;
- Protecting financial institutions against weather-related loan defaults; and
- Financing disaster relief and encouraging structured social safety net policies.

Over time, other potential benefits can emerge that contribute to development, including the following:

- Promoting investment in higher-return activities among rural households;
- Expanding rural finance through improved access and better terms of credit for farm households and agricultural enterprises; and
- Providing a mechanism to manage the most costly source of risk, so government funds can be used for other social purposes during a natural disaster.

In many economies, insurance markets may be the missing link for stronger development of rural finance. Financial institutions in developing economies should be more willing to provide credit to rural and farm households that have weather insurance because these households will be able to utilize insurance indemnity payments to repay their loans. Weather insurance products can also be used by the financial institutions themselves to protect their portfolios against excessive losses due to defaults associated with extreme weather events. Insurance is one way to remove some of the uncertainty about future economic status. Individuals and enterprises will be more willing to invest in economic activities that offer higher-expected returns if they can use insurance to protect themselves from potential losses resulting from an extreme weather event.

Reducing the economic impact of severe weather events is one important step in supporting agricultural growth, poverty alleviation, and development of rural finance. The challenge is to overcome the constraints and market failures that limit the development of insurance markets in developing economies. It is important to note that catastrophic weather is by no means the only constraint to effective banking and insurance markets. Lack of infrastructure, inexperienced financial markets, weak regulatory and judicial systems, adverse price fluctuations, and distorting government interventions are common obstacles that must also be addressed to further financial market development.

1.4 Demand Assessment — Weather Risk in Vietnam[4]

Market research evaluates the demand for, and supply of risk management mechanisms for weather risks to determine if there is a potential market for index insurance products. Understanding the consequences of weather risk on the agricultural sector is useful for informing decisions about how to support rural households and the agricultural economy. To illustrate, in this section, some of the primary weather risks in Vietnam are highlighted in the context of the potential demand for agricultural insurance.

Vietnam is prone to a variety of weather risks which can inflict significant hardships on many households and particularly on agricultural households. Table 1.1 is an outline of the relative disaster risk in Vietnam and shows that extreme weather events are the most frequent and most destructive of the natural disasters that occur in Vietnam. Extreme weather and anomalies in the arrival and duration of the rainy season can have adverse consequences on agricultural production and rural livelihoods. Heavy rainfall from storms and typhoons can cause serious problems with flooding, erosion, landslides, and saltwater contamination.

Table 1.1 Relative Disaster Risk in Vietnam

High Risk	Medium Risk	Low Risk
River Flood	Hail and Rain	Earthquake
Typhoon	Drought	Technological Accident
Rainfall Inundation	Landslide	Frost
Erosion/silting	Fire	
Seawater intrusion	Deforestation	

Source: UNDP, 2004

One reason that water-related disasters are so serious is that most of the population of Vietnam lives in areas susceptible to flooding. Figure 1.2 shows the areas that are prone to different types of water-related natural disasters. Low-lying areas along the coast and in the deltas have been utilized for rice production and aquaculture, yet are vulnerable to floods, inundations, and sea surges. The inland areas are mountainous and are prone to flash flooding during rain storms.

Crop losses are often caused by an accumulation of factors. The most serious losses are caused by typhoons (20–50 percent), although the area affected tends to be limited. Droughts and water-logging are also important (10–30 percent) and affect a wider area. Cold spells, dry spells, and dry-hot winds cause less severe damage (5–20 percent) and affect a limited area. In the past, rainfall has been a more important factor than temperature. These problems could worsen with the effects of climate change.

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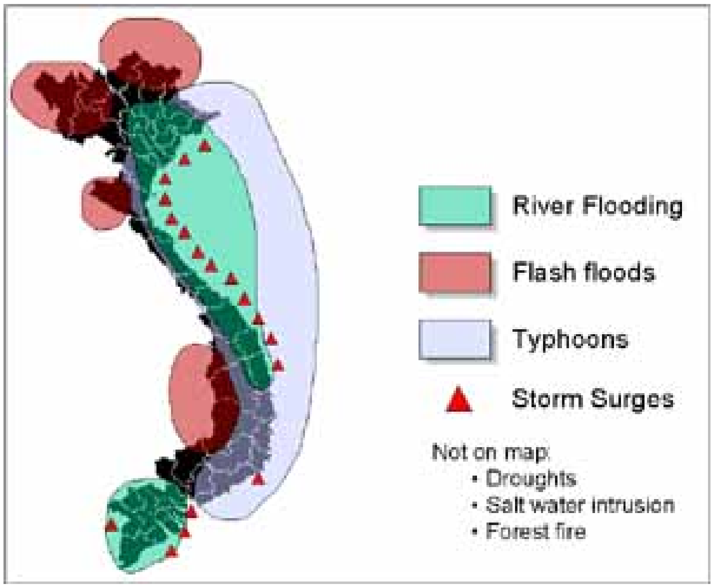
[4] GlobalAgRisk has contributed to numerous publications on the subject of agricultural risk management and the challenges of agricultural insurance which can be referenced for further reading. Some that are referenced for this publication include: Skees (1999a, 1999b, and 2001), Skees and Barnett (1999), Skees (2003), Skees et al. (2006), Skees and Hartell (2006).

Figure 1.2 Water Disasters in Vietnam



Source: UNDP, 2004

Vietnam has a monsoon season and the annual flooding of rivers is expected as part of the natural cycle. Farmers incorporate the expectation of the flood cycle into their production decisions to account for this seasonal phenomenon. However, heavy rains, sea surges from tropical storms, and early arrival of the seasonal flood are difficult to plan for and can cause heavy crop damage. In 2000, for example, the entire Dong Thap Province was inundated by flooding. In 2003, torrential rain caused flooding in Thai Binh that damaged 60,000 ha of rice, half of which was a total loss (UNDP, 2004).

1.4.1 Focus Group Surveys: Key Findings from Dong Thap

On the demand side, the evaluation is undertaken using qualitative surveys and focus groups. These tools are designed to elicit what risks are of most concern to target clients, their perceived need for a risk transfer product, and their risk profile and to assess the level of educational effort that would be required.

Farmer surveys confirm that flooding is the major concern among farmers in Dong Thap. Everyone remembers the serious problems associated with early flooding from 2000. Focus group surveys that were conducted in two districts of Dong Thap in February of 2007 demonstrate that farmers there are concerned about early flooding that causes losses in the second (summer/autumn) rice crop. Furthermore, the feedback obtained from these focus groups also suggest that farmers understand and like the idea of linking an agricultural insurance product to loans. Not only did many farmers lose their crops and incur additional debt, but some also ultimately lost land rights when they were unable to pay off the debt. Additionally, the farmers who did aggressively harvest their crop early to avoid the flooding problems still suffered economic loss due to added cost and poorer quality rice that obtained lower prices. The majority of farmers participating in the focused groups expressed a strong interest in having the opportunity to purchase agricultural insurance to protect against extreme flooding.

1.5 Supply Assessment — Challenges to Agricultural Insurance Markets

It is important to review some of the key issues and experiences with agricultural insurance to provide an understanding of the advantages and disadvantages of different approaches. We begin with a brief description of the traditional approaches to agricultural insurance (Box 1). The remainder of the discussion focuses primarily on the challenges of Multiple Peril Crop Insurance (MPCI) since it has been the most commonly applied agricultural insurance mechanism. Box 2 provides an explanation of MPCI, Named Peril Crop Insurance, and Area-Yield Crop Insurance.

Box 1.1 Flood and Its Impacts by Province

Dong Thap. Both poor and better-off farmer households in the Dong Thap communes rank flood as the biggest risk to their agricultural activities and their livelihoods. Although floods are common in the Mekong River Delta area and can bring beneficial silt and alluvium to the rice fields and fish to local residents, extensive floods since 1990 during the spring/summer harvest devastate crops, damage houses and property, and cause loss of life. High floods occurred in 1991, 1999, and 2000, wiping out almost all of the crops. Because many households consume the food that they grow, when they lose an entire harvest, they can fall into starvation.

Thai Binh. Farmers in the Thai Binh communes also rank flood as the number one agricultural risk. It is most common in July and August (although heavy storms can occur anytime between June and October) and can cause significant damage to the September rice harvest. Unlike the Mekong River Delta floods, in Thai Binh's Red River Delta, floodwaters do not distribute fertile alluvial soil to the province's farms.

Major flooding occurred in Dinh Phung and Thanh Tan most recently in 2003 and 2004. The 2003 flood caused 85–100 percent crop failure in the communes. All secondary crops and fish were lost. In 2004, floods reduced the rice crop by 75 percent and wiped out all secondary crops. The 2005 storm was less severe but still flooded half of Thanh Tan's rice fields, resulting in a 70–100 percent loss of the winter/spring crop.

Vinh Phuc. Due to the varied topography in Vinh Phuc, floods are not a major concern as they are elsewhere. Nonetheless, flooding is a problem in select locations. Twelve out of the 15 Dong Thinh villages flood every year, during heavy rains. Problems with the drainage system make it very expensive and often ineffective to pump water out of the fields. In contrast, only a few villages in Ngoc My commune experience floods. The impact of flooding is worse in July and August, when northern Vietnam experiences many storms and heavy rains. Flooding at this time can devastate the summer/autumn rice crop, which is the largest of the year, destroying between 70 and 80 percent of the crop in an average year and up to 100 percent in a bad year. In normal years, due to the low level of agricultural productivity, farm households have to buy rice to cover two months of consumption. When floods occur, households have to buy enough rice to cover four to five months of consumption.

Source: Microfinance Opportunities, 2007

Despite the strong interest in agricultural insurance among policy makers in Vietnam, developing these markets is very challenging. There are four core problems associated with agricultural insurance:

1. Adverse selection;
2. Moral hazard;
3. High administrative costs; and
4. Correlated risks.

These four problems often result in agricultural insurance programs that are not financially sustainable due to high administrative costs and large losses (Hazell, 1992; Hazell, Pomareda, Valdes, 1986; Skees and Barnett, 1999; Skees, 1999a, 1999b, and 2001). These problems are challenging anywhere, yet the challenges are magnified when farm units are small, markets are not well-developed, regulations are unclear, and data and information are lacking as they are in many developing economies.

Box 1.2 Traditional Types of Agricultural Insurance Products

Yield-based Crop Insurance (Multiple Peril Crop Insurance, or MPCI). MPCI typically protects against multiple perils meaning that it covers many different causes of yield loss. MPCI is a useful product where the damage to crops is complex (for example, many perils interacting, such as rainfall and disease) and it would be difficult to attribute losses to a single peril. MPCI can have a variety of different product structures, but in a broad sense, an insured yield (e.g., tons/ha) is established, as a percentage of the historical average yield of the insured farmer. MPCI provides an indemnity if the actual farm-level yield is less than an agreed percentage of the average yield established for the farm. MPCI requires that individual farmers are classified according to their risk exposure. A farm-level loss assessment is needed to make an estimate each individual policyholder's losses and to calculate indemnity payments. MPCI was first developed in the United States, and is now predominantly used in the United States, Canada, and Spain. Despite the advantages of MPCI to the farmer, it has proved highly problematic for insurers to offer because it is very expensive to administer and farmers (especially smallholders) are usually unwilling to pay premiums that are sufficient to cover the insurer's cost of providing MPCI.

Damage-based Indemnity Insurance (Named Peril Crop Insurance). Damage-based indemnity insurance is crop insurance where the indemnity is calculated by measuring the percentage damage to a field caused by a specific cause of loss. Hail insurance is a common example on a named peril crop insurance. The percentage damage measured in the field, less a deductible expressed as a percentage, is applied to the pre-agreed sum insured. The sum insured may be based on production costs, or on the expected revenue. Named peril insurance products have been the first crop insurance products offered in many countries. The cost of offering named peril insurance is significantly less than the cost of offering multiple peril insurance: it is easier to conduct risk assessment for a single named peril than for multiple perils; risk classification is easier so the potential for adverse selection is greatly reduced; and the loss adjustment costs are usually lower.

Area-Yield Index Insurance. Area-yield index insurance is insurance where the indemnity is based on the realized average yield of an area such as a county or district. The insured yield is established as a percentage of the average yield for the area. An indemnity is paid if the realized yield for the area is less than the insured yield regardless of the actual yield on a policyholder's farm. This type of index insurance requires historical area-yield data and standardized procedures to make and verify yield estimates.

Source: Skees et al., 2006; Belete et al., 2007

1.5.1 Adverse Selection

Successful insurance programs require that the insurer have adequate information about the nature of the risks being insured. This has proven to be extremely difficult for farm-level insurance such as MPCI. Farmers always know more about their potential crop yields and risk exposure than any insurer. This asymmetric information is the major problem with insuring farm yields. If an insurer cannot properly classify risk, then it is impossible to provide sustainable insurance. Those who know that they have been favorably classified will buy the insurance; those who have not been favorably classified will not buy. This phenomenon, known as adverse selection, initiates a cycle of losses. Increasing the premium rates uniformly in response only exacerbates the problem, as only the most risky individuals will continue to purchase the insurance. The problem can only be corrected if the insurer can acquire better information to properly classify and assign premium rates that reflect the risk exposure of the individual policyholder.

1.5.2 Moral Hazard

Another common problem with MPCI is moral hazard. Moral hazard occurs when insured individuals change their behavior in a way that increases the potential likelihood or magnitude of a loss. Moral hazard occurs when, having purchased insurance, farmers reduce fertilizer or pesticide use or simply become more lax in their management. At the extreme, moral hazard becomes fraud if policyholders actually attempt to create a loss. Again, the problem is asymmetric information. Unless the insurer can adequately monitor these changes in behavior and penalize policyholders accordingly, the resulting increase in losses will cause premium rates to increase to the point where it becomes too expensive for all but the riskiest farmers.

Insurers must also be able to identify the cause of loss and assess the magnitude of loss without relying on information provided by the insured. For automobile or fire insurance the insurer can generally identify whether or not a covered loss event has occurred and the magnitude of any resulting loss. For MPCI this is not always the case. It is not always easy to tell whether a loss occurred due to some covered natural loss event or due to poor management. Nor is it easy to measure the magnitude of loss without relying on yield information provided by the farmer.

1.5.3 High Administrative Costs

To control for the problems of adverse selection and moral hazard, insurers must invest heavily in administrative costs for risk classification, monitoring, and loss adjustment. However, this drives up the cost of the insurance, which can make it unaffordable for smaller farmers or unattractive to all but the highest risk farmers. Furthermore, the cost to control for these problems becomes even more expensive when the agricultural sector consists of many small farms.

To illustrate actual experience, Table 1.2 provides information on the actuarial performance of crop insurance programs from several different countries, where A= administrative costs, I = indemnities, and P= premium. For an insurance program to be financially sustainable, the expenses should not exceed the premium revenue. Insurance expenses can be categorized into administrative costs and indemnities. Insurance is often evaluated by examining the loss ratio, indemnities divided by premium, where I/P should be less than 1. However, this fails to account for the administrative costs, which, for multiple peril insurance programs, are typically quite high. Only Japan was able to keep payouts in line with premium, but that was achieved through massive investment in controlling moral hazard, adverse selection, and fraud, as evidenced by the very high ratio of administrative costs over premium (A/P) in Japan of 3.57 from 1985 to 1989.

Table 1.2 Loss Ratios for Select MPCI Programs

Country	Period	I/P	A/P	(I+A)/P*
Brazil	1975–81	4.29	0.28	4.57
Costa Rica	1970–89	2.26	0.54	2.80
Japan	1985–89	0.99	3.57	2.60
Mexico	1980–89	3.18	0.47	3.65
Philippines	1981–89	3.94	1.8	5.74
United States	1980–89	1.87	.55	2.42

** A= Administrative Costs, I = Indemnities, and P= Premium*
Source: Hazell, 1992

Furthermore, the simple loss ratio I/P does not account for the other administrative and operational expenses (denoted by the variable A). Here, administrative costs broadly encompass many expenses, including delivery, loss adjustment, controlling for fraud and abuse, and risk classification. When these additional costs are included ([I+A]/P), all of the loss ratios are well beyond a financially sustainable level. Also, many of these administrative costs are fixed costs, meaning the administrative expenses do not adjust in relation to the premium volume from an insurance transaction. In general, administrative costs increase relative to premium volume as average farm size decreases.

In the global experience, the only MPCI programs that have been able to achieve a loss ratio where indemnities are less than premiums have required substantial investments in administrative costs (e.g., Japan). When administrative costs are added to the equation, (I+A)/P, none of the programs have ratios that are less than 2.

Recent data suggest that several of these countries have improved their ratios in recent years. Nonetheless, these data demonstrate what happens in the early years and represent a strong message for any country that is just starting a MPCI program. It takes a good deal of time to establish a program that even approaches a ratio of 2 to 1 for this measure. Even at a ratio of 2 to 1, the social benefits of public investments in MPCI would have to be twice the cost. While one can expect many benefits from crop insurance, it is unlikely that the benefits will exceed twice the cost. Better systems for developing agricultural insurance markets must be considered.

1.5.4 Correlated Risk

When considering the potential feasibility of any risk transfer instrument, a major consideration is the degree of correlation in financial losses caused by the risk. Insurance is based on the basic principles of diversification. Agricultural production losses tend to be characterized by some degree of positive spatial correlation. This is particularly true when the extreme weather is the cause of loss. Weather risk is often highly correlated — i.e., many people in an area are affected by a single event and all are likely to suffer loss. In many cases, the more severe the event, the wider is the geographic impact. For example, severe drought or excess rainfall can create widespread damage across entire communities and regions.

Positive spatial correlation in losses limits the risk reduction that insurers could otherwise obtain by pooling risks from different geographical areas. Aggregating independent (i.e., uncorrelated) risks into a single insurance pool reduces the variance of losses. In other words, for a pool of independent loss events, such as car accidents or personal injury, the mean of the individual variances is always greater than the variance around the mean loss of the pool. This result follows from the statistical property known as the "law of large numbers." Society benefits from insurance markets that pool uncorrelated risks since the risk faced by the pool is less than the pre-aggregated sum of individual risks (Priest, 1996). Traditional insurance works on the condition of independent risks, where only a small portion of policyholders may have a claim at one time (Rejda, 2001; Miranda and Glauber, 1997; Skees and Barnett, 1999). The premium collected from policyholders is used to pay indemnities on the assumption that the premium collected in a single year will usually be greater than the expected claims.

However, exposure to correlated risks can result in large losses among many policyholders from a single event. In these situations the indemnities may exceed the collected premium. Without access to additional financing (reinsurance or capital markets) to cover the insurance company against the large financial exposure from correlated risks, local insurance markets may go out of business as they are likely to not have a sufficient pool of resources to pay out the indemnities. The risk of correlated losses increases the financial exposure of the insurer, and as a result, it also increases the cost of maintaining adequate reserves or reinsurance to fund potentially large indemnities caused by systemic loss events. This in turn increases the price of the insurance. In general, the more those losses are positively correlated, the less efficient insurance is as a risk transfer mechanism.

Thus, the presence of correlated risk can be a constraint to the development of insurance markets. Where insurance is available, insurers are often reluctant or lack the financial capacity to cover correlated risks. The risk of correlated losses can also be a constraint to agricultural lending because lenders are likely to restrict lending to farmers for fear that defaults among a large proportion of its clients could occur if a severe weather event results in poor agricultural production.

Other risk transfer markets are better suited for risks that are highly positively correlated. For example, well-developed futures exchange markets exist for sharing risks associated with commodity prices, interest rates, and exchange rates. In recent years, various capital market instruments have developed for transferring highly correlated weather risks or risks associated with natural disasters.

However, agricultural production losses cannot be classified as fully independent or highly positively correlated. They are "in-between" risks (Skees and Barnett, 1999). This implies that, if used exclusively, neither insurance nor capital market instruments are well-suited to transferring agricultural production risks. A careful blending of these instruments is needed to foster development of more sustainable agricultural risk transfer opportunities.

1.5.5 The Cost of Agricultural Insurance

The problems described above are all embedded into the cost of insurance. In order for an insurance company to recoup the cost of meeting the challenges of adverse selection, moral hazard and correlated risk and maintain solvency it must include these costs in the insurance premium paid by the policyholder. A number of expense factors must be carefully addressed. Each of these factors adds to the expense of developing and implementing an effective and sustainable agricultural insurance program. Understanding these cost factors also provides significant insight into guiding principles for developing agricultural insurance. To understand the different expenses that must be accounted for, consider the standard cost equation below, which categorizes the cost factors that are built into the insurance premium (Skees et al., 2006; Belete et al., 2007).

Insurance premium = Expected annual loss
+ Expense loads
+ Cost of capital

The factors that are included in the each of the cost categories are explained in detail below. The cost of each of these components will vary depending on the risks covered, characteristics of the insurance sector and target market, the structure of the insurance contract, among other things.

Expected Annual Loss. A critical function for any insurer is to estimate the cost of the risk being insured; that is, the amount of indemnity that must be paid out on average each year. This is done through a risk assessment to estimate the expected probability of annual loss. If the insurance product has been in existence for many years, historical loss costs (indemnities/sum insured) can sometimes be used to estimate the cost of the risk. However, historical loss cost data may not be adequate for estimating future indemnities if the insurance product covers losses from extreme but infrequent events such as devastating drought. For new insurance products, historical loss cost data will not be available. Thus, actuaries must attempt to use other data sources (e.g., historical yield data, weather data, etc.) to simulate what the loss cost would have been had the insurance product been sold in previous years. Insurance companies will always supplement such quantitative analysis with expert judgment. This is particularly true when the insurance product insures against losses from highly infrequent but potentially catastrophic loss events.

Expense Loads. The insurance premium must include an expense load to cover all of the administrative and operational expenses of providing the insurance. These expenses can vary widely. Some of the different types of expenses that get factored into the premium are described below.

Cost of Information to Control Adverse Selection. An insurer will attempt to classify potential policyholders according to their risk exposure and charge higher (lower) premium rates to those whose agricultural production is more (less) risky. Such classification requires information on the risk exposure of the potential policyholder relative to other agricultural producers. To understand why this is important, suppose that the insurer is not able to accurately classify potential policyholders according to their risk exposure. This must be done to control adverse selection.

Often it is very difficult to conduct farm-level risk classification because information on farm-level yields or losses is not available. Comprehensive local data on weather or area crop yields are also often difficult to obtain unless such data have been systematically collected, organized, and archived in useable formats. Without these data, it is very difficult for an insurer to even determine which crops or regions of the country are relatively more prone to losses — much less conduct farm-level risk classification. Public investments in quality data are often needed to facilitate development of agricultural insurance.

Cost of Monitoring to Control Moral Hazard. Moral hazard occurs when, as a result of purchasing insurance, individuals change their behavior in ways that increase the likelihood and/or the magnitude of losses. Moral hazard can be something as simple as irrigating less or using less pesticide as a result of having purchased crop insurance. It can also be a deliberate attempt to defraud the insurer and collect more indemnity than is really due. Insurers attempt to control moral hazard in part through product designs that include deductibles and coinsurance. These designs ensure that the policyholder shares in any losses so there is less incentive to engage in riskier behavior. Insurers also attempt to monitor the behavior of policyholders to make sure that they use widely accepted best management practices and do not utilize production practices that are expressly forbidden by the insurance policy.

Cost of Product Delivery. The cost of selling agricultural insurance policies can be quite high. Trained sales staff must travel to remote rural areas, meet with farm-level decision makers to explain the insurance policies, obtain signatures on sales contracts, and eventually collect premiums. Sometimes the cost of delivery can be reduced if crop insurers can form relationships with organizations such as input suppliers or lenders who already have sales staff in the countryside and can combine their services. Also farmer associations or cooperatives can sometimes serve as an insurance distribution channel. An example of a linkage to lending is provided by the Philippines Crop Insurance Organization. The majority of farmers insured are recipients of a supervised credit program. The French mutual insurance company, Groupama, has been involved in similar practices for well over 100 years. In India, farmers taking loans from state-supported lenders are required to purchase crop insurance that is packaged with the loan. Premiums are collected by the lender. Any insurance indemnity is applied first towards the loan balance. If the indemnity exceeds the loan balance, the difference is put into a bank account for the policyholder.

In a well-developed insurance market, insurance sales agents often also sell various types of farm supplies and production inputs. They use point-of-sale laptop computers for entering relevant information and can often issue insurance policies while meeting with the farmer. This reduces the number of trips that sales agents must make to remote rural areas to meet with farmers. Obviously, a sophisticated information technology system is required to support such efforts. Similar systems have been developed in India by BASIX — a rural services organization that has developed weather insurance products for smallholder farmers.

Where a crop is being grown for export or for processing, and a single export or processing channel exists, it may be possible to provide crop insurance in an automated way to all contracted farmers. An example is Windward Island Crop Insurance Ltd, a company protecting banana growers in four Caribbean islands against hurricane and localized wind damage. Another example is Mauritius Sugar Insurance Fund Board, which provides protection for sugar growers against a variety of perils, but particularly cyclone and rain.

Cost of Loss Adjustment. When an insured loss occurs, the magnitude of the loss must be calculated to determine the amount of indemnity due the policyholder. For named peril and multiple peril crop insurance products, this requires that a trained loss adjuster visit the farm, determine whether the loss occurred due to an insured peril, and, if so, estimate the magnitude of yield loss. The cost of loss adjustment can be quite high. For MPCI, this is especially true when a high proportion of policyholders experience a loss due to a widespread event such as a drought.

Other Administrative Costs. In addition to information, monitoring, delivery, and loss adjustment costs, there are other costs of administration associated with selling and servicing insurance products. The administrative load on the premium must cover the all the operational expenses including the cost of skilled personnel, commissions for insurance agents, staff training, marketing costs, the purchase and maintenance of computers, vehicles, and buildings, etc.

Product Development Costs. Developing new agricultural insurance products is an expensive activity which involves market research, product design, and actuarial pricing. For any proposed insurance product, the insurer must ask whether the probability of loss can be accurately estimated and priced. The insurer must also conduct market research and estimate how the costs of information, monitoring, loss adjustment, delivery, administration, and access to capital vary for different product designs. The start-up costs can be significant. In areas with small emerging insurance markets or little experience with insurance, additional investment in stakeholder education, and legal and regulatory reviews may also be necessary. The insurer would expect to generate excess returns for a period in order to recover these initial development costs. Thus, an additional load would be added to the premium to recover this expense.

Cost of Capital. The third major cost component for any viable insurance company is the cost of ready access to capital. Companies writing agricultural insurance must consider making a reasonable rate of return on the risk capital. Capital is also required to reduce the probability of insolvency. Insurers must have access to sufficient capital to pay all indemnities in full that might occur in a given year with a high probability (e.g., 99 percent). A thorough risk assessment must also provide some indication of how large the insurer's loss ratio could be in any given year. This is often referred to as the loss ratio probable maximum loss (PML). The larger the loss ratio PML, the more the insurer will need access to ready sources of capital. The amount of contingent capital required can be particularly high for multiple peril policies that insure against losses over spatially covariate perils. For example, a widespread drought can generate massive losses in a single year. By selling insurance for different crops or in different regions, an insurer can diversify its portfolio of insurance policies to some extent. Such diversification reduces the insurer's loss ratio PML and thus, the insurer's contingent capital needs. However, even with this type of diversification, correlated risks are likely to pose a problem and add to the insurer's financial exposure. For example, even in a country as large and well-diversified in crops as the United States, the loss ratio PML remains quite large requiring the use of a mixture of government and global reinsurers to manage the highly correlated losses.

When insurance is being regulated according to international standards, having proof of sufficient access to contingent capital is a requirement. Some of the necessary capital may come from the insurer's accumulated reserves. However, taxation and regulatory structures often make it cost prohibitive for insurers to accumulate large reserves. There is also a large opportunity cost of accumulating large capital reserves. Furthermore, an extreme loss event could occur before sufficient reserves are accumulated. Thus, most insurers use a combination of reserving and contingent capital to finance their risk exposure. Insurers can purchase access to contingent capital through reinsurance. However, the larger the loss ratio PML, the higher will be the insurer's cost of obtaining sufficient access to contingent capital, i.e., the larger the PML, the higher the price of reinsurance. For example, because MPCI is subject to losses from correlated risks the cost of reinsurance is much higher for MPCI than for named peril insurance. The reinsurance costs which are a true measure of some of the cost of capital must be factored into the insurance premium.

1.5.6 Government Intervention in Insurance Markets

By considering each of these cost components one can see why the cost of providing MPCI is very expensive. International experience has shown that farmers (and especially smallholders) are unwilling to pay premiums that are sufficient to cover the insurer's cost of providing MPCI. Further, the problems of moral hazard and adverse selection lead to increasing costs which ultimately drive up the price of the insurance making it less affordable for the farmers and the insurance companies. Thus, markets for agricultural insurance have been difficult to develop and sustain and are unlikely to develop on their own in the private sector.

Governments have become increasingly involved in agricultural insurance to compensate for failures in the private insurance market. Most MPCI programs have large premium and/or administrative subsidies paid by government in an attempt to reduce the price of insurance for the farmer. In some cases, government acts as a direct provider of the insurance, in others, via a public-private partnership. For example, some governments provide subsidized reinsurance for MPCI policies. In the United States, the federal government provides a highly subsidized reinsurance contract for insurance companies that sell MPCI policies. In Spain, the consortium of insurance companies is mainly reinsured by the public reinsurance company Consorcio de Compensación de Seguro. By way of contrast, government premium subsidies have rarely been applied to named peril insurance products such as hail insurance. This is because the costs of providing named peril insurance are low enough that farmers can afford to pay the premium (Belete et al., 2007).

Premium subsidies are often used to increase participation in an insurance program. Premium subsidies make MPCI more affordable for farmers but they do not address the underlying high costs of providing MPCI. MPCI is expensive because of adverse selection, moral hazard, and high loss adjustment, delivery, administration, and reinsurance costs. Subsidies hide adverse selection and moral hazard problems by bringing the lower risk farmers into the pool of very high-risk farmers. Having lower risk farmers are in the risk pool can improve the overall actuarial performance of a program, although it is deceptive. The problems with adverse selection and moral hazard will remain. When subsidies are increased, the riskier farmers obtain even more benefit since the subsidized premium is much lower than a premium rate that accurately reflects their risk profile (Skees, 2003). Such interventions are often an expensive drain on government resources and there is little evidence to show that these interventions have generated any sizeable social benefits or that the benefits exceed their costs (Hazell, 1992; Hazell, Pomareda, and Valdes, 1986).

For a full scale MPCI insurance program, the costs of subsidies can be astounding. The 2009 budget for the United States Department of Agriculture has set aside USD 9.3 billion to support the host of programs that now fall under crop insurance. Still, numerous studies have documented widespread adverse selection and moral hazard problems with the MPCI program in the United States. Premium subsidies mask these problems by making MPCI more affordable for farmers. This brings the lower risk farmers into the pool and improves the actuarial performance when subsidies are not considered. But in the end, the United States still has a program where the ratio of indemnities plus administrative costs still exceeds two times what farmers pay for premium.

Premium subsidies can also create perverse behavioral incentives. Premium subsidies are typically calculated as a percentage of the unsubsidized premium (e.g., a subsidy equal to 50 percent of the unsubsidized premium). In a proper risk classification, farmers producing the most risky crops or producing in the highest risk areas should be charged the highest premiums. When the percentage premium subsidy is applied, the largest premium subsidies will be paid to the highest risk farmers. So the government is disproportionately subsidizing those who choose to produce the riskiest crops or produce in the riskiest areas. As a result, government premium subsidies can encourage farmers to produce a high-valued but risky crop in a region that is not well-suited to production of that crop. In years where there is no loss, the farmers benefit by earning higher returns. In years when there is a loss, the farmers are protected by highly subsidized insurance. Many experts now believe that in certain regions of the United States, farmers choose to produce specific crops based on MPCI premium subsidies. Ironically, the MPCI program, that is designed to help farmers manage risk, now causes many farmers to take on even more risk because of the premium subsidy.

If governments wish to provide crop insurance subsidies, it is likely far better to focus those subsidies on developing the market infrastructure (Belete et al., 2007). Government investments in providing data and information can reduce the cost of risk assessment, risk classification, and monitoring. Government investments in establishing an appropriate legal and regulatory framework reduce the cost of administering crop insurance programs. Government investments in education and capacity building can reduce the cost of delivering crop insurance products as better informed potential buyers of insurance are more likely to make the purchase and increased expertise among stakeholders will support the implementation and sustainability of the insurance market. Government investments in research and product development can lead to new and improved insurance products, such as index insurance, which can be offered at lower cost.

Governments may also want to subsidize insurer access to contingent capital — particularly, for low-probability, high-consequence events (catastrophic risks). Evidence suggests that those at risk tend to ignore the probability of the most extreme and infrequent loss events. But insurers do not ignore these events and must consider the probability of such catastrophic losses in setting premiums. This creates a gap between what buyers are willing to pay and what sellers are willing to accept for protection against very infrequent but catastrophic losses.

The government may have limited comparative advantage to pricing risk and providing insurance products when compared to the private insurance industry. Insurers control adverse selection by segregating the individual risks. Low insurance premiums are offered to low-risk producers, while higher premiums are charged to high-risk producers as a signal of their true risk exposure. The insurance industry thus plays a central role in discovering the true cost of risk (Belete et al., 2007). However, price segregation does not always conform to the social objectives of public policy. As a consequence, public insurance makes little effort to control adverse selection through risk segregation and instead offers an average premium rate to all parties regardless of their risk profile. Under voluntary insurance, this absence of risk segregation leads to adverse selection. Compulsory insurance may be viewed as a solution to adverse selection as it forces low-risk producers to stay in the insurance pool. However, this does not reduce risk, but rather creates a wealth-redistribution effect from the low-risk policyholders, who are overpaying their premiums, to the high-risk policyholders, who are underpaying for their insurance coverage.

The prevention of moral hazard is based on some degree of risk sharing by the policyholder through coinsurance and deductibles, and exclusions on insurance coverage. However, limiting coverage in this way is usually inconsistent with the government's desire to offer farmers universal coverage against all sources of risk. As in the case of adverse selection, social objectives may prevent the government from effectively controlling moral hazard problems. However, the government can have a comparative advantage in absorbing catastrophic losses that are beyond the financial capacity of the insurance industry if global reinsurance is not available.

A common problem with many agricultural insurance programs is the lack of clarity regarding the objectives of the public intervention. This lack of clarity creates considerable inefficiencies. If the policy objective is to increase the incomes of rural households or to create a social safety net that ensures some minimum level of income for farm households, agricultural insurance is a very blunt and inefficient instrument for achieving those goals. Generally, these types of social policies involve direct transfers of wealth from the government to rural households. Insurance can be an effective risk management tool, but it is generally not an efficient tool for transferring wealth to economically disadvantaged households.

1.5.7 Constraints to Agricultural Insurance in Developing Economies

The previous section outlines the common challenges with traditional agricultural insurance programs. The key challenges with MPCI have been documented and can be summarized as follows (Skees, Barnett, and Collier, 2008):

- MPCI is highly susceptible to adverse selection. A great deal of information is required to classify the risk exposure of potential policyholders. Generally, the insured farmer knows much more about their real risk exposure than the insurer. Those who perceive that they have been misclassified to their benefit (i.e., charged a premium rate that underestimates the true cost of their risk exposure) will tend to purchase insurance while those who have been misclassified to their detriment will not;
- MPCI is highly susceptible to moral hazard. It is practically impossible for the insurer to monitor the behavior of all policyholders. Thus, it is often difficult to know whether yield losses were the result of some unavoidable peril or just poor management;

- Loss adjustment is difficult and costly. Highly skilled loss adjusters must try to determine whether the yield loss was due to an insured peril and, if so, the magnitude of the loss;
- Delivery costs are quite high. The farmer must provide historical data on hectares planted and tons produced. The sales agent must be able to verify these data based on objective third-party sources;
- MPCI is data intensive, requires highly skilled underwriters, and involves monitoring of policyholder behavior. Thus, the administrative costs are quite high;
- Because it protects against multiple perils, the cost of risk for MPCI is higher than for named peril insurance;
- Among the perils that are typically covered by MPCI are spatially correlated risks such as drought. This implies that loss ratios in any given year can be extremely high so the insurer must have access to large amounts of contingent capital. Obtaining access to sufficient contingent capital to cover this large financial exposure can be extremely expensive; and
- Due to market failures in providing agricultural insurance, MPCI programs are reliant on substantial government support.

The challenges and costs of providing MPCI are magnified in the context of a developing economy. MPCI programs typically serve commercial farmers with large landholdings. In most developing economies, the high transaction costs of marketing to and monitoring small farms is one of several factors that impede the development of agricultural insurance markets. The agricultural sector is often characterized by a large number of smallholder farmers, a large agricultural sector that employs a majority of the rural and poor labor force, weak market infrastructure, and limited experience with insurance. These aspects can add considerable transaction costs to the development of agricultural insurance markets.

The costs of product delivery can be greatly increased when trying to provide an insurance product to the rural poor. Access can be difficult in remote or sparsely populated areas. Rural households may not have any prior experience (or possibility prior negative experiences) with insurance, thus additional education and promotional efforts are needed to develop their understanding and trust of the product. Since loss adjustment for MPCI must be conducted for each insured farm, the cost of loss adjustment increases greatly when a large percentage of the policyholders are smallholders.

Because smallholder farmers have less land and fewer resources to spend on insurance, their sum insured, and thus the premium generated from the transaction, will be relatively small. This creates a constraint to providing insurance to the rural poor, in that small premium transactions may not cover the delivery costs and other administrative expenses incurred. Innovations in delivery linkages and technology can help to lower the delivery costs of providing agricultural insurance to smallholders and the rural poor. Linking insurance to credit is one way to reduce the delivery costs since an agent does not need to visit individual households. The insurance becomes part of the loan transaction.

Product development costs can also be much greater in a developing economy context. The lack of appropriate market infrastructure can also discourage the development of insurance markets. The data needed to assess the risk and develop an insurance product may be unavailable or of poor quality. In developing economies weather and agricultural data is often limited in quality and quantity due to disruptions in funding and inconsistencies in procedures. Accessing and processing the data can require a significant amount of effort on the part of the insurer — an expense which they would expect to recover through a load on the premium.

Other constraints in the market infrastructure can be an inhibiting factor to market development. For example, the lack of a strong regulatory environment can be an obstacle for introducing new products and also for protecting the policyholder from fraudulent practices. Technical insurance and regulatory expertise is often lacking in developing economies. This can limit the capacity for developing and supporting insurance markets.

Access to capital can also be a constraint to the development of insurance markets. Emerging insurance markets in developing economies may not conform to international standards and can have difficulty accessing international reinsurance markets which are capable of providing the large contingent financing needed for catastrophic risk. Additionally, the market volume may not be large enough to justify the research costs of an international reinsurance company. Before they decide to offer reinsurance they will conduct their own market analysis and risk assessment to price the reinsurance. These transaction costs can often be too high to justify involvement in a small insurance market. Domestic insurance companies may be unable to take on too much financial exposure if they cannot access sufficient capital.

Governments may be motivated to support the provision of agricultural insurance market development to address some of these market constraints by providing reinsurance or other forms of support; however the decision to support an insurance market must be carefully evaluated in terms of the opportunity costs of government funds. As the global experience has shown, public support for agricultural insurance programs can become quite costly, and with MPCI the costs often increase over time as adverse selection and moral hazard inflate the loss ratio. With a large agricultural sector the cost of supporting a traditional agricultural insurance program could create a very large drain on the government budget.

Due to the challenges and constraints that exist, agricultural insurance programs have not been very successful, particularly in developing economies where they are often short-lived due to the expense and inefficiencies. Chapter 2 discusses index insurance as a more financially feasible approach to agricultural insurance that is being considered and applied in developing economies.

1.6 Conclusion

There are many reasons why markets that allow for transfer of extreme weather risk are desirable even though a review of agricultural insurance demonstrates a history of poor performance and that such insurance is offered on an extremely limited basis. Extreme weather risks contribute to poverty, slow the adoption of technology, constrain access to credit, and slow economic development. Despite the needs, the quest to develop agricultural insurance markets is extremely challenging. International experience has demonstrated that the cost of providing MPCI is very high. This is particularly true in countries with a large agricultural sector that comprises predominantly smallholder farmers. Reviewing the limitations and experiences with traditional approaches to agricultural insurance leads to some key principles that can guide the development of effective agricultural insurance policies (Skees et al., 2006):

- Relative risk varies by crop and region and these differences in relative risk must be reflected in insurance premium rates. Failure to do so will create inequities among the insured and inefficient allocation of resources. Ideally, risk classification should occur at the level of the policyholder. However, at the very least, premium rates must reflect differences in risk for different crops (and varieties), different regions, different production practices (e.g., irrigated versus non-irrigated production), and different soil types. If all producers are offered coverage at the same premium rate, adverse selection is inevitable;
- Agricultural producers employ many different risk management strategies. Insurance products should be developed so as to complement effective existing risk management strategies;

- Because farmers employ many different risk management strategies, some will not want (or need) insurance. Mandatory insurance coverage only increases moral hazard and the financial exposure of the insurance program;
- Risk management is always costly, and these costs should be largely carried by those taking the risk in order to preserve incentives for efficient management;
- Some perils are not insurable because they occur too frequently;
- For perils that are potentially insurable, insurance products should be tailored to address the specific risk characteristics of the peril;
- When developing insurance products one must be aware of the potential for adverse selection. Effective risk classification (also called "underwriting") is critical to the long-term success of insurance products;
- When developing insurance products one must be aware of the potential for moral hazard. It is critical that insured producers not be able to engage in activities that increase the likelihood or magnitude of indemnity payments;
- When developing insurance products, one must have sufficient data to calculate premium rates. The more uncertainty about the nature of the underlying risk, the more insurers will load premium rates;
- Insurance products are best suited to protecting against losses from independent risks. Capital market instruments are best suited to protect against losses from correlated risks. When perils are neither completely independent nor completely correlated, some combination of insurance and capital market instruments may be required; and
- Regulators should ensure that insurers have access to sufficient amounts of ready capital. MPCI loss ratios can be much higher than those for other lines of insurance — especially when there is potential for spatially covariate losses caused by events such as drought or typhoon. Capital requirements should be based on a thorough risk assessment that determines loss ratio PMLs.

Even when these best practices are followed, the cost of delivering and loss adjusting MPCI policies will likely be excessive for smallholder agriculture. However, the use of subsidies to increase affordability and accessibility of MPCI products simply masks the high cost of providing MPCI without addressing the underlying causes. Even more troublesome, subsidies can generate incentives for farmers to actually take on more risk. There are a number of other ways governments can provide support to reduce the costs of providing various types of crop insurance through the development of risk market infrastructure (Skees et al., 2006, Belete et al., 2007). More detail on each of these areas for support is provided in Chapter 2.

Create an Enabling Legal and Regulatory Environment. Among the most important functions for government in facilitating agricultural insurance markets is the establishment of an enabling legal and regulatory framework. Agricultural insurance is a special class of insurance business with characteristics that are somewhat different than other classes of general insurance, such as automobile or property and casualty insurance. It is important that the insurance law and the regulatory system account for these differences properly so as to ensure consumer protection and the financial solvency of insurance companies.

Enhance Data and Information Systems. To develop any crop insurance product, insurers require reliable, impartial data on agricultural production. As much of the data required for crop insurance have public good characteristics, these data are unlikely to be collected, verified, and archived by private-sector companies. Therefore, the government should provide these kinds of data. Furthermore, government investments, collecting, processing, and archiving relevant data, as well as ensuring that these data are easily available to insurance companies and other market developers could further stimulate new agricultural insurance markets.

Support Education and Capacity Building. Government should be actively engaged in public awareness and capacity building during the early stages of agricultural insurance market development. Very often agricultural insurance, or even general insurance, is not very well understood by rural farmers and therefore educational efforts are critical to ensure that farmers understand the advantages and disadvantages of different insurance products and how these can fit into an overall farm-level risk management strategy. Support for specialized training and technical assistance may also be needed to build the capacity among insurance companies, the insurance regulator, and other stakeholders.

Support the Costs of Product Development. As described earlier, the high start-up costs of product development can be a deterrent to the development of insurance markets in developing economies. Insurers may fear that the initial investment required will not be recovered due to small market volume or replication by competing insurance companies. Thus, some level of government support for product development can be justified. These investments should be targeted at feasibility studies and developing pilot tests of new products with the involvement of local private-sector partners. Every attempt should be made to ensure that the knowledge and technology for new product development will be passed on to local experts as soon as possible.

Provide Catastrophe Reinsurance/Risk Sharing. Agricultural insurance is highly subject to spatially covariate risks such as drought or extreme temperatures. This implies that, in any given year, indemnities can be very high relative to premiums collected. Insurers must have access to large amounts of ready capital to pay these indemnities. Reinsurance is the most common means that insurers use to gain access to additional financial capacity. However, reinsurance can be expensive. There are a number of different ways that governments can help reduce the cost of reinsurance for private insurance companies with and without direct subsidy.

In general, there is no "one-size-fits-all" policy recommendation for the role of government in agricultural risk management. Most governments consider at least three criteria when analyzing alternatives for agricultural risk management needs:

1. Fiscal constraints;
2. Social relief for serious catastrophes; and
3. A desire to facilitate more market-oriented risk transfer.

To facilitate analysis and identification of appropriate policy response, it is important to identify different layers of risk that correspond to effective solutions for markets and for social programs. The role of government and public policy should be tailored specifically to each of those risk layers in order to best meet the three criteria mentioned above. In so doing, governments can attempt to segregate social welfare programs that use public funds to respond to low-probability, high-magnitude events from more market-based insurance programs that can be facilitated with less government fiscal exposure, making certain that these two forms of government intervention are complementary and not working at cross purposes (Skees, Barnett, and Hartell, 2005).

In assessing proper roles for government, one must first consider the characteristics of risks faced by agricultural households, the economic benefits that can be created by risk management tools, and the challenges associated with creating and maintaining risk management tools such as insurance. Keep in mind that insurance is not the only solution for managing risk and sometimes may be the inappropriate policy response depending on the risk profile. In any case, farmers need access to a variety of risk management tools to deal with different situations. Financial risk management mechanisms (savings, credit, and insurance) are all important tools for managing cash flow problems. However, physical risk management mechanisms (management/production techniques, irrigation equipment, pesticides, and fertilizers) are also important for enabling farmers to mitigate or respond to certain types of risk. The greater access a farmer has to a variety of risk management tools, the better ability that farmer will have to deal with different problems that may arise.

Chapter 2 describes the process of conducting a risk assessment to characterize the risk profile and risk management needs. There is no universal solution to agricultural insurance, thus a risk assessment helps guide the development process to identify the type of approach that may be most suitable for a particular region or target market. Chapter 2 presents the role of the risk assessment in informing policy decisions and continues on to describe the process of developing a market for agricultural insurance and the suggested role of various stakeholders. Chapter 2 also introduces index insurance as one approach that may allow a first step in developing effective and affordable agricultural insurance markets.

Chapter 2 The Role of Risk Assessment in Setting Insurance Priorities and Policy

2.1 Introduction and Review of Chapter 1

Chapter 1 *Challenges in Developing Agricultural Insurance Markets* emphasizes risk assessment as an essential first step in developing agricultural insurance and provides context for agricultural insurance by considering the effect of catastrophic weather risk on agricultural livelihoods and rural economies. Catastrophic weather tends to be the most disruptive type of agricultural risk that can push poor households into chronic poverty and slow economic growth. Insurance is one instrument in a larger portfolio of risk management instruments that can be particularly helpful in managing catastrophic weather risk, but insurance markets for catastrophic weather risk are usually missing in developing economies.

An important and related institution is agricultural lending. In Vietnam, despite agricultural lending policies that are quite lenient, survey work completed in 2006 suggests that farmers in Dong Thap did lose land rights after the 2000 floods. These surveys also suggest that farmers are using inefficient strategies to manage natural disaster risk. For example, the presence of weather risk appears to be slowing adaptation of certain technologies in Vietnam. Farmers are likely involved in lower-risk and lower-return strategies that are inefficient and slow the potential growth of the agricultural sector. Thus, even though Vietnam is different than many developing economies in its social structure, risks affect small farms in many of the same ways as in other developing economies — risks create poverty traps and slow economic development.

Chapter 1 also examines traditional agricultural insurance markets, using MPCI programs to demonstrate common problems with this type of insurance. Collecting information on individual policyholders is the source of some of the largest challenges, and greatest costs, of traditional agricultural insurance products such as MPCI. It requires extra costs, which many times are fixed costs, to monitor for classic problems of adverse selection and moral hazard. MPCI also requires a loss adjustment, estimation at the farm level of the actual yield losses from an insured event, which adds to the costs for the insurer. Thus, collecting farm-level information can be a large component of the cost of these traditional insurance programs.

The high cost of MPCI programs makes them unsustainable in the market in all but a few special circumstances. Subsequent government intervention in agricultural insurance markets is motivated by a mix of market and social objectives, which often are not well-defined and distinguished from each other. As a result, public funds are used inefficiently and perverse incentives are created among the insured that encourages greater risk taking. In developed countries, government intervention in agricultural insurance markets, usually by subsidizing premium and reinsurance costs of MPCI, come at substantial cost to public financing and tend to grow over time. Unless the country is very wealthy and agriculture represents a small share of gross domestic product (GDP), subsidies for agricultural insurance are generally unsustainable.

In countries dominated by smallholder farms, the administration cost per policy increase tremendously. World experience demonstrates that countries that are not willing to invest in monitoring and loss adjustment cost will soon incur actuarial problems as the average losses over time are much greater than the average premiums collected. Because many of the costs of these programs are fixed for each policyholder, the costs of insuring many small farms is relatively much higher than insuring relatively fewer large farms. At the same time, per unit premium is much less. In this situation, the market has little incentive to offer insurance to smallholder farms. Additionally, many developing economies lack the market infrastructure and full capacity to develop and sustain insurance programs for catastrophic risk. Thus, despite a demand for agricultural insurance in many countries, high transaction costs and market constraints can prevent the development of these markets.

After reviewing the basic economic problems associated with traditional agricultural insurance presented in Chapter 1, it is clear that traditional agricultural insurance is not an effective or efficient approach and is not financially feasible for most developing economies. New approaches to managing agricultural risk need to be considered that take into account the problems with traditional insurance programs as well as the market constraints that are common to developing economies. In Chapter 2, we assess how insurance might fit into a broader risk management approach. Chapter 2 establishes a process for developing agricultural risk management policies that are more sustainable, effective, and efficient for Vietnam and other developing economies.

2.1.1 Roadmap for Chapter 2

Chapter 2 is designed to provide a *conceptual foundation* for agricultural risk management. This conceptual foundation can be used as the basis in the strategy for agricultural insurance market development. In this chapter, we establish a more general set of recommendations about agricultural risk management policy and move to utilizing these general suggestions in a specific application, a model for insurance market development. The following three goals provide the roadmap for Chapter 2:

1. Establish the importance of understanding and assessing risk in an overall agricultural risk management framework and identify the potential strategies for governments to address the risk. Chapter 2 begins by setting the foundation for how to assess risk. A risk assessment examines how the risk affects the local economy and is useful for decision makers wanting to improve risk management strategies. The first step towards assessing the development of an appropriate risk management framework is gaining an understanding of the most significant risks to agricultural livelihoods in a particular region, for example, evaluating a weather risk by severity, frequency, and how it affects conditions in that region. Different segments of the population within a region may be affected differently and may have different strategies for managing the risk depending on their characteristics (e.g., whether they are poor or better off, what kinds of crops they farm) — thus, the first step is to understand the impacts of risk at the local level. Another important step is gaining an understanding of who is paying for the risk and how they are doing it. As discussed in Chapter 1, someone in society is "paying" for the losses associated with the risk (e.g., households may be paying through lost production or assets, banks may be paying through loan restructuring and defaults, government agencies may be paying through disaster relief efforts, etc.). Understanding how weather risk is already managed at these levels is essential to guiding the development of appropriate and targeted risk management strategies.

The insights of a particular risk assessment is the starting point for policy makers in considering means to facilitate the development of efficient and effective risk management. We outline ways governments can contribute to management of catastrophic risk with risk mitigation infrastructure, disaster assistance programs, and insurance market development. Insurance markets can be particularly helpful for managing risk, and we describe investments that are likely to create enabling market conditions and build stakeholder capacity.

2. Provide practical suggestions for insurance market development. As a component of encouraging market development, policy makers will benefit from a vision of how to prioritize the types of insurance markets to initially concentrate. A logical first step is addressing the most crippling risks first — catastrophic weather events — in a way that is targeted to local conditions. In countries with a preponderance of small farms, traditional agricultural insurance products (e.g., MPCI) are unlikely to be the most efficient approach. Index-based insurance is likely a better alternative for these countries when addressing catastrophic weather risk. Index insurance markets that effectively address catastrophic weather risk are likely to act as a catalyst for the emergence of more traditional agricultural insurance products where suitable (named peril and MPCI) and are likely to improve rural financial markets.

The structure of index insurance has several cost-saving benefits: most notably, it does not require collecting farm-level information. Index insurance payments are based on an observable variable that is strongly correlated with the losses of the insured. For agriculture, these variables are typically weather risks such as rainfall. Thus, by using measurements from the weather station closest to the insured, an index insurance product could protect against drought by insuring against low rainfall during the production season. *Basis risk*, which is the possibility of a mismatch between the weather index (for example, the measurement of rainfall) and the losses of the insured, is the biggest problem with index insurance.

To reduce basis risk, spatial correlation must be carefully considered: the insured risk must create correlated losses (losses that affect many of the insured at the same time in roughly the same fashion). Thus, while index insurance is likely to be important for some catastrophic weather events such as drought and excess rainfall, index insurance is poorly suited for other weather events that create losses in an unpredictable way, for example, sea surge. A strategy for addressing weather events that index insurance cannot successfully cover is first, develop the market by using index insurance for correlated catastrophic weather risks, then, use the new, expanded capacity of the index insurance market to develop different products that address more challenging risks. We review the development of index insurance markets in India and Malawi to illustrate the different applications of two existing index insurance programs. Additionally, we describe several disaster relief programs that use an index insurance structure.

3. Illustrate a specific agricultural insurance Market Development Model. Developing index insurance markets is a multifaceted task requiring implementation of a wide spectrum of diverse considerations and strategies. We provide a model for index insurance market development intended to guide a publicly supported project team. The model relies heavily on three general types of activities: assessment, creating capacity and support, and program implementation (pilot testing). The model also provides opportunities to monitor progress, evaluate the risks, and adjust activities accordingly. It is possible that indicators may suggest that it is not feasible to continue market development and other risk management strategies (e.g., building risk mitigation infrastructure) are more appropriate. The development model encourages pilot testing new insurance products on a relatively limited scale so that stakeholders can learn from the implementation process and improve the program before investing in large-scale implementation.

Because Chapter 2 moves from a general conceptual foundation for risk management to specific applications of that foundation for index insurance, several themes such as risk assessment and building capacity emerge throughout this document. Our intention was to avoid unnecessary redundancy and yet illustrate how these themes have a variety of conceptual and practical implications.

2.2 A Conceptual Foundation for Agricultural Risk Management

Designing appropriate agricultural risk management policies requires assessing the risk and defining the role of government especially in building capacity. This section develops a conceptual foundation for agricultural risk management and policy. In Chapter 3, this conceptual foundation serves as the basis for explaining the developmental process for two products in Vietnam — flood insurance in Dong Thap and drought insurance in Dak Lak. In Chapter 4, the same conceptual framework is used to support recommendations for next steps in public policy that will facilitate developing agricultural insurance markets in Vietnam.

2.2.1 Risk Assessment

The process of risk assessment results in gaining a clear understanding of a specific risk and how it affects households and firms. A risk assessment determines the nature of the risk by examining a variety of important factors. Since the same risk can have different effects in different contexts, a risk assessment gathers information about the specific risk and its effects and uses this information to estimate the social costs and benefits of implementing different policy alternatives for addressing a specific risk in that context.

While risk assessments provide important information, policy makers must ultimately decide what policies are most appropriate to adopt since government is likely to maintain a variety of programs with differing priorities (including some socially and some commercially oriented). For example, prioritizing economic growth goals or social welfare goals may result in different outcomes. Coordinating programs so that they are complementary is an important consideration that is likely to reduce social costs. Along these lines, clearly delineating programs in terms of market development or social solutions (e.g., risk mitigation infrastructure, disaster relief) can increase their effectiveness.

Risk assessment identifies opportunities for both market development and social solutions. Our assumption is that where effective insurance markets can emerge, these markets can manage risk efficiently; however, many risks cannot be managed effectively by insurance markets. Thus, a risk assessment establishes whether sustainable insurance markets are feasible for a specific risk and target population. Social solutions can then be built around market failures. Potential social solutions are also evaluated in the risk assessment process. We believe this approach encourages market development and minimizes social costs. The following subsections provide an overview of the important categories for assessing a specific risk.

2.2.1.1 Classifying Risks by Severity and Frequency

Classifying risk by its severity and frequency is an important first step of risk assessment that leads to designing appropriate solutions. Consider an example of classifying the risk of excess rainfall by severity. For a low severity event, excess rainfall could result in slightly more rainfall than farmers would like. As a result, farmers may have lower revenues that season, but experience no other significant consequences. For a moderate severity event, excess rainfall could result in more substantial crop losses, requiring farmers to use savings or take out a loan from the bank to cover expenses. For a high severity (or catastrophic) event, excess rainfall may completely destroy a crop, wash out roads, and disrupt whole communities. In this scenario, farmers may have to sell livelihood assets or take other drastic measures to survive. Thus, differing levels of severity are likely to require different solutions.

Because agricultural production is so dependent on the weather, the risk events of most concern for farmers and firms in the agricultural sector are the high-severity, catastrophic weather risks, such as floods or droughts. These catastrophic weather risks usually result in correlated losses — losses that affect many people in the same region at the same time. Addressing the most severe correlated risks first may have the most social benefit because of the magnitude of loss and the number of individuals affected at the same time. Furthermore, more frequent weather events that create less severe losses can generally be managed with other risk coping mechanisms and even credit at certain levels. Catastrophic weather risks are the focus of agricultural insurance precisely because it is especially difficult for individual households and firms to manage this type of risk.

Classifying the frequency of the event identifies which risk management mechanisms are most efficient and appropriate. Severe risks that happen relatively frequently (e.g., once every five years or more frequently) are likely most effectively managed by some physical or behavioral mitigation such as building levies, installing irrigation systems, or planting crops that are less prone to the risk (e.g., drought resistant crops). For risks that occur relatively less frequently (e.g., every 7 to 15 years), some blend of insurance and physical and behavioral mitigation may be preferred. For risks that occur even less frequently (e.g., less frequently than every 15 years), government-supported disaster assistance may be needed. In this case, too, some blend of physical and behavioral mitigation, insurance, and disaster assistance may be most effective. Policy makers will benefit from weighing the costs and benefits of different approaches, and a blended approach that segments risks is likely to be the most efficient approach.

2.2.1.2 Classifying Risk by Regional Effects

As the same type of risk can affect different regions differently, the risk must be understood in the local context and risk management policies should be designed based on the specific needs of the region. The risk can be observed as affecting a local system, which requires understanding the physical effects of a disaster, how it affects households and firms, what the short- and long-term consequences are for the local economy, and how stakeholders plan around these events. For example, consider flooding in Dong Thap Province. Assessing this risk requires understanding the unique Mekong River system, including the Tonle Sap and annual inundation, how rice production has developed around this process, the production windows in which rice producers are most vulnerable, and the importance of rice production to the regional economy. Thus, the risk management strategy we used in designing flood insurance in Dong Thap was based on this type of information obtained during the risk assessment.

2.2.1.3 Classifying the Risk Exposure of Households

Just as the same type of risk may affect different regions differently, so too a risk may affect different segments of the population in the same region differently. For example, commercial farmers who produce crops intended for export may experience different consequences than subsistence farmers who consume much of their own crop. A catastrophic event may destroy roads typically used to transport the commodities of commercial farmers; however, these infrastructure losses may affect subsistence farmers less severely. Conversely, yield losses may more severely affect subsistence farmers who tend to have less cash and more limited access to credit. Thus, risk management policies should be designed based on the specific needs of the target market.

2.2.1.4 Identifying the Direct and Indirect Consequences of Risk[5]

An underlying assumption of the risk assessment is that when losses occur, someone in society is paying for them, either *directly* — households may "pay" for flood losses by losing their property due to loan default, or *indirectly* — the national government may "pay" for flood losses by forgiving household debt. Catastrophic weather risk often results in both direct and indirect losses. Direct losses include production or asset losses (e.g., crops or homes), increased default rates for banks, and the cost of disaster assistance for governments. Indirect losses include foregone business opportunities if lenders or members of the agricultural value chain become unwilling to serve farmers in high-risk regions. Additionally, indirect losses may also occur due to government policy. For example, if lower risk farmers are charged the same interest rates as higher risk farmers for loans, the lower risk farmers are likely paying for some of the losses of higher risk farmers.

[5] This and following sections that describe aspects of risk assessment, index insurance characteristics, the potential role for national-level government in financial risk management, and a market development process is drawn from Skees et al. (2006) and GlobalAgRisk (2008b).

Thus, the risk assessment examines the effects of the risk on households, enterprises, and local, regional, and national governments. In the following subsections, we illustrate basic questions intended to assess the economic and institutional aspects of the effects of the risk.

2.2.1.4.1 Assessment of the Economic and Institutional Implications of a Weather Risk

Economic Assessment and Social Welfare Effects. Once the major risk or risks affecting the target population have been identified, the economic and social welfare effects of those risks are evaluated. Some of the primary questions that must be address in an economic assessment are developed below. These assessment questions are intended to illustrate aspects of the risk assessment process, but by no means is this list exhaustive. Our discussion of risk assessment is intended to highly the complexity of understanding even a single specific risk.

Are there one or more catastrophic events that are known to directly undermine the welfare of rural households or to impede the delivery of critical services to rural areas?

Events likely to meet this condition include well-defined extreme weather events such as droughts, excessive rainfalls, floods, freezes, excessive temperatures, deficit sunlight, and hurricanes.

How widespread are the economic effects of this event?

If a risk tends to create widespread losses, managing this risk can be more difficult because many households in the community are likely to need assistance at the same time. Events that cause widespread catastrophic losses are likely to be the most disruptive risk for individuals and the economy as a whole.

What is the nature of the economic impacts of this catastrophic event?

Does the extreme event destroy property such as homes, crops, livestock, irrigation facilities, storage structures, or other capital equipment? Does it destroy public infrastructure on which rural households and enterprises depend, such as roads, bridges, railroad systems, public irrigation systems, and water reservoirs? Thorough documentation of the economic impacts of the extreme event is not required for the risk assessment; however, research that enhances the ability of individuals to assess their risk exposure (e.g., flood risk mapping) may have many public good outlets. For example, flood risk mapping can help the government prioritize infrastructure projects but can also be used by banks to assess the risk of an agricultural loan or by firms to determine a location for their business expansion.

Institutional Assessment and Existing Risk Management Strategies. Assessing existing institutions and mechanisms for managing risk provides necessary information for determining where improvements may be needed. An institutional assessment examines the current roles of the government, market (insurance and banking), and donor organizations in risk management. The following questions should be considered for an institutional assessment:

How are risks currently being handled by financial, insurance, or government institutions? What weaknesses, if any, exist in the ability of these institutions to provide risk management services to rural households?

The cost of catastrophic events is already internalized somewhere in the country's political and economic systems. In particular, it is important to understand how existing government programs may be absorbing these costs. In many developing economies, state-supported banks change the terms of an outstanding loan for those affected by a natural disaster. Such policies have numerous negative consequences: they are fiscally costly and they do nothing to improve incentives for improved risk management practices. In addition, these types of programs and policies are generally not transparent and are difficult to uncover when working in developing economies. Discovering and understanding these programs and policies is extremely important because they can potentially crowd out other risk management strategies that may be more efficient.

How do households and firms currently manage income risk from catastrophic events?

Characteristics of the target population may affect the strategies they use to manage risk. Poorer farmers may be more likely to implement crop diversification; better-off farmers may have access to consumption loans. Many households, especially the poor, are usually not able to manage catastrophic risks effectively. Developing effective policies requires implementing risk management mechanisms that complement mechanisms already available. If the risk is being managed in an effective and efficient way, policymakers can embrace this strategy and focus on risks that are not being effectively managed.

At times, risk management strategies may work effectively but be inefficient. For example, a bank may decide to avoid agricultural lending in a region with catastrophic risk. This strategy protects the bank, but reduces growth opportunities for the bank, households, and the rural economy in the risky region. Thus, more efficient risk management mechanisms such as insurance could be particularly beneficial in this setting.

Because managing agricultural risks requires different strategies depending on the severity and frequency of the risk and its effects on the region and specific groups, policy makers are unlikely to be able to develop a single strategy that will be effective and efficient in all scenarios. A question emerges: if risks must be understood on a local level, what is the most effective role for agricultural risk management policy at the national level? In the next section, we describe a strategy for national-level government.

2.2.2 Role of National-Level Government for Risk Management

This section focuses on national-level agricultural risk management policy with an emphasis on the role of capacity building. Because catastrophic weather risk events occur at the local and regional level, national-level government agencies may act most efficiently as a coordinator of risk management strategies tailored to local conditions. Thus, while proper agricultural risk management must avoid using the same solution throughout the country, carefully constructed national-level agencies can make risk management strategies cohesive and enhance opportunities for lessons learned through experience with risk management strategy implementation. In addition, policy makers must consider how commercially and socially oriented government investments can be structure to be complementary to prevent social programs from "crowding out" markets. Crowding out is a common problem in agricultural insurance throughout the world. If farmers feel that the government will provide assistance after the disaster, they are less likely to purchase insurance. By the same token, if farmers believe that their bank loans will ultimately be forgiven when they suffer from crop losses caused by a disaster, they will be less likely to purchase insurance. Thus, being clear about where the social programs will be used and where the responsibility is left for the farmer is an important aspect of a comprehensive risk management policy for any country.

In what follows, we briefly note considerations for risk management policy involving physical and behavioral mitigation investments and natural disaster relief policies but emphasize financial risk management policies. When the market can effectively provide access to insurance to manage certain weather risks, household demand may quickly increase. The extent to which weather risks can be managed in the market frees government resources for other important uses. Thus, creating enabling market conditions for insurance markets to develop is a particularly important component of an agricultural risk management policy.

2.2.2.1 Physical and Behavioral Mitigation

By physical mitigation, we are describing infrastructure investments such as irrigation, levy systems, and dams that reduce vulnerability to a risk. Building this infrastructure is certainly a suitable role for governments. Still, these projects often carry significant cost and should be evaluated by whether these resources are being used most efficiently. This involves evaluating the opportunity cost of the investment.

For example, consider the hypothetical situation where a government must choose between developing a $10 million irrigation system that protects against catastrophic losses (a 1-in-25-year drought) and a $30 million irrigation system that protects against extreme catastrophic losses (a 1-in-100-year drought). This cost-benefit analysis would be informed by a risk assessment that includes considering alternative risk management strategies. In this case, an effective and efficient solution may include building the $10 million system and managing the extreme catastrophic risk using financial risk management.

Governments may also encourage behavioral mitigation such as appropriate use of fertilizer through farmer education. It should be acknowledged that government support for a specific industry diverts resources from other government opportunities.

2.2.2.2 Disaster Relief Policies

Disaster assistance for events that occur too frequently is likely to distort incentives and encourage farmers to plant in higher risk areas. These incentives can result in increasing government losses over time and agricultural industries developed in regions where conditions are not suitable to the crops grown. Still, when disaster events occur relatively rarely, households may discount these events so heavily that they do not prepare properly for them. Thus, some involvement in disaster relief is likely a necessary role for government.

An emphasis on *ex ante* disaster financing has improved disaster risk management programs. This approach uses macro-level insurance policies to finance disaster relief, which has been found to be an efficient solution in some locations.[6] Governments establishing these disaster programs should be careful to clearly identify how program resources will be dispersed in the event of a disaster to ensure that disaster relief reaches its intended target groups.

Disaster programs should also be carefully designed in conjunction with insurance products and other risk management mechanisms that are available. Ideally, disaster assistance and insurance should be complementary to enhance the protection of households without overlaps or gaps in coverage. When too much overlap occurs between disaster programs and private-sector insurance, households and firms have fewer incentives to purchase insurance; when gaps emerge between disaster programs and private-sector insurance, households, and firms may experience painful losses that require long-term recovery.

2.2.2.3 Financial Risk Management

Developing financial risk management mechanisms such as insurance, credit, and savings markets can provide an important range of risk management tools for households and firms. Insurance is typically best suited for risks of moderate to high severity, while savings and credit more effectively manage lower severity risks. Thus, supporting insurance market development may play an important role in agricultural risk management policy for catastrophic risks, and fits nicely into rural financial services development as addressing catastrophic risks is likely to improve opportunities for credit and savings.

Because risks affect different segments of the population in different regions differently, no single insurance solution will be most effective for all catastrophic weather risk problems. The most productive role for government agencies may be to build capacity among stakeholders in the government and in businesses and to create conditions that enable markets to emerge.

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[6] Examples of these social programs using an index insurance structure are provided in Section 2.3.4 Index Insurance.

In this section, we begin using the term "weather insurance," which describes any insurance intended to protect against weather-related losses. Weather insurance is likely to cover both moderate and severe losses. Pest risk in agriculture is not included in weather risk as pest risk depends heavily on farm management practices and is thus quite difficult to insure. Pest risk may be addressed using other risk management strategies than insurance (e.g., farmer education, research and development on resistant crop varieties, etc.). Nonetheless, weather insurance can also be more comprehensive than crop insurance. By framing weather insurance as a form of business interruption insurance, farmers can use the insurance for losses other than crop shortfalls. As Chapter 3 will demonstrate, a late onset of the monsoon creates extra costs to coffee farmers in Dak Lak as they must extend the irrigation period. Crop yields may not suffer. However, the cost of production can increase significantly.

As Chapter 1 illustrates, governments have struggled in supporting insurance markets. Providing premium subsidies distorts incentives, encouraging farmers to take more risk at the expense of the government and increasing the cost and problems that will accompany the next natural disaster. Premium subsidies may even motivate farming on lands that would otherwise be unprofitable to farm. The experience of higher income countries over time is that premium subsidies tend to benefit the riskiest and wealthiest farmers and create a system so tied to the political economy that reducing or changing subsidies becomes extremely difficult. Even targeted premium subsidies rarely work as planned. Subsidies are very much a path-dependent policy choice. Once they are implemented, it is extremely difficult to make any needed changes. Thus, much care and consideration is needed before governments pursue this strategy.

Rather than using direct premium subsidies, governments can make investments that create an enabling environment for insurance markets to develop. When governments create conditions that encourage market development, a variety of public benefits emerge. One benefit is that opportunities for more risk management strategies tailored to a specific local risk more easily develop. As summarized in Chapter 1, we describe some important activities for governments that are likely to support broader financial service development.

2.2.2.3.1 Supporting Improvements in the Legal and Regulatory Environment

Governments can update their insurance laws and regulations, making them consistent with international law to improve the chances of gaining access to global markets for risk transfer. Human capacity building within financial regulatory agencies is also a critical public investment because managing the correlated losses of catastrophic weather risks requires stricter provisioning standards than risks resulting in independent losses. Regulators must ensure that insurers' capital reserves are sufficient to meet potential claims, or that insurers have access to capital through reinsurance to handle extreme losses.

If an effective legal system is not in place, insurance contracts may lose validity. For example, it is not uncommon for insurance companies to refuse to pay valid claims simply because there is no effective oversight. This will most certainly undermine public confidence and demand for insurance. On the other hand, insurers may be reluctant to sell policies if there is a possibility that the government could alter the terms of the insurance contract after the insurance is sold. If judges and lawyers do not have a good understanding of insurance law, insurers may be forced to make indemnity payments in excess of their obligations under the policy.

Ultimately, access to global insurance and reinsurance markets is important for developing sustainable weather insurance markets and depends heavily on standards put in place by the insurance regulator. Regulatory officials can establish rules and regulations that both facilitate access to global insurance and reinsurance markets. In most cases, domestic insurance companies lack the financial resources needed to withstand the large losses that will occur in some years. This is one reason why insurance for weather risk is not offered by domestic insurance markets. Access to external financing to cover large losses when they occur is critical for a solvent insurance market.

2.2.2.3.2 Supporting Improvements in Data Systems and Data Collection

In supporting the development of weather insurance markets, governments can have a direct and immediate effect by providing greater access to existing weather data. Timely access to reliable and continuously collected weather variables is critical to the development of weather insurance markets. Other types of information can also be important in the development of weather insurance: for example, yield data and other information on losses caused by extreme weather events, changes in land use and input use intensity, and records of past disaster management activities or infrastructure changes. Most governments have reasonably good systems for collecting weather data, but they are missing quality systems for archiving and sharing historic weather data. Even more troublesome, some countries do not view the collection of weather data using government resources as a public good. Rather, they view it as a profitable resource and consequently charge in excess of handling service for access to data. Providing easily accessible, good-quality weather data is likely to have more social benefits than the revenues created by charging firms or development organizations seeking access to these data.

2.2.2.3.3 Supporting Risk Management Education and Capacity Building

In many developing economies, stakeholders may have little or no experience with insurance, particularly in rural areas where access to financial markets is often limited. Farmers and other rural households may benefit from broad agricultural risk management education. For example, segmenting the risk and deciding which risk management mechanisms are most appropriate to manage different risk segments may be helpful. In this context, education regarding savings, credit, and insurance and their potential benefits in a risk management strategy are likely to enhance the ability of farmers to manage their risk. Other stakeholders involved in market development may also require technical training specific to the insurance products being proposed. Technical assistance can help build the knowledge and expertise within the country to develop and sustain the market. Capacity building can strengthen the public and market institutions that support market development and implementation.

2.2.2.3.4 Supporting Product Development

The initial start-up costs of product development can be very high. One of the challenges associated with private-sector development of new financial products is the ease with which they can be copied and replicated by others. This "free rider" problem discourages many companies from making initial investments required for new product development, especially in underdeveloped markets. Thus, some level of government support for product development can be justified. These investments should be targeted at feasibility studies and developing pilot tests of new products with the involvement of local private-sector partners. Every attempt should be made to ensure that the knowledge and technology for new product development will be passed on to local experts as soon as possible.

2.2.2.3.5 Supporting Financing for Catastrophic Losses

Until a sufficient volume of business has been established, extreme losses for the domestic insurance pool may need to be underwritten, perhaps through contingent loans from government and/or donors, until international reinsurers are willing to participate in the risk sharing of a new product. For example, the World Bank has a contingent loan for the Mongolian Index-based Livestock Insurance (IBLI) Pilot. If losses for the insurance companies and the domestic reinsurance fund are fully exhausted, the World Bank loan can be accessed to make indemnity payments.[7]

In efforts to enhance the complementarities of disaster assistance and insurance, governments may consider financing for low-frequency, high-severity events. Evidence suggests that those at risk tend to ignore the probability of the most extreme and infrequent loss events, but insurers do not ignore these events and consider the probability of such catastrophic losses when setting premiums. In some cases, this can create a gap between what buyers are willing to pay and what sellers are willing to accept for protection against very infrequent but catastrophic losses. Governments can provide the financing in a number of ways that still maintains incentives to domestic insurers to operate in a proper fashion. Thus, governments can engage in a variety of activities that have far-reaching benefits for insurance market development.

2.3 Practical Suggestions: Agricultural Insurance Market Development

We now consider a framework for how to advance agricultural insurance relying on the conceptual foundation provided above, including risk assessment and the many opportunities for governments to support insurance market development as a component of a more comprehensive agricultural risk management policy. This framework is also informed from international experience with agricultural insurance and new approaches that are being pilot tested in numerous developing economies.

2.3.1 Address the Catastrophic, Correlated Risk First

The most difficult risk for insurance markets to manage is correlated, catastrophic risk. We have discussed ways for the government to support financing for catastrophic losses, and these are important. Regarding an agricultural insurance market framework, the priority for government support is insurance products that address the big risk — the catastrophic risk that cripples the local economy and impedes financial service development.

2.3.2 Develop Solutions Appropriate for the Region

Identifying the most significant weather risk and how the impact is manifest usually differs by region. Thus, the type of insurance product also differs and requires a good deal of customization to meet the needs of farmers, households and value chain participants. Governments must be careful to support solutions appropriate to the circumstances of the risk; otherwise, incentives can emerge for households to farm crops unsuitable to specific regions. Supporting solutions appropriate to the risk means that governments may be unable to offer the same insurance products (e.g., traditional insurance, index insurance, etc.) in all regions.

2.3.3 Tailor Solutions to the Target Market

Because of the characteristics of different groups, different insurance mechanisms are likely needed depending on the target market. For example, Chapter 1 highlights the significant difficulties that small farm size creates for traditional agricultural insurance. However, for some of the larger communal farms in Vietnam, depending on how they are managed, traditional agricultural insurance may be more

[7] See Appendix B Index-based Livestock Insurance in Mongolia; see Section 2.4.3.2 Risk Financing for more on the risk financing structure in Mongolia, and also, Collier, Murphy, and Skees (2008b) and Mahul and Skees (2005).

manageable in the long term. Additionally, for the poorest households who have very little or no cash or assets, products sold on insurance markets may be less suitable than other, more direct forms of government support intended to build their asset bases.

As a start toward insurance market development, we suggest policy makers focus on addressing the big risk first in a way that is suitable to local conditions and the needs of the target market. In the next section, we describe index insurance, a form of insurance that is well-suited for addressing many types of catastrophic weather risk, especially for regions with small farms. Index insurance is effective for small farms, but can also be used by large farms, banks, members of the agricultural value chain, and others. Index insurance products can be tailored in a variety of ways to address the big risk, and this process may begin by creating insurance products for risk aggregators such as banks or members of the agricultural value chain. If index insurance can effectively transfer the big risk out of a region, credit and savings can grow more rapidly and additional insurance products that address other risks are likely to emerge. As index insurance markets enhance the capacity of local insurance regulators, insurers, delivery agents, banks, and households Regarding the use and benefits of agricultural insurance, the market is likely to segment as it matures to more effectively meet the needs of customer groups. For example, opportunities for traditional agricultural insurance may emerge for larger farms, while smaller farms are likely to rely on index insurance. At that time, policy makers will have to determine what role is most effective for the government regarding those markets. Thus, index insurance can be a first step toward broader agricultural insurance market development.

2.3.4 Index Insurance[8]

The unique characteristic of index insurance that distinguishes it from traditional forms of insurance is that indemnity payments are based on values obtained from an index that serves as a proxy for losses rather than upon the individual losses of each policyholder. The underlying index is based upon an objective weather measure (e.g., rainfall, wind speed, or temperature) that exhibits a strong correlation with the variable of interest (e.g., crop yield loss or default rates).

Weather index insurance, which bases payments on an important weather variable such as rainfall, may be the most common form of index insurance. Area-yield index insurance is another common form of index insurance. Farmers purchasing area-yield index insurance receive a payout when average yields fall below a predetermined threshold at the county level. Because of their reliance on county-level yield data, area-yield policies are often infeasible in developing economies because these data are not collected.

Index insurance has a defined threshold and a limit that establish the range of values over which indemnity payments are made. The threshold marks the point at which payments begin. Once the threshold is reached, the payment increases incrementally as the value of the index approaches the limit. For example, an index insurance contract designed to transfer the risk of drought would begin making indemnity payments if rainfall levels, as measured at an agreed weather station, fall below the threshold over a defined time period, such as a month or a season. Indemnity payments would increase proportionately for each unit of rainfall below the threshold until the agreed limit is reached. The maximum indemnity would be paid when rainfall is less than, or equal to, the limit.

[8] For more on index insurance, see also Barnett, Barrett, and Skees (2008), Barnett and Mahul (2007), Skees et al. (2007), Varangis, Skees, and Barnett (2002), and Skees, Hazell, and Miranda (1999).

The payment rate for an index insurance contract is the same for each policyholder who has the same contract, regardless of the actual loss experienced by the policyholder. Unlike traditional insurance contracts, the underlying risk for a weather index insurance product is the behavior of the specific weather variable that contributes to production losses or lost income for other reasons such as the need for additional irrigation or lower prices due to quality problems associated with specific weather events. The amount of indemnity payment received will depend on the amount of liability purchased (the value of the insurance).

The following example illustrates the structure of an index insurance contract for drought risk that begins making payments when rainfall is 100 mm or less. The maximum indemnity payment is made when rainfall is at or below 50 mm for the season. The assumption of this example is that farmers in the region where the index insurance is offered begin to experience increasingly severe losses as rainfall fails to exceed 100 mm. Production losses are assumed to be near total should rainfall not exceed 50 mm.

Index variable: Total accumulated rainfall measured in millimeters as recorded at a local weather station during the defined cropping season

Threshold: 100 mm of rainfall

Limit: 50 mm of rainfall

Liability purchased by the policyholder: $50,000

Payment rate: Based upon shortfalls in rainfall, the payment rate is calculated as the difference between the threshold value and the actual realized value of the index, divided by the threshold minus the limit.

= (threshold – actual value)/(threshold – limit)

= (100 – actual value)/(100 – 50)

Indemnity payment: The payment rate multiplied by the total liability:

= (100 – actual)/(100 – 50) x $50,000

Table 2.1 shows indemnity payments due under this example contract for different scenarios. The amount of indemnity paid per mm of deficient rainfall is calculated by multiplying the payment rate by the amount of liability purchased ($50,000).

If the threshold is 100 mm, the farmer is likely to experience economic losses when rain is less than that amount.

Then, payment when rain is, for example, 80 mm (second case in Table 2.1)

= (100 – 80)/(100 – 50) x $50,000 =

= (20)/(50) x $50,000 =

= (0.40) x $50,000 = $20,000

Table 2.1 Payments Due under Different Rainfall Level Scenarios

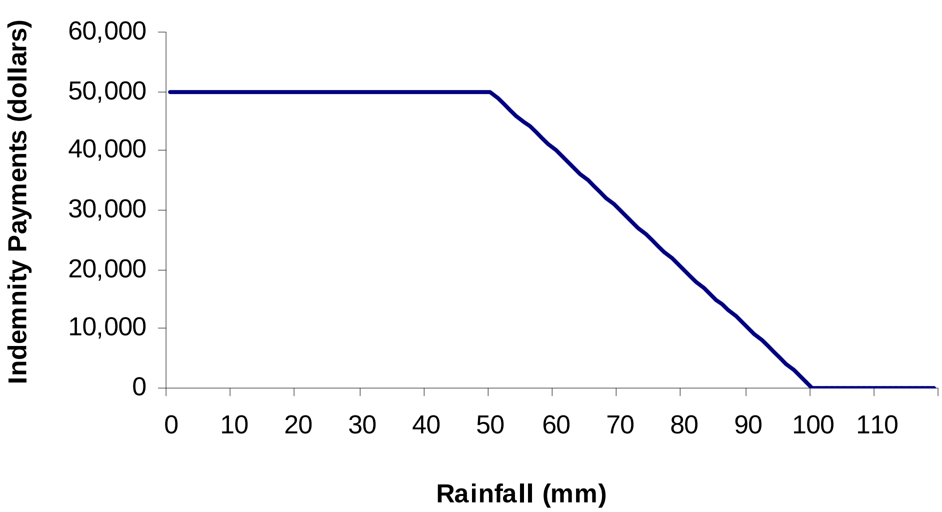
Total Rainfall	Indemnity Payment Due
110 mm	None. The threshold has not been reached.
80 mm	$20,000.
50 mm	$50,000.
40 mm	$50,000. The limit of 50 mm has been exceeded.

Source: Authors

Figure 2.1 illustrates the payout structure for the hypothetical contract presented above. The payout rate is proportional, meaning that for each additional mm of deficit rainfall between the threshold and the limit, an equal increment of indemnity is due.

Regardless of the type of index on which an index insurance contract is based, when the threshold is reached, the amount of the payment made is based not on the actual losses sustained by the person who purchased the policy but on the value of the index relative to the threshold (subject to the limit) and the amount of the liability purchased. While the payment could be somewhat less than, or more than, the loss sustained by the individual policyholder (basis risk) the index insurance, if properly designed, should reflect a close correspondence between indemnities and losses.

Figure 2.1 Payout Structure for a Hypothetical Rainfall Index Insurance Contract



Source: Skees, 2003

2.3.4.1 ADVANTAGES OF INDEX INSURANCE

When comparing index insurance to traditional farm-level agricultural insurance, it is useful to recall the equation from Chapter 1 (see below) that highlights the various components that influence the price of insurance.

Price of insurance = Cost of the expected annual loss

+ Expense loads:

  + Cost of information to control adverse selection

  + Cost of monitoring to control moral hazard

  + Cost of loss adjustment

  + Cost of delivery

  + Cost of administering the insurance program

  + Cost of product development

+ Cost of correlated risk

+ Cost of ready access to capital

The advantage of index insurance for developing economies is that it can be simpler and less costly to administer than traditional forms of insurance. Index insurance can control some of the cost factors associated with insurance in the following ways:

Simpler Information Requirements. Because index insurance premium setting is not tied to observations of an individual's yield history, but rather to the distribution of a weather variable, there is no need to classify each individual potential policyholder according to their risk exposure. As already discussed, this a significant informational constraint on traditional agricultural insurance. It is unlikely that the information required for traditional agricultural insurance will be readily available in a developing economy, and it would require a great amount of effort to develop or obtain the level of detained information required to make a proper risk assessment. However, in the case of index insurance based on rainfall, no household-level information is needed. The underwriting uses historic rainfall data to evaluate the severity and frequency of insufficient rainfall.

No Loss Adjustment. One of the significant challenges for traditional insurance products is the high cost of loss adjustment. As discussed, under a traditional insurance policy, the insurer has to determine whether each individual household has suffered an insured loss and, if so, the extent of the loss. This can be extremely costly, particularly in remote, rural areas and/or in regions dominated by small farms. In the case of index insurance, there is no need to conduct household-level loss adjustment. Indemnities are based solely on the realization of the underlying index relative to the prespecified threshold.

Reduction of Moral Hazard. Because the indemnity does not depend on the individual's actual losses, the policyholder cannot change his or her behavior to increase the likelihood of receiving a payment.

Reduction of Adverse Selection. Index insurance is based on objectively measured weather variables which reduces the opportunity that informational asymmetries can be exploited to the benefit of the most risky individuals.

Standardized, Transparent, and Flexible Structure. Index insurance contracts can have simple and uniform formats. Contracts do not need to be tailored to each policyholder and so, again, administrative costs are lower. Thus, index insurance contracts should be more easily understood by the insured than many forms of traditional insurance. Because index insurance payouts are based solely on the measurement of the index, contracts can be easily redesigned for a different target market based on the same weather event. For example, rural households, lenders, agricultural processors, and local governments are likely all affected by the same weather risk, and appropriate contracts could be designed for each, based on their vulnerability to the weather risk.

Reinsurance Function. As mentioned previously, the potential for large financial losses from correlated weather risk is an inhibiting factor to the development of insurance markets. Opportunities for pooling portfolios of risk within Vietnam are likely to be higher with index insurance than for traditional insurance. Because opportunities for moral hazard and adverse selection are reduced and no loss assessment is needed, the due diligence requirements for evaluating the index insurance portfolio of an insurer is lowered. If insurers are using the same standardized methods for pricing the risk of the insurance product, they should be able to more easily pool these risks. The government could play an important role in coordinating this risk pooling. Still, access to international reinsurance markets is likely needed to manage the most extreme risk of the portfolio.

Thus, index insurance does not require the insurer to collect farm-level information, conduct loss adjustments, or control for moral hazard or adverse selection, which is likely to result in significant cost savings for the insurer that it can pass on to households in the form of lower premiums. And it could very well reduce the cost of delivery and administration, at least when thinking about standardization. This could remove three significant cost categories as shown below.

Price of insurance = Cost of the annual expected loss

+ Expense loads:

~~+ Cost of information to control adverse selection~~

~~+ Cost of monitoring to control moral hazard~~

~~+ Cost of loss adjustment~~

+ Cost of delivery

+ Cost of administering the insurance program

+ Cost of product development

+ Cost of correlated risk

+ Cost of ready access to capital to pay for all losses

2.3.4.2 LIMITATIONS OF INDEX INSURANCE

Despite these cost savings and the other benefits described above, index insurance has several limitations. While index insurance can potentially overcome many of the problems associated with traditional insurance, there are still significant challenges that must be overcome for index insurance to become a viable risk mitigation mechanism in developing economies. The limitations of index insurance highlight the importance of conducting a thorough risk assessment that evaluates if index insurance is appropriate. Upcoming sections in this chapter on feasibility study, product design, and pilot development will further discuss how to address these issues. Some of the challenges of index insurance are the following:

Basis Risk. Index insurance relies on a measurable variable that indicates the occurrence of an event that is likely to cause large and correlated losses among the insured. With an index insurance contract, there is basis risk, which is the chance that the indemnity payment a policyholder receives does not match the actual loss. The policyholder could suffer a loss and not receive any or enough indemnity to compensate for the loss. It is also possible that an insured could receive an indemnity even when he/she has not suffered a loss that is consistent with the payment. One of the fundamental preconditions for index insurance is that the targeted weather event causes a similar pattern of losses over a relatively broad geographic area. Index insurance will not work well for weather events such as hail or tornadoes that cause isolated and random loss in the same geographic region. It also cannot be used where many microclimates exist within a relatively small geographic area. The lower the correlation of production losses across space, the higher is the basis risk. Too much basis risk can reduce demand for the insurance product if potential buyers determine that the index is not likely to be representative of their loss experience and will therefore offer them inadequate protection against the risk. While basis risk is an inherent problem with index insurance, basis risk can be minimized through product design and application. It should also be noted that traditional types of insurance is not totally absent of basis risk. Loss adjusters may estimate a different level of loss that differs from the true loss or the loss perceived by the farmer.

Because of the problems of basis risk, index insurance must only be used to insure against events that create relatively homogenous, correlated losses. If moral hazard and adverse selection can be overcome, traditional insurance may be better suited for independent, uncorrelated, risks.

High Start-up Costs. Index insurance programs require a significant amount of up-front investments that inhibit the private market from developing index insurance markets independently. Examples of start up costs include feasibility analysis and risk assessment, product design, capacity building, legal and regulatory review, etc. Private firms are reluctant to incur these costs since once a product is developed competing firms can easily replicate the product and draw away clients before product development costs have been recouped. As a result, governments and/or donors often finance some of the start-up costs to support market development. In this case, the ease of replication of a successful product by many firms will help expand the market.

Not Suitable for Complex Risks. Index insurance relies on identifying a suitable measure that can sufficiently serve as an indicator of losses. For certain risks, identifying the appropriate measure must be a priority. A rainfall index can adequately capture many drought events. Some risks are more dynamic and the losses are more difficult to attribute to a single variable. Complex risks may not be suitable for index insurance because it will be difficult to create an index measure that is strongly correlated with losses. If the index cannot accurately serve as a good proxy for losses there will be a basis risk problem and dissatisfaction among the insurer and the insured. In Mongolia for example, the major risk to livestock herders was catastrophic livestock losses from severe winter conditions, which occurs from a dynamic interaction of weather variables (drought, low temperature, snowfall, wind speed). However, no single weather variable exhibited sufficient correlation with livestock mortality. Thus, the index insurance product instead relied on the aggregate livestock mortality within an area. The livestock mortality index captures catastrophic losses that occur from any type or combination of risk events.

The dynamics of some risks are usually too complicated and unpredictable to be sufficiently insured with index insurance except in special cases. Flash flood, typhoon, and sea surge are some of the most complex risks to insure for any form of insurance. Identifying a suitable index that proxies losses will not be possible for these risks in most cases. Flood risk is also extremely complicated. Both natural conditions and management decisions influence the occurrence of flood and the impact of the event. The index insurance for flood developed for Dong Thap province is possible only because there are negligible upstream management influences on the annual flood and because there has been ongoing rigorous monitoring and modeling of flood effects in the province.

2.3.5 Feasibility Assessment of Index Insurance

Investigating the initial feasibility of a potential index insurance project is a targeted form of the risk assessment evaluation described above and focuses on preconditions. A series of specific questions are asked to determine if index insurance would be a suitable and feasible risk management solution. The output of the analysis will be a recommendation to either pursue a full feasibility and pilot design or a recommendation to terminate the inquiring. The feasibility assessment involves evaluating weather, economic, data, institutional, and demand factors.

2.3.5.1 Weather Assessment

Focusing on the major weather risk identified in the risk assessment, it is necessary to investigate the characteristics of the risk to determine if the preconditions are met for index insurance to be possible.

Does the weather risk result in correlated losses?

One of the fundamental preconditions for index insurance is that the targeted weather event causes a similar pattern of losses over a relatively broad geographic area. Index insurance will not work well for weather events such as hail or tornadoes that cause isolated and random loss in different geographic regions. It also cannot be used where many microclimates exist within a relatively small geographic area. Index insurance relies on a measurable variable that indicates the occurrence of an event that is likely to cause large losses for many households.

How frequently does the weather risk occur?

Index insurance is most suitably designed to protect against infrequent but severe weather risks (e.g., 1 in every 7 to 10 years). If a severe event occurs regularly, the probability of loss will be high and, thus, the cost of index insurance (the premium charged by the insurer) will be high. Frequent risks require other strategies for mitigation and management. For example, appropriate farming systems and risk-coping strategies must be adopted to fit into a consistently harsh environment (e.g., extremely arid regions).

Is the weather risk observable and easily measured?

The event that creates the losses must be measured by reliable and secure systems that can be used to develop the index and make the payments. The methods used to record the events must be transparent, objective, and reliable for the index insurance to work properly.

Index insurance requires that the policyholder not be able to influence the value of the underlying index. Otherwise, moral hazard problems will occur. This is one reason why index insurance is often based on weather variables. It would be much more difficult to create index insurance for something like a contagious livestock disease since human actions can play a large role in containing or exacerbating the spread of those diseases.

2.3.5.2 Index and Data Assessment

If index insurance is to be successfully implemented, an appropriate index must be identified and adequate historical data on the index must be available. In identifying whether an appropriate index exists, the following questions should be considered:

Does a variable (index) exist that is highly correlated to the losses caused by the extreme event?

If index insurance is to provide effective risk protection, the underlying index must be closely aligned with losses experienced by policyholders in a particular geographic area. The focus here is on the relationship between the underlying index and actual losses incurred by policyholders. For example, if the major risk is drought then the correlation between rainfall at critical periods in the crop cycle and reductions in crop yields or increased costs must be strong.

Potential variables that could serve as an index include standard weather variables compiled by the meteorological service, such as rainfall and temperature; satellite imagery of vegetative cover, flooding, and El Niño Southern Oscillation (ENSO); government-compiled statistics directly related to losses, such as regional crop yield, livestock mortality; and other environmental variables such as river flow and reservoir levels.

How many years of reliable data are available for the candidate index and how dispersed are the geographic locations at which they are measured?

An insurer must have reliable data from which to establish premiums for index insurance. Ideally, insurers prefer at least 30 years of data that conform to international standards. Insurers may be willing to work with fewer data provided that supplementary data exist, such as measurements from other nearby geographic locations.

Can the index be measured objectively using consistent, secure, and transparent methods?

It is best for the weather variable to be measured by an independent entity or agency that has no financial stake in the outcome of the event. This precondition gives the insurer confidence that the index cannot be manipulated to influence whether indemnities are made. Some examples of desirable weather observations include secure weather data from the national meteorological agency, objective and scientifically developed data from other national and international agencies, satellite data from certified companies, etc.

2.3.5.3 Institutional Assessment

The institutional assessment examines the current roles of the government, market (insurance and banking), and donor organizations in risk management. The following questions should be considered for the institutional assessment:

Does the country have a well-established legal and regulatory framework for its banks, insurers, and security exchanges, and which regulatory agency is likely to have authority over the index insurance?

As with any insurance product, index insurance must conform to the laws and regulatory requirements of the country. Sometimes this is not easy with index insurance, since index insurance contracts are relatively new and novel instruments, and there may be no precedence to provide guidance. Lack of clarity regarding the regulatory status of index insurance creates a business risk for insurers and reinsurers, potentially undermining their interest in participating in a pilot demonstration project. As part of the feasibility study, the insurance regulator should be consulted to introduce them to the concept of index insurance and to gauge the interest of the regulator to facilitate proper oversight and regulatory approval of contracts for a pilot demonstration project.

Do banks, microfinance institutions, and/or insurers operate successfully in the target regions and could they serve as financial intermediaries for the sale of the index insurance contract?

The insurer that writes the index insurance may not want to market or distribute the product directly to individuals. Instead, it may be more cost effective for the insurer to establish a partnership with a local financial intermediary that is capable of aggregating individual risks and providing local services. This could be any form of a rural lending institution, or a collection of such institutions. Often these risk aggregators bear some consequences of catastrophic weather events along with individuals. For example, the rural lender may experience widespread loan defaults when its clients experience catastrophic drought. Although it is not essential that a commitment of a local partner be secured during the feasibility study, identifying possible partners and testing their general interest in cooperating is prudent.

Do stakeholders perceive the political and economic environment as stable?

Because of the time required to investigate, develop, and test index insurance, and because the risks suitable for index insurance are not frequent events, it is important that the country have political and economic stability to support the long-term commitment and planning that is needed. If insurers and other private-sector stakeholders are concerned about policy risk, they may be less willing to invest in an index insurance program until uncertainty associated with potential policy changes is resolved.

Are stakeholders committed to index insurance market development?

It is a complex and time-consuming undertaking to develop an index insurance scheme in any country for the first time. The users, government agencies, (re)insurance companies, donors, and all others involved in the development of index insurance must be very committed to the work and willing to invest time and resources in order to successfully develop and launch a pilot demonstration project.

2.3.5.4 DEMAND ASSESSMENT

For index insurance to be viable, the targeted group must show some willingness to pay for the insurance. During the feasibility stage, demand assessment can be evaluated through research as well as discussion groups with potential users. This may also involve concept testing to obtain feedback on potential product design.

Who is likely to benefit from index insurance and what are their general financial and economic characteristics?

To assess the potential success of index insurance, a potential target sector must be identified and its financial and economic characteristics understood. In particular, the practitioner should know the typical size of the farm per rural household; typical sources and timing of income (on-farm versus off-farm income) and how these sources are affected by catastrophic weather events; and the degree of credit use (possibly through microfinance institutions). Clearly, the potential benefits of index insurance increase if household income is relatively low and highly exposed to the extreme weather event indexed by the index insurance.

How do the potential beneficiaries of index insurance currently manage income risk from catastrophic events, and, in particular, do programs or financial products currently exist that may compete with or complement index insurance?

To assess the potential success of index insurance, one must evaluate existing mechanisms and institutions for risk management and identify weaknesses or gaps. Some programs, such as disaster assistance programs, could be enhanced by the introduction of index insurance. Others may interfere with attempts to introduce index insurance. Examples of competing products and programs include other insurance products offered by private insurers or the government, implicit insurance coverage offered by banks in the form of routine debt forgiveness policies, public programs operating in nearby areas, and free government provided disaster assistance in times of extreme weather events.

Do the potential beneficiaries of index insurance have experience using formal financial services?

Are the potential beneficiaries of index insurance receptive to the idea of insuring or risk sharing using formal financial contracts? Do they have experience with formal financial services, including savings deposits, consumer or business loans, or other types of insurance products? Do cultural norms undermine the use of financial risk-sharing arrangements? The success of the index insurance pilot program is higher if the potential beneficiaries of index insurance have experience with formal financial transactions.

What are the levels of risk tolerance and willingness to pay among potential users?

Under some conditions, focus groups or field surveys may be used to gauge risk tolerance and willingness to pay. Such activity should be conducted only if the potential users have some prior knowledge of insurance products. In many cases, no such knowledge exists and the best way to determine demand is with a pilot project that actually offers index insurance in the marketplace.

The development literature is full of examples of how the poor suffer more than others due to catastrophic risk. While it is common to hear that the poor will not pay for risk transfer, it should not be forgotten that the poor are likely already "paying" for these risks in one fashion or another. When asset-poor households make decisions to employ low-risk, low-return production practices, they are effectively paying what an economist may characterize as "an insurance premium," or in effect they are self-insuring. When the poor must go to costly and inefficient sources for loans after a crop failure or a natural disaster, they are also, in effect, paying a premium for their risk exposure.

One important economic consideration that is likely to affect demand is high inflation. Policyholders purchasing insurance before an agricultural season begins will see the value of their insurance contract reduced over the growing season. Such inflation problems are likely to have a negative effect on demand.

2.3.6 International Experiences with Index Insurance[9]

While the potential of index insurance has been investigated for over a decade, its first applications in lower and middle income countries were in Mexico (2002) and India (2003). Since that time, roughly 30 index insurance pilot projects have been or are being implemented in lower/middle income countries. These projects have attempted to provide insurance against natural disasters to increase access to credit for households or to fund government and donor safety net programs. Most of these programs remain in the pilot stage and some have been discontinued; however, others have expanded quickly (e.g., India) resulting in growing markets with competing firms and increased product offerings or improved government safety net programs (e.g., Mexico). We present profiles of programs in India and Malawi to illustrate experiences with index insurance.

India.[10] India has the largest agricultural insurance market in the world. Its government-owned insurance provider, Agricultural Insurance Company of India (AICI), alone reported 18 million insurance policies in 2005. This is partly due to the mandate that all crop loans provided by the Indian bank must be insured by AICI. However, the traditional AICI policies have presented several problems to farm households including long delays for indemnity payments (up to 2–3 years), payments based on the crop's minimum market price at the time of the loss, and payments delivered based upon government declaration of drought or floods, which has been largely influenced by political pressures.

In 2003, BASIX (a microfinance institution), ICICI Lombard (a large insurer), and the World Bank partnered to introduce rainfall index insurance to increase lending opportunities in rural sectors because BASIX had experienced a high default rate on agricultural loans due to drought. Some 230 groundnut

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[9] For more information and evaluation of international experiences with index insurance, see Skees (2008), Skees and Collier (2008), and Skees et al. (2007).

[10] Sources: Belete et al. (2007), Hartell et al. (2006), and Collier, Murphy, and Skees (2008a); for more on the India case, see Giné, Townsend, Vickery (2007), Manuamorn (2007), Ibarra and Syroka (2006), Hess (2003), and Skees and Hess (2003).

farmers participated in the initial pilot project, which insured for drought, and reported positive satisfaction overall. In contrast to AICI traditional policies, these index insurance policies were more objective and timely as indemnities were based on rainfall and paid within one month at the crop's going market rate. BASIX conducted product evaluation based on client feedback, and in 2004, they provided policies that were further tailored to meet farmer's needs. BASIX also improved accessibility by reducing costs of delivery through simplifying the underwriting process and training loan agents to sell index insurance. Since the pilot, BASIX has continued to increase its use of index policies and has offered them in more regions across India. BASIX also bought index insurance policies from ICICI Lombard to protect its loan portfolios.

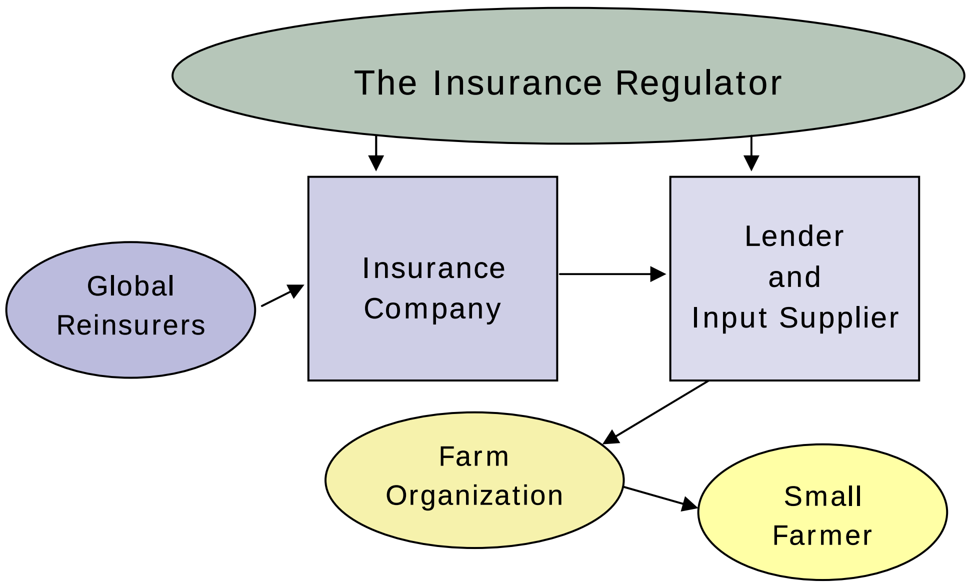
Due to the success of BASIX, other insurers are now providing index insurance in India. For instance, AICI began offering index insurance in 2004, and in 2005, it sold 120,000 of the 250,000 index insurance policies sold in India that year. In 2008, AICI sold over 1 million policies. Many of these policies were mandatory as they were tied into loans obtained from the State agricultural bank. Weather station infrastructure has limited the expansion of rainfall insurance in India and as a result public and private stakeholders are investing in new weather stations. India has over 100 million farm families. Given the apparent popularity of index insurance, the market is expected to continue to expand. Nevertheless, weather index insurance has been available only since 2003 and there are still many important adjustments ahead before this new market matures.

Malawi.[11] Drought is the most frequent weather disaster in Malawi. In terms of the number of individuals affected, all six of the most severe natural disasters in Malawi were droughts (UN/ISDR, 2008). Largely due to drought risk, crops tend to have low yields associated with low access to credit, poorly functioning input markets, and low uptake of technology (Hess and Syroka, 2005).

Groundnut farmers in Malawi were unable to obtain the credit needed to purchase certified groundnut seed because of the high default risk in the event of a drought (Alderman and Haque, 2007). A drought in 2004–2005 led to high default rates ranging from 30 to 50 percent for agricultural loans. Malawi has neither land tenure nor a national identification system, reducing opportunities for contract enforcement for the bank. Many lenders refused to offer credit for agriculture after the 2004–2005 drought (Mapfumo, 2007). A pilot was launched in the 2005–2006 growing season linking the Insurance Association of Malawi; the smallholder farmers union, National Smallholder Farmers' Association of Malawi (NASFAM); and two lenders (Alderman and Haque, 2007). (Figure 2.2 illustrates the relationships of key stakeholders for this program.) The two lenders provided loans to smallholders who agreed to purchase index insurance. The loan covered the costs of seed and insurance premiums (Opportunity International, 2005). These products were presented as a bundled packet, which results in lower delivery costs than using an insurance sales agent.

[11] Adapted from Skees and Collier (2008); for more on the Malawi case, see Jaffee et al. (2008), Alderman and Haque (2007), Mapfumo (2007), Hess and Syroka (2005), and Syroka (2005).

Figure 2.2 Key Stakeholders for Malawi-Type Weather Insurance



Source: Authors

Farmers purchasing the index insurance agree to sell their yields to NASFAM. NASFAM acts as a delivery channel for the loan and insurance payouts and deducts the price of the loan from its payments to farmers for their yields. Insurance policies only cover the cost of seed for which farmers borrow from the bank, paying premiums at 6–7 percent of loan values. In the event of a payout, NASFAM deducts the amount from the farmer's loan and passes the payout on to the bank. NASFAM deducts the leftover loan liability from farmers' yield proceeds. In the event of a total payout, indemnities equal the value of the loan, and NASFAM does not deduct any amount from yield proceeds for loan payments (Opportunity International, 2005).

The product has been piloted in four areas, and to keep basis risk at an acceptable level, households must be within 20 km of a weather station to participate (Syroka, 2005). For the 2005–2006 growing season, 892 farmers purchased weather insurance for a total sum insured of USD 35,000. In the 2006–2007 growing season, farmer uptake increased to 1,710 groundnut farmers and a rainfall index-based insurance contract was also purchased by some 826 farmers for maize production. Client uptake of the rainfall index insurance product may have been inhibited by the good 2006 groundnut crop. No claims were paid and there was no demonstration effect. However, farmers report yields for using hybrid seed rose by 140 percent (Mapfumo, 2007).

During the 2006–2007 season, the lenders learned that some farmers purchasing the weather insurance were side-selling their crops to avoid repaying the loan. Thus, while weather index insurance was creating access to the higher-yield seed and protecting the lender from drought risk, coordination in the groundnut value chain was insufficient to support this product. Value chains for other commodities including tobacco and paprika are more strongly integrated, which should reduce the amount of side-selling. Tobacco in Malawi is sold through an auction, and farmers create forward contracts with tobacco processors to sell their tobacco crop. In 2007–2008, the weather index insurance product was tailored to protect tobacco against drought. Instead of selling insurance to individual farmers, the index insurance products were designed to protect a portfolio of loans between a lender and a tobacco processing company. The insurance products were associated with individual farmers so that if payouts occurred for a particular weather station, the tobacco company would repay the loans of the appropriate farmers.

Tobacco has the added benefit of being grown by more farmers in Malawi than groundnut, and expansion of this insurance pilot was planned for the 2008–2009 season (Jaffee et al., 2008).

In sum, Malawi is an innovative and interesting case that demonstrates potentially valuable linkages into the value chain. Given the well-established value chains in Vietnam, lessons from the Malawi experience may help those developing new agricultural insurance products in Vietnam. Nonetheless, Malawi has an infant program that represents experience in a single country, and questions regarding its international scalability and sustainability remain. PepsiCo is following a similar model for potato farmers in India. The potatoes are used for potato chips sold in India. In this case, the lead was from a major multinational firm (PepsiCo) that clearly understands that they have developed human capital with smallholder farmers growing specialized potatoes for their market. By helping the farmers manage adverse weather risk, they also reduce their own risk of losing their human capital investments due to the farmer going out of business and increase farmer loyalty.

2.3.7 Index-based Social Solutions for Market Failures[12]

As described above, index insurance will not be an effective solution for all types of catastrophic risk. If the nature of the risk is complex or the event occurs too frequently some type of public-sector role in risk mitigation and management may be justified. Flood, typhoon, and sea surge are risks that are very difficult to insure because of their complexity. Frequent catastrophes may require public support for mitigation measures such as support for diversification to less vulnerable activities, construction of infrastructure to prevent losses, and in some cases relocation to less vulnerable areas.

In other situations, if there is a catastrophic risk that occurs very infrequently the demand for insurance against the risk may be very low, even if the risk event results in major losses. The low probability of loss often leads people to fail to plan for catastrophic risk, a phenomenon known as cognitive failure. Social programs for disaster relief benefit the public good if they can support livelihoods and economic well-being during a catastrophic event. Structuring disaster relief similar to insurance, i.e., with *ex ante* plans in place about when and how funds will be allocated, can be much more efficient and effective than disaster relief that is determined after the event has occurred.

The government may also have an interest in providing catastrophic insurance for those living in extreme poverty who may be unable to afford insurance premiums. Such safety net programs help the poorest households from falling deeper into poverty but these should be carefully structured to avoid problems with moral hazard. Providing coverage for only infrequent, catastrophic risks minimizes the risk of moral hazard. Providing insurance as a social program should only be considered for situations where insurance is not feasible and should complement, rather than crowd out market-based risk management mechanisms.

Below are several examples of where index insurance has been used to provide financing to supplement disaster relief programs and/or provide a social safety net to low income populations.

[12] For more on index-based social solutions, see Ghesquiere and Mahul (2007) and Skees, Barnett, and Hartell (2005).

Mexico.[13] Mexico has a history of many natural disasters such as hurricanes, earthquakes, floods, and drought that have severely affected the Mexican economy. Drought in particular has harmed the agricultural sector in Mexico. As a result, the Mexican government developed a natural disaster fund, FONDEN, (Fondo de Desastres Naturales), to provide relief for low income victims and to rebuild uninsured infrastructure in the event of catastrophic losses. FAPRACC (Fondo para Atender a la Población Rural Afectada por Contingencias Climatológicas) is a subsidiary of FONDEN and was developed to provide immediate relief in the event of natural disasters to subsistence farmers who do not have access to formal insurance markets. FAPRACC offers contingent payments in the case of catastrophic losses due to several extreme weather events including severe drought, frost, hail, windstorm, excessive rainfall, and flood. Catastrophic losses are determined at the state level. Payments for FAPRACC are divided such that the state declaring the disaster is responsible for 30 percent and the federal government is responsible for 70 percent. Mexican state and federal budgets absorbed these costs and were put under considerable constraints because of them. Therefore, the Mexican government began pursuing innovative insurance paradigms to improve the sustainability of these disaster relief programs.

In 2002, Agroasemex, a government-owned reinsurance company, began a pilot study selling weather index insurance at the state level to finance the state's liabilities for FAPRACC. Conducted in the Mexican state Guanajuato, this pilot insured maize against drought based on rainfall statistics from local weather stations. Agroasemex bore 50 percent of the risk and passed the remainder of its liabilities to international reinsurers. The pilot offered contracts based on local weather station measurements. Drought was predetermined on the basis of the rainfall index instead of by government declaration, which had been subject to political pressure. Local technical commissions provided quality control by checking weather stations' reports of drought conditions against the impact on local farms. Due to satisfaction at both the federal and state levels with the pilot study, Agroasemex extended the program to another state, Puebla, in 2004, and to 18 states in 2005. The index policies continued to insure for drought but expanded the types of crops insured to include maize, sorghum, barley, and beans. Diversifying against drought across 18 states for several crop varieties has allowed Agroasemex to further insulate its portfolio from risk.

In 2006, the Mexican government also purchased an index-based catastrophe bond from SwissRe for earthquake risk. The index is based on Richter scale readings and provides quick access to financing to supplement FONDEN resources for disaster relief in the event of a major earthquake.

The pilot study and its extensions are part of a larger scheme intended to increase farmer access to insurance. Further penetration of formal insurance markets is needed in Mexico, and disaster relief is but one component of a larger paradigm for mitigating risks among rural farm households. However, at the state level, weather index insurance has thus far been a success for the Mexican government as it has improved the sustainability of one of their natural disaster funds by transferring risk from state budgets to national and international reinsurers.

Ethiopia.[14] In 2006, the World Food Programme purchased rainfall index insurance from AxaRe (now PartnerRe) on behalf of the Ethiopian government to finance famine relief efforts. By partially financing these activities with index insurance they could drastically reduce their response time to emerging

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[13] Source: Ibarra (2007) and Skees et al. (2006). Additional documents on this and other disaster relief programs in Mexico (in Spanish) can be found at the website of Agroasemex, http://www.agroasemex.gob.mx/

[14] For more information on the example from Ethiopia, please see Skees and Collier (2008), Alderman and Haque (2007), Syroka and Wilcox (2006), and WFP (2006).

disasters. The payouts from the index insurance supplemented the traditional sources of financing and food relief. The program was designed to provide financing for social program and coordinate with plans to develop more commercial index insurance markets at the local level for less severe drought events.

2.4 Market Development Model for Developing an Index Insurance Market

In this section, a methodology is suggested for index insurance market development that builds from the conceptual foundation described in the first section of the chapter. First, we suggest more general strategies that are likely to increase the likelihood of success, particularly in terms of scalability and sustainability, in developing an index insurance market. Then, we provide a market development business model that is designed to develop index insurance markets while contributing to broader financial service and risk management development. Finally, we discuss some aspects of the market development business model that merit greater detail. The intended audience for these guidelines is a publicly supported project entity involved in market development and interested in economic development that can be driven by agricultural insurance markets. Whereas we discuss a potential government role for national-level risk management policy above, in this section, we discuss an entity working to develop a market once the core aspects of a national risk management policy is determined. During the project, it will be important to work with a variety of public and private stakeholders including insurance regulators, weather data agencies, insurers, reinsurers, banks, and households. For specific aspects of the program such as legal and regulatory, risk financing, and product design considerations, developers may benefit from gaining the expertise of international specialists.

2.4.1 Priorities for Insurance Market Development

Developing new insurance markets is difficult. Not only do market developers need to design a product that meets consumer demand, but they must also work to establish conditions that are likely to create a sustainable and scalable market. Additionally, policy makers often have important economic development goals in mind (e.g., financial service development) that they hope the project will address. Thus, we offer several general strategies to guide market development.

2.4.1.1 Use the Risk Assessment to Identify and Address the Big Risk First

Our approach to developing and strengthening financial markets focuses on identifying and creating insurance products that address the "big risk" first — by transferring the catastrophic risk out of the local community and to the global market. Removing the exposure to catastrophic risk that impedes rural economic growth and financial markets is the first step to developing broader, sustainable financial markets.

Because of the flexibility of index insurance, insurance can be designed for a variety of applications. Feasibility assessments may actually indicate that improving weather risk management for specific types of firms important to the rural economy may be an important step to addressing major risks. For example, if banks can insure their loan portfolio against the weather risk of concern, more households may be able to access loans for production and/or consumption. In turn, the process of creating index insurance products for lenders can increase the sophistication of regulators, insurers, lenders, etc., creating an enabling environment for the development of broader financial services for the poor over time.

2.4.1.2 Build the Capacity of Stakeholders

Both the sustainability and the scalability of our approach are enhanced by a commitment to building local capacity during the market development process so that in the long term, local stakeholders will have the knowledge and skills to support and maintain the new insurance program, and these stakeholders become (and attract) the local champions who can carry the project forward. To understand the risk and create suitable financial mechanisms to manage the risk requires detailed training in risk assessment, product design, and program implementation. As a result of this tailoring process, local stakeholders likely need broader capacity building for index insurance programs than is typical of other financial services for the poor (e.g., microfinance).

Numerous stakeholders must be educated about the value of using index insurance, which is time consuming and requires both sharing new ideas and shaping those ideas based upon feedback from the stakeholders. While some basic principles are transferable, again, it is critical that ideas be tailored to local conditions. The level of capacity of key stakeholders before the project begins will affect how quickly market development activities can progress and how project investments are allocated. For example, insurance and financial markets in India are more advanced than those in many developing economies. In the pilot project for India, therefore, while outside professionals were involved, much of the pilot design and implementation was conducted by market-based firms in India (e.g., ICICI Lombard and BASIX). It was also possible to implement a weather insurance pilot very quickly (in roughly six months' time from the initial discussions). By contrast, insurance markets in Mongolia are not nearly as advanced as those in India and local insurance companies had little access to international capital. Thus, the Mongolian project took a few years to develop, was supported by a variety of donors, and the pilot design required significant involvement from outside professionals. Additionally, the project was also designed with the government and the World Bank organizing the financing to pay for the most extreme risks. Still, the project is designed to transition to the global market over time. The Mongolian project is being implemented by a unit that is tied to the MoF with participation from four insurance companies in Mongolia. India and Mongolia likely represent the two extremes of how much time and outside expertise is needed to design a pilot project with India requiring far less time to develop than Mongolia.

2.4.1.3 SYNTHESIZE LEARNING

Integrating experience with index insurance market development into a larger framework for agricultural risk management helps clarify how risk management mechanisms can complement each other potentially resulting in more suitable and cost-effective strategies for managing natural disasters in Vietnam. This information provides knowledge about how these products may be replicated or adapted for new markets.

2.4.2 Market Development Model

We assume policymakers have some initial indicators that a catastrophic weather event is creating significant and problematic losses in a specific region. Beyond this, much of the feasibility assessment needed to reach appropriate risk management solutions are included in the model. Again, feasibility assessment is a targeted form of risk assessment that evaluates the risk and the suitability of a specific risk management strategy, index insurance in this case, to address the risk. If previous risk assessment research exists, its findings can enhance and expedite the Market Development Model.

Our approach progresses through three general phases. The first two phases are a combination of feasibility assessments and capacity building while the third phase is implementation. The end of each phase provides an opportunity to monitor progress, evaluate the risks, and adjust activities in the next phase accordingly. It is possible that indicators may suggest that it is not feasible to continue market development or that market development should be suspended for a time.

Below, we give a general outline of these three phases that highlights the activities for each phase of the model. Because building human and institutional capacity is at the core of this model, many "public goods" benefits occur throughout these market development activities, described in this overview under "outcomes."

Rapid Feasibility Assessment and Basic Education on Weather Risk Management. Market development begins by determining if the specific weather risk is a good candidate for index insurance given the regional context and establishes basic education for stakeholders regarding weather risk management. A field-based rapid feasibility assessment considers the following criteria to determine the potential need for weather risk transfer and to assess if an index insurance structure could be developed:

- Presence of significant correlated weather risk;
- Local capacity exists/can be developed;
- Existence of enabling legal, regulatory, and political environment;
- Sufficient data exist to support the product; and
- Preliminary risk modeling indicates feasibility.

Identifying the weather events that concerns the community the most, and why, may reveal new information to help focus thinking for the next set of questions about the preconditions for implementing weather index insurance.

Outcomes for Rapid Feasibility Assessment and Basic Education. Beyond the importance of evaluating the regional context for creating a weather index insurance market, the reports and education conducted in this phase help local stakeholders identify weather risk impacts and how effectively addressing these risks might strengthen the rural economy. Reports from the rapid feasibility assessment can also inform decisions regarding private and public investments.

Feasibility and Market Development. During this phase, market development includes more rigorous efforts to prepare local stakeholders and institutions for a weather index insurance market. These activities build on the preliminary risk profile created in the rapid feasibility assessment and basic education phase. Early efforts in this phase focus on managing weather risk more generally while later efforts in this phase emphasize specific training on weather index insurance. The following activities fall under this market development process:

> *Market Research.* Market research evaluates the demand for, and supply of risk management mechanisms for weather risks to determine if there is a potential market for index insurance products. This activity also evaluates the weather data and logistics of delivering a product to determine if it can be supplied at a price affordable to the target market;
>
> *Legal and Regulatory Review and Advising.* A full legal and regulatory review is undertaken. Additionally, assisting regulators as they determine how weather index insurance might best fit into the current legal and regulatory framework is critically important. Legal and regulatory work continues through all phases;
>
> *Stakeholder Workshops and Education.* Stakeholder workshops bring together a variety of potential decision makers (e.g., insurers, regulators, delivery agents, agricultural risk aggregators, reinsurers, etc.) to discuss the risk profile, provide education on appropriate weather risk management, and determine how to proceed with product development. This phase also includes some individualized stakeholder training; and
>
> *Prototype Product Designs.* Activities required to develop a prototype product include conducting focus groups, quantitative surveys, and risk modeling, and identifying appropriate data sources. The preliminary prototype design creates a rough sketch of the intended product and is presented to the regulator and other stakeholders for feedback. If the project moves to the third phase, implementation, product design continues in collaboration with the local insurance partner.

Outcomes for Feasibility and Market Development. Because this phase is designed to prepare local stakeholders for a weather index insurance market, much institutional capacity building is required. This work can benefit weather risk management and financial services more broadly (e.g., the legal and regulatory review and recommendations can improve local insurer standards and increase access to reinsurance for many lines of insurance). Additionally, work conducted in this phase can benefit the development of weather index insurance more broadly (e.g., the design of index insurance products based on alternative data sources).

Implementation. In this phase, stakeholders participate in implementing an index insurance program through product development and testing, pilot testing, and review and refinement. The components of the implementation phase are the following:

> *Partnership Development.* Local partners work together to manage the insurance program. Specific training regarding weather index insurance is often needed;
>
> *Product Development and Testing.* Local partners develop a product and establish low-cost delivery mechanisms. Some legal and regulatory work such as drafting a policy document occurs in this phase;
>
> *Pilot Testing.* The insurance product is pilot-tested on a limited scale to determine its viability. The pilot test evaluates the performance of many aspects of implementation to identify what modifications are needed to improve the product. Pilot testing can occur for several seasons; and
>
> *Review and Refinement.* Implementation should include well-structured monitoring of implementation indicators, opportunities for stakeholder feedback at incremental stages, and other feedback loops to continually improve the project and products. If at the conclusion of the pilot testing, the project has demonstrated useful outcomes and continues to hold promise, it should be expanded from pilot status to a larger scale and/or, given stakeholder feedback, new products should be introduced. At this point, the responsibility for scaling up would be primarily that of the local insurance partner or other insurers that want to enter the market.

Outcomes for Implementation. Introducing weather index insurance markets can have many positive outcomes for households and other rural stakeholders. Local active partners are trained for this task and often develop new skills in this process (e.g., pricing index insurance and properly financing correlated risk). The target market (e.g., poor households) receives education regarding effective weather risk management. For insurers and other active partners, implementing a weather index insurance program is a crucial learning experience as these partners are much more motivated to learn when they have a business risk. Often, stakeholders may only be willing to take the necessary business risks with the support of trusted and knowledgeable advisors.

2.4.3 *Clarifying Specific Aspects of the Market Development Model*

In this section, we clarify some important lessons from the suggested Market Development Model. We outline these areas in particular because they are some of the more complicated aspects of index insurance market development. Developers may benefit from utilizing international experts on these areas.

2.4.3.1 LEGAL AND REGULATORY ISSUES

Beyond the feasibility assessment issues, careful consideration should be given to the legal and regulatory standards as these can shape product development and affect the success of the insurance program during implementation. Working with regulators can improve the product development process for insurers.

Regulatory Responsibilities. Regulators govern the insurance industry. First, regulators establish which products can be sold as insurance. If index insurance does not fit into the legal framework for insurance, there is a risk that the product will fall outside the regulatory net and that consumers and insurers will not be protected adequately.

Second, regulators establish reserving requirements so that insurers have adequate capital to honor their indemnity liabilities. Thus, it is critical that regulators who are accustomed to dealing with insurance for independent risks understand that insuring correlated risk with weather index insurance requires much larger reserving requirements and reinsurance for local insurers.

Third, regulators outline guidelines to protect customers and insurers. For example, insurers must disclose the limitations of index insurance. Also, customer insurance fraud must be controlled with laws that impose penalties if the fraud is detected, for example, tampering with a weather instrument used to make a index insurance payment.

Fourth, regulators decide who can underwrite and sell products. For example, most countries correctly have laws that preclude banks from underwriting insurance risk. This is quite logical as the bank could easily double their exposure — as an insurer they would have to pay for large losses when a catastrophic weather event occurs, and as a bank they would have large default rates as their customers incur problems that prevent them from paying off loans.

Still, insurers may want to use the established client network of a bank to sell insurance to households because this decreases delivery costs. In this case, banks or bank staff act as sales agents for the insurer, and they must abide by regulatory guidelines regarding customer/agent interaction. If banks decide to link insurance to lending, regulatory oversight from both the banking and insurance regulators is required, which can increase administrative costs.

Regulatory Considerations. There are well-defined international standards applicable to the regulation and supervision of the insurance business, and although these standards are not specifically written for index insurance, they do provide a precedent for insurance regulators including guidelines for insuring correlated risk. Where countries largely comply with these standards, the regulatory risk should be minimized. The extent to which insurers are required to meet international standards and best practices is also important for insurers as it will affect their ability to attract international risk transfer.

Insurance regulators determine how index insurance fits into a country's insurance law. Two common regulatory qualifications all insurance products are that 1) individuals purchasing the insurance have an "insurable interest," and 2) the insurance acts as a suitable proxy for losses of the insured. Conceptualizing index insurance as a form of business interruption insurance that compensates for consequential losses and extra costs has advanced regulatory discussions regarding index insurance. Regarding the issue of insurable interest, business interruption insurance recognizes that firms may experience significant revenue losses even if they experience no losses in assets. For example, if a drought lowers farm yields in their region; agricultural processors are likely to experience lower revenues. Thus, agricultural processors have an interest in insuring against drought.

Regarding the qualification that insurance acts as a suitable proxy for losses, traditional business interruption insurance engages in a complicated *ex post* lost adjustment process to determine how the insured risk reduced revenues for the insured. Regulators are likely to recognize that an *ex ante* estimation of the losses of the insured based on losses during previous weather events of the same severity may be at least as accurate as *ex post* estimates.

Other legal and regulatory conditions are also important to the long-term sustainability of index insurance markets (e.g., risk financing and marketing standards). Because several ongoing weather index insurance programs exist, some important legal and regulatory precedents are in place and should be helpful for stakeholders interested in developing index insurance markets.

Strategies for Working Effectively with an Insurance Regulator. Developers of new insurance products should obtain expert legal and regulatory advice as soon as possible in the feasibility stage or early in the design process. Given that index insurance is relatively new, the experience of local lawyers will often be limited. Thus, consideration should be given to obtaining the expertise of international legal and regulatory experts who have experience implementing index insurance in other jurisdictions. Failure to engage the regulator early on could be very costly. In the initial meetings with the regulator, the aim should be to:

- Explain what the pilot is seeking to achieve and the benefits of index insurance if the pilot is successful;
- Explain how index insurance fits with internationally accepted regulatory standards and how it fits into the local context;
- Seek the regulator's preliminary views as to the appropriate classification of the product;
- Discover whether the regulator has any particular concerns that could be addressed in the design of the product; and
- Discover whether the regulator is likely to impose regulatory obligations that would seriously affect the operation of the pilot or the feasibility of the product.

When a draft sample of the insurance policy is available, providing it to the insurance regulator for review and feedback is recommended. Gaining official regulatory approval of the index insurance contract before a pilot project begins is highly recommended.

2.4.3.2 RISK FINANCING[15]

Risk financing is another component of index insurance market development that is likely to be challenging. Local insurers do not always have experience with international reinsurers, and index insurance pilot projects are not always large enough to be attractive investments to international reinsurers. Thus, in some cases, governments have intervened to act as the reinsurer until reinsurers gain interest in the market. Depending on the size of the index insurance pilot, this position can create large financial exposures for the government; thus, careful consideration is needed and strict rules about the time frame of government support are needed before entering into such a public-private partnership.

In simple terms, households transfer their big risk to local insurers who transfer their big risk to international reinsurers. Enabling this arrangement requires careful consideration on the part of insurers due to the correlated nature of weather risk. When insurers accept household weather risk they face the possibility of extreme losses that can easily exceed revenues generated by premiums in that year. Therefore, insurers must develop contingency plans for dealing with losses.

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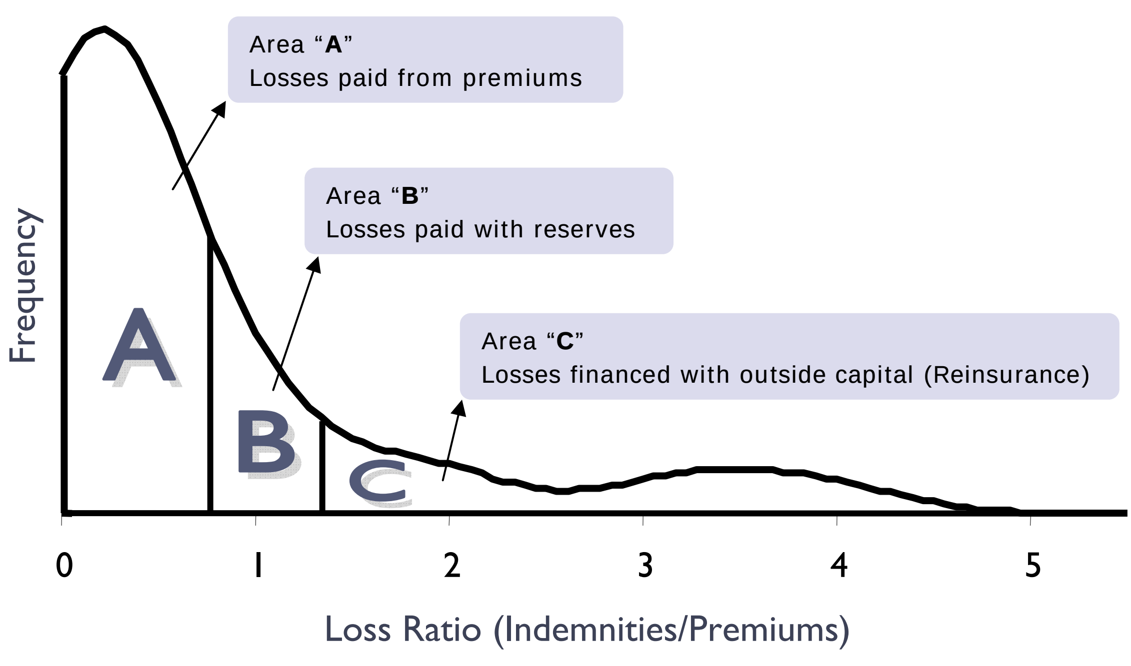
[15] For more on innovative risk financing for index insurance see Skees, Barnett, and Murphy (2008) and Ghesquiere and Mahul (2007). For more on the Mongolia case, see Mahul and Skees (2005).

A common and effective strategy is for the insurer to segment its portfolio and develop appropriate risk management strategies for each segment. Figure 2.3 represents the potential losses of a possible insurer portfolio to illustrate this tactic. The figure estimates costs in terms of a loss ratio, which compares total indemnity payouts to premium revenues. The higher the loss ratio the larger are insurer losses. Suppose an insurer requires 30 percent of premium revenues to cover administrative costs. The remaining 70 percent of premiums can be used for indemnity payouts, if needed. When indemnity payouts are less than 70 percent, insurers should put some of their revenues in a reserve fund for years when payouts are higher. Payouts less than 70 percent of premiums occur most years and are represented by Area A. Area B represents indemnity payouts of 70 to 110 percent of premium revenues. This level of indemnity payouts results in insurer losses for the year. Insurers can pay for liabilities in excess of premium revenues using reserve funds. Area C represents losses over 110 percent of annual premium revenues. Losses above 110 percent of premium result from the widespread effects of low-frequency, high-severity events. Local insurers rely on international risk transfer such as reinsurance to prepare to pay for losses in Area C.

Obtaining reinsurance can be expensive. Even with index insurance, obtaining commercial reinsurance for an emerging insurance market can be difficult. For this reason, the need for this type of risk layering has led to innovative public-private partnerships for managing weather risks for agriculture. Governments may choose to provide some form of catastrophic stop loss for insurers while insurance markets mature in their countries. There are also examples where donors such as the World Bank have provided contingent loans to help governments manage stop loss arrangements, for example, for earthquake risk in Turkey and livestock mortality risk in Mongolia.

Figure 2.3 Example of a Risk Segmentation Approach to an Insurer's Portfolio



Source: Authors

2.4.3.3 Considerations for Designing an Insurance Pilot

A pilot project can be a challenging but very useful endeavor because, with relatively low cost and investment, potential problems and, more importantly, potential applications of the scheme not previously considered can be discovered. The activities and suggested best practices that follow will be required either by private firms that are most engaged in the development or by government agencies.

Identify the Target Market. The feasibility study should provide a clear picture of the potential target market. As discussed previously, there may be a number of potential users of index insurance. While farm households may be the initial target market, it is important to keep the policy dialogue open to other potential users, especially those in the agricultural value chain such as agricultural lenders, commodity processors, agricultural exporters, or other enterprises vulnerable to weather risk. Any group that has an insurable interest and that could benefit from purchasing the index insurance should be considered.

Design and Price Insurance Using Commercial Practices. An overriding principle for pilot design involves the use of commercial practices. Index insurance should be relatively simple and easily understood. The design and the data available will drive the pricing of the insurance products. The risk must be priced based on insurance principles. Improperly priced products can contribute to adverse selection, as discussed earlier. Thus, it is very important that insurance products are priced relative to the risk that is being underwritten, which results in a higher price of insurance in higher risk areas and a lower price in lower risk areas.

Consider Appropriate Delivery Systems. In many cases, rural credit providers such as banks or microfinance institutions may provide the lowest-cost delivery system for products designed for households. Loan officers can sell index insurance by simply adding the cost of the product to the loan. However, such an approach should still be transparent. India has had a government crop insurance program in which the insurance is built into the loan. However, in many cases, the farmer is not informed about any aspect of the insurance. Such an approach does not foster a good market environment and is less likely to encourage the policyholder to engage in more productive farming because of the insurance.

Set Appropriate Dates for Sales Closing. For any index insurance, it would be a major mistake to allow sales to go beyond the time when individuals have information about the weather events that are being insured. For example, in Peru, indicators that an El Niño may happen begin to emerge about nine months before losses start to occur. Thus, the sales closing must come before this type of knowledge is available. When these types of events are predictable, it may be useful to have a multi-year insurance contract that would extend into two to three years of protection for well-defined events. Generally, these events will be occurrences that cover a specific time within the year as well.

Establish a Monitoring and Evaluation (M&E) Protocol. A pilot project should involve an M&E protocol. It is important to set performance criteria and contain expectations and to set clear development objectives. M&E can be used to make necessary adjustments during pilot implementation. If possible, a baseline survey can be highly useful for testing the impact of the pilot. However, index insurance is different from many other financial products. It would be a mistake to use short-term payment history or loss experience as an indicator of success. Since index insurance generally is used for infrequent yet severe risks, it is altogether possible to have very few payments over a short pilot test or, if an extreme event does occur, it is possible to have large losses for the insurance company offering the index insurance. The focus of M&E should be on more fundamental issues such as whether the access to rural credit is improving and whether the terms of credit are improving.

2.4.3.4 POTENTIAL RISKS

Many types of risk affect the viability of an index insurance program. The Market Development Model mitigates risk by providing opportunities at the end of each phase to receive feedback and evaluate the likelihood of success and adapt project goals. The following is a list of the most common risks affecting index insurance.

Legal and Regulatory Risk. The possibility that country laws or regulations, or the attitude or decisions of the regulator will preclude the desired index insurance products or linkages, making them more difficult and expensive to implement or reducing their benefits; additionally, there is the possibility that new laws may be created that will be inconsistent with index insurance. Working with the regulators throughout the country activity reduces this risk.

Data Risk. The possibility that insufficient reliable data exist to price the risk or to act as an ongoing index for the insurance product.

Insurability Risk. The possibility that the weather risk may be uninsurable with index insurance. For example, if catastrophic weather events do not result in spatially correlated losses, index insurance is inappropriate. Also, if the weather risk occurs too frequently (e.g., 1 in 4 years), insurance is likely inappropriate.

Financing Risk. The possibility that financing arrangements for extreme losses, such as through reinsurance, cannot be obtained or are prohibitively expensive. Dialoguing with reinsurers throughout the country activity or pursuing alternative financing sources reduces this risk.

Institutional Risk. The possibility that lack of capacity or mismanagement by stakeholders (e.g., insurers, regulators, etc.) can reduce the effectiveness of the weather insurance program. This risk is reduced by extensive market development and stakeholder education activities.

Market Risk. The possibility that stakeholders (e.g., insurers, target users, etc.) may not be ready to commit to index insurance. Understanding index insurance and appreciating its value takes time and is part of the education process. Our experience has been that initially reluctant stakeholders recognize the value of these products as their exposure to them continues. Market research at the beginning of the project, and stakeholder education throughout the course of the project help to identify and mitigate these risks.

Political Risk. The possibility that the political environment can challenge the likely success of an index insurance program. This risk recognizes the potential of government instability, but also that new policies may emerge such as premium subsidies for other types of agricultural insurance that "crowd out" index insurance.

2.5 Conclusion

In this chapter, we discuss general strategies for developing an agricultural risk management policy framework with emphasis on agricultural insurance market development. We emphasize the importance of understanding a risk in terms or its severity, how it affects different regions, and how it affects different stakeholders. Addressing the big risk — correlated, high severity risks — should be a priority for agricultural risk management policy. Weather risks such as drought or flood are particularly threatening to agricultural livelihoods. The remainder of the chapter focuses on developing a framework for addressing catastrophic weather risk.

Conducting a risk assessment is crucial in designing appropriate policies to address risk. The risk assessment evaluates the effects of risk on rural households and firms (e.g., financial institutions, agri-businesses, etc.) and examines how the risk is being internalized in the economy. Risks may have direct costs such as asset losses or disaster relief costs; however, risk assessments may also have indirect costs such as reduced economic growth due to inefficient risk management strategies by households and firms. For example, firms may refuse to expand business to regions where they consider that these risks are too high. Increasing access to more effective and efficient risk management solutions can greatly reduce the cost of a catastrophic weather risk.

Governments can contribute in many ways to improved agricultural risk management; however, policy makers are advised to carefully consider the costs and benefits of government programs. Attention must be given to the possibility that government programs for agricultural risk management often inadvertently create disincentives for proper risk management. For example, premium subsidies have often led farmers to take risks at the government's expense. Chapter 1 described some areas where governments can support insurance market development without creating market distortions. Creating enabling market conditions for insurance markets to form is a particularly attractive government contribution. If these markets form, they are likely to preserve farmer incentives to manage risk and improve household productivity. When governments focus on financing start-up costs, rather than supporting premiums for the life of the program, agricultural insurance programs are likely to be more sustainable.

Developing a vibrant agricultural insurance market is a process. To establish these markets, policy makers may want to focus on building capacity and creating enabling market conditions. The first priority in terms of product design is for products that address the major risks that constrain economic growth and result in significant welfare losses. Index insurance is a particularly attractive type of insurance product to begin this process because it is most suitable for catastrophic risks and maintains much lower costs than traditional agricultural insurance for regions with small farms. After stakeholders gain experience with index insurance markets, opportunities for additional insurance products and significant market segmentation are likely.

Index insurance is typically designed based on measurements of a weather event that is closely correlated with agricultural losses, such as rainfall. Payouts are based solely on the index. The structure provides many cost-saving benefits over traditional forms of agricultural insurance; however, index insurance does have the limitation of basis risk — the possibility that insurance payouts may fail to match the actual losses of individual policyholders. Basis risk can be reduced but not eliminated with proper product design.

Developing an insurance market is a challenging endeavor, and we describe a particular approach for index insurance that is designed to provide risk and feasibility assessment research, engage in capacity building among local stakeholders, and minimize costs. This Market Development Model is segmented into three phases that increase opportunities for feedback in enhance product development. The Market Development Model also has a strong emphasis on pilot testing an insurance product, which has the advantages of allowing stakeholders to learn in action, creates opportunities to refine the product based real-world performance, and reduces expenditures compared to testing an insurance product on a broader scale.

Agricultural insurance market development, beginning with index insurance, is likely to have many positive economic and social benefits. In the short term, we anticipate that the development of scalable and sustainable weather risk transfer markets will have the following results:

- Improved efficiency in managing catastrophic weather risk for agricultural stakeholders;
- New products effectively alleviate weather risk consequences for the rural poor;
- Improved access to risk financing for catastrophic weather risks; and
- Advancing legal and regulatory standards for index insurance facilitates the development of index insurance products in other regions.

In the medium to long term, we expect that the development of catastrophic weather insurance markets will have positive development impacts including:

- Weather insurance for rural lenders encourages lenders to offer more credit, or better terms of credit to smallholder farmers;
- Weather insurance for value chain members increases smallholder access to inputs and international markets;
- Weather insurance for households leads them to improve production strategies, e.g., adoption of technology, increased use of credit, savings, and inputs;
- Improved weather risk management allows households to specialize in higher return livelihoods (e.g., farming cash crops); and
- Catastrophic weather insurance enables rural households to avoid poverty traps.

In the next chapter, Chapter 3, we profile the general approaches of risk assessment and product development presented here using a two specific cases in Vietnam: the Dong Thap flood insurance product and the Dak Lak drought insurance product. These actual examples will provide helpful insights to readers considering how to apply suggestions in the Chapters 1 and 2.

Chapter 3 Applications of Risk Assessment and Product Development in Vietnam[16]

3.1 Introduction

Chapter 3 discusses two applications of risk assessment and product development in Vietnam that are developed using the GlobalAgRisk Market Development Model (Figure 3.1).[17] The topics presented in Chapters 1 and 2 — basic economics of agricultural insurance, the performance of agricultural insurance internationally, the role of institutions in agricultural insurance market development, the purpose of risk assessment as a guide to policy priorities, and a Market Development Model for agricultural insurance — provide the rationale and conceptual approach behind the two applications. These applications are being developed as pilot programs that can serve to demonstrate the development process for agricultural insurance markets. The aim, which includes development of stakeholder human capital and regulatory advising, is to create mechanisms for transferring a portion of catastrophic production risk out of the agricultural sector and out of the country and thereby advance rural financial markets. Developing and piloting index-based weather insurance for correlated natural disaster risk is the starting point for this effort.

Vietnam demonstrates the best case to date where GlobalAgRisk has applied its Market Development Model presented in Figure 3.1. The assignment was clear in that there were no public dollars from the Vietnam government for supporting any new agricultural insurance products — thus, conducted as a true market test. The experience included clear stages of prefeasibility, market research, stakeholder workshops and education, insurance prototype design, and partnership development. To provide a further perspective of what we mean by stakeholders, our workshops included a wide range of participants, including; 1) insurance companies; 2) banks; 3) government officials; 4) NGOs; 5) donors; and 6) academics. The rich discussions and relationships that emerged from these workshops have proven invaluable and have resulted in many positive externalities. For example, bringing donors together to interact about natural disasters in Vietnam where risk assessment and insurance as used as the point of reference helped with ongoing activities from United Nations Development Programme and the Ministry of Finance.

Vietnam has no insurance for the multiple natural disasters (e.g., flood, typhoon, inundation, erosion, sea-water intrusion) that plague this growing economy. The total Vietnam insurance market is only 2 percent

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[16] Index-based agricultural insurance market development in Vietnam is an activity being led by GlobalAgRisk, Inc., with initial support for the technical assistance activity from The Asian Development Bank via a subcontract with World Perspectives International, Washington, DC. The Ford Foundation in Vietnam currently supports an extension of that initial effort. The Department of Insurance (DoI), Ministry of Finance, and government of Vietnam (GoV) initially requested investigation of index-based solutions to agricultural insurance and have provided an important and active role throughout the process, not only as the insurance regulator but also as a facilitator of project efforts. The World Bank Agriculture and Rural Development Commodity Risk Management Group (ARD/CRMG) contributed to the effort with several joint missions to Vietnam during important risk assessment phases and by contributing to the feasibility study and commissioning a remote sensing-based analysis as a method to validate flood modeling.

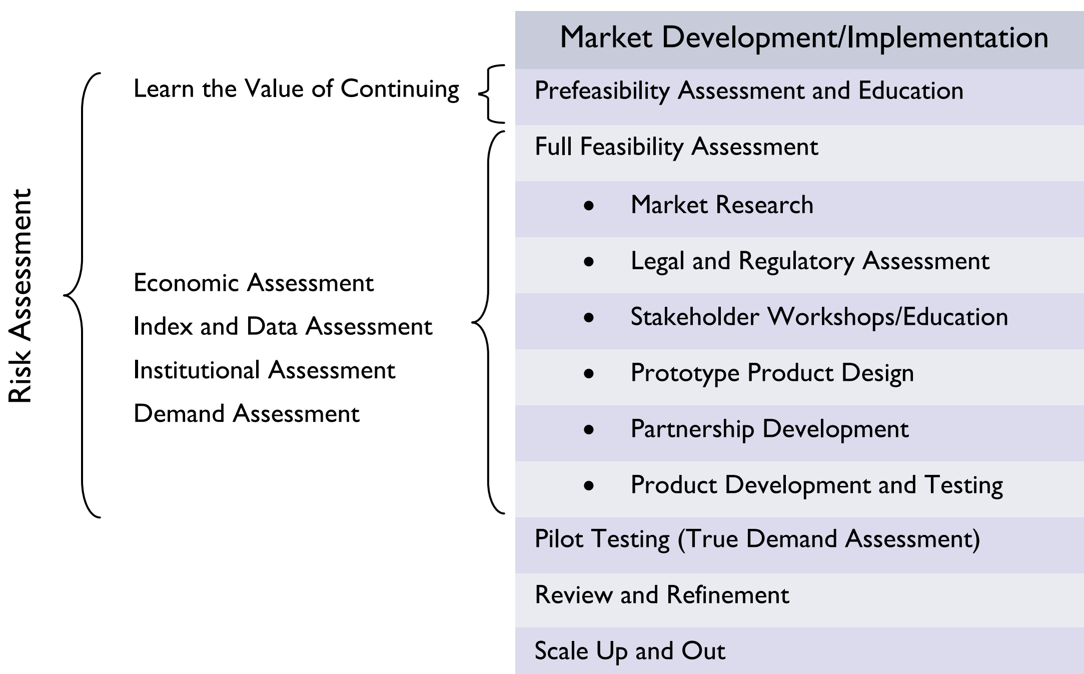
[17] See GlobalAgRisk (2008a, 2007).

of GDP, yet it is growing at a fast pace, having 16 percent growth from 2006 to 2007. Agriculture is 20 percent of GDP with nearly 80 percent of the population tied to farming in Vietnam. Agricultural insurance is also essentially absent in the Vietnam economy.

The first application is an index-based consequential loss/business interruption insurance product against early onset flood events occurring in Dong Thap Province of the Mekong Delta. This product was designed specifically to address the risk exposure of the VBARD, the dominant agricultural lender to rice producers. The product also has application to other participants in the rice value chain, such as processors and exporters. This flood insurance product is a fully priced commercial product and has been developed with the GlobalAgRisk Market Development Model.

The second application is an index-based livelihoods interruption insurance product against specific drought events in the coffee producing region of Dak Lak Province in the Central Highlands. The drought insurance is being targeted initially to small individual coffee producers usually with less than five hectares of coffee plantings. As with the Dong Thap flood product, this type of insurance can potentially be of value to other participants in the coffee value chain. At the time of this writing, the product is in the full feasibility stage of development and its inclusion in this chapter serves as an example of the beginning stages of a project, when the risk assessment and product development framework is used in the challenging context of economically serving the risk transfer needs of many small agricultural producers.

Figure 3.1 GlobalAgRisk Market Development Model



Source: GlobalAgRisk, Inc.

3.1.1 Review of Why Weather Risk Transfer is Important

Complete financial markets involve savings, lending, and insurance — tools for managing risk in a dynamic fashion. Savings and lending services are found to improve when insurance markets perform well (Skees and Hartell, 2006). Insurance options for agricultural activities are often absent in many developing economies because a large number of small-sized farms makes insurance delivery expensive, and lenders are reluctant to lend to farmers because of the risk of widespread default due to correlated natural disaster risk. The results are limited or no access to credit for producers, higher interest rates, or both. In short, banks are not good vehicles for transferring natural disaster risk.

In Vietnam, the situation is somewhat different as the main agricultural lending bank is largely a state bank which is recapitalized by the government in the event of default. VBARD also mandates certain lending practices that require lending at low interest rates in areas where natural disaster risk is common. Thus, the portfolio of VBARD is strongly exposed to the vast array of natural disasters in Vietnam. Given these practices, in one sense, VBARD is acting as an agricultural insurer. To the extend that VBARD allows lenders to restructure loans without penalty when they suffer losses due to natural disasters, VBARD practices can also crowd out interest in agricultural insurance. Nonetheless, the ongoing adoption of more disciplined banking practices in Vietnam will, in the next stages of market transition, alter the risk landscape faced by Vietnamese lenders.

Farmers use a variety of strategies to manage risk: risk mitigation, risk transfer, and management of retained risk. Common risk mitigation strategies include irrigation, integrated pest management systems, the adoption of risk-reducing technologies such as pesticides or improved seed varieties, and diversification across commodities, regions, and/or off-farm enterprises. Some of the most effective risk management strategies, however, depend on availability of affordable working credit, which may not be forthcoming if the agricultural system is encumbered with significant natural disaster risk. This demonstrates how agricultural households end up using low-risk, low-return production strategies. At the same time, these producers remain exposed to natural disaster risk making them vulnerable to poverty traps (Barnett, Barrett, and Skees, 2008; Carter and Barrett, 2006; Dercon, 2005).

Even when producers effectively utilize available risk mitigation and/or risk transfer mechanisms, they still retain some degree of residual risk in the form of very rare but highly catastrophic events as well as frequent but low-cost idiosyncratic events. Retained risk management typically involves well-functioning rural financial markets with both savings and lines of credit that can smooth intertemporal consumption across low- and high-income periods.

The role of index insurance is to manage the correlated risk of widespread production losses by transferring that risk to those willing and better able to assume those risks, such as the international reinsurance market. This role is enhanced when blended with banking and credit services (Skees, 2003; Skees and Barnett, 2006). For example, the local banking sector should be able to work with individual producers to help them manage idiosyncratic and basis risk via enhanced savings and credit arrangements, thereby enabling them to smooth consumption over bad times.

In Vietnam, nearly 8 million rural households use formal credit. Formal savings, however, is much less used. If progress could be made in developing new risk transfer products for natural disaster, lending and savings in rural finance could be further extended and strengthened (Hazell, Pomareda, and Valdes, 1986).

3.2 CASE 1: Dong Thap Early Onset Flood Index

Initial discussions with the Vietnam Department of Insurance (DoI) and other stakeholders in the insurance and agricultural sectors suggested that the focus of initial development efforts be targeted on rice. Rice is one of Vietnam's most important food security and export crops. Advice from stakeholders also emphasized that flooding was among the most critical risks that negatively affect Vietnam farmers. Through stakeholder discussions, two provinces located in Vietnam's largest river basins were identified as being important and potentially good candidates for investigation, Thai Binh Province in the Red River Delta region and Dong Thap Province in the Mekong Delta region (Figure 3.2). Thai Binh is located about 110 km southeast of Hanoi and has approximately 53 km of coastline on the South China Sea. Dong Thap is about 171 km west of Ho Chi Minh City, shares 52 km border with Cambodia and is about twice the area of Thai Binh. The economies of both provinces are dominated by agriculture, with rice being the most important crop, both experience destructive flood events that significantly disrupt rice production and livelihoods, and in both provinces VBARD serves as the dominant rural lender.

3.2.1 Prefeasibility: Identification of a Potential Pilot Area

During the prefeasibility stages, members of the project traveled to Thai Binh and Dong Thap provinces to meet with local stakeholders and to perform a rapid risk assessment. While the two provinces were identified on the basis of a broad understanding of the types of risks faced by agricultural producers, the local assessment sought to narrow the focus and answer a number of specific questions that bear directly on the design of indexed insurance instruments. As the project entered the feasibility stage, these questions were also pursued in participatory and focus group surveys of rural farm households in selected districts and communes of each province. The following general questions were considered:

- What are the biggest risks faced by farmers?
- What is considered to be the single most important risk faced by agricultural producers?
- What is the magnitude of loss for each risk, the duration of the disruption?
- When do these hazards occur? How frequently do they occur (subjectively)?
- What coping mechanisms are used when this hazard occurs?
- What mitigating mechanisms do producers employ against this hazard?
- What affect does this risk have on household assets, and terms and use of credit?
- What state/provincial/district/commune level responses are there to these risks?

Figure 3.2 Thai Binh (North) and Dong Thap (South) Provinces, Vietnam

Source: Authors

The initial prefeasibility assessment confirmed that flood events are the major peril affecting the harvests of many rice producers in both river basins, with characteristics of slow onset flooding in Dong Thap and rapid onset in Thai Binh where there is little lead-time as heavy rains can create problems quickly. There is generally some lead-time between when excess rainfall occurs in the upper Mekong River Basin and when flooding occurs in Dong Thap. Flooding in both provinces is a normal and annual occurrence. Of course, these flooding stages cannot be insured. Insurance should be organized for events that occur about 1 in 7 years. The most problematic flood events for rice producers are those which are unexpected or which occur earlier than anticipated. These less frequent, early occurring, destructive flood events may be insurable using carefully developed index-based insurance.

The initial assessments based on hydrological flood modeling of Southern Institute for Water Resources Planning (SIWRP), located in Ho Chi Minh City, suggested that the timing of a major build-up of water in the Mekong River is the most likely insurable risk for the Dong Thap Province. In this case, water levels in the Mekong River, as it crosses the border into Vietnam at the Tan Chau Gauging Station, could serve as a key indicator of early onset flooding. One important characteristic is that the flood regime is influenced predominantly by upstream water flow which makes creating an index more straightforward than when flooding is a result of a multitude of factors. In addition, previous delta-wide flood modeling by SIWRP, using as much as 30 years of data, indicated that the water level at the Tan Chau Gauging Station is a good proxy for downstream and overland flooding in the province. By contrast, the flood regime in Thai Binh is more complicated where preliminary indications is that excess rainfall is the major source of risk.

Consequently, an insurance product against unanticipated flooding would need to be indexed to rainfall measures at key weather stations. Modeling this flood regime, and creating and pricing an index, is complicated by the sparse geographic coverage of rainfall gauging stations and short or incomplete rainfall series. Nonetheless, there are ways to develop an index for these risks. More problematic is sea surge that creates flooding along the coast. These events would be more difficult for index insurance.

Following the prefeasibility stages, consultation between the project and major stakeholders concluded that the insurability conditions where better met in Dong Thap. For example, there was more detailed prior work and understanding of the flood regime, the early onset flood event was more clearly defined, reliable and verifiable data could be obtained, and the index could most likely be based on a single measure of water levels. While a carefully designed index for flooding in Thai Binh could be possible, it was recognized that further work should focus on where the most gains could be made more quickly in terms of developing a pilot activity based on the principles of index insurance, risk assessment, and of the overall market development process. Within Dong Thap, the districts of Tam Nong and Thanh Binh were selected for farm-level prototype survey testing of potential insurance products. These districts were selected based on their importance in provincial rice production and their vulnerability to early flooding.

3.2.1.1 Dong Thap Province and Preliminary Risk Assessment of Early Onset Flooding

Results of the prefeasibility stage provided enough information to move to the full feasibility stage. Risk assessment is among the first major activities that must occur during the feasibility stage. Dong Thap province lies in the seasonally flooded alluvial plains on the north bank of the Mekong River, bordering Cambodia (Figure 3.3). One of the two branches of Mekong River, the Tien Giang River, runs 105 km through the province north from Cambodia to the south of the province. There are seven districts in the province west of Tien Giang River (almost 69 percent of total area of the province) that are dominated by rice production and usually deep underwater at the height of the flood season. On the east side of the river are four districts having a high population density and good infrastructure. Cultivation of rice and fruit trees is the main activity in these four districts, along with food processing and handcrafts. Dong Thap has two major cities, Cao Lanh and Sa Dec, and 139 communes with an average population density of approximately 449 persons/km^2 (2006) over a total land area of 3390 km^2.

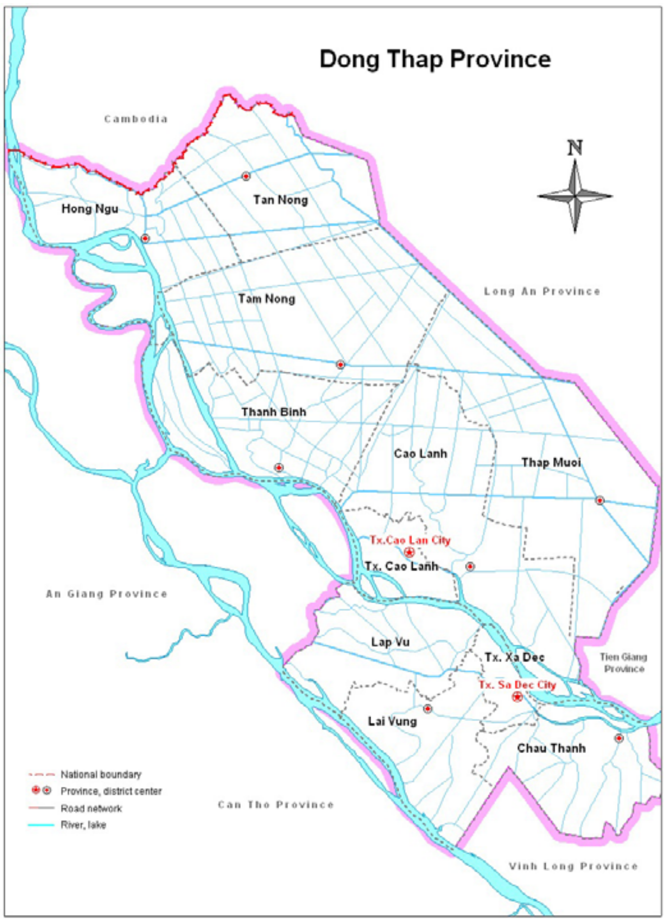
The total area of agricultural land is 220,900 ha with 180,000 ha is used for crop production. Many farm households obtain up to 90 percent of their income from rice production. In addition to rice, other crops grown across the province include mungbean, soybean, and fruit trees such as orange, mango, mangosteen, long gan, and banana. Fruit production has expanded to approximately 10,000 ha and is frequently grown in conjunction with rice. Aquaculture is also becoming an increasingly important activity also often as a complement to rice production.

3.2.1.2 Initial Risk Parameters

As flooding in the Mekong Delta is an annual occurrence that is critical for maintaining the region's productivity, Vietnam has made massive investments in building infrastructure and acquiring knowledge in the Mekong Delta to extend the growing season, and farmers have adapted their production activities to accommodate and take advantage of the flood cycle. Flood season in Dong Thap typically begins around mid-June with the rise of the Mekong River and lasts until the end of January. Large areas are flooded to a depth of 2 m. Flooding generally peaks between late September and the end of October when some areas are under as much as 3.3 m of water. The floodwaters are fresh but sometimes are contaminated by sulphates leached from the soil, typically at the beginning of the flood season.

The second season or summer/autumn rice crop is sown in April/May to be ready for harvest in June/July, just in advance of the annual flooding. When the flooding develops as expected, there is no problem and farmers are able to complete their harvest. Problems occur when the flooding advances unexpectedly early during the later part of June and early July when many farmers still have unharvested rice in the fields. This can create significant direct loss of the unharvested crop, a slowing of harvest activity during the advancing flood, and an impact on rice quality when harvested under less than optimal conditions.

Figure 3.3 Eleven Administrative Districts of Dong Thap Province



Source: Authors

Other crops and farming activities are also negatively affected by early onset flooding. When early onset flooding begins, small farmers in many parts of Dong Thap must allocate their time to a variety of activities (for example, moving animals or placing sand bags on dykes) and incur additional cost to reduce their losses. Household labor is being used to the maximum extent possible during these events. Production losses, quality losses, and additional expense all contribute to potential difficulties in seasonal production loan repayment. Farmers are reluctant to reschedule or default on their loan obligations as doing so makes it more difficult to obtain loans in a timely fashion for the next production season.

Consequently, farm households will reduce consumption and take loans from family or the informal sector to meet their formal loan obligation. However, during a widespread catastrophic event, these informal strategies can break down, leaving farm households with no choice but to reschedule their loans or default.

While flooding in the Mekong Delta is a function of multiple conditions, numerous expert opinions in the region, including flood modeling analysis conducted by SIWRP, informed the project that the river's water level as it crosses into Vietnam, at the Tan Chau Gauging Station, is the major indicator of flooding. This station is frequently used both in hydrological modeling and by the government as an indicator station for flood severity downstream and measures the natural flow of water before it moves into the complex of dykes and canals that are pervasive in the Mekong Delta system. Because of this characteristic, the Tan Chau Gauging Station, rather than water-level gauging stations downstream or in the province, is the preferred location at which to base a water-level index.

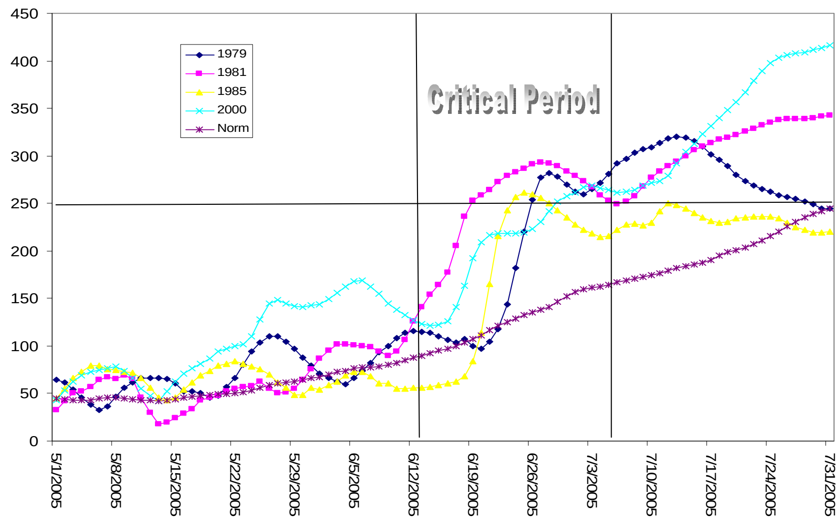
A valid index must also be free of human manipulation and for locations downstream this criterion is not met since flood control authorities have some ability to manipulate water flow, particularly during the early onset flood season (Ruck, 1999). Upstream, the Mekong system has few manmade obstructions above the Cambodian border and there are a number of dams in China, but only about 10 percent of the water that flows into Vietnam comes from China. Thus, the water coming across the border is largely from natural flows and rainfall in China, Laos, and Cambodia. This makes it possible to use a time series on water levels at the border as a mechanism to understand the risk of downstream flooding. If these conditions were not the case, then actual losses caused by flooding may not be sufficiently correlated with water levels at the border. These issues, particularly of upstream water control structures, are investigated further in the risk assessment.

In terms of harvest vulnerability, the initial estimate of the period between June 15 and July 5 was chosen for examination. Stakeholders and others with experience analyzing flooding in Dong Thap indicated that when floodwaters at Tan Chau Gauging Station reach a level of 250 cm, there begins to be downstream flooding that affects rice production and harvest in some areas of the province. This level is based on an understanding that 50 cm of standing water in a rice field causes substantial disruption. The project obtained preliminary data from 1977–2004 on daily water levels at Tan Chau Gauging Station from the Data Center for the National Hydro-Meteorological Agency. Water levels above 250 cm were examined for the period of harvest vulnerability (Figure 3.4). When this threshold is used, 4 out of 27 years had excess water levels during this period which represents roughly a 1-in-7-year occurrence.

This meets one of the criteria for an insurance product, which is that the events do not occur too frequently. Events with a frequency much higher than 1 in 7 would be considered uninsurable since premiums would become prohibitively expensive. The flood event of 1985 is of additional interest as it appears to have peaked and then declined. Questioning whether such an event would create significant problems before temporarily subsiding may have implications for how a potential index is calculated.

In the initial stages of the risk assessment, the 250 cm threshold and harvest vulnerability period, while well-informed, are provisional on further analysis. Nevertheless, the initial estimates in the market development process begin to shape a vision, and provide a vehicle for discussions with stakeholders, for what a final index insurance contract might look like. At this stage, an initial product design was also advanced but, for purposes of this presentation, a full discussion of developing the specific contract is deferred to later sections.

Figure 3.4 Daily Water Levels of Four Extreme Water-Level Years, June 15–July 5



Source: Authors, from historic data on daily water levels at Tan Chau

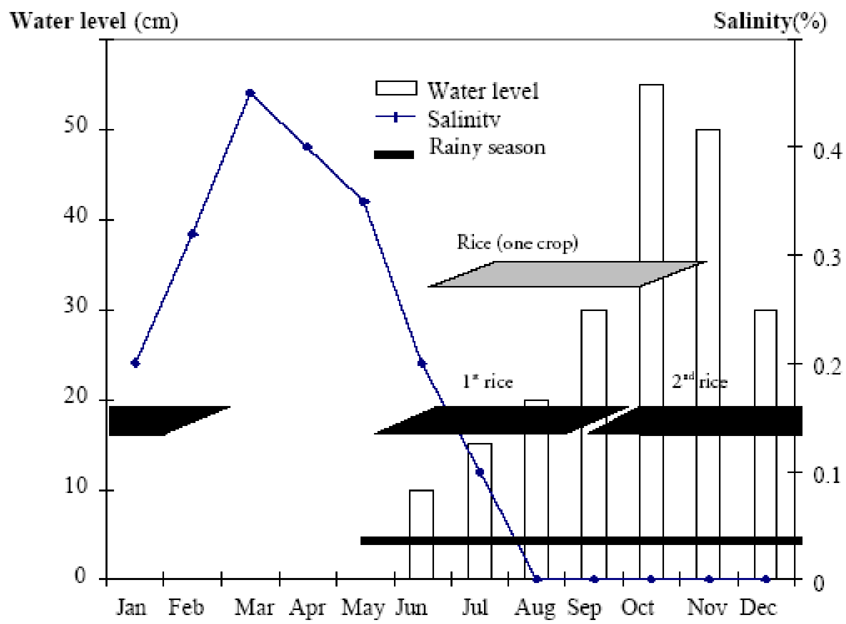
3.2.2 Full Risk Assessment of Rice Production and Flooding in the Mekong System

3.2.2.1 Rice Production and Crop Calendar in Dong Thap

The cropping seasons in the Mekong River Delta region vary from a single to triple crop of rice, with rice planted in the winter/spring, summer/autumn and rainy seasons. This region typically supports a double rice-cropping system described as DX-HT (Dong Xuan-He Thu). The first crop, or DX crop (winter/spring) is planted at the end of the rainy and flood season (around or near the end of January) with harvest taking place from February through March and depends on irrigation. In areas affected by deep flooding, seedlings of the second, or HT crop (summer/autumn) are planted in April or May and depend on irrigation; the HT crop is harvested beginning in late June until the first weeks in August before the onset of flooding (Chiem, 1994; Liew et al., 1998). The short season high-yield rice varieties (HYV) have mostly replaced traditional rice and floating rice varieties in the most favorable regions. In particular, floating rice is still cultivated in areas where late rainy season moisture is insufficient for HYV to mature before the arrival of floodwaters. Areas with highly acidic soils are also unsuitable for HYV (Chiem, 1994).

The particular crop regime is largely determined by topography, broad flood water regimes, rainfall patterns, salinity problems, and availability of irrigation (Liew et al., 1998). A generalized crop calendar showing the interaction of the rice season with the rainy season, flood water levels, and salinity is shown in Figure 3.5.

Figure 3.5 Generalized Rice Cropping Calendar for the Mekong Delta



Source: Minh, 2001

3.2.2.2 Rice Harvest Progression and Early Onset Flood Vulnerability

The issue of identifying the rice cropping calendar for Dong Thap is important for the correct design of the flood insurance product. Conceptually, the problem of flooding in Dong Thap is one where early onset flooding causes problems in completing the summer/autumn season rice harvest. In general, rice farmers have adapted their rice cultivation around cyclical waterflows, including the annual flooding during the rainy season. While flooding may also affect the sowing of the winter/spring season rice crop, the primary flood problem for producers is when the flood arrives earlier than normal, interfering with summer/autumn rice harvest.

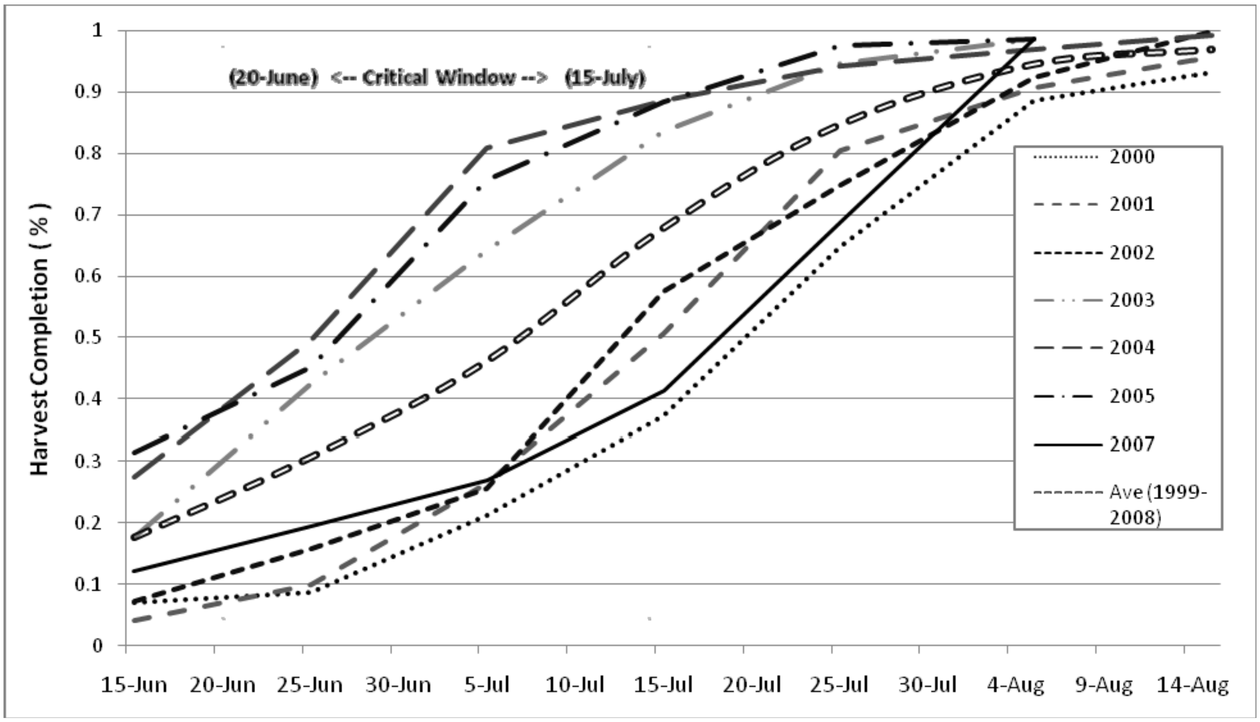
Initial risk assessment roughly identified the window of early onset flood vulnerability to lie between June 15 and about July 5. This was based on an examination of historical water level time series data from the Tan Chau Gauging Station and input from stakeholders. Using this data, approximately 4 out of 27 years had excess water levels coinciding with the summer/autumn harvest. However, the position and length of the critical window of vulnerability can have an impact on the observed frequency of an early onset flood event given a set threshold. Consequently, there is a need to further examine and finalize the location of the critical period.

The question is how early onset flood events above 250 cm affect normal rice cropping patterns and to determine if the critical window of vulnerability should to be adjusted to more accurately reflect actual flood damage and interruption of harvest activities.

To look more closely at the incidence and impact of early onset flooding, harvest data were obtained and examined for the years 1999–2008. Separately, limited data describing summer/autumn rice losses were also obtained and used to assess how much of the harvest was incomplete. Losses are described in terms of area completely lost, and area where yield was suppressed.

Figure 3.6 depicts cumulative summer/autumn rice harvest completion in Dong Thap. The average is computed for the full 1999–2008 series while the graph depicts representational years only. On average, harvest progression begins slowly, with less than 30 percent of the crop area harvested by around June 25. Harvest progresses more rapidly with approximately 50 percent of the rice harvested by July 7 and slightly more than 75 percent completed by July 20. The rate of harvest then begins to slow and is substantially completed by the end of the first week in August.

Figure 3.6 Harvest Completion of the Summer/Autumn Rice Crop, Dong Thap Province, 1999–2009



Source: Authors

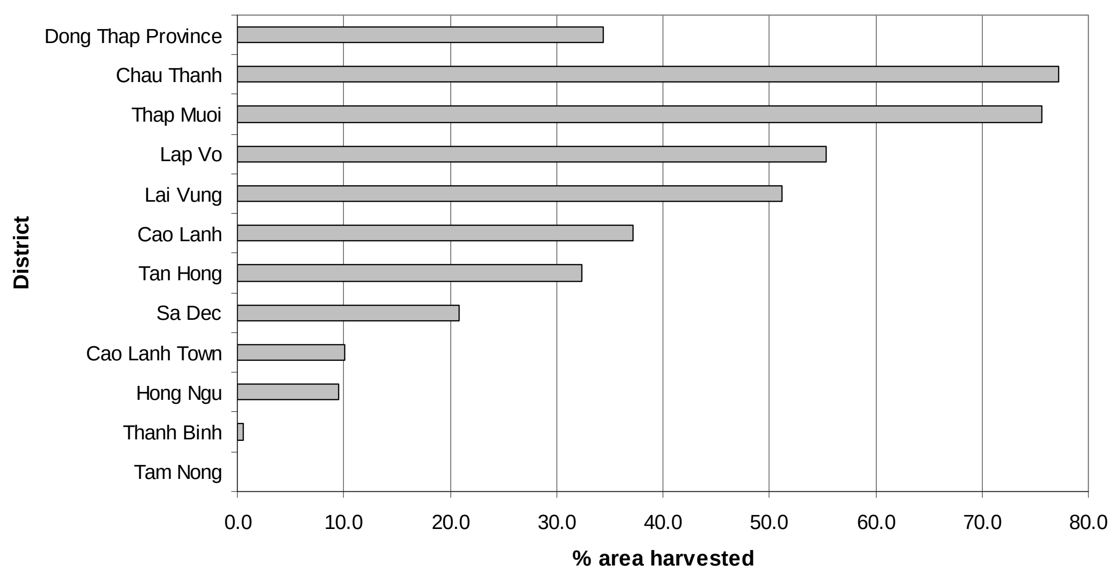
Immediately apparent is that harvest during the early onset flood years of 2000, 2001, and 2002, progress considerably slower relative to the mean. During early onset flood years only 20–30 percent of harvest is completed by the time that 50 percent is completed on average. The difference is even more striking when compared to some individual years when 70 percent of the harvest is completed by that time. At the other end of the scale, early onset flood years clearly shift the start of harvest. Whereas the group of non-early onset flood years has progressed to 20–30 percent of area harvested, the group of early onset flood years has barely harvested 5 percent. This clearly indicates that early flooding seriously affects harvest operations. Loss data, although there may be reason to question the methodology for making estimates, are consistent with the harvest progression information. Whereas for non-early onset flood years, rice area unharvested or subject to yield reduction is less than 1 percent of area planted, the impact of early flooding was recorded as 19 percent (2000), 5 percent (2001), and 11 percent (2002). The year 2007 displays an approximate ten-day delay in harvest although this was not an early onset flood year.

Information from the Planning Division of the Department of Agriculture and Rural Development of Dong Thap indicates that the seeding of the summer/autumn crop was delayed in order to avoid insect diseases from the previous growing cycle. While the 2007 harvest season proceeded normally, it is worth pointing out that the delay in planting increased the risk exposure and would have made the impact of an early onset flood more severe.

In light of the patterns of harvest vulnerability, the project adjusted and shifted the window to encompass a slightly later time period. The choice of June 20 to July 15 defines a 25-day contract period that corresponds to the most important and most intense period of harvest activities. The window encompasses slightly more than 40 percent of the key harvest activity. The terminal data of July 15 were fixed also in part because after that date the frequency of water levels exceeding the threshold becomes too great. This is not a limitation of the insurance since the buildup of water represented by the threshold that occurs after July 15 has much less impact than the earlier flood events on overall harvest activity.

The harvest completion represented in Figure 3.6 is aggregate for the province. There is, however, substantial variation in the rice crop calendar across districts as depicted in the harvest progression viewed on June 30, 2005, a normal flood occurrence year (Figure 3.7). The average progression of rice area harvested in Dong Thap is approximately 34 percent, whereas in the important rice producing districts of Tam Nong and Thanh Binh, less than 1 percent of the summer/autumn rice harvest is completed by the same date.

Figure 3.7 District Rice Harvest Completion as of June 30, 2005

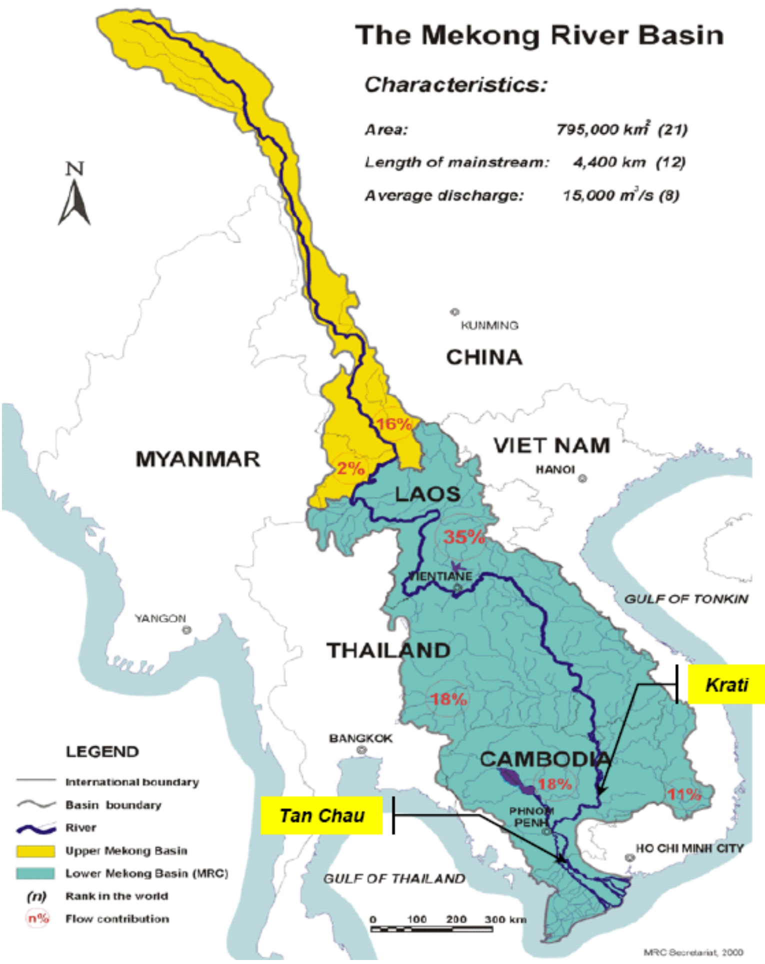


Source: Authors

3.2.2.3 ASSESSMENT OF THE MEKONG FLOOD REGIME AND THE DEVELOPMENT OF EARLY ONSET FLOODING

The focus of this component of market development activity is on catastrophic insurance against unseasonably early flooding that negatively affects the second season rice crop prior to and during harvest. To understand the development of early onset flooding, it is necessary to have an understanding of the Mekong River system. The Mekong River basin encompasses six different national territories spanning nearly 2750 miles ending in the South China Sea. Figure 3.8 illustrates this system and indicates the location of the two gauging stations used in the analysis and design of the insurance product. While the headwaters originate in Tibet and China and contain nearly half its length, the contribution of the upper Mekong to total river flow is only 18 percent. Precipitation developing primarily in Laos contributes 35 percent to flow while Cambodia and Thailand contribute 36 percent combined. Vietnam's contribution to annual discharge is 11 percent. In its upper reaches, the Mekong River is swift flowing with deep channels. The river flow slows as it progresses into the lower delta. The Kratie Gauging Station in Cambodia is important for hydrological modeling because river level measures here have a predictable hydrological relationship with volume and with river levels and volume downstream at Tan Chau Gauging Station.

Figure 3.8 River Flow in the Mekong River Basin

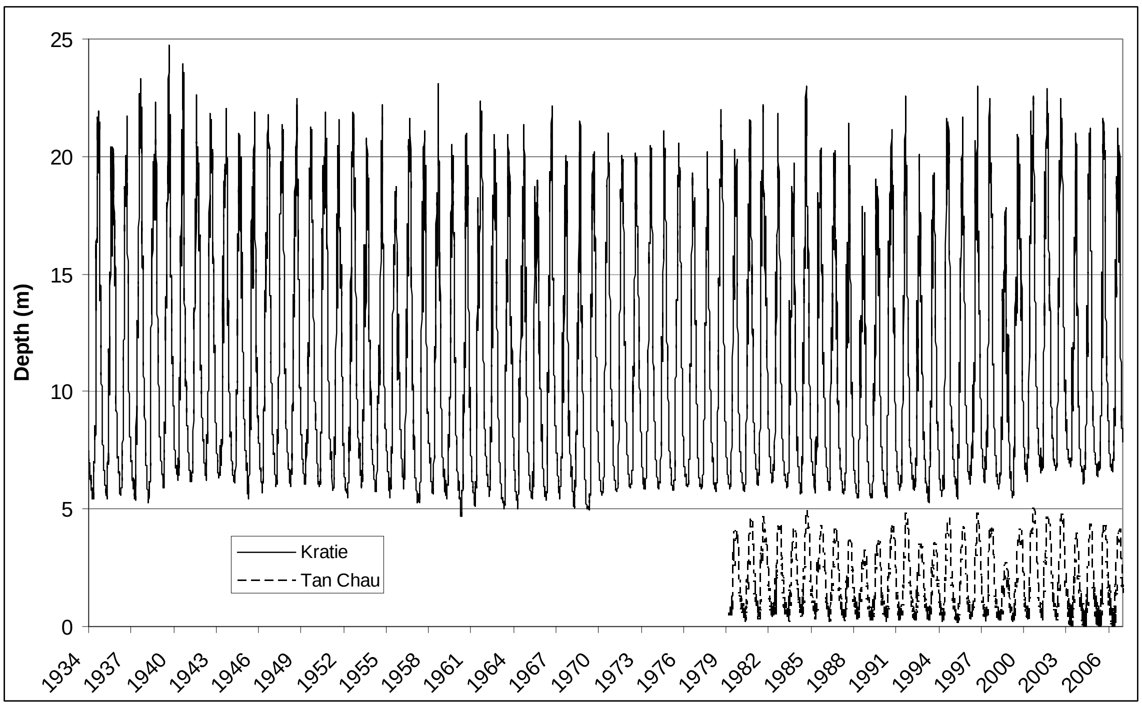


Source: Mekong River Commission Secretariat, 2000

The lower Mekong region has two distinct weather patterns, a dry period and a five-month rainy period extending from June to October. Similarly, the Mekong River exhibits an annual flood cycle. Water levels are lowest in March and April with river build-up commencing in May. However, significant river flows usually do not begin until mid- to late July with the peak flow event in September or October (Lu, Wang, and Grundy-Warr, 2008). River discharge is highest during this period with nearly 80 percent of the river's total annual discharge occurring between June and November. This cycle creates the well-known "flushing" of the lower Mekong systems and the delta region in Vietnam that contributes to its high fertility. This cleansing and renewing characteristic of the flooding is well-appreciated by Vietnamese farmers and policy makers who have a policy for "living with the floods" that involves balancing personal life and property protection while maintaining desirable and beneficial flood action (Weichselgartner, 2005).

Figure 3.9 depicts the annual flood pulse using available data from the Kratie Gauging Station since 1934 and the Tan Chau Gauging Station since 1979. The flooding is characterized by a predictable, single peaked pulse with a larger amplitude upstream than downstream. Water movement is correlated between the two stations with a simple Pearson coefficient of 0.86 over the period of record of 1979–2006. For the time period of the proposed insurance contract, the maximum water levels are correlated at 96 percent for these two key gauging stations. There appears to be little in the way of long-term patterns in either series in terms of the peaks and troughs. Despite the apparent volatility of the pulse amplitude, flooding in the delta region is a slow onset event with the water levels increasing slowly and receding slowly.

Figure 3.9 Mekong Annual Flood Pulse at Kratie and Tan Chau Gauging Stations



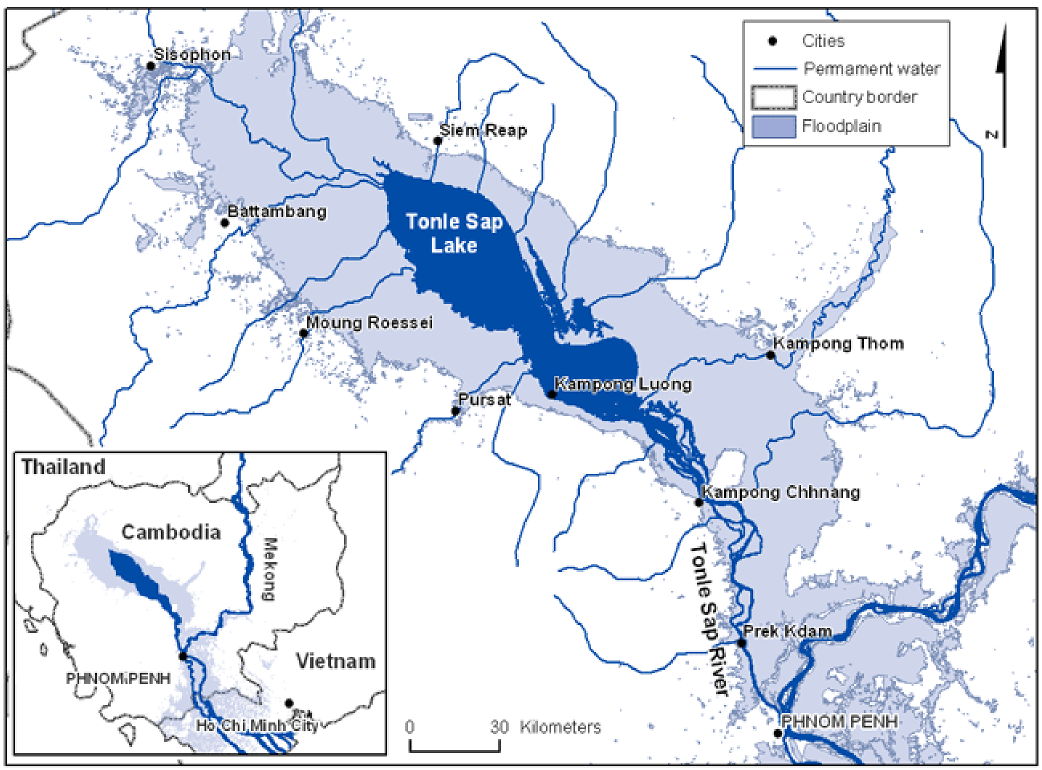
Source: Authors

A key factor in the natural regulation of the annual flood pulse in the Mekong Delta is the presence of the Tonle Sap water system (Figure 3.10). The Tonle Sap Lake and its adjacent floodplains lie in Cambodia above Phnom Penh and are connected to the Mekong River by the Tonle Sap River. At its smallest, Tonle Sap Lake covers an area of approximately 2,700 km^2 at about one meter deep. During the flood season, high waters flowing down the Mekong River push back and reverse the flow of the Tonle Sap River, expanding the area of its lake to as much as 15,000 km^2 and up to a depth of nine meters. When the flooding recedes, the Tonle Sap River resumes outflow and contributes to as much as half the Mekong River volume throughout the ensuing dry season.

The reversal of the Tonle Sap River and subsequent overflow from the Mekong River into the Tonle Sap basin acts as a natural "shock absorber," modulating the onset of the flooding downstream and acting as an immense reservoir. This action, in part, explains why the flooding is a slow onset event, but also helps to explain how the Mekong River, once the flooding has built up, is the primary driving force of downstream flooding.

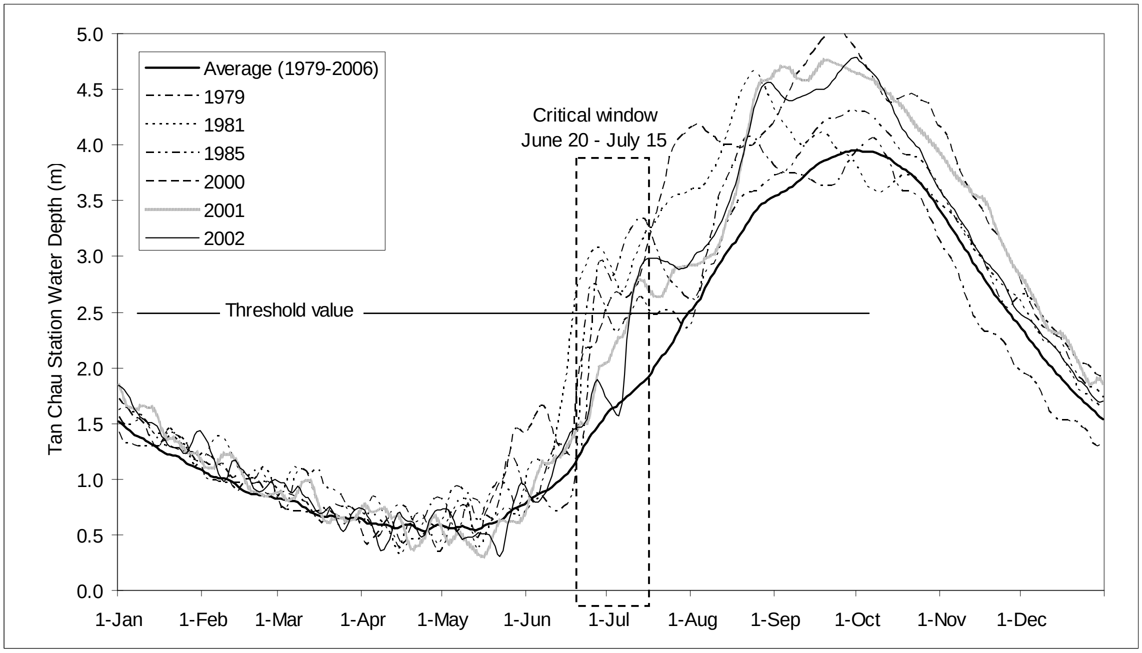
Using the new data and a three-day moving average measurement (Figure 3.11), 6 out of 27 years had excess water levels during the critical period of harvest vulnerability. At this threshold, early flooding could be expected to occur roughly 1 in 5 years. The higher calculated frequency also implies that an insurance product using these parameters will be more expensive than one with lower frequency. This does not mean an insurance product cannot be designed that is still effective at transferring catastrophic risk, but it does suggest that during the actuarial analysis (pricing), the threshold level may need to be determined, in part, on considerations of affordability.

Figure 3.10 The Tonle Sap, River, and Floodplain Extent



Source: Salidjanova, 2007

Figure 3.11 Three-Day Centered Moving Average of Daily Water Levels, Tan Chau Gauging Station



Source: Authors

One of the most important early onset flood years in recent memory was in 2000. Not only did this flood arrive early in the harvest season it also was a high magnitude peak flood causing considerable damage to agricultural and civil infrastructure. During surveys, many farmers recounted having difficulties in repaying their working capital loans. The overall impact of the flood event was severe enough that some households were compelled to sell land to meet their obligations. The 2000 flood represents a 1-in-10-year event based on the empirical data from the Tan Chau Gauging Station. In response to the widespread damage, the government has worked to strengthen the dyke protection system in Dong Thap. Some stakeholders believe that such a large impact from a similar flood is no longer possible and, hence, the value of insurance to protect against flood impact may be limited. Nonetheless, focus group surveys among farmers revealed that many farmers remain concerned about extreme early flooding. While enhanced flood control measures undoubtedly have some ability to alter flood impact, the infrastructure improvements may have led to a false sense of security and an underestimation of the risk (Browne, 2005). There are at least two reasons to remain cautious. First, the improved embankment system is untested against a flood event of similar severity as the 2000 event. Second, while severe, the 2000 event is not the worst possible flood. Falsely believing that assets and activities are fully protected may only increase the risk exposure of households to future high magnitude events. This reinforces an argument for mixing risk mitigation infrastructure activities with financial solutions for overall risk management. Still, the question remains to what extent does improvement in infrastructure control flooding of various magnitudes. This question is asked in the next section where the extent of possible future flood events is modeled.

3.2.3 Validation of the Risk and Index

Many issues must be considered when choosing an appropriate index to proxy a catastrophic loss event. In addition, during the market development process new information is often obtained that requires a modification of assumptions or design strategy. This section provides a brief perspective on such issues and especially those relating to "due diligence" and validation of the index — that is, an investigation of the conditions that makes an index a reliable indicator of a catastrophic loss event. For example, among the insurability conditions described in Chapter 2, are the criteria that the index is free of manipulation, that the index is a good proxy for loss, and that the potential insured should not be able to predict the event. Without these conditions being met, no insurance or reinsurance company would be willing to assume the risk and offer insurance since it implies greater uncertainty and the possibility of severe adverse selection.

3.2.3.1 Hydrology and Risk Mapping

A series of flood risk maps by SIWRP[18] were generated for the vulnerable period of June 20 to July 15. During this period early onset flooding can occur at different flood magnitudes. During the process of creating these maps, the project worked extensively with professionals from SIWRP to develop a research protocol that would focus on the major causes of early onset flooding. Three major events can contribute to flooding: (1) buildup of water in the Mekong River due to heavy rainfall upstream; (2) direct rainfall in Dong Thap province; and (3) tidal surge coming up the river from several points of origin, primarily at the mouth of the Mekong Delta. Historical flood data were then compared to data collected from weather stations on the common risk factors for flooding (e.g., river overflow and sea surge). SIWRP performed an analysis with their flood models to isolate each cause of flooding and to understand its significance and impact on differing regions of Dong Thap. Importantly, these models are modifiable and updated to account for natural and man-made changes over time, such as recently added dykes and canals.

SIWRP also developed simulations to map annual exceedance probabilities (AEP). AEP estimates are the likelihood and level of flooding given a particular meteorological event (e.g., sea level, river level) in any one year. For example, an AEP of 15 percent for the river level at Tan Chau Gauging Station suggests that this pattern of flooding will occur roughly 1 in every 7 years. In this way, SIWRP has determined the likelihood of each isolated flood risk. This form of mapping is commonly used by insurers who are determining flood zones and premium rates for insureds living in vulnerable areas.

SIWRP flood risk maps show that flooding in Dong Thap occurs from two major pathways: flow from the mainstream of the Mekong River and flow overland from the Vietnam-Cambodian border. The dykes and embankments in Dong Thap provide some control with waterflows and flooding as well as drainage at the end of the flood season, including small embankments that provide early onset flood control. When water levels exceed the height of the embankments, floodwater flows into most at-risk fields of Dong Thap. Next, medium-sized embankments provide flood control to farmers with moderate risk of flooding.

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[18] Refer to SIWRP (2006) for a full technical report of the strategy and procedures of the hydrological modeling and flood mapping. Normally, SIWRP focuses its hydrological analysis on the maximum extent of the annual flood rather than on questions posed by this project. As such, the analysis of the impact of early onset flood events represents an important extension to the skills and expertise available at SIWRP. It is also instructive to note that the flood risk mapping was an iterative exercise that was modified as new information or problems arose. For example, the hydrological model was modified to use river volume rather than river flows from a reference station in order to provide a better match of modeled results with empirical observations.

If flood water exceeds these embankments, it will enter the fields. For low-risk areas, a dyke system fully controls flooding. Farmers in low- and moderate-risk areas can open gates to flood the fields after harvest as part of their normal soil management regime. Finally, for populated areas, a dyke system fully controls flooding and remains closed for the entire flood season. Flooding from the mainstream of the Mekong River highly coincides with river levels at Tan Chau Gauging Station, an indication that this gauging station is a valid reference point in determining future flooding and information from the station can be relied upon to develop an index insurance product.

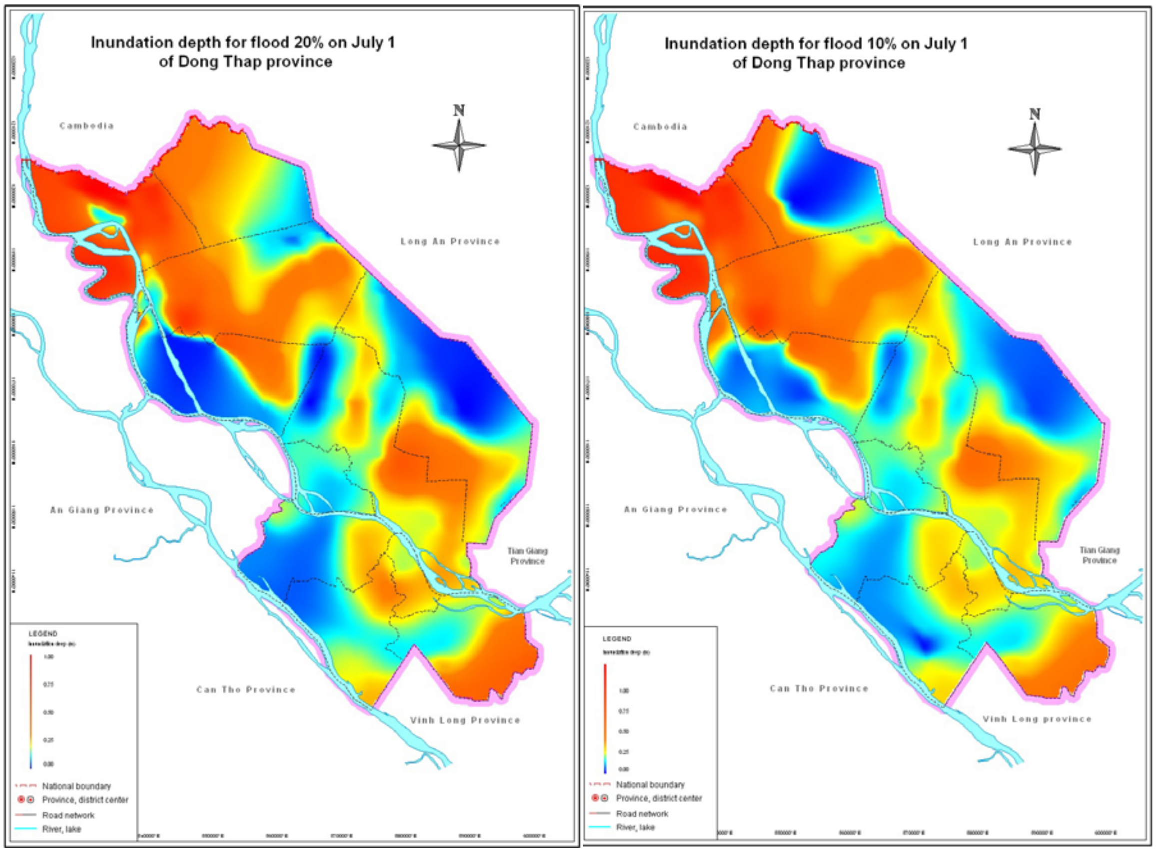
The second major pathway for flooding occurs from overland water flow from the Vietnam-Cambodian border. Seventeen years of historical flow data at Kratie Gauging Station allowed SIWRP to model this overland flow. Kratie Gauging Station is a key location for measuring this overland flow because it represents the point near where overbank flows begin from the mainstream Mekong. These data allow SIWRP to map flooding caused by the complex interaction of the Cambodian floodplain and the Tonle Sap Lake.

Other potential sources of flooding in Dong Thap include sea surges and excess rainfall. In developing the flood maps, it was very important to understand the relative influence of these two sources to early onset flooding as that would determine the suitability of river levels at Tan Chau Gauging Station as the sole index. While sea level is not a major cause of flooding in the Mekong Delta, it can increase flood levels and the duration of flooding. Generally, this is an issue for later in the flood season (i.e., periods beyond July 15). The effects of rainfall are less clear as available rainfall data are unsuitable for modeling procedures. The conclusion following the modeling, however, is that sea level and rainfall are negligible influences on early onset flood events. Consequently, the river level at Tan Chau Gauging Station can be used as a suitable proxy, and index, for downstream flooding.

Figure 3.12 presents examples of the flood risk maps: AEP 20 (1-in-5 year) and AEP 10 (1-in-10 year). These maps should be considered as snapshots of a flood event of a certain magnitude as they depict the extent of a possible flood event on July 1, approximately the middle of the period of harvest vulnerability. For each case, one can imagine how the flood would start slow and build up to the point depicted, and then continue to grow in extent and depth. Darker orange to red areas reflect the deepest inundation levels. The rice crop is considered to be at severe risk and harvest constrained when water levels in the field exceed one-half meter. Additionally, the SIWRP analysis found that this level of provincial flooding is consistent with Tan Chau Gauging Station water levels of 270 cm and greater, 20 cm higher than the initial threshold estimate of 250 cm. Furthermore, the buildup of water is generally increasing during the annual flood. This behavior is different from the flood experience in many other parts of the world where flooding of rice fields from rainfall can inundate fields to considerable depth but also recede quickly. In those systems, depth and duration are both important parameters in rice plant mortality. In the Mekong system, on the other hand, the flooding continues to build until reaching its peak around the first part of October.

The districts of Tam Nong and Thanh Binh are largely flooded in excess of one-half meter in these maps. It is estimated that these two regions alone encompass 30–40,000 hectares with a rice crop value exposure of USD 36–50 million. An important condition displayed in the flood risk maps is that a substantial area of Dong Thap province is susceptible to early and severe flooding even given recent improvements to flood control structures. It is also important to realize that modeling and flood mapping do not consider the possibility of flood control failure which must be considered as an increasing possibility under the most severe flooding conditions.

Figure 3.12 July 1 Flood Risk Maps Showing Extent of Early Onset Flooding, Dong Thap Province



Source: Southern Institute for Water Resources Planning (SIWRP), 2006

3.2.3.2 Indicators of Early Onset Flooding

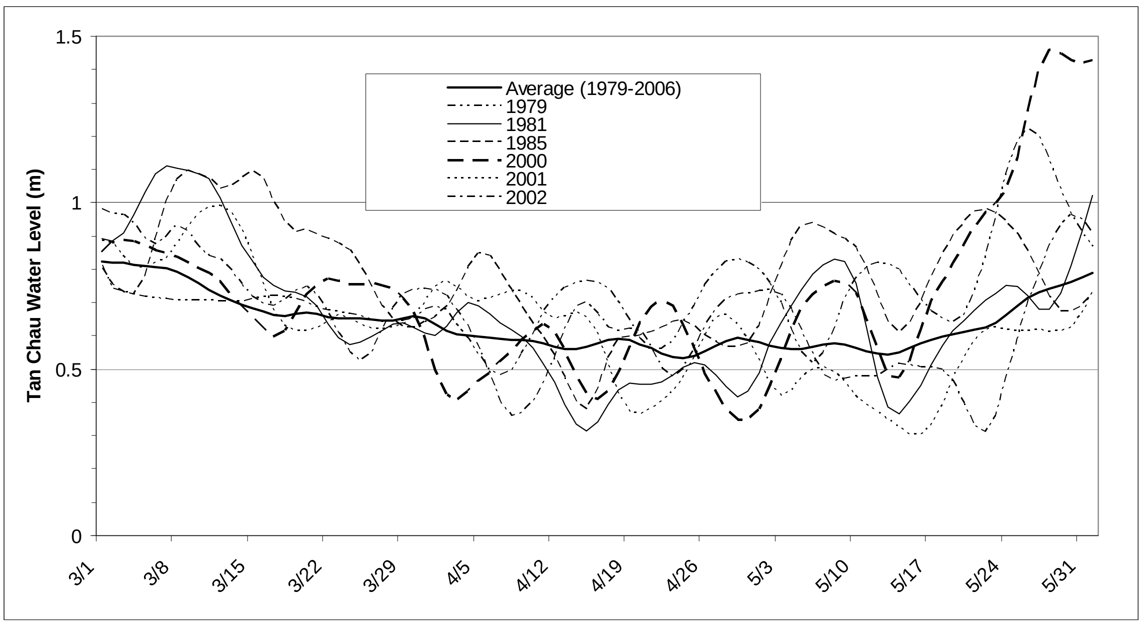
When designing an insurance product, it is of considerable importance to prohibit sales of insurance contracts before it becomes possible to accurately forecast an early onset flood event. Otherwise, the insurance company would be exposed to unsustainable adverse selection since policies would be purchased only when clients knew they would experience flooding.

Forecasting the severity of flooding is difficult and subject to many interconnected parameters. The Mekong River Commission (MRC) monitors water levels along the length of the Mekong River Basin and makes forecasts for key water level gauging stations.[19] Even with their extensive experience studying the river system, the MRC restricts prediction to a five-day forecast at those specific locations. However, prediction that creates possibilities for adverse selection would only need to be accurate the majority of

[19] The MRC is the supranational institution that implements the 1995 Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin between Vietnam, Cambodia, Lao People's Democratic Republic, and Thailand. The agreement defines the joint management of the Mekong River resource for mutual economic, cultural, and ecological benefit. China and Myanmar became Dialogue Partners of the MRC in 1996.

the time and not have to predict exact levels. To study this further, the historical three-day centered moving average river level data at Tan Chau Gauging Station during early onset flood years were examined against the average of all years for the period of the historical low flow point in advance of the window of harvest vulnerability (Figure 3.13). Inspection of these data reveals that near the end of May, and particularly for the 2000 flood, strong increases in water levels above average could serve as an indicator of early flooding. While not all the early onset flood years display this behavior, the signals are sufficiently strong to enable reasonably accurate early prediction. To avoid the potential for adverse selection using this information, the project therefore recommended that the sales closing date for any flood insurance product based on an index of river levels at Tan Chau Gauging Station be fixed at May 15.

Figure 3.13 Three-Day Centered Moving Average Water Levels and Indication of Early Onset Flooding during the Low Flow Period, Tan Chau Gauging Station, March 1–May 31



Source: Authors

3.2.3.3 TAN CHAU GAUGING STATION AND DATA HANDLING

Any effective index should possess a number of attributes that lend it credibility and trustworthiness. These include accuracy of measurements on which the index is based, it should be reliable with backup systems in place, measurement devices should be physically secure from tampering and accidental damage, measurements should be reported in a timely manner, and the reporting should be cross-validated and certified by a disinterested agency having no financial stake in the outcome of the index. In addition, the historical data series should be transparent in terms of potential limitation of the data and document important anomalies such as missing observations or structural breaks resulting from changes in measurement equipment or measurement location. Insurers, reinsurers, and policy holders of an index insurance contract will demand these characteristics from any proposed index as they have taken a financial position against the index. This section briefly summarizes a review of these issues relative to the Tan Chau Gauging Station early onset flood index.

3.2.3.3.1 Managing Agency

The organization that is responsible for recording measurements and the maintenance of the Tan Chau Gauging Station is the Southern Region Hydro-Meteorological Center (SRHMC) headquartered in Ho Chi Minh City.[20] It is one of nine hydro-meteorological centers throughout the country and falls under the jurisdiction of the Vietnamese Ministry of Natural Resources and Environment. Given that Vietnam is a member of the UN World Meteorological Organization, the Tan Chau Gauging Station meets international standards for recording and reporting. The SRHMC supervises the operation of 50 hydro-meteorological stations in southern Vietnam including the entire Mekong Delta region. Tan Chau Gauging Station is a nationally managed station and equipped through cooperation between the government of Vietnam (GoV) and the MRC. The station is the official station for setting the government flood warning levels for the Mekong Delta and provides instant water level measures for flood management decision making. Clearly, the GoV and the MRC place a large burden on the Tan Chau Gauging Station for many key reasons. This emphasis suggests that this station will be well-maintained and reliable.

3.2.3.3.2 Station Location and Equipment

The current water level gauging station is located on the west bank of the main branch of the Mekong River at Lat/Long 10.80, 105.23, in the vicinity of Tan Chau City. In 2007, the station's location was moved to a new, more secure site approximately 400 meters downstream due to river bank erosion in the vicinity of the existing station. The new station went online June, 2007. Prior to the move, the existing station had been in continuous service since 1977 under the direction of the SRHMC. The impact of the change of location on the level of comparability on river level measures is felt to be minimal by staff of the SRHMC in part due to the small change in elevation between the two sites. No official recalibration has been made to the official historic data series.

The gauging station is normally staffed by two engineers and four technicians trained by SRHMC. During flood season there may be as many as 10 people working at the station to make more frequent manual recordings. Access to the building housing automatic recording equipment is limited to three authorized staff members. At this station, the supervising engineer has 25 years of experience.

The new building housing the equipment includes a seven-meter-deep tank which is connected to the main branch of the river via piping in a system that maintains the same water level in the tank as in the river. This system is designed to minimize the influence of wake and surface wind on the recording of water levels. Water level measures are reported twice daily, at 07:00 and 19:00. The following three redundant measuring systems are currently in place to record water levels:

1. MinData Australia model 3500 data logger remote data acquisition system, supplied by the MRC and operational since 2007;
2. Stevens Type A-71 chart recorder in service since 1977; and
3. Manual recording using a step or a staff gauge installed on the river embankment.

[20] Southern Hydro-Meteorological Center, No.8 Mac Dinh Chi Street, District 1, Ho Chi Minh City, Vietnam. Web address: http://www.kttv-nb.org.vn/

3.2.3.3.3 Records Handling and Reporting Procedures

The SRHMC reports the 07:00 water level locally and nationally through the internet, radio, television, and print. Recordings are also provided to the MRC. The public service water level recordings are transmitted automatically from the MinData Australia data logger to these various water level reporting outlets. However, the source of data for the official record is made from the Stevens chart recorder. Data accuracy is guaranteed +/- .5 cm. Each day the Stevens chart recorder is inspected and water level noted twice daily (more frequent during flooding or if a problem is suspected). Along with the MinData Australia observations, the recordings are reported to the SRHMC central office daily. Stevens charts are transported to the central office once each month. There, the recordings and observations are checked for accuracy before warranted with a government seal. The entire data series are published as a collection in six month intervals.

However, for an index contract designed to make timely payments, special reporting and verification procedures are needed. Under arrangements of a separate service contract, the SRHMC management agreed that, for the limited amount of data spanning the vulnerable period, hourly river level observations could be verified and certified within two days of the last recording. This contract was developed between Bao Minh and SRHMC.

3.2.3.4 Upstream Impacts on the Flood Regime

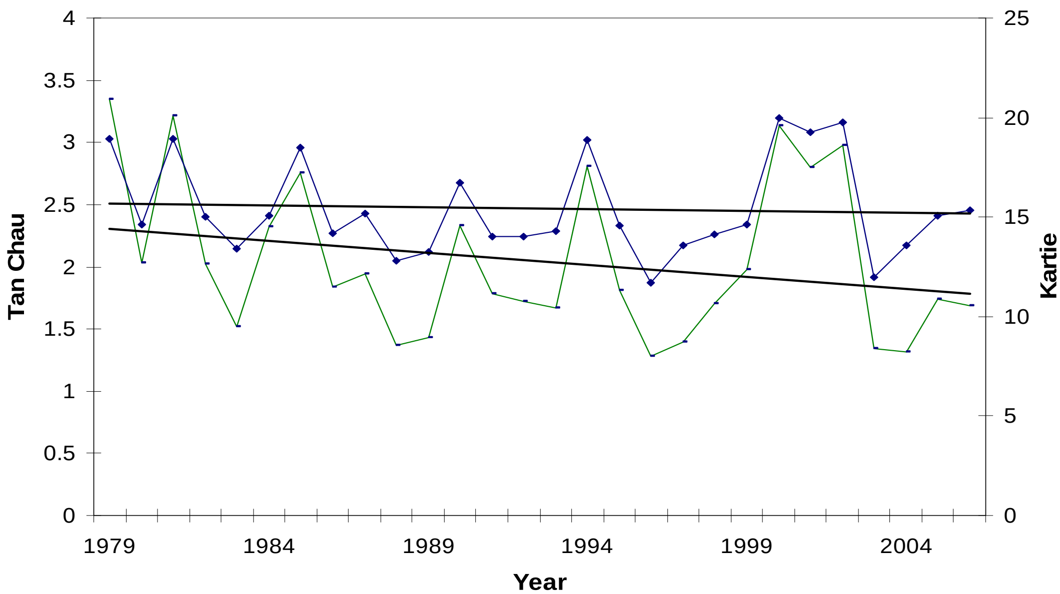
Above the Vietnam-Cambodia border, the Mekong River remains one of the most underdeveloped rivers of its kind in the world. Nonetheless, developments that are planned above Vietnam may create concern for underwriting early onset flood risk sometime in the future. Like the tidal and rainfall impacts, the impacts of developments that have occurred are also present in the historic data. However, in a review of these issues and the protracted discussions with experts in the system, the conclusion is that any of these developments are unlikely to have changed the likelihood of extreme flooding for the critical time period proposed for an index insurance contract. It would seem that the major underwriting consideration should be whether there is a “shock” upstream (e.g., breach of a dam). Even then, this type of problem would likely need to coincide with a time period of excess rainfall and flows upstream.

While over a half-dozen hydroelectric and irrigation control dams are planned for the Upper Mekong basin, only two have been built in China (Mehtonen, 2008). China accounts for 16 percent of the overall flow and evidence suggests that the impact of dam operation in the lower reaches of the Mekong is negligible. Thus, any shock that would involve a breach of a dam is very far upstream and it is unclear that the released water would significantly influence the level of water at Tan Chau. This has to do with the great distance between the dams and the delta region, the small contribution of the upper dam catchment to total flows, and the relatively small size of the dams in operation. Impact is felt as one gets closer to the structures — on lower than normal water levels, for navigation for example, and for possible impacts on the filling of the Tonle Sap Lake. In general, the observation has been that water levels are lower than before dam construction, which may be due to both water usage from the reservoirs and generally due to drier climatic conditions (Mehtonen, 2008; Lu, Wang, and Grundy-Warr, 2008).

Most of the development upstream appears to be diverting water for other uses. This is likely what explains the divergence over time in water levels between the Kratie and Tan Chau Gauging Stations during the period of early onset flood vulnerability. Figure 3.14 shows the trends from the Kratie and Tan Chau Gauging Stations using a maximum three-day centered moving average from 1979 to 2006. Water levels at Kratie Gauging Station have no trend; while at Tan Chau Gauging Station there is a pronounced downward trend. The water levels for this time period are correlated at 96 percent.

Assuming that the data are mostly unadjusted, this is an impressive correlation. A visual examination of Figure 3.14 suggests that the high levels track more closely than the lower levels. This fits with descriptions that Tonle Sap Lake acts as a sponge where increased flows will back up into the lake. Those who express concerns about how developments upstream may cause problems of increased flooding appear to be mostly concerned about the later part of the flood season when the Tonle Sap Lake is most likely to be full and can no longer serve as the back-up for excess water moving through the system.

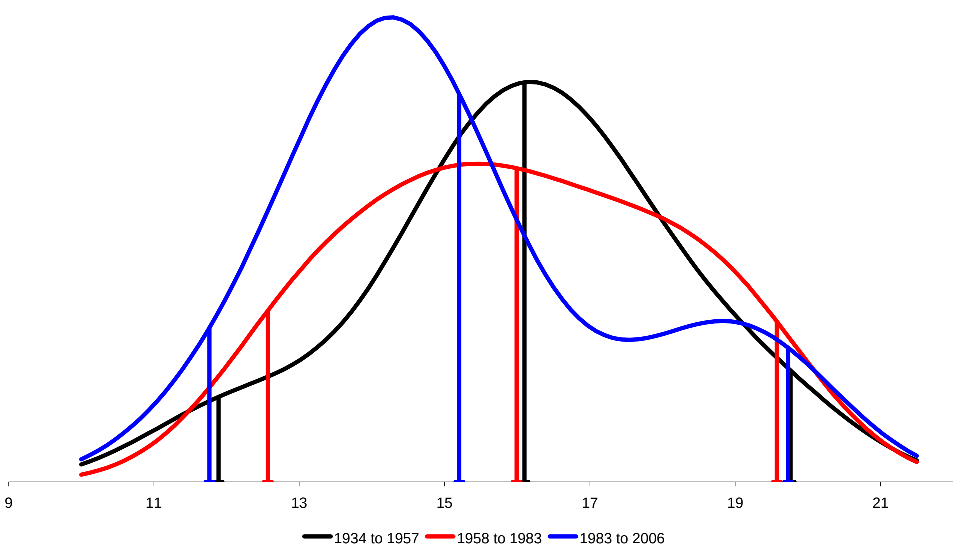
Figure 3.14 Comparison of Tan Chau Gauging Station and Kratie Gauging Station Historic Water Levels during the Period of Vulnerability, June 20–July 15



Source: Authors

To examine the issue further, the Kratie Gauging Station water level record is used to generate a kernel smoothed distribution for three different time periods, 1934–1957, 1958–1983, and 1984–2006. As shown in Figure 3.15, there is a backward shift in the mean water level in recent years and a distinct change in the distribution, demonstrating a bimodal pattern. However, that the mean in recent years shifts left and yet the 2-standard deviation mark remains nearly the same as during previous periods suggests that while the region is getting drier the severity of flood events during the critical window remains unchanged. As for longer-term issues, upstream developments are something that must be monitored. In terms of contract underwriting, this would be an annual review item before renewal of any contract.

Figure 3.15 Kernel Smoothed Distributions from Kratie Gauging Station



Source: Authors

3.2.4 Motivating Business Interruption Insurance

While index-based insurance attempts to overcome many of the problems and costs associated with traditional agricultural insurance, the approach still encounters significant administrative costs in the delivery of policies to many small households. In some cases, designing insurance policies for individual households may not be the most appropriate starting point to spur market development. Sometimes significant results and learning opportunities can be gained sooner and at lower cost by focusing first on risk aggregators who share or carry some of the individual's exposure to natural disaster. Banks and other lending entities are one immediate example as they carry many types of risks associated with lending to agricultural producers. In the market development process, it is important to reach scale quickly. By presenting products that can reach some significant scale, it is more likely that key stakeholders such as the insurance regulator and the global reinsurance market will be focused and provide input and services that are more appropriate for longer-term sustainability. Small pilot projects that may sell a few hundred policies to small households are many times viewed as only experimental and, thus, do not receive the same attention.

Natural characteristics of certain risks also better lend themselves to insurance solutions in the aggregate. Insurance against food risk is an important example. One reason that flooding is so difficult to insure is because flood control management decisions can have a profound influence on who experiences flooding and when. This makes it very difficult to rate and underwrite the risk at the individual level. Risk zoning as was described above with the AEP mapping, grouping areas with a demonstrated level of similar risk exposure, is one approach to partially overcoming this problem of serving individuals. But in the case of flooding, the Mekong Delta has multiple dykes and cannels given ample opportunity for managers to divert water from one area to another.

This makes it difficult to design an individual flood insurance product because someone could decide to divert water to areas where a larger number of farmers are insured rather than following a set protocol for water management. Still, much can be gained by first working in the aggregate to address the big risk exposure of financial institutions serving agriculture. This creates an opportunity where success and good performance will drive initiatives to create more individualized products.

Consequently, the project decided to focus on the flood risk exposure of VBARD, one of the main risk aggregators in Dong Thap and by far the dominant lender to agricultural producers. This section outlines VBARD lending activities and practices and develops the argument that VBARD is in many ways already acting as an insurer because of these practices. Next, it is proposed that an insurance product be targeted to the business interruption and consequential costs and losses suffered by VBARD as individual creditors have trouble in repaying after an early onset flood event. Finally, the discussion advances to how VBARD could ultimately use this type of insurance as part of an overall strategy that blends insurance and reserving in such a way as to reduce overall cost. As outlined in the beginning of this chapter, the main assumption regarding the approach is that VBARD, and the financial sector in general, are committed to making credible steps toward the application of commercial banking principles that are consistent with their drive to equitization.

3.2.4.1 VBARD Lending in Dong Thap

VBARD is the largest bank operating in Dong Thap. When surveyed in December 2006, VBARD had approximately 110,000 outstanding loans with rural households worth VND 2,590 billion (USD 164 million). Overall, the VBARD loan portfolio accounts for 70 percent of the rural financial market in Dong Thap.

For customers to receive a loan from VBARD, they first contact their local branch and complete the appropriate paperwork with the assistance of a credit officer. Loans are then appraised and re-appraised at the local branch and sent to the district level for approval. All household members that are 18 years of age or older must sign the loan documents. When a loan is for less than VND 30 million (USD 1,900), borrowers do not need to provide collateral but are required to provide a business plan. When borrowing over VND 30 million, households submit their Land Use Certificates and a list of their assets as collateral.

VBARD provides short-term (less than 12 months), medium-term (1–5 years), and long-term (greater than 5 years) loans. As of summer 2009, the interest rate for short-term loans is 1.15 percent per month; for medium- and long-term loans, it is 1.25 percent per month. These rates tend to be lower than private banks. Interest rates are uniform for all borrowers without adjustment for relative production risk. Data on loan size for the districts of Tam Nong and Thanh Binh show that small loans make up about 75 percent of the total number of VBARD loans. Medium-sized loans (VND 31–50 million) account for about 20 percent, and large loans (over VND 50 million) account for the remaining 5 percent.

The overwhelming majority, 85 percent, of VBARD loans in Dong Thap are short-term production loans tied to production cycles. Loan duration for rice production is usually 4 months. Loan officers and the client agree on a loan repayment schedule of principal and interest based on the customer's production characteristics. The repayment schedule may be different for the loan's principle and interest. For some small loans, the interest payment is due monthly but the loan principal deadline will coincide with production events such as a crop harvest. To illustrate, for rice production loans in Tam Nong district, VBARD collects loan interest and principal at maturity coinciding with the end of each crop cycle. Hence for the summer/autumn planting season, households borrow in May and repay loans at the end of August.

In the past, VBARD would forgive debt in the event of a significant natural disaster. This policy has since changed permitting only loan rescheduling. If loans are overdue because of natural disasters, disease, etc., credit officials will recommend rescheduling to the branch director at the customer's request. A loan can be renewed once or several times; but not beyond one production cycle for short-term loans, and not exceeding 6 months for medium- or long-term loans. In the event that clients cannot repay a loan within 30 days after the rescheduled period ends, regulations allow VBARD to seize and sell household assets to recover the principal and any unpaid interest. In practice, VBARD rarely does so due to complex legal procedures. Nonetheless, farm surveys conducted in Dong Thap in 2006 revealed that this did happen during the 2000 flooding and that farmers are concerned about this issue.

The VBARD Dong Thap district office has risk funds that insulate them in the event of large default losses. In 2006, defaulted loans were 1 percent of the district's total loan portfolio. The practice of requiring districts to maintain risk funds as a form of provisioning demonstrates that VBARD is moving to more commercial principles. Finally, VBARD continues to hold debts from borrowers who were affected by the early onset flooding of 2000 (a full 9 years after the event). These debts do not accrue interest, a policy which is not supposed to be put in practice in the future. Still, this new rule has not been tested in Dong Thap as there has not been a significant flooding event in recent years. Typically, these debts must be paid after 5 years.

3.2.4.2 MOTIVATING BUSINESS INTERRUPTION INSURANCE FOR VBARD

The GoV is currently transitioning many of its state-owned banking and financial services toward greater market orientation that includes the modernization of insurance regulation and other changes to improve the conditions for general insurability and risk transfer. As a component of these changes, the cost of rescheduling loans is being transferred to the provincial and district levels. There are real and significant consequential costs associated with widespread loan restructuring, along with the cost of loan defaults as financial regulations continue to evolve.

VBARD is a *de facto* risk aggregator and agricultural insurer through its lending practices. To review, characteristics of VBARD lending include (1) nearly flat interest rates that are charged throughout the country, thus VBARD pools risk nationally; and (2) in the event of a natural disaster that affects loan repayment ability, VBARD performs a loss assessment to determine if loans should be rescheduled. In the past, the government periodically recapitalized the bank for loan forgiveness and other additional expenses, but the practice of debt forgiveness has been discontinued as the government moves to shape VBARD into a more accountable commercial enterprise. Nonetheless, the GoV is still a source of capital should VBARD suffer from capital shortfalls. Loan rescheduling and some amount of commune-level loss adjustment continue to take place if the borrower qualifies. And like an insurer, VBARD now maintains local reserves to protect against losses created when the debt is rescheduled. These recent regulatory changes towards commercialization are serving as an important catalyst for VBARD and other lenders to consider innovative options to cover their lending exposure from natural disaster risk.

There are several possible approaches one might take in considering natural disaster risk transfer for VBARD. One approach is to develop insurance contracts that are tied to the expectation of loan default of clients resulting from an early onset flood event. While intuitively appealing, in the context of Vietnam, there are a number of difficulties with that structure. Current banking practices rarely move bad debt off the institution's accounting books. While there are loans considered to be in default, in practice, the bank rarely writes off such non-performing debt. Not having clear procedures to do so causes problems justifying the criteria of insurable interest as outlined in Chapter 2. A second problem with insurance tied to loan default is that it opens a pathway for *subrogation*, which would allow the insurance company to have a claim on assets of the defaulting clients in cases when an insurance claim is paid. The complication in this case is that the flood insurance would act as protection to the overall lending portfolio from the expected default rate during an early onset flood event and does not directly identify individual borrowers. It is also unlikely that claims of subrogation by an insurance company would be cost effective given the difficulty in seizing assets as experienced by VBARD. Finally, tying insurance to only loan default ignores other substantial costs associated with loan servicing and rescheduling.

An alternative approach is to consider only the direct and indirect opportunity costs and consequential losses accruing to VBARD when there is an increase in loan rescheduling needs caused by the early onset flood event. These costs arise because current VBARD lending practices do not include additional penalties or interest for rescheduling of loans. As such, these are funds that VBARD does not have available to lend its borrowers for future investment and production capital needs. These additional costs during times of natural disaster can be thought of as costs associated with disruption to the normal course of business. To be specific, what a business interruption insurance targets is the opportunity cost and consequential risk to VBARD that follow when loans are not repaid on time given the insurable event (early flooding). It is not insurance for individual loan default risk of farmers or even the portfolio credit risk of VBARD.

The business interruption approach avoids complications arising from subrogation and gives VBARD considerable flexibility to best use the indemnity payments from the insurance. However, because insurance payouts are tied to an insurable interest that relates to hardship experienced by agricultural producers, it would be inappropriate for a payout to be used in a manner that is inconsistent with measures aimed at reducing the costs of rural lending activities.

The strategy recommended by the project, would be to consider how indemnity payments made by the business interruption insurance could be used to substitute for some portion of the reserving requirements (setting aside of cash reserves) imposed by banking regulators to ensure solvency in event of widespread default. Holding cash reserves can be expensive in terms of forgone opportunities to invest relative to the cost of purchasing an insurance policy to offset some of the need for cash reserves. The exact mix of these two risk management instruments would be a function of the rate of return on capital and the insurance premium rate. The banking regulator might also impose limits of contingent funding coming from insurance indemnity payments relative to cash reserves, particularly since the need for reserving includes many items other than early onset flood risk. The goal of blending the two risk management instruments, insurance and cash reserves, is to reduce the overall cost of being able to meet financial obligations while considering the many sources of risk to the banking enterprise. This type of dynamic and innovative risk management will be needed as VBARD makes the transition to more commercial principles.

One use of an insurance payout which serves as a form of reserving would be to dynamically manage decisions regarding when and if to forego interest rate charges for some clients after a major flood event. Adjusting interest rates for clients under threat from flood impacts would likely lower the default rate of those holding debt for the maximum five-year limit

One of the necessary elements in creating a flood index for business interruption is to estimate the value or cost of the business interruption and determine if the index is a good proxy for these costs. These issues are examined in a subsequent section. First, however, having motivated the business interruption and consequential loss approach, it is necessary to review a number of legal and regulatory aspects of index insurance and business interruption.

3.2.5 Legal and Regulatory Risk in the Insurance Contract

Index insurance is a relatively new type of contractual arrangement from the point of view of the insurance regulator and is not specifically covered by international standards. As such, there are a number of legal and regulatory risks to consider that are often overlooked during the design phase of index insurance products. To minimize the legal and regulatory risk, an international legal and regulatory expert was retained to provide a review of the issues for the DoI and to assist in drafting an appropriate index insurance contract.

3.2.5.1 RELEVANT LEGAL FRAMEWORK

The relevant legal framework for this type of product consists of the following:

- The Civil Code 2005, and particularly section 11 [Articles 567 to 580] which deal with insurance contracts. The Civil Code governs the relationship between the parties to a contract and section 11 governs the relationship between the insurer and the insured;
- The Law on Insurance Business [No. 24 of 2000] also governs the contractual relationship between participants in the insurance market but also provides for the regulation and supervision of market participants; and
- Decree No. 45-2007-ND-CP [Providing Guidelines for the implementation of a Number of Articles of the Law on Insurance Business] and Decree No. 46-2007-ND-CP [Financial Regime for Insurers and Insurance Brokers] contain provisions relevant to the supervision of insurance business.

3.2.5.2 LEGAL RISK IN AN INSURANCE CONTRACT

For a contract to be regarded as an insurance contract, it must normally include the following features:

- The person/entity insured must usually have an insurable interest in the object insured;
- The person/entity insured must suffer a loss on the happening of the insured event; and
- The payment made to the insured by the insurer must represent an indemnity or compensation for that loss.

Previously, the issue of subrogation rights was raised in the context of a policy that compensated specifically for loan default of client farmers of VBARD in the event of early onset flooding and subsequent recovery rights by the insurer. When a contract is characterized as credit default insurance, a form of property insurance, the legal expert agreed that an insurance company would have right of subrogation under the Civil Code. In addition, from a practical standpoint, subrogation would be unworkable under an index-based credit default policy because indemnities are not tied to specific loans. In contrast, an index product characterized as business interruption insurance avoids encumbering a contract with subrogation issues. Business interruption can be considered a type of valued policy where the parties to the insurance contract agree in advance on the value of the insured loss given certain events that will cause a loss.

With regard to the provision that insurance must be compensation for actual sustained loss, the legal expert noted that the Civil Code contains provisions that, in his view, would enable the parties to an insurance contract to agree on the basis for the compensation provided that it is a genuine pre-estimate of the loss and that the index selected is a reasonable proxy for the insured's loss. A description and estimate of the insured's loss is therefore critical and the index must be chosen such that if the threshold is met, it is nearly certain that the insured will suffer a loss. This does not imply that the basis risk inherent in an index policy must be eliminated. Traditional insurance always contains an element of basis risk and valued policies trade off a degree of basis risk because of the savings in transaction cost. What becomes important however is that the insured can never recover more than the loss sustained under a total loss. That is, the expected total loss must always be equal or more than the maximum payment under the index insurance contract.

To the knowledge of the project, no index contract dispute has been tested in court so there is no precedent to guide in structuring the contract. While it must be accepted that there is some legal risk, the proposed business interruption contract is written to minimize legal risk. And while it is fundamentally a matter of Vietnamese law, the preliminary view of the legal expert is that:

- Excess water at the Tan Chau Gauging Station can be regarded as "the insurable event";
- VBARD or the other banks can insure a sum up to their maximum loss, but cannot "over insure" — see Articles 41 and 42 of the Insurance Business Law; and
- As the basis for the insurance payment can be "agreed by the parties in the insurance contract" (see Article 46.1 of the Insurance Business Law), the water level index may be used as the basis for the insurance payment.

3.2.5.3 Regulatory and Supervisory Concerns

Before a new type of insurance product is introduced, the insurance regulator must be satisfied that the insurer can cover the risk or that any "risk gap" is otherwise covered. There are three principle considerations for the regulator which include capital, reserves, and reinsurance.

An insurer needs to consider whether existing capital will support the contract risk when agreeing to the maximum sum insured otherwise there is a risk that the insurer will not be able to pay the claim and that other lines of business will be jeopardized. Reinsurance will reduce capitalization requirements. From a regulatory perspective it will be necessary for the insurer to reserve appropriately. Although the index insurance is a short-term product, the usual short-term reserving rules will not be sufficient. In this case the premium is calculated on the exposure to risk over a period of years and part of the premium in the years where there is no early onset flooding therefore represents a payment for the "bad year" when there is early onset flooding. The reserving requirement should, therefore, take account of the intertemporal nature of this contract.

Throughout the market development process and design of the prototype insurance contact, the project maintained a close collaboration with the insurance regulator, the DoI, who is fully aware of the various legal and regulatory issues. The DoI itself undertook several reviews of the draft insurance contract to ensure compliance with relevant regulation. These reviews should be seen in as a sign that the regulator desires to facilitate a solid contractual footing for the product. While carefully reviewing capitalization and reserving requirements is always good business practice, it should be noted and kept in context of a market development activity that it is unlikely that VBARD will want to insure more than a fraction of its total maximum business interruption loss sustained during an early onset flood event. At this time, VBARD has other provisions for coping with these consequential losses and extra cost that are created by early extreme flooding. Nonetheless, as VBARD adopts commercial practices, this form of insurance can be blended with provisioning as a more effective way to manage these risks.

3.2.6 Valuation of Business Interruption Loss

One of the conditions for the index approach to properly qualify as insurance is for the insured and insurer to agree that the index is a reasonable proxy for loss and that a pre-estimate of loss genuinely represent actual losses sustained during an insured event. This section outlines a methodology to estimate the cost of business interruption.

The value of business interruption is not currently an accounting item in VBARD records. These values have to be estimated using a reasonable methodology that reflects the exposure that would be experienced today should there be an early onset flood event. Again, loss in the proposed index insurance is defined as the expense and costs incurred by VBARD due to interruption of its business from early onset flooding in Dong Thap Province. While the methodology uses the value of loans made and loans unpaid, it is not the loans themselves that are being insured, but rather the opportunity cost of business interruption. The interruption stems from the need of VBARD to restructure and reschedule the operating loans to rice producers due to the financial distress caused when the annual flooding arrives earlier than anticipated, interfering with and degrading the rice harvest. In addition, there is a spillover effect that the project did not estimate. Borrowers of operational loans who are having difficulty may also experience problems meeting the obligations of other consumption or investment loans they have with VBARD.

3.2.6.1 PRE-ESTIMATE VERSUS *EX POST* LOSS ESTIMATION

The essential difference between an index policy and most non-index policies is the point in time at which the loss is assessed and agreed. In the case of most non-index policies the loss is assessed after the insurable event takes place and, generally, when the insured makes a claim. In the case of a traditional business interruption policy, this would involve a loss adjuster making an estimate of the losses suffered by VBARD after the flood. Particularly in the case of a business interruption policy, the figure arrived at by a loss adjuster would always be only an estimate of the actual loss. The loss adjuster would use an appropriate methodology to determine a reasonable estimate of the loss. As part of this, the loss adjuster would make many assumptions. Other loss adjusters could reasonably make different assumptions in the same circumstances and arrive at very different estimates of the loss. At the end of the process it is likely that only a single loss value would be developed. In some traditional business interruption insurance policies, the insured would have to agree on that number or appeal by requesting another loss adjuster.

Under an index policy, the principal is exactly the same. The parties agree on a reasonable estimate of the insured's loss. However, instead of a loss adjuster determining the estimated loss *after the event*, the parties agree on the loss estimation *in advance*, prior to entering into the contract. For business interruption based on early flooding, the higher the index, the greater will be the payment. This is based on the entirely reasonable assumption that if the river level is higher, the flooding will be worse and the consequential losses and costs will be greater. In other words, the level of the river represents the best estimate of the loss incurred by VBARD.

To summarize, in the case of both an index and non-index business interruption insurance:

- The parties must agree the estimated loss;
- A methodology is used, and assumptions made, to arrive at an estimate that both parties consider reasonable; and
- The sole difference between the two is the point in time when the estimate is made.

3.2.6.2 VALUATION METHODOLOGY AND APPLICATION

The method developed to evaluate the business interruption losses takes the observations of flood impact from previous early onset floods in recent record and asks what would be the impact of a similar flood today. This process is generally referred to as stress analysis. It is important to consider the impact that would occur today rather than only the impact of those events in the past since the physical infrastructure, government policy, and financial position of borrowers may be different causing different expected consequential losses and costs. A Delphi technique was employed to refine the estimates of impact of early flooding. Participants in the Delphi exercises included district and provincial level VBARD managers in Dong Thap as well as VBARD head office managers familiar with the conditions in the province.

The valuation method is composed of three distinct steps. In brief, step one involves estimating the impact on harvest today of early flooding of various magnitudes and, based on that information, estimating the proportion of loans that would experience problems with normal repayment. Step two calculates the value of rescheduled loans over five years for the different flood scenarios and estimates the payoff rate and the number of loans not yet paid by that time. Step three applies an opportunity cost to the streams of outstanding rescheduled loan values over the five years and finds the current value, the net present value (NPV), of the opportunity cost. This yields the maximum probable loss estimate of business interruption. Of this amount, it was recommended that VBARD insure only a fraction, perhaps 20 percent, rather than the full amount. The reason is that the insurance should work as a complement to other strategies available to VBARD to manage its business interruption risk. Taking a small position should also ease any concerns that either the regulator or insurer might have about the possibility of over-insuring. This position of the maximum probably loss taken by VBARD represents the maximum sum insured (MSI) which is a key parameter in the proposed index insurance contract.

The following examines each step in more detail to illustrate that the proposed flood index is indeed a good proxy for business interruption loss.

3.2.6.2.1 Step 1: Estimate Impact on Repayment

Table 3.1 shows the correspondence between historically observed early onset flood events, their frequency, and estimates of the impact from the point of view of the current year. For example, in the year 2000, the maximum water level during the critical window of June 20–July 15 was 2.98 meters. Given the distribution of all maximum flood levels during this time frame, this represents a 1-in-10-year event. Using historical records from VBARD and data on the rice harvest progression, a preliminary estimate was made of the hectares not harvested and percentage of problem loans. Note that the water level of 3.50 meters has not yet been observed during the critical window during the period of record. However, given the estimated kernel probability distribution of historical water levels, water levels of 3.5 this would represent a 1-in-100-year event. Also note that the water level observed during the critical window in year 2001 is too frequent to be considered insurable. It is included here only for illustration.

Table 3.1 Estimate of Unharvested Area and Problem Loans Due to Early Onset Flooding, 2008

Tan Chau Gauging Station River Level (Meters)	Year	Event Type (Years)	Frequency (%)	2008 Estimate	
				Unharvested Area (Ha) (%)	Loans with Problems (%)
3.50	Unobserved	1 in 100	1.0	60	45%
3.35	1979	1 in 33	3.4	35	30%
3.13	1981	1 in 15	6.9	25	20%
2.98	2000	1 in 10	10.3	20	10%
2.85	2002	1 in 7	13.8	10	8%
2.76	2001	1 in 6	17.2	(Too Frequent to Insure)	

Source: Authors

The preliminary estimates were adjusted by asking Delphi experts (provincial and district level VBARD managers), "What would be the rice hectares not harvested in 2008 if the same water level as observed in 2000 were to occur during the critical window?" This procedure corrects each preliminary estimate to account for new infrastructure and new technology on the impact of early onset flooding. The next step was to adjust the preliminary estimate of the percentage of loans likely needing rescheduling given the estimate of hectares not harvested and the financial vulnerability of rice producers in 2008. Again, this information cannot be found in data records and is necessarily an estimate because it is forward looking to an event impact that has not happened yet. This is a general procedure for stress analysis. However, the estimates are based on historical observation corrected for the current operating and financial environment by the Delphi experts.

The Delphi experts cited several justifications for their suggested changes to the preliminary estimates which were higher than the experts believed. First, they agreed that changes in the infrastructure have altered the severity of early onset flooding from previous years but they also agreed that flood risk still remains. Second, they indicated that more recent changes in rice cultivation practices have developed that allow for earlier planting and consequently earlier rice harvest, thus somewhat mitigating the impact of early onset flooding during the critical window detailed in the pilot insurance product. These advances are on the margin, likely related to the rate of varietals adoption, since earlier harvest is not evident from recent rice harvest progression data.

The next information needed is the value of portfolio lending vulnerable to the early onset flood event. This value comprises two parts. One part is the current (2008) value of operational lending for the second season rice crop and the other part is the value of current (2008) investment and consumption lending. These values can be found or closely estimated from current VBARD records. Total VBARD lending in Dong Thap for the two components outlined is approximately VND 1,800 billion of which approximately

VND 500 billion is second season rice operational loans. When thinking about the total portfolio of lending that could be exposed to early onset flood impact, it was agreed that a rice producer would have trouble meeting the loan obligation on a consumption or investment loan if he also had trouble repaying a shorter duration operational loan. In addition, non-producers who are nevertheless dependent on successful rice harvest for a significant proportion of their income would also experience problems repaying a consumption or investment loan in the event of a severe early onset flood. It was estimated from VBARD records and Delphi input that the combined amount of the operational lending and spill over that is vulnerable amounts to approximately VND 1000 billion in 2008.

3.2.6.2.2 Step 2: Estimate Value of Rescheduled Loans

The annual value of rescheduled loans over five years, corresponding to the river levels shown, estimated if the event were to occur in 2008 are shown in Table 3.2. In the second column, for year 2008, the value is simply the proportion of loans experiencing difficulty multiplied by the value of the vulnerable lending portfolio. This value is reduced over subsequent years as borrowers continue to make payments and close out their loan obligations. However, even after five years some proportion of the original rescheduled loans remains unpaid. While in a normal year the failure to make repayment on a rescheduled loan can be as low as one percent of the value of lending, during a year when early flooding creates difficult conditions the failure to make repayment on rescheduled loans can reach as high as 20 percent. This value is exactly what was observed during a review of lending outcomes following the 2000 flood. It was agreed by VBARD experts that this value could be higher if penalties or higher interest were charged on rescheduled loans. To be conservative, the 20 percent value was retained in the calculations.

Table 3.2 Annual Value of Rescheduled Loans Unpaid over Five Years (VND Billion)

Tan Chau Gauging Station River Level (Meters)	2008	2009	2010	2011	2012	Value of Outstanding Loans after 5 Years (20%)
3.50	450	330	240	180	144	90
3.35	300	220	160	120	96	60
3.13	200	147	107	80	64	40
2.98	100	73	53	40	32	20
2.85	80	59	43	32	26	16

Source: Authors

The repayment rate between the estimated initial impact and the value of outstanding loans after five years was modeled as a non-linear decreasing function of time. This approach assumes that a greater proportion of people will be able to repay their loans in the first years but that for those who are unable to repay initially, it becomes more difficult to make repayments and hence, the repayment rate falls over time. The shape of the payback function and the remaining value of loans unpaid are consistent with the idea of poverty traps — the vulnerability to adverse shock is so great for some people that they are never, or only over a long period of time, able to fully recover.

3.2.6.2.3 Step 3: Estimate Opportunity Cost and Maximum Possible Loss

The final step shown in Table 3.3 is to calculate the business interruption cost of each of these outstanding loan balances for each year and then to express the sum of the values in terms of current value. It is given that the opportunity cost to VBARD of having an outstanding loan balance unpaid is 10 percent, which is a very conservative value of the cost of capital given that the annual charges for current interest rates exceeds 13 percent. Next, the net present value for each of the water levels at Tan Chau Gauging Station is found over the five year interval. The discount rate applied in the NPV calculation is 5 percent.[21]

Table 3.3 Annual Opportunity Cost and Net Present Value of Business Interruption

Tan Chau Gauging Station River Level (Meters)	2008	2009	2010	2011	2012	Net Present Value
3.50	45	33	24	18	14	120
3.35	30	22	16	12	10	80
3.13	20	15	11	8	6	53
2.98	10	7	5	4	3	27
2.85	8	6	4	3	3	21

Source: Authors

For example, the business opportunity cost experienced by VBARD for a water level of 3.13 m during the critical window is estimated to be VND 53 billion (~ USD 3.3 million). The value of the maximum probable loss that could be sustained by VBARD from business interruption should a 1-in-100-year early onset flood event occur, corresponding to a water level of 3.5 m at the Tan Chau Gauging Station during the critical window, is approximately VND 120 billion (~ USD 7.5 million). If VBARD were to take a position of 20 percent of the maximum probable loss to insure, the maximum sum insured (MSI) in an insurance contract would be VND 24 billion (~ USD 1.5 million).

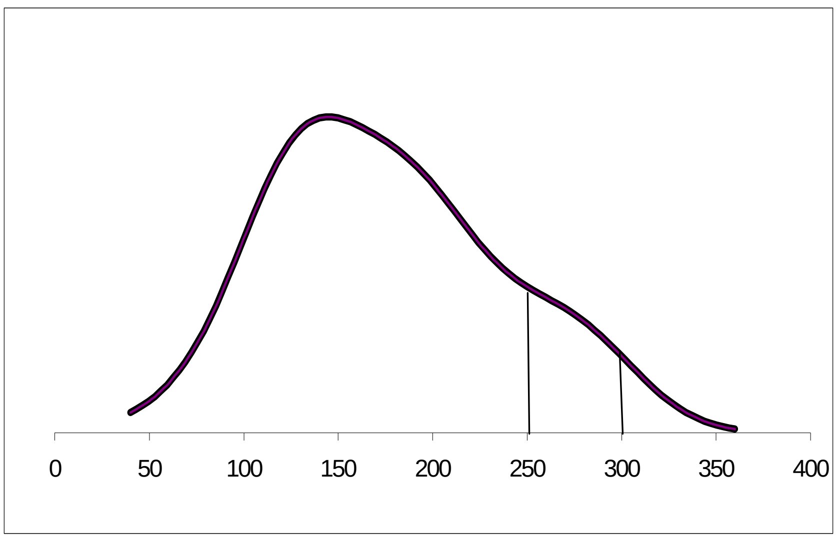
3.2.7 Prototype Business Interruption Contract

To begin thinking about a prototype index-based contract to address the early onset flood risk, it is instructive to estimate the probability distribution function (pdf) of the index over the specified time period (Figure 3.16). This provides a visual indication of the distribution of possible extreme events and is

[21] There are a variety of arguments for a higher or lower discount rate in the net present value calculations. However, the results are not highly sensitive to changes in the discount rate since the bulk of the present value occurs in early periods. For example, if a discount rate of 10 percent were used, the value of the maximum possible loss would only decrease from VND 120 to 107 billion.

among the first steps on underwriting the contract as it provides an estimate of the pure risk. Many actuaries use kernel smoothing procedures to estimate the pdfs, as is done for these data. The estimated pdf is represented in Figure 3.16 based on the maximum three-day centered moving average water level values during the vulnerable period for the 27 years of available data. While there have been no observed values that exceed 300 cm during this time period, the data and the smoothing procedures used here clearly demonstrate that this is possible. Insurers always approach these types of problems with a belief that the worst events are not fully represented in the past data. As shown here, there is enough area under the curve above 300 cm that insurers would load premium rates to account for the probability of such extreme events (even though they have not occurred for the past 27 years). Of course, 27 years does not provide the proper time to capture what can be a 1-in-100 year event. This is a major reason that insurers use procedures such as a kernel smoother to lengthen the tails of a probability distribution that is developed from a small sample size.

Figure 3.16 Kernel Smoothed Probability of Maximum Water Levels at Tan Chau Gauging Station, June 15–July 5



Source: Authors.

The most straightforward index insurance contract to understand and price is one with a linear payout function having a defined upper limit after which indemnity payments cease. Including and upper limit on the contract limits the downside risk for the insurer which helps to keep the insurance affordable. In practice, this does not necessarily mean that the value of the insurance is diminished for the insured. This is because, at some high level, the additional losses sustained by an additional unit of floodwater will begin to diminish.

In the case of the linear contract, the payment rate (PR) is calculated as the product of the maximum sum insured (MSI) by one over the difference between the upper limit (UL) and the threshold value (T):

$$PR = MSI \times [1/(UL - T)].$$

Given that MSI is expressed in terms of monetary units, the payment rate is also expressed in monetary units. The percentage PR on any MSI is found by substituting 1 in for MSI. Should an early onset flood event occur, the business interruption loss payment, the indemnity, is calculated as the minimum of either the product of payment rate (PR) by the difference between the maximum river level (MRL) and the threshold (T) or the maximum sum insured (MSI):

Indemnity = min [{PR x (MRL- T)} or MSI].

VBARD, or any risk aggregator who purchased such a contract, would determine the amount of exposure they have to early flooding and then make a decision about the MSI (liability) needed to protect this exposure. The MSI (liability) selected would drive both the total premium and the indemnity payments.

While the final business interruption contract is priced by the insurance company and their reinsurance partner, the project undertook exploratory pricing analysis to help identify some of the critical parameters and as an educational exercise. Recall that at the threshold of 250 cm, an early onset flood event was estimated to occur approximately 1 in 5 years. At this level, the insurance would be considerably more expensive as it includes more frequent, though less disruptive, events. Raising the threshold reduces the frequency that an insurance contract would pay but it also makes it more affordable while continuing to provide protection for the truly disruptive and catastrophic early onset flood events. Based on the analysis, the project recommended a threshold level of 280 cm during the vulnerable period, also called the period of coverage, and an upper limit of 350 cm. At this threshold, the frequency that an insurance against an early onset flood event would pay indemnities is approximately 1 in 7 years, a level that is usually considered insurable for catastrophic events. Using these values for the threshold and upper limit, the percentage payment rate for such a contract would be 0.1428 per cm of floodwater in excess of the threshold. For example, if the is levels where at 300 cm (20 cm over the threshold) the payment rate would equal 28.6 percent of the MSI.

For a pilot test, the project recommended that the MSI selected be set at USD 1 million (which is only 13 percent of the maximum exposure calculation for a 1-in-100 year event of USD 7.5 million). However, it is also important that the total sum insured be large enough to interest those market participants who are needed to effectively transfer the risk. This level of coverage is generally considered to be the minimum size needed to sustain commercial interest in a product beyond a pilot activity. This is particularly important for the global reinsurer.

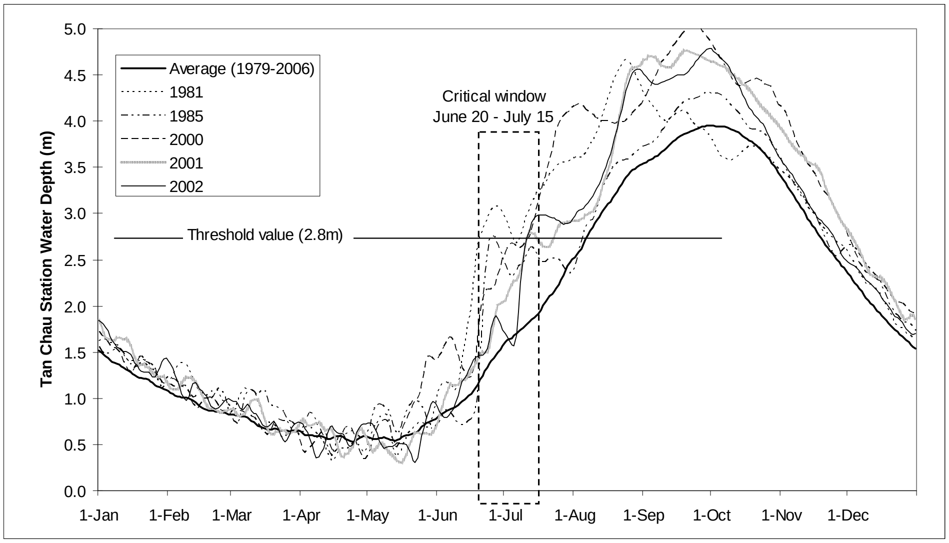
3.2.7.1 Elements of the Index Insurance Contract

Every index insurance contract will have the following or very similar elements. While the legal contract will include specific wording, it will define all of the elements included below, sometimes organized on a format called a term sheet or schedule. The elements presented here correspond to the actual contracts offered to VBARD and based on the prior discussion.[22]

The Risk: Early onset flooding in Dong Thap Province. Early onset flooding as measured by water levels exceeding 2.8 m at the Tan Chau Gauging Station is empirically estimated to occur in approximately 1 in 7 years (Figure 3.17).

[22] The actual contract wording is not included here since it is a specific legal document between the insurance company and VBARD. The insurance company offering the product in 2009 was Bao Minh. The reinsurer offering to cover 90 percent of the risk was ParisRe.

Figure 3.17 Threshold and Period of Cover of the Early Onset Flood Contract



Source: Authors

Period of Insurance Cover: The risk of early onset flooding is the period June 20 to July 15 which is when the rice harvest is progressing. Flooding after this period is considered normal flooding (Figure 3.17).

River Level Index: The river level index is the maximum three-day centered moving average of daily water level during the period of cover.

Location of Index Measure: River level at the Tan Chau Gauging Station.

Threshold and Limit: The insurance begins making payments for each one (1) centimeter of water when the river level index reaches 2.8 m (threshold). The insurance stops making payments when the river level index reaches 3.5 m (limit).

Insurance Cover: USD 1 million — this represents the maximum sum insured payable to VBARD for business interruption.

Premium Rate: The percentage amount of payment per unit of insurance coverage obtained from the insurer. A typical rate for this kind of catastrophic insurance with this frequency of payment is roughly +/- 15 percent.

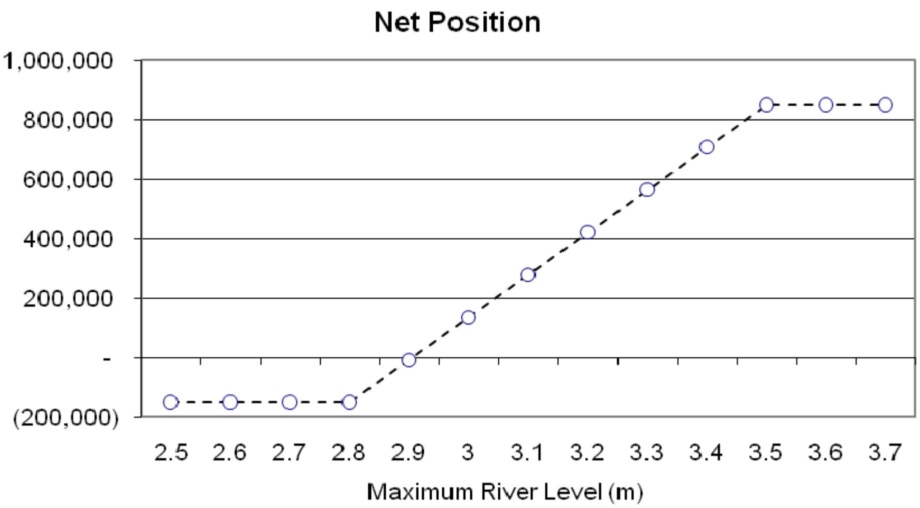
Premium: The amount payable from VBARD to the insurer for a certain level of insurance cover. For example, for USD 1 million of coverage provided at a 15 percent premium rate, the calculation is simply: (1,000,000 * 0.15) = USD 150,000.

Indemnity: The amount that VBARD receives for business interruption losses is based on the river level index. The indemnity ranges between 0 and USD 1 million depending on the maximum river level index observed during the period of cover. With USD 1 million and this contract, the payment would equal USD 285,714 should the river reach 300 cm during the insured period.

Net Position: The schedule of indemnity received by the insured after including the amount of premium and final value of the river level index (Figure 3.18); The payments are discrete and correspond to each one (1) centimeter increment of the water-level index (USD 14,286).

VBARD Risk Exposure: Business interruption maximum probable loss was estimated at VND 120 billion (~ USD 7.5 million) and represents an *ex ante* genuine pre-estimate of loss. Actual insurance coverage (maximum insurable loss) should be some fraction of the maximum probable loss. An insurance policy with USD 1 million cover represents a maximum insurable loss that is ~13.3 percent of the maximum possible loss based on these estimates. VBARD could select a higher sum insured and, in the future, may be advised to do so as they can substitute this insurance for provisioning requirements.

Figure 3.18 Example of Net Position at 15 Percent Premium and USD 1 Million Coverage



Source: Authors

3.2.8 Pilot Testing the Business Interruption Insurance Pilot: A Limited Market Test

As discussed in previous chapters, in regard to the Market Development Model, estimating the demand for a new insurance product where none existed before is very problematic. This is why a limited pilot activity is recommended where the true market demand can be actually observed at reasonable cost. This is the same method used by businesses when they use limited test markets to gauge demand for a potential new product. This section describes the various involved stakeholders and details some of their activities to bring the business interruption insurance contract to the market test stage.

3.2.8.1 DOMESTIC INSURANCE PARTNER: BAO MINH INSURANCE CORPORATION

Early during the technical assistance work, the project met with a number of important domestic insurance companies in order to identify an enthusiastic and engaged insurance partner. This is an important consideration in the market development approach since it requires a strong commitment in terms of time and resources to bring a new product to market. The project selected and worked closely with the Bao Minh Insurance Corporation, headquartered in Ho Chi Minh City. Bao Minh has an extensive book of business throughout Vietnam and was interested in the idea of index-based insurance as a way to reach the underserved agricultural sector and as an opportunity to expand their business activities. Bao Minh spent considerable time learning about the index approach and understanding the problem of early flooding in Dong Thap.

As part of their due diligence, the Bao Minh legal department thoroughly reviewed all aspects of the proposed business interruption insurance as this type of contract is unlike their normal lines of business. In preparing the contract, the insurance company organized a service contract with the SRHMC for the timely reporting and certification of the river level data from Tan Chau Gauging Station.

3.2.8.2 Reinsurance and Regulatory Approval

One of the attractive features of index-based insurance is the ease that these types of contracts can be transferred to international markets. As described in Chapter 2, a domestic insurance company would not want to retain the full exposure contained in the business interruption contract due to the difficulty in diversifying catastrophic risk. Large payments can be expected in serve flooding years. Instead, reinsurance is used as the financial vehicle to transfer a portion of the risk out into the international markets. The project approached three different reinsurance companies, representing over half the global reinsurance capacity, to introduce them to the business interruption flood insurance concept and build their interest in participating in the market development effort.

Bao Minh was able to obtain reinsurance from ParisRe, a major international reinsurance company based in Paris. France. Before agreeing to provide reinsurance, underwriters from ParisRe examined the project documentation relating to those critical elements of the index as described previously, such as upstream influences on river levels, information about the station, and other analysis that examined key aspects of river level behavior during the proposed period of vulnerability (period of cover). Using the same information and thresholds as used by the project, ParisRe then independently priced the risk and presented an offer to Bao Minh on the reinsurance. ParisRe offered an index-based business interruption quota share reinsurance contract with 10 percent local retention. This means that the reinsurer would pay 90 percent of an insurance claim while Bao Minh would pay 10 percent of the claim. In addition to sharing proportionally in the risk, ParisRe and Bao Minh would share proportionally the premium collected.

Finally, before business interruption insurance could be offered, regulatory approval of the contract to VBARD and of the reinsurance relationship had to gain the approval of the insurance regulator, the DoI. As outlined in the legal and regulatory section, the review of the contract is to ensure compliance with Vietnamese insurance laws and regulations. The review of the reinsurance relationship is to ensure that the liability contained in the legal contract could be met in the event of a claim. In both cases, the DoI provided their review and approval in writing to the insured and the insurer.

3.2.8.3 Business Interruption Insurance Offer

The insurance contract for the business interruption impact of early flooding in Dong Thap province was offered twice to VBARD by Bao Minh, first in 2008 and again in 2009. In each instance the contract was fully priced using commercial principles, the sum insured was for USD 1 million, the contact was backed with an excess of loss reinsurance from ParisRe to transfer the risk internationally, and the contract had regulatory acceptance.

The first market test (2008) was rushed and allowances were made on the sales closing that provided enough information about water level in the Mekong River that VBARD could anticipate that the probability of early onset flooding was very low. VBARD did express interest in the product and encouraged the project to continue the work so that an offer in 2009 would be made on a timely basis allowing for more time to evaluate the purchase decision.

The 2009 contract offer was sufficiently early and proceeded by two agricultural insurance education workshops as well as the preparation of additional materials specifically requested by VBARD. The actual offer involved a formal meeting between representatives of Bao Minh and VBARD management in Hanoi. At that time, VBARD representatives expressed the need to inquire of its legal department the taxation consequences of receiving indemnities, after which the contract would be presented to the VBARD management. After consideration, questions, and interest that extended until the sales closing date of May 15, VBARD did not purchase the product. Although the project has not yet received any formal feedback, one comment heard was that VBARD has already provisioned, or set aside cash reserves for the current year and so they did not feel they needed insurance. Another comment was that VBARD did not think it would flood in 2009.

In considering this outcome, it is important to recognize that the question of early onset flood incidence is not one of speculation. However, if VBARD found empirical evidence to suggest the early flooding was unlikely, then the insurance sales window will need to be positioned earlier in the year to avoid potential adverse selection. In addition, there may have been some confusion regarding the question of provisioning. The project has presented the contract as a means for the bank to blend risk management strategies: reserving and using this new form of insurance. Using insurance to offset a portion of the reserving requirement represents an improvement in bank risk management in the course of ongoing transition to more commercial principles. As it stands, VBARD and the government continue to hold much of the costs of agricultural risk. It is hoped that VBARD will consider the question of insurance and provisioning requirements at the time those decisions are next made, and begin a dialogue with Bao Minh and the project team regarding the potential of a subsequent offering of the business interruption insurance.

3.2.8.4 Value Chain Applications

The project feels strongly that the flood index insurance product is a major breakthrough and will attempt to leverage the existing work and relationships through a variety of different potential venues. Bao Minh demonstrated significant leadership and commitment to the development process for the product, which can be used in future years. While the initial business interruption contract was developed with agricultural lenders in mind to help prepare for and ease into transition, the contract as developed can also be applied to other customers in the rice production value chain. The fact that the product is positioned as a form of business interruption insurance to compensate for consequential losses and extra costs associated with early extreme flooding opens new opportunities.

A variety of firms in the value chain for rice production that are exposed to early onset flood risk should be interested in the business interruption insurance product. For example, any firms that are exporting high quality second season rice from the Mekong Delta should be interested in this product. Not only are these firms exposed to throughput risk (lower amount of rice to export), they are also exposed to quality risk as an early onset flood event adversely affects the quality of the high value second season of rice. The value of exported rice exceeds USD 100 million. Early onset flooding will likely reduce that number by more than 10 percent.

The product can also be used to provide early payments for the consequential costs and losses for a wide range of stakeholders as they prepare for what is highly likely to be an extreme peak flood event during late September and early October. The reason is because the time period focused on with this contract is an excellent forecast of serious peak flood problems to follow. For example, the flood insurance product would have made substantial payments in 2000. These payments would have been received just before the major catastrophic peak flooding that occurred later in the year.

As part of the market development process, and to help capture some value of the product development investment, the project is recommending that a commercial broker be identified to pursue market opportunities of this type prior to the 2010 flooding season.

3.3 CASE 2: Dak Lak Drought Index

There is a clear parallel of business interruption, consequential losses, and extra costs at the enterprise or risk aggregator level with "livelihoods interruption insurance" at the household level. While the specifics often depend on the type of risk and risk management response, it is often the case that the financial impact of a natural disaster on households is not one of simple loan default. Sometimes, in the course of coping with a manifest risk, farmers often take measures that mitigate the impact of the event. Such actions in the face of a disaster might even be able to save the better part of crop production but in doing so the household incurs additional, unanticipated expenses and often at a moment in time when they are most cash constrained. So even if production is saved, the additional costs incurred still translate into financial difficulties including that of operating capital loan repayment. Lack of cash at critical moments may even prevent the household from taking the appropriate action to mitigate the impact of the natural disaster. In addition, such a disaster might affect other activities, such as curtailing off-farm employment as well as household consumption, depending on the food security situation.

3.3.1 Prefeasibility

To begin, ongoing market development work for livelihoods-inspired, index-based drought insurance for individual coffee producers in the Vietnamese central highlands province of Dak Lak is described. In early consultation with stakeholders, serious drought events in this region were identified as an important risk since much of the agricultural activity and economic prosperity for many households are dependent on coffee production. Output and input price volatility is also a factor in economic well-being, but among natural disasters, drought was indicated as being the most disruptive. Managing drought risk is particularly important since the coffee tree is a perennial plant, taking at least three years to establish and reach full production levels. Therefore, drought stress that kills coffee trees has financial consequences for the household beyond losses of the current crop cycle.

Unlike the flood events described in the Dong Thap case, drought is more amenable to insurability at the individual farm level, though there are still difficult challenges to deliver the product in a cost effective fashion. Drought is usually a widespread correlated event that cannot be readily influenced by management. Nevertheless, basis risk can present itself spatially, especially if there are microclimates in a drought zone and if there are insufficient rainfall gauging stations to capture regional variation in drought intensity.

3.3.1.1 COFFEE PRODUCTION IN DAK LAK

From the early 1990s, Vietnam has expanded production and emerged as one of the largest coffee exporting nations, especially of Robusta beans, with Dak Lak province contributing nearly half of all national output. This expansion of the coffee area in Vietnam and other regions was a response, in part, to high international prices following a major killing frost in Brazil, a dominant coffee producing country. Typical of many agricultural booms and busts, subsequent production recovery in combination with area expansion flooded coffee markets resulting in sustained low prices from 2000 to 2004 (Jones, 2006). The ensuing low profitability resulted in a contraction of the coffee area that has since recovered near to pre-2000 levels. Estimates of average yield between 2000 and 2006 are around 1.9 tons/hectare.

Coffee production is dominated by small farms. Farms managed and operated by only one family account for 95 percent of coffee production while state-owned farms account for the balance. Fully two-thirds of coffee farms are of 1 hectare or less with only 3 percent larger than 3 hectares (Marsh, 2007). Coffee is dominant in the rural economy with an average 45 percent of rural households involved in coffee production (Marsh, 2007). Clearly, coffee production in Dak Lak is small-scale farming.

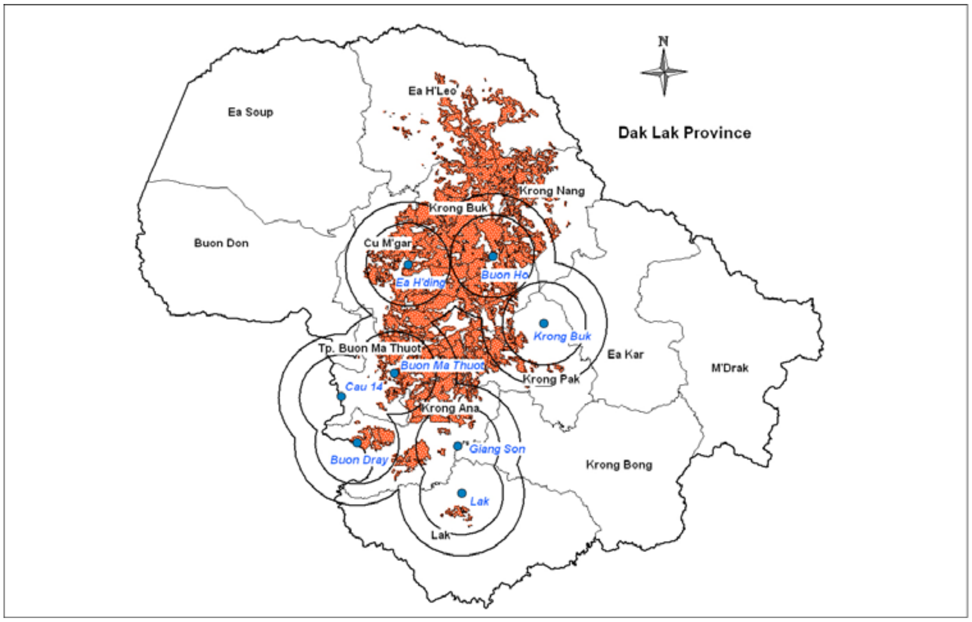
Robusta coffee production is well-suited to the climate and soil conditions of Dak Lak. The key physical feature of Dak Lak that enables coffee production is the basaltic soil structure that allows for high water infiltration. The shallow basalt layer sits atop a harder, less penetrable dome which results in substantial groundwater storage that is accessible by even shallow hand-dug wells. This stored groundwater is critical for coffee production as it is the source of irrigation for coffee trees during the dry period that follows harvest in December. The coffee producing area in Dak Lak (Figure 3.19) is roughly approximated by this physical characteristic.

Coffee cropping patterns and the interaction with the annual rainy season that runs from April to November is shown in Figure 3.20. The crop calendar indicates the normal expected need for irrigation cycles, usually three, which are spaced about 20 days apart beginning in March.

3.3.1.2 Risk Identification and Proposed Index

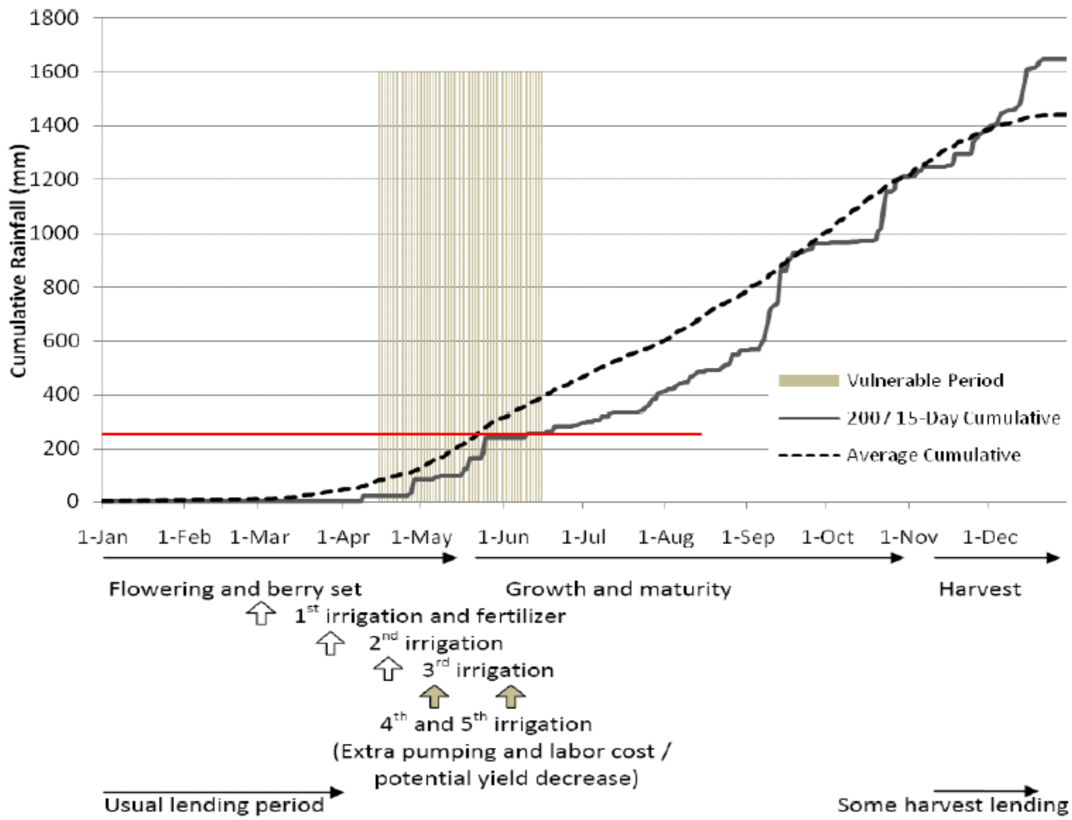
Drought in the region is usually characterized by slow onset of the rainy season (April, May, and June). Drought during this period necessitates additional irrigation beyond the normal cycles. However, since this season follows the dry season and a previous three irrigation cycles, groundwater is generally depleted. The impact is to extend the typical irrigation cycle from one day up to one week per hectare due to slowed well recharge. The extra pumping and extra labor costs can be as high as one-third the usual annual production costs, which range between USD 300–600/ton. Depending on the severity of the drought, production losses may also be experienced. One such drought occurred in 2005, when between 10–30 percent of the coffee area in Dak Lak was affected. This drought is depicted in Figure 3.20 for Krong Buk district, where the 2007, 15-day cumulative rainfall is shown to fall below average cumulative rainfall during the vulnerable period.

Figure 3.19 Coffee Production Area with Rainfall Station Locations, Dak Lak.



Source: Authors

Figure 3.20 Annual Rainy Season and Cropping Calendar, Krong Buk District, Dak Lak



Source: Authors

The proposed index-based livelihoods insurance against drought would be designed to cover the additional costs incurred by individual farmers when there is insufficient cumulative rainfall in the early rainy season. The provisional window of vulnerability is estimated to be for the period between April 15 and June 15. For a particular farmer, the index would be the cumulative rainfall measurements taken from the nearest rainfall station up to some maximum distance, such as 15 kilometers, as shown in Figure 3.19. If the index does not exceed a certain minimum threshold, such as 200 mm during that time, then indemnity payments would be made to the farmer. Because of geographic and weather pattern differences, the period of vulnerability and thresholds may be slightly different for each rainfall station.

3.3.2 Development Process

This product is in the ongoing development process. The process has gone beyond the pre-feasibility stage and has entered into the feasibility stages with the major goal to design a product and receive reactions for coffee farmers about their interest in the product. Ongoing work includes further understanding of spatial analysis of rainfall patterns, the determination of rainfall zones for each index, prototype product interviews to refine critical product parameters, and estimation of maximum possible loss. As with the flood product, the insurance contract will need to be written such that it meets the regulatory approval of the DoI. Work to this point, strongly suggests that the product will need to be written as a business interruption insurance product given the dynamic nature of irrigation and coffee production. Such a policy should be more attractive than a traditional crop insurance product because coffee farmers can still have a crop yield due to extra efforts to irrigate and save the crop. The extra irrigation will mean that there is little or no crop loss that would trigger a payment from a traditional insurance product; yet, the farmer has incurred significant extra costs to save the crop.

In conjunction with the insurance company, product delivery channels will need to be identified and personnel trained. Whereas the flood product was offered to a single client during the pilot, the drought product will be offered to many small coffee producing households. Even though index insurance eliminates the need for loss assessment, product delivery and sales can still be a significant cost. In general, the traditional insurance agent model is not cost effective when selling individual small-valued policies. Consequently, product delivery will depend on an organization having an established and well-trusted network that readily connects with individual farmers in order to minimize delivery and service costs. To be successful, the delivery channel must also be prepared to educate farmers about the benefit, and the limitations, of the drought insurance.

3.4 Conclusion

This chapter, Chapter 3, reviews two pilot activities of agricultural insurance market development in Vietnam. Each application demonstrates a market development approach that emphasizes a thorough risk assessment targeting the weather risks that are most disruptive for agricultural producers and that also hinder rural financial market development. The examples of index-based business interruption insurance against early onset flooding in Dong Thap Province and against drought in Dak Lak Province reveal that the process of market development is iterative, that is, ongoing market research and risk assessment expose new information used to update assumptions and insurance product design. In addition, the process of insurance market development is not just about designing insurance products, but encompasses stakeholder education, consideration of the legal and regulatory basis of the risk transfer mechanism and of the arrangements for sufficient risk financing, which itself requires the detailed examination of the many facets of a natural disaster risk.

The examples also demonstrate the usefulness of a business interruption approach to agricultural insurance against natural disaster. Business interruption has the ability to capture significant expenditures made and costs incurred by farmers responding to a natural disaster. These costs may only be partially reflected in simple measures of yield reduction or production loss. Furthermore, the combination of the index-based and the business interruption approach to insurance market development seeks to preserve positive incentives in the agricultural system by rewarding diligent risk management and risk mitigation activities and by making more transparent the "price" and incidence of risk in an agricultural system.

Finally, an important message from these examples and from the lessons in Chapters 1 and 2 is that in insurance market development, there is no "one-size-fits-all" policy. Even though both examples use an index-based approach each product must be tailored to the specific conditions of the stakeholders, the region, and the risk.

The last chapter, Chapter 4, is a guide, supported with information from the previous three chapters, for policy makers to developing an initial framework for agricultural insurance and presents what is essential to building this framework: risk assessment, establishing priorities for insurance market development and an institutional system to support this formulation.

Chapter 4 A Policy Vision for Developing Agricultural Insurance

4.1 Introduction

This chapter is designed as a summary chapter to provide policy makers guidance for developing agricultural insurance. While each of the four chapters can be read independently, the rationale and guidance provided in this chapter is supported by material from the previous three chapters. To provide links to the other chapters, "Quick Reference" sections provide information directing the reader to the other chapters for specific reference and further reading.

Because of the unique risks and population characteristics of each country, agricultural policies must also be unique. Just as the great diversity across a country calls for proper risk assessment and product design that is carefully tailored for the local level, it is generally a mistake to exactly transfer a policy between countries without properly accounting for unique differences. Agricultural risk management policies must therefore be developed and evolved through an iterative process.

Chapter 1 reviewed the difficulties with implementing traditional agricultural insurance in countries that are dominated by small farms. While international experience, such as the experiences of the Vietnam cases presented in Chapter 3, can be used to assess policy choices regarding agricultural insurance, each country has many unique characteristics so it would be unwise to transfer policy solutions from other countries without considering the context. For example, like many developing countries, small farms dominate the landscape of Vietnam. Multiple weather risks affect the daily lives of these farms; however, the institutional settings in Vietnam are quite different than many countries. For example, Vietnam has many social programs that provide assistance to families involved in farming. Within the last fifteen years, Vietnam policy makers have worked to make banking services available to Vietnamese farmers by creating a dual state bank system. For the poorest farmers, the Vietnam Bank for the Poor offers loans. For more commercial, yet still quite small farms, the VBARD provides loans. As was developed in other chapters of this handbook, VBARD practices have served to provide a form of agricultural insurance. For some time, VBARD forgave loans of farmers suffering from a natural disaster and even now restructures loans for these farmers. While this does not relieve the full stress of lost crops due to bad weather, VBARD practices do serve as a form of agricultural insurance, given that interest rates to farmers do not reflect the differences in risks due to bad weather that are faced by farmers in different regions of Vietnam. Ultimately, the government of Vietnam pays for these added costs by recapitalizing VBARD.

To be clear, any assessment of policy choices involving agriculture insurance must consider how these policy choices fit with existing policies within a country. Several steps should be involved in the policy development process:

1. **Identify general policy goals.** Policy makers must conceptualize and communicate general goals to guide agricultural risk management efforts. For example, priorities for investment may differ if policy goals highlight strengthening the rural economy, easing the transition to more market-oriented policies, protecting farm households from revenue shocks, or providing a safety net for the poor;

2. **Develop an initial framework.** Policy goals can shape the framework for implementing insurance market development. Risk assessment describes a risk and its effects in a specific local context. Findings from risk assessment highlights which risk management strategies are likely to meet policy goals in the most cost effective fashion. In this way, risk assessment also identifies policy choices. Testing these policy choices on a small scale, as in a pilot, allows learning through experience and creates opportunities to assess the effectiveness of these strategies for meeting policy goals;
3. **Clarify policy goals based on experience.** The risk assessment process and experience with specific risk management mechanisms should allow policy makers to develop more specific goals for addressing a risk in a specific context;
4. **Develop an Agricultural Insurance Law.** Only after experience with specific products and an enhanced policy vision has been established should an Agricultural Insurance Law be developed. Establishing an Agricultural Insurance Law too early increases the likelihood that mistakes will be made. An Agricultural Insurance Law is likely to be most effective as an enabling framework that allows markets to develop to meet local needs; and
5. **Create capacity.** During the course of developing policy goals, conducting risk assessments, and forming an initial agricultural risk management framework, it will become clear where national capacity in supporting the agricultural insurance market development is lacking. Often this has to do with the support and coordination of information systems that can be used by all of society and that will enhance the market development processes for agricultural insurance. Such systems will also enhance the effectiveness of policy mechanisms to respond to local needs and changing risks.

It is wise for policy makers to take a careful approach to developing an Agricultural Insurance Law. Research on public policy illustrates the high social cost associated with attempts to reverse the course after policies have been adopted (e.g., Pierson, 2000). Support for this observation comes from the experience with agricultural insurance policy in many countries. In particular, this experience has shown that several developing countries have had to abandon these efforts as they were found to create perverse incentives and ever-increasing government costs. Thus, developing effective and appropriate agricultural insurance policies that frame the role of government in a workable fashion from the outset can have significant long-term benefits. For example, while it may seem useful to start by introducing a subsidy, significant foresight is needed to fully understand the long-term implications of different subsidy choices. Subsidies that are tied to premiums will grow in direct proportion to sales, making the subsidy unsustainable in the long run.

This chapter proposes an initial framework for policy makers to consider and what is essential to building this framework: risk assessment, establishing priorities for insurance market development and an institutional system to support this formulation. The framework that is presented assumes that policy makers want to create an efficient and effective means to transfer weather risk into local and global markets in a way that does not require large and persistent government expenditures. Policy makers, with the assistance of in-country technical experts, must develop the policies goals that guide and shape the initial framework into a fully functioning agricultural insurance program.

4.2 Role of Government: Spurring Agricultural Insurance Markets

For long-term sustainability of insurance markets, it is best if the role of government is one of facilitator and not direct delivery of insurance products. Before getting into some details regarding a proposed approach for developing agricultural insurance markets, it is useful to frame the core areas where government expenditures can be used. This includes establishing an appropriate enabling environment and providing certain public goods. More specifically the government can support such things as:

- Improvements in the legal and regulatory environment;
- Improvements in data systems and data collection;
- Educational efforts about the use of weather insurance;
- Product development; and
- Access to global markets.

In some cases, governments may choose to provide financing for catastrophic losses as will be discussed in this chapter. In general, however, governments should not be in the business of providing insurance directly from a government agency. And while the government of Vietnam is prepared to provide public expenditures to support agricultural insurance, significant caution should be taken in providing direct premium subsidies. Direct premium subsidies undermine the incentives for insurance companies to design and insure products in a careful fashion. Furthermore, direct premium subsidies generally favor wealthier farm households, eroding poverty objectives. Even targeted premium subsidies rarely work as planned. Governments can incur significant expenditures with many of the items discussed below, however these types of expenditures can be more easily targeted and budgeted than direct premium subsidies. As will be developed below, direct premium subsidies represent an open-ended expenditure that grows as the premium base grows.

4.2.1 Supporting Improvements in the Legal and Regulatory Environment

In many countries, governments do not consider the role that insurance markets can play in coping with exposure to weather risks. Instead, they tend to focus on the provision of government aid following an extreme weather event. The expectation of government aid following an extreme weather event reduces the demand for weather insurance.

Insurance is a highly regulated activity in all countries and index insurance will be subject to regulatory control. Any index insurance will be regulated and supervised by the country's regulator of financial services. A failure to consider the impact of the regulatory system and to obtain the necessary regulatory authorizations could result in the provision of the index insurance being unlawful and in the providers of the insurance, and possibly intermediaries, committing a criminal offence. In the case of Vietnam, while the work of the index insurance project has made significant progress in obtaining clarity about how index insurance can fit into Vietnam law, there is still no law that explicitly recognizes index insurance as a legitimate form of insurance. As Vietnam considers such legislation, it should be kept in mind that any new laws should be made consistent with international law so as to improve the chances of gaining access to the global markets for risk transfer. Human capacity building within financial regulatory agencies is also a critical public investment.

4.2.2 Supporting Improvements in Data Systems and Data Collection

By providing greater access to existing data, governments can very directly and immediately support the development of weather insurance markets. Data are critical to the development of weather insurance markets. The data used for index insurance must be credible. The equipment involved in developing weather data must be reliable, accurate, and secure from any potential tampering, and professionals must be trustworthy. Most governments have reasonably good systems for collecting weather data. In these cases, data should be archived so that all available historic data can be easily accessed by stakeholders who wish to develop new products.

In addition to weather data, other types of information are also important in the development of weather insurance. Some examples include yield data and other information on losses caused by extreme weather events, changes in land use and input use intensity, and records of past disaster management activities or infrastructure changes.

4.2.3 Supporting Educational Efforts about the Use of Weather Insurance

To increase the likelihood that information is presented in a balanced way and that sufficient investments are made in a broader educational effort for an untested product, public funds from governments may be required. It is important that potential users be well educated about the advantages and disadvantages of the product. If insurance is not commonly available in the countryside, general education about insurance and risk management may be necessary. Index insurance policies are typically much simpler and easier to understand than traditional farm-level insurance policies. However, potential users may need help in evaluating how well the index insurance works for their individual risk.

4.2.4 Supporting Product Development

One of the challenges associated with private sector development of new financial products is the ease with which they can be copied and replicated by others. This “free rider” problem prevents most companies from making the initial investments in new product developments, especially in underdeveloped markets. Thus, some level of government and/or donor support for product development can be justified that invests in feasibility studies and the development of pilot testing of new products with the involvement of local private-sector partners. Every attempt should be made to ensure that the knowledge and technology for new product development will be passed on to local experts as soon as possible. The framework developed in this chapter pays particular attention to developing institutions that can enhance product development that is in the public interest.

4.2.5 Supporting Access to Global Markets

An insurance regulator must understand how to establish rules and regulations that both facilitate access to global insurance and reinsurance markets and regulate how domestic insurance must protect their positions to enable full payment of indemnities if there are significant losses. Domestic insurance companies are unlikely to have the financial resources needed to withstand the large losses that accompany significant adverse weather that damages crops or assets. Good rules and regulations can facilitate access to the global markets. The regulator can also provide information about these global markets to local stakeholders (e.g., changing regulations to allow local companies to use these markets). These tasks are clearly within a government’s regulatory and administrative spheres of influence and can aid in facilitating market development for weather insurance with relatively modest budgetary outlays.

Ultimately, access to global insurance and reinsurance markets is important for developing local weather insurance instruments. Government should refer to international experience and best practice guidance in establishing appropriate enabling environment, providing public goods that support market development and for any other interventions they might consider.

4.2.6 Supporting Financing for Catastrophic Losses

Until insurance companies establish a sufficient volume of business, extreme losses may need to be underwritten, perhaps through contingent loans from government and/or donors, until international reinsurers are willing to participate in the risk sharing of a new product. For example, the World Bank has a contingent loan for the Mongolian Index-based Livestock Insurance (IBLI) Pilot (see Appendix B). If losses from the Mongolian index insurance held by the insurance companies and the domestic reinsurance fund are fully exhausted, the World Bank loan is used to make indemnity payments beyond that level.

Another possible role for government or donors may be to provide financing for low-probability, high-consequence events. Evidence suggests that those at risk tend to ignore the probability of the most extreme and infrequent loss events. But insurers do not ignore these events and consider the probability of such catastrophic losses in setting premiums. Thus, for protection against very infrequent but catastrophic losses, there is a gap between what buyers are willing to pay and what sellers are willing to accept. There are a number of ways that governments can provide the financing that still provide incentives to domestic insurers to operate in a proper fashion.

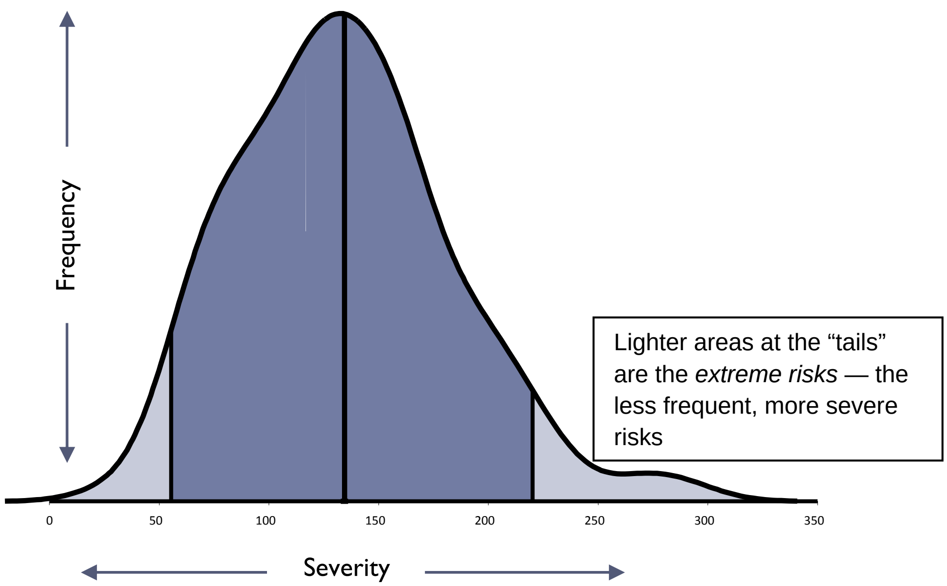
4.3 Risk Assessment Informs Policy Goals and Choices

Given the discussion above about what the government can contribute to the development of markets for agricultural insurance, it is now important to focus on how these activities might proceed. As was emphasized throughout this chapter, risk assessment is a crucial first step of any agricultural risk management effort because appropriate strategies cannot be formulated without a clear understanding of the risk. As was more fully developed in Chapter 2 and illustrated in Chapter 3, risk must be understood in a local context. *Four aspects of the risk* are particularly important to assess:

1. **Frequency and severity.** Risks are best characterized in terms of a probability distribution function (pdf) such as presented in Figure 4.1. A pdf enhances policy development because certain risk management mechanisms are more efficient at one level of severity than another. For example, insurance is most efficient for severe risks. As noted in the introduction to the handbook, extreme weather risks are of greatest concern because they are the most destructive and often overwhelm other risk management strategies. These types of risks are the focus of this publication. The frequency of the risk will also affect which mechanisms are most appropriate;
2. **Effects of regional characteristics.** The specific aspects of a region must also be identified in a risk assessment. There can be wide regional variation in the source of risk, the types of crops produced, level of infrastructure, and integration into the value chain which will affect the choice of risk management mechanisms. For example, flood risks for rice production in the Mekong Delta differ from those in the Red River Delta;
3. **Effects of farm household characteristics.** Characteristics of farm households such as the size of their landholdings, whether they are poor, or whether they produce export crops, will affect the type of risk management mechanisms that are most suitable for them. Figure 4.2 provides a view of the farm structure in Vietnam. The vast majority of farms are small households with limited assets and limited access to loans that would allow them to invest in capital improvements; and

4. **Effects of current risk management strategies and institutions.** Assessing how households and firms currently manage a specific risk can be important for addressing the risk. This process is guided by the principle that the losses from a specific risk are being absorbed somewhere in the society. Losses are experienced directly by destruction of assets and production; however, losses are also experienced indirectly through foregone business opportunities or extra expenses during severe weather events.

Figure 4.1 Probability Distribution Function: Severe Risks and Extreme Risks



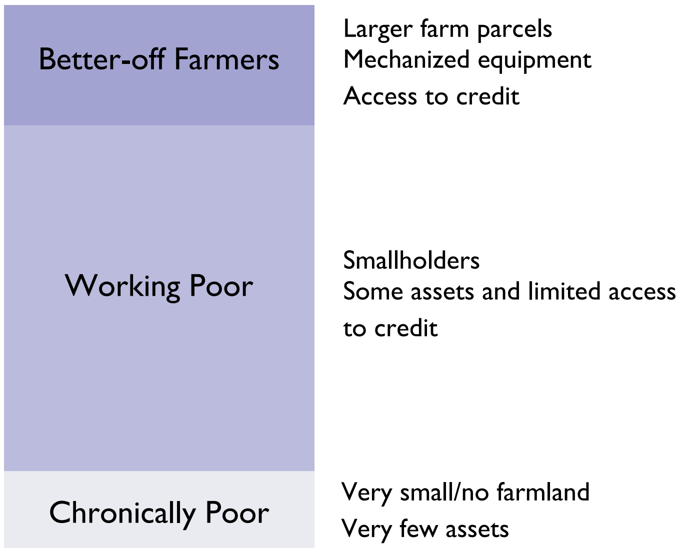
Source: Authors

Leveraging currently available risk management strategies that are effective and efficient is preferred. For example, much of the success of microfinance is due to utilizing the long-established risk sharing strategies of the poor (Armendarez and Morduch, 2007). Often, however, the poor will have ineffective means to manage catastrophic risk.

The effect of current institutional policies on risk management practices is also an important consideration. Chapter 3 highlights the institutional incentives created by the previous policies of VBARD — that its prior policy of debt forgiveness after extreme weather events rewarded the riskiest farmers. These practices are continuing in a way where VBARD is acting as an indirect insurer for agricultural producers.

In sum, risk management policies must be designed for the *specific conditions* of the risk. Thus, a suggested role for the central government is to coordinate resources and grow capacity for the development of effective *local solutions.*

Figure 4.2 Characteristics of Farm Households in Vietnam: What Is the Most Suitable Risk Management Approach for Each?



Source: Authors

4.3.1 Developing Policy from the Risk Assessment Findings

Risk assessment enhances understanding of the risk and estimates the costs and benefits of alternative risk management strategies. Risk assessment is also a critical step in identifying opportunities for introducing agricultural insurance. Agricultural insurance markets have the potential to transfer risk in a more cost-effective fashion than many choices involving government aid if they are designed with that goal in mind. Thus, when insurance can effectively transfer catastrophic risk, these markets are preferred. However, not all risks are insurable. In addition, many factors can result in insurance market failure. The four aspects of the risk described above are a helpful starting point for understanding when insurance market failure is likely to occur. Agricultural insurance market failure is likely when:

1. The risk being insured occurs too frequently;
2. The institutional capacity is low and/or the target market is remote;
3. The target market is poorest households owning very few assets; and
4. Current government policies crowd out insurance markets. For example, if households expect unconditional disaster relief from the government, they may be less likely to buy insurance.

In cases where insurance markets are feasible, the government can facilitate market development. The government can *encourage insurance market development* by reducing the high start-up costs associated with developing insurance through:

1. Creating an enabling legal and regulatory environment;
2. Increasing access to weather and crop data;
3. Increasing access to the findings of publicly funded risk assessments;
4. Building technical capacity in the insurance market;

5. Educating the target market;
6. Developing appropriate product designs; and
7. Enhancing the financing of catastrophic losses through risk pooling and access to global reinsurance.[23]

In cases where insurance markets are *not* feasible, governments may choose to invest in a social solution. *Social solutions* can include the following:

1. Physical risk mitigation, e.g., levies, dams, and irrigation;
2. Regulatory risk mitigation, e.g., improving building and zoning codes;
3. Behavioral risk mitigation, e.g., household and firm education or policies that elicit positive behavior;
4. Disaster relief (see Quick Reference 1);
5. Safety nets to protect the chronic poor; and
6. In extreme cases, household relocation.

Quick Reference 4.1

Designing Disaster Relief Programs with Index Insurance Principles

Disaster relief programs may operate more effectively if designed using insurance principles. These programs identify *ex ante* (before the event) what types of events would trigger disaster relief and budget for these events accordingly. Using an objective index as the trigger, such as rainfall levels for drought relief, can be a useful structure that can improve response time of aid and reduce political complications. Careful consideration of how disaster relief funds will be used *ex ante* is also needed to ensure that disaster programs operate to meet policy goals. Disaster risk can even be transferred to global reinsurance markets, which can smooth government expenditures for disaster relief.

More information: Chapter 2

It is important not to force an insurance solution when insurance is simply not workable. Policy makers would do well to create clear distinctions between market and social goals. If the risk assessment predicts insurance market failure, investments in a social solution are likely to result in greater social benefits at less cost than trying to support the insurance industry with ongoing subsidies.[24] In some cases, insurance can complement social investments. However, social investments may be needed first. For example, once a dam has been built so that the frequency of flooding is less, it may then be possible to introduce some forms of insurance for flooding events that will occur despite the infrastructure investments.

[23] Chapter 2 provides an in-depth review of government activities that are likely to support insurance market development.

[24] Chapter 1 clearly illustrates the experiences of developed and developing countries with premium subsidies, which tend to be problematic and expensive to implement.

Whatever the policy, if policy makers carefully consider what incentives new investments and programs create, there is a better chance that they can *avoid* institutional structures that reward 1) unnecessary risk taking among households and firms, 2) unnecessary risk taking by government, and 3) the development of unsustainable insurance products due to open-ended fiscal exposures.

4.4 Framework for Agricultural Insurance Market Development

In this section, we suggest using a framework that focuses on those risks that the risk assessment indicates are insurable. Chapters 1, 2, and 3 illustrate that insurance market development should be developed in a three-stage process. First, index insurance markets should be developed (see Quick Reference 2). Second, index insurance markets should be expanded to new regions and new risks and named peril insurance products may be introduced on a limited basis. Third, more advanced and specialized products (e.g., MPCI) targeted toward specific markets should be pursued after successful experiences with weather index insurance and named peril insurance products. Agricultural insurance programs are complex to develop; this three-stage process builds capacity to allow all stakeholders (government agencies supplying data and risk assessment services, government institutions responsible for legal and regulatory issues, insurance companies, and delivery agents) to manage more complicated markets as development progresses.

Quick Reference 4.2

Types of Insurance for Weather Risk

Index Insurance. Index insurance insures against a specific weather risk that affects agricultural production (e.g., drought, floods). Insurance payments are based on an index of the risk (lack or rainfall for drought) that serves as a proxy for losses of the insured. Index insurance is only suited for risks resulting in correlated losses. No individualized loss adjustment is needed, making index insurance more feasible for smallholders (if delivery costs can be contained). Index insurance is subject to basis risk — the possibility that losses of the insured will not match insurance payouts. Basis risk can be reduced but not eliminated though appropriate product design.

Named Peril Crop Insurance. Named peril insures against a single, specific risk. Typically, the risk results in independent losses (it only affects a few policyholders at a time). Named peril requires loss adjusters to assess damages on individual farms. Hail insurance is the most common form of named peril crop insurance.

Multiple Peril Crop Insurance (MPCI). MPCI is a comprehensive insurance that protects against crop yield losses from many types of risk. Some of these risks result in correlated losses (they affect many policyholders at the same time). MPCI programs are difficult to manage due to very high costs, partially because MPCI programs reduce farmer incentives to properly manage risk. Developed countries address these high costs using large government subsidies. MPCI is particularly poorly suited in countries dominated by smallholder farmers due to the high cost of delivery and the dual problems of adverse selection and moral hazard.

More information: Chapter 1 (for MPCI and Named Peril) and Chapter 2 (for Index Insurance)

4.4.1 First Stage of Insurance Market Development Framework: Develop Index Insurance Markets

The priority of the suggested framework is for insurance market development to first address the biggest risks — catastrophic events that result in widespread economic and social welfare losses. Addressing the biggest risks first increases opportunities and the ability to manage less severe risks at a later date. Other financial services such as savings and lending can be used to address the more frequent and less severe risks.

Index insurance is an effective mechanism to address some of the biggest weather risks. Several *benefits of index insurance* motivate developing these markets first:

1. **Suitable for correlated risks.** Index insurance is particularly suitable for managing correlated risks that cause the most widespread losses. Vietnam is prone to a variety of natural disaster, many involve correlated weather risks;
2. **Suitable for smallholders.** Index insurance is appropriate when the dominant farm structure is one of many smallholders whereas, MPCI is not;
3. **Flexible structure.** Index insurance has a flexible structure. Besides products for households, products can also be designed for rural firms such as banks and other members of the agricultural supply chain. Additionally, index insurance could be sold to a variety of demand aggregators such as farmer cooperatives or communes, and the group members can informally decide how payments should be distributed: this lowers the administrative costs and places the burden on the group of farmers to control for adverse selection and moral hazard; and
4. **Simple structure.** Index insurance has a simpler structure than traditional forms of agricultural insurance. Thus, the goals of building capacity among public- and private-sector stakeholders and familiarity for agricultural insurance among target markets are advanced by beginning with index insurance markets.

It is important to recognize that some significant weather risks such as storm surge and flash floods are not appropriate for index insurance. These risks are very difficult to insure in any fashion. Thus, the priorities in the early stages of development should be risks that are more easily managed by index insurance, such as drought or excess rainfall.

4.4.1.1 Pilot Program Offers Benefits over Testing a Full-Scale Program

It is recommended that pilot programs are used to test insurance products at the early stages of market development. Pilot programs test the design of and demand for an insurance product in a limited area — a few districts or provinces. Monitoring and evaluating performance on a smaller scale allow for improvements without committing large resources to the program. Pilots also develop capacity among stakeholders and begin the education process for the target market. If pilot testing indicates the market is likely to be successful, stakeholders could carefully expand the insurance market.

4.4.2 Second Stage of Insurance Market Development Framework: Expand Insurance Markets

During this stage, priorities include expanding index insurance markets and implementing named peril products for some risks. Index insurance markets can be expanded or scaled up in several ways:

1. **Geographically.** Successful products are tested in new markets;
2. **Covering new risks.** Products are designed to cover additional major risks where there is already index insurance activity. For example, index insurance products protecting against extreme temperatures may be introduced in a region where drought products exist; and
3. **Designing for different groups.** Index insurance products are designed to meet the needs of different target clients. For example, products may be sold to households and agricultural processors.

To effectively reach some markets and to help reduce costs, innovative delivery systems should be carefully considered during market expansion. One method is to link insurance to the services of existing demand aggregators (e.g., savings, credit, seed, or other agricultural inputs). Advancements that increase administrative efficiency will also be important for insurers working in these markets as competition is likely to emerge for successful products. Target markets may benefit from this competition through lower insurance prices.

For those risks that result in independent losses, *named peril insurance* could potentially be introduced since index insurance cannot protect against independent losses. If named peril products are to be offered to smallholders, insurers must overcome the difficulties of the cost of providing loss assessment for small-value contracts. These costs increase as the insured land parcel size decreases.

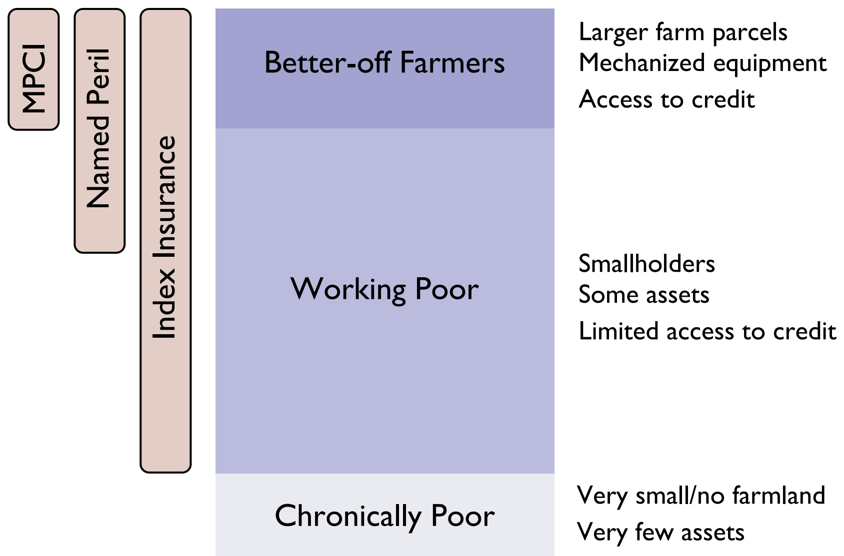
4.4.3 Third Stage of Insurance Market Development Framework: Specialize Insurance Markets

After moving through the first two stages of the development framework, policy makers and other stakeholders will have gained some experience with agricultural insurance. This experience will help to clarify policy objectives regarding agricultural risk management. The experiences will undoubtedly identify new opportunities for insurance markets not originally anticipated as well as some unanticipated market failures.

The processes of building capacity and transferring big risks out of a region create opportunities for specialized insurance products to emerge. Because farming is so risky, farm households are likely to have demand for coverage against several perils and more comprehensive coverage. An agricultural insurance market may be able to leverage its new expertise to design suitable products. One such product could be innovative MPCI products for relatively large farms.

Even in the long-term, MPCI markets are unlikely to be feasible for smallholders, as reflected in Chapter 1 where the failures of MPCI for countries with a preponderance of smallholders, such as Vietnam, are highlighted, and even the difficulties with such programs when trying to serve larger farms. Figure 4.3 illustrates that appropriate long-term goals for insurance market development must be built around the characteristics of farm households. Index insurance products are more likely to be accessible for a wider set of farmers. MPCI products should be restricted to the larger farms. A wider variety of insurance outcomes are possible for better-off households with larger land holdings but feasible insurance markets are more limited for smallholders and may not be possible (or advisable) for the chronically poor.

Figure 4.3 Characteristics of Farm Households and Long-Term Expectations for Agricultural Insurance Market: Index Insurance Most Accessible for a Wider Set of Farmers

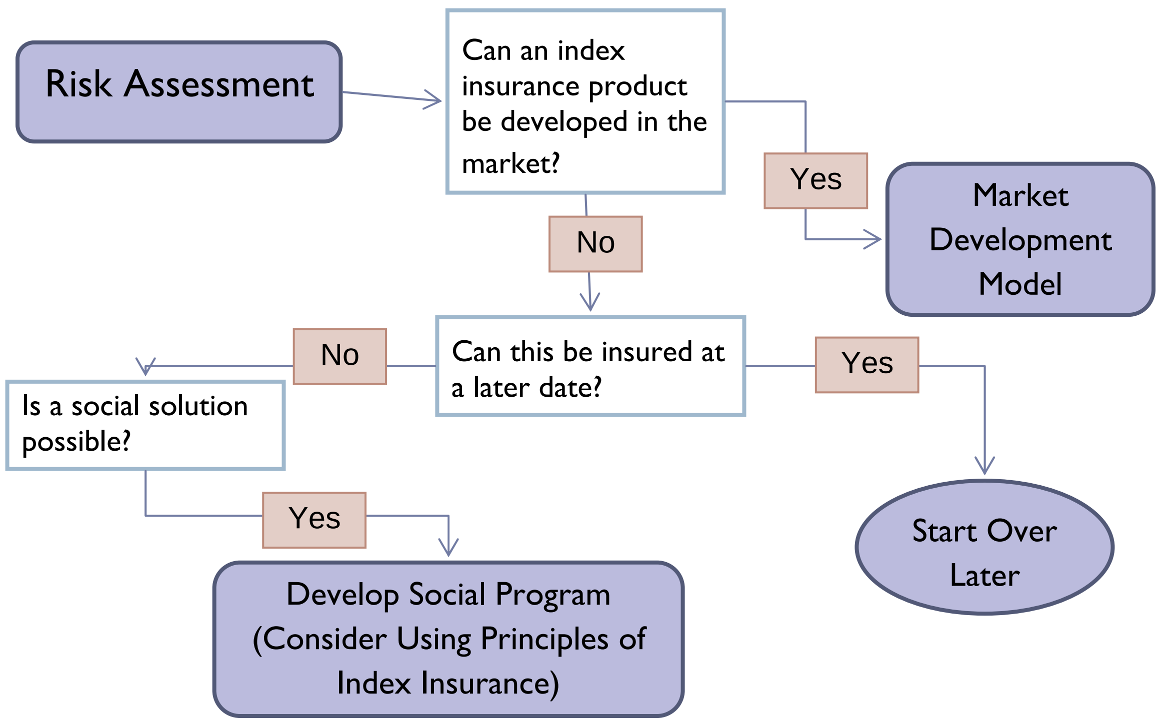


Source: Authors

4.5 Developing Social Investments around Potential Markets

The market development framework provides guidance in the coordination of risk management investments for social protection purposes. The risk assessment process provides a means to identify whether a risk can be effectively managed with market-based insurance. If not, a social solution may be feasible. Figure 4.4 illustrates the risk assessment decision process.

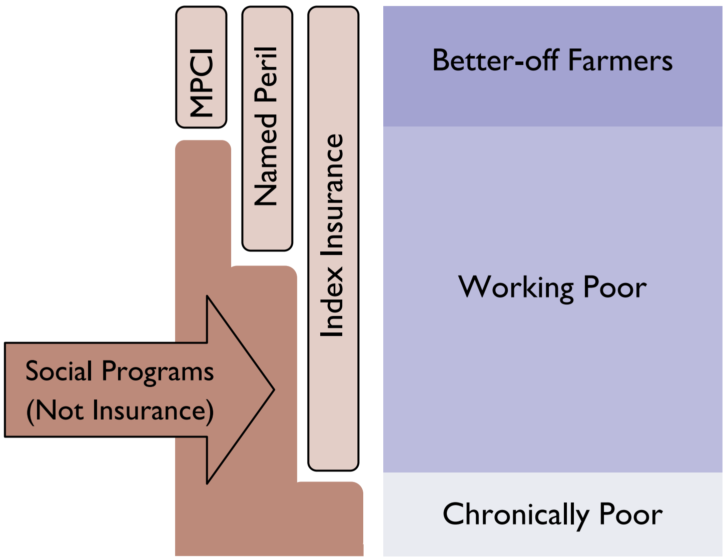
Figure 4.4 Risk Assessment Decision Tree for Identifying Priorities in Market Development



Source: Authors

If policy makers follow this decision structure then social programs would be built for those areas where insurance markets typically fail (see Figure 4.5). Such an approach can improve the harmony between commercial and social goals. The intention is that risk management policies neither "crowd out" markets nor fail to protect populations for whom markets have failed.

Figure 4.5 Balancing Risk Management and Social Policies: Blending Insurance and Social Programs



Source: Authors

In practice, clearly identifying opportunities for markets, effectively targeting social programs, and ensuring complementarity are, of course, *quite difficult*. Using the decision tree in Figure 4.4 and the designing programs that work in the market versus those that are more socially oriented is not easy. The important message is that proper risk assessment increases the likelihood that policy goals will be better defined, and a logical framework for market development is critical to designing effective policies that maximize social benefits relative to social costs. It is rarely the case that a single strategy will emerge as the single best policy choice. Policy effectiveness is also enhanced by establishing the flexibility and feedback systems to make adjustments that guide program improvements. These systems should use stakeholder feedback to tailor risk management strategies that fit into a local context.

4.6 Suggested Risk Management Institutional Structure

There are multiple paths government can take to facilitate the development of effective and efficient agricultural insurance markets. The assumption about policy goals is that these markets are needed insofar as they help to strengthen overall rural financial markets which is placed in the context of ongoing developments of banking and other financial services. Well-functioning rural financial services, of which insurance is a part, are expected to contribute to rural economic development. Social solutions to risk are also meant to contribute to rural economic development but operate through different pathways to target specific conditions or groups. These goals, as articulated, are those that have guided the agricultural insurance market development activities described in Chapter 3. The following suggestions regarding an institutional structure to pursue insurance market development is premised on these goals and is meant to be a guide, an illustration, of what is possible. In fact, it is suggested that whatever action government takes to establish and facilitate market development institutions, it does so in the same manner as presented in Chapters 2 and 3.

The learning that can occur from such a market development process when started on a limited pilot test basis will better inform policy makers about developing the enabling framework for market development. Pilot projects may benefit from international technical assistance that can bring wide-ranging experience with institutional development from many parts of the world. Keeping the initial legal framework flexible is quite important as it will allow for adjustments as mistakes are made.

A possible model that adheres to the market development process and the goal to remain flexible while learning from pilot programs designed to develop agricultural insurance might include the development of the following three institutions:[25]

1. An agricultural risk management agency;
2. A market development entity; and
3. A risk pooling entity.

In the following sections, the role of each of these institutions is first reviewed followed by a description of the relationships among public and market-sector institutions in insurance market development and management.

4.6.1 Agricultural Risk Management Agency

Developments in the agricultural insurance markets could be well-served by a centralized agency that is responsible for overseeing and coordinating all agricultural risk management programs, but only if that agency recognizes the importance of risk assessment and product design at the local level to account for the great diversity across a country. This oversight function requires strong communication with local stakeholders to ensure that risk management strategies are properly tailored to local needs.

As outlined in Chapter 2, three general areas of risk management exist for severe weather risks — risk mitigation, insurance markets, and disaster relief. The Agricultural Risk Management Agency could provide accountability to entities pursuing each of these types of projects and work to coordinate programs so that they are complementary. The Agricultural Risk Management Agency does not develop markets itself but rather ensures that the work done by others meets the overall market development goals. As such, this agency would not need to be large, but it does need to have sufficient authority to direct activities and call together the appropriate stakeholders and representatives from various other government agencies and market entities to be able to fulfill its coordination responsibilities. Figure 4.6 provides a basic schematic for basic functions of the Risk Management Agency with linkages to an Insurance Market Development Entity.

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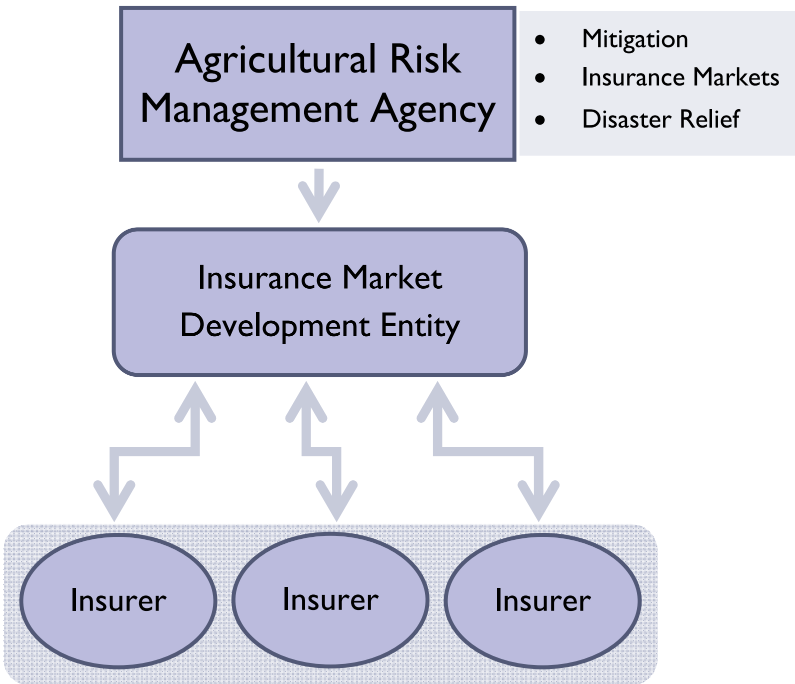
[25] The term "agency" is used to describe an institution that is funded and managed by the government; the term "entity" is used as a more generic description of an institution that could include funding and management from government and/or the market sector.

Figure 4.6 Building the Risk Management Institutional Structure: Basic Functions of the Agricultural Risk Management Agency and Link to an Insurance Market Development Entity



Source: Authors

4.6.2 Insurance Market Development Entity (IMDE)

The purpose of the Insurance Market Development Entity (IMDE) is to specialize in creating insurance markets. As a result, the IMDE will quickly develop expertise in assessing risk, designing insurance products, training and coordinating stakeholders, and implementing and evaluating insurance programs. The IMDE could work from a development model such as the Market Development Model proposed in Chapter 2, which emphasizes risk assessment, capacity building, and pilot testing (see Quick Reference 3). The Market Development Model provides sufficient flexibility to allow the IMDE to tailor strategies to a specific region.

Because the IMDE is heavily involved in risk assessment (called "feasibility assessment"[26] in Quick Reference 3), the IMDE would work closely with the Agricultural Risk Management Agency as the risk assessment findings inform any risk management strategy that is used. The IMDE is an effective candidate to perform this risk assessment (instead of another institution) because assessing the feasibility of markets is a logical first step before considering social strategies. In other words, if the IMDE decides that the risk cannot be insured, it is likely necessary to evaluate if a social strategy can be adopted to manage the risk.

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[26] Feasibility assessment is targeted risk assessment specifically intended to determine the suitability of a particular risk management strategy such as index insurance market development.

The IMDE has the difficult challenge of using its expertise to spur development but it must also transfer responsibility and leadership to an insurance partner and the other local stakeholders as their capacity develops. The goal is for the IMDE to be involved in the early stages of market development. Insurance companies would be expected to take on new products that emerge. The IMDE would be actively involved in several development efforts at the same time. It would not be involved in running any insurance programs. Proper incentives should be put in place to ensure that insurance partners take on the new products that are introduced by the IMDE and assume full responsibility for the operational details associated with these markets as time progresses. Insurers will often prefer the IMDE to carry the business risk of the program and to manage technical aspects, especially during the early phases of a program where the insurance product may provide very small profits. Still, it is in the insurer's best interest to learn to actively manage the program during this period as it is effective training for the insurer to manage the market and to expand insurance markets in the future. If the insurer cannot manage the new insurance products after the IMDE involvement has ended, it may mean that there is no market for the product or that more development work is needed. It is likely important that a clear timetable be established to get insurance companies actively involved in new products as quickly as possible. Care in selecting an insurance partner for a specific project is also critical to ensure success and that the insurance partner will make credible investments during the process. Finally, careful assessments of the project's performance in addressing a risk transfer will be needed. Part of the evaluation must involve learning if farmers and others will actually purchase the products that are designed at a sufficient level to continue offering them.

Quick Reference 4.3

Market Development Model

The Market Development Model is intended to assess feasibility for an insurance market, prepare local stakeholders to manage the market, and test an insurance product. The model comprises three phases.

Phase 1: Rapid Feasibility Assessment and Basic Education on Weather Risk. This phase quickly assesses whether a specific risk is suitable for insurance. If insurance is not feasible, market development stops and the risk assessment information from this phase can inform other agricultural risk management strategies (e.g., risk mitigation or disaster relief).

Phase 2: Feasibility and Market Development. This phase assesses market conditions (e.g., demand for insurance) and addresses any unanswered questions from the rapid feasibility assessment. Developing an insurance product and preparing insurers, delivery systems, and data and regulatory agencies to manage an insurance program are also part of this phase.

Phase 3: Implementation. This phase tests the insurance product on a limited scale, a pilot test. Pilot testing provides opportunities to learn about the effectiveness of the product. As stakeholders gain capacity, the IMDE encourages the insurer to take responsibility to manage and expand the insurance program.

More information: Chapter 1

Stakeholders in the IMDE. Since the IMDE would work with a variety of government agencies and market firms, including these stakeholders in the decision process for market development projects will be important. The creation of a project planning committee could serve this function and include IMDE staff but also stakeholders from other government agencies (experts in insurance, agriculture, data systems, etc.), the private sector (insurers, rural lenders, and others), and perhaps even donor partners (NGOs) working to improve agricultural risk management. While such a committee is likely to provide helpful insights from a variety of viewpoints, special care must be taken to avoid *rent seeking* on the part of private sector firms and government agents representing a specific region or agency.[27] The composition of the committee can create the proper tension between market and social interest as a means to balance these interests. Increasing transparency of committee decisions, providing opportunities for feedback from the local level, and avoiding favoritism among private firms are all important to balance market and social interest.

After this general committee specifies which risks and regions are of highest priority, specialists from each region should be included in its project development process as these local experts can help effectively guide the project. Again, rent seeking is likely to occur if the process is not carefully controlled. To that end, the IMDE would need a set of specific policies governing the relationships that are allowed between IMDE and stakeholder organizations, and what are allowable expenditures. For example, the IMDE should not have to pay for public good data resources beyond a simple handling fee. The agricultural risk management agency should be used to facilitate access to needed data sources.

4.6.3 Risk Pooling Entity[28]

A Risk Pooling Entity would increase the feasibility of index insurance by enhancing opportunities to manage correlated risks (see Quick Reference 4 for a description of correlated risk). Because index insurance bases indemnities on an objective measure — such as rainfall data from local weather stations — opportunities increase to pool risk among insurance companies. For index insurance, the risk to the portfolio of these insurance policies is based solely on the frequency and severity of the insured event. In contrast, risk pooling is more difficult for traditional agricultural insurance because these products base payouts on individual loss adjustments, which involve management protocols that vary across firms. Mongolia has a structured risk pooling arrangement for the IBLI program that is supported by the Mongolian government using a contingent loan from the World Bank for extreme losses (see Appendix B).

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[27] *Rent seeking* describes the efforts of individuals or firms working to enact government policies that promote their own benefit over general social benefits (see Tullock, 1967).

[28] The risk pooling example and description of managing correlated risk in Quick Reference 4 were adapted from GlobalAgRisk, 2008, an online course written for the World Bank Institute.

Quick Reference 4.4

Managing Correlated Risk

Weather risks are generally "correlated risk" — that is, the same weather event affects a wide area and thus creates severe losses, which are difficult for an insurer to manage.

Most local insurers can and are accustomed to providing risk transfer for "independent risks" such as car accidents or death of the breadwinner. For independent risks, the risk of one insured is not correlated with that of others, so the losses of the few are paid by the indemnities of the masses. Insurers manage this arrangement through diversification within the portfolio — they have many clients and it is unlikely all their clients will experience a loss at the same time.

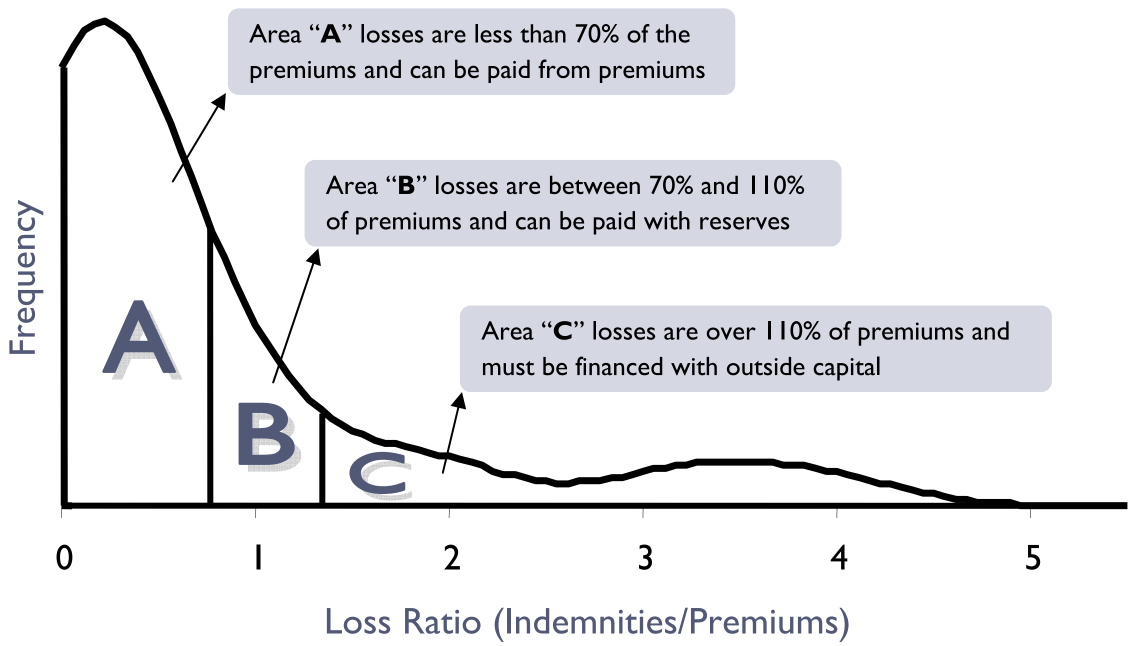
Unlike independent risk, insuring against a correlated, severe weather risk is certain to result in a very large loss sometime in the future. In other words, the losses of the masses must be paid at once. Thus, special arrangements must be made to ensure that weather risk transfer does not swamp the resources of the insurer and put it out of business. Usually, local insurers purchase insurance themselves, called "reinsurance," to cover their risk portfolio. A number of global reinsurance companies offer this special line of insurance.

More information: Chapter 2

A variety of catastrophic risks provides opportunities for pooling risk. The Risk Pooling Entity transfers the extreme risks of the insurer to the insurance pool. Figure 4.7 illustrates how insurers could manage correlated risk in their insurance portfolios using risk transfer and highlights the need for an insurance pool. The figure estimates costs in terms of a loss ratio, which compares total indemnity payouts to premium revenues. The higher the loss ratio the larger are insurer losses.

Insurers typically employ a risk layering approach to portfolio management. Suppose an insurer requires 30 percent of premium revenues to cover administrative costs. The remaining 70 percent of premiums can be used for indemnity payouts, if needed. In this case, when the indemnities paid out are above 70 percent of the premiums collected, the insurance premium would not be adequate to pay for losses. When indemnity payouts are less than 70 percent, insurers should put some of their revenues in a reserve fund for years when payouts are higher. Payouts less than 70 percent of premiums occur most years and are represented by Area A. Area B represents indemnity payouts of 70 to 110 percent of premium revenues. This level of indemnity payouts results in insurer losses for the year. If insurance companies have done proper reserving, they should be able to pay for liabilities in excess of premium revenues using reserve funds. Area C represents losses over 110 percent of annual premium revenues. Losses above 110 percent of premium result from the widespread effects of those *extreme events*: low frequency, high severity events at the "tails" (the lighter color ends of the pdf shown in Figure 4.1). Insurers typically rely on international risk transfer such as reinsurance to prepare to pay for losses in Area C.

Figure 4.7 Risk Layering: Managing Correlated Risk in an Insurer Portfolio by Distribution of Losses



Source: Authors

Obtaining reinsurance can be expensive and difficult. Even with index insurance, obtaining commercial reinsurance for new and untested products can be challenging. As a result, the need for this type of risk layering has led to innovative public-private partnerships for managing weather risks for agriculture. Government could coordinate risk pooling among insurers selling index insurance. The extreme risks (Area C) of the index insurance portfolios of insurers could be transferred to the Risk Pooling Entity. This Risk Pooling Entity could diversify its portfolio by accepting risk from index insurance portfolios for a variety of risks from different regions.

The Risk Pooling Entity is likely to reduce the cost of risk transfer compared to using the global reinsurance market. To maintain a sustainable partnership that creates proper incentives, the Risk Pooling Entity must base risk transfer costs on the level of risk it is accepting from the insurer. Still, unlike the commercial firms in the global reinsurance market that have a responsibility to shareholders to increase the wealth of the firm, the Risk Pooling Entity could operate in the form of a mutual insurance that could potentially provide risk transfer at a lower cost than global markets.

The Risk Pooling Entity would need to carefully manage its own portfolio to ensure solvency. One strategy is for government would be to start a reserve fund for the Risk Pooling Entity that would protect it from large losses in the early years of operation. The Risk Pooling Entity would also obtain reinsurance to protect against extreme losses that exceeded its reserves. In the long term, the Risk Pooling Entity would increase its reserves as it portfolio grew.

The cost of purchasing international reinsurance by the Risk Pooling Entity would need to be passed to the insurers participating in the pool; however, using a single reinsurance contract for the pool should reduce transaction costs over each insurer operating independently to obtain reinsurance.

Reinsurance markets require special considerations and there is a significant body of research that can help in understanding these markets (Cummins and Mahul, 2009; Doherty, 1997, Froot, 1999; Priest, 1996; Skees, 1999b; Skees, Barnett, and Murphy, 2008). Stakeholders should be aware of a number of issues. First, insurers that have previous working relationships with reinsurers seem to be more likely to obtain approval for new insurance products. A likely component of this finding is that some insurers may not engage in internationally recognized best practices. Thus, working to improve the management standards of these insurers is an important long-term goal. Second, perhaps due to the relatively small number of firms providing international risk transfer, reinsurers have been accused of oligopolistic pricing for risk transfer. Organizing a pool of risk and putting this pool out for bidding among reinsurers may improve the pricing. However, the Risk Pooling Entity will find it difficult to reinsure the risk pool if the risks that are accepted into the pool are not properly classified and their underlying contracts appropriately priced.

4.7 Relationships among Government Stakeholders

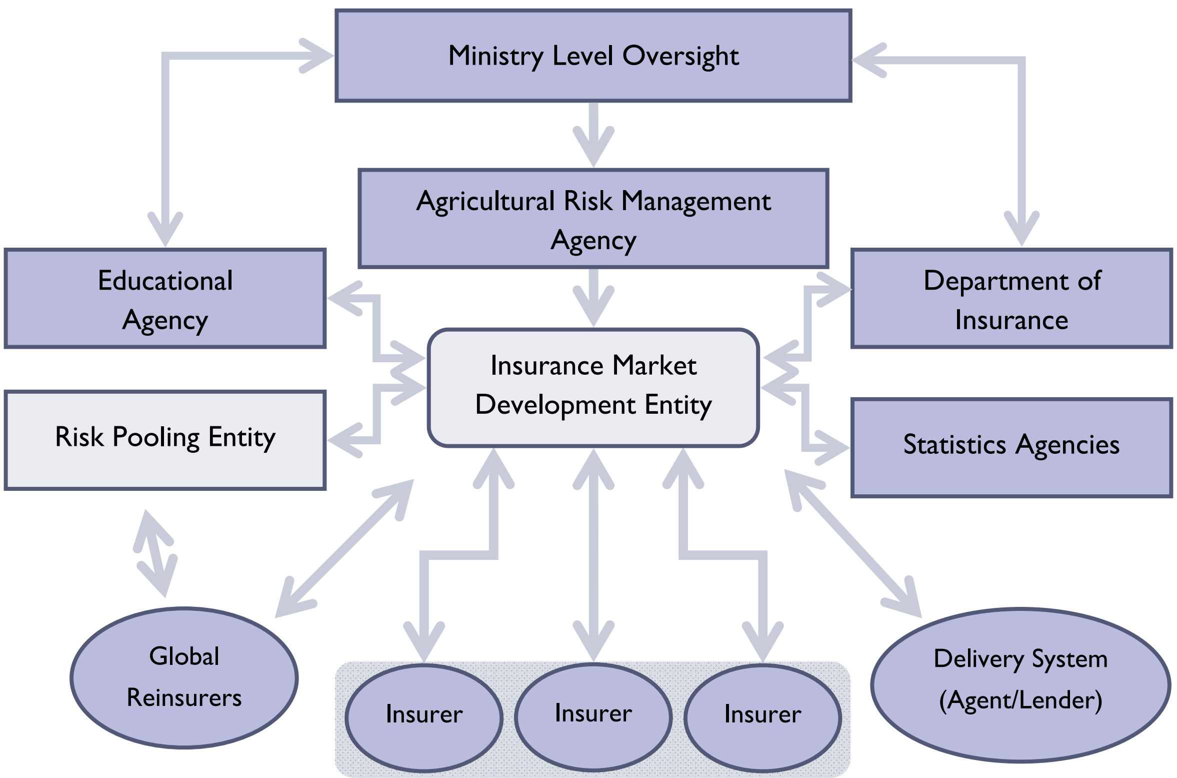
Developing and supporting an insurance market requires partnership and coordination among many government agencies and entities and is the responsibility of the Agricultural Risk Management Agency. In this section, the key stakeholders are described and figures are used to illustrate how to create an environment where the responsibility for the insurance market shifts from the IMDE to the insurance companies. Additional stakeholders include the following:

1. **Department of Insurance**. Providing an appropriate legal and regulatory framework to support insurance markets is crucial to the long-term sustainability of these markets. If regulatory standards are too lax, irresponsible insurers can become insolvent and sully the reputation of the insurance industry. Alternatively, if regulatory standards are too strict, it may stifle appropriate creative solutions in the insurance industry. An important distinction is that insurance products for correlated risks require special provisioning considerations beyond those of insurance for independent risks. Chapter 2 outlines specific legal and regulatory considerations for index insurance, and the International Association of Insurance Supervisors provides more general guidelines helpful for insurance market regulation;
2. **Statistics Agency**. Data are crucial to all forms of agricultural insurance. In general, improvements in data systems for weather, crop yield, and losses from natural disasters will be important to longer-term expansion of insurance markets. Index insurance relies heavily on measurements of weather variables and having a credible, independent source for data collection is needed to support the credibility of the insurance product. In other words, insurers and potential clients must trust the statistics agency. An important role of the statistics agency is maintaining, updating, and expanding data systems;
3. **Educational Agency**. Much research has shown that farmers can benefit from education that improves farm management practices, and risk management training is an important aspect of that process. Experience with index insurance has shown that farmers are much more likely to purchase the insurance if they understand the product and can learn about it from a trustworthy source; and

4. **Ministry Level Oversight.** The Agricultural Risk Management Agency described earlier is likely to have some ministry oversight that coordinates its broad efforts with other investments. Determining who is to oversee this agency is difficult because these risk management strategies include a nexus of departments: agriculture, finance, transportation, social welfare, and domestic security. Strong partnerships among several ministries will ultimately be needed for agricultural risk management.

Figure 4.8 illustrates the relationships between key stakeholders in the insurance market development framework. As should be apparent, the IMDE plays a central role in coordinating public- and private-sector stakeholders during the market development process. Because the IMDE would work regularly with these government agencies, strong relationships are likely to develop that should facilitate market development. One role of the IMDE is to help these agencies develop working relationships with the insurer(s) in the developing market.

Figure 4.8 The Risk Management Institutional Structure: Relationships between Key Stakeholders



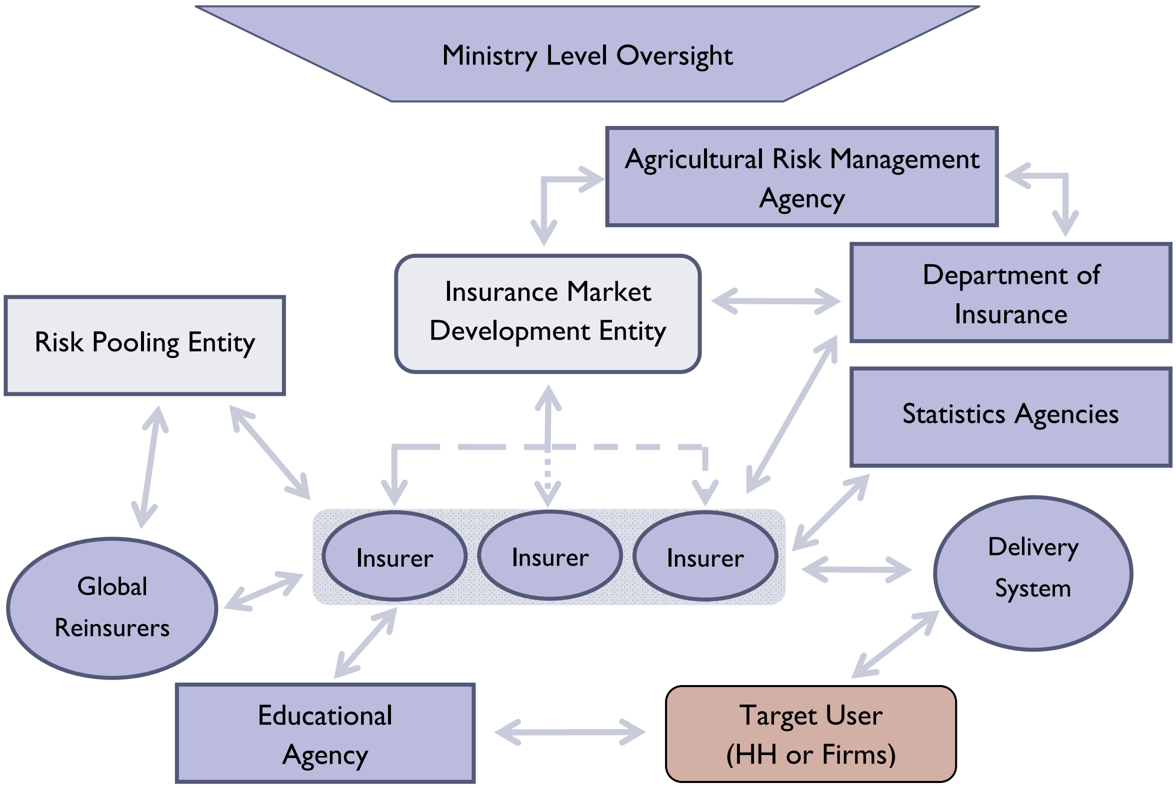
Source: Authors

Several possible models for working with insurers are possible. First, the IMDE could identify a single insurance partner and work to build the market with this partner. For this insurer, the increased costs in terms of allocating time and resources to the market development project are likely to be offset by being the first seller in the new insurance market and through increased capacity to manage the insurance product. Other insurers in the region benefit because they can quickly adopt and modify the insurance product and do not have to make as many up-front investments as the first insurance company. A limitation of having a single insurance partner, however, is that if the insurer fails to cooperate or manages aspects of the market development project poorly, significant setbacks can occur through damage to the reputation of agricultural insurance in that region. Thus, insurance partners must be chosen carefully.

Second, the IMDE could work with several insurance partners in the same market, providing more generalized capacity building. This strategy would likely be most effective if the IMDE also worked with these insurers individually regarding product development. In this case, several versions of index insurance would enter the market at roughly the same time. On one hand, this increased competition is likely to improve the quality of the insurance products; on the other hand, educating the target market and preparing them to choose from among several types of products could be confusing. If not carefully managed, introducing several products at the same time could also introduce conflicting themes in the market due to insurers trying to differentiate their products. Another alternative is to work with several insurance companies but in several different markets, perhaps also addressing different kinds of risks. This approach might also better serve the development of the Risk Pooling Entity which would benefit from the diversity of risks entering its portfolio.

Figure 4.9 illustrates that as insurers build capacity, they should be able to manage the insurance market, and the IMDE can reduce its responsibilities. Over time, insurers should be able to engage in market development with little or no involvement from the IMDE. The coordination and capacity building initiatives of the IMDE create a foundation that expedites future market development efforts. For example, as the IMDE partners with the Department of Insurance to develop appropriate insurance products that are properly regulated to protect insureds and insurers, the legal and regulatory hurdles for creating similar insurance products are greatly reduced.

Figure 4.9 Initial Activities of the Insurance Market Development Entity Create the Foundation for Stakeholder Coordination and Build Insurer Capacity



Source: Authors

As markets develop and insurers learn to effectively manage index insurance markets, the role of the IMDE is likely to change. The initial activities of IMDE will be assumed by the insurance companies. The IMDE would become less involved in the full range of market development activities and assume the role of seeking out new opportunities via risk identification and risk assessment functions. In no case should the IMDE run insurance programs. This is the role for the insurance companies operating within the country.

Because of the significant expertise built by the IMDE, it is likely to have a significant advantage for designing innovative insurance products that can work in the Vietnam context. By using the Market Development Model, the IMDE would be able to identify risk that cannot be insured and that may require other solutions such as social infrastructure investments or standing disaster funding to compensate those most severely damaged; Flash flooding events are a clear example. The IMDE would also become the institution that would gain from international expertise regarding the development of named peril products for certain risks and, eventually, multiple peril insurance products for larger farms.

4.8 Conclusion

Agricultural insurance markets can play a significant role in assuring that smallholders continue to have access to other financial services such as lending and savings. Having access to the full range of financial services, including agricultural insurance, will provide managers of small farms the needed protection to adopt improved seed varieties, invest in fertilizer, and make other capital investments needed to increase productivity. Yet, as this handbook has demonstrated, developing agricultural insurance markets will require time and proper investments from the government.

This chapter emphasizes the investments that are needed from government to facilitate the development of agricultural insurance markets. A clear message emerges —government should move carefully by developing the institutions that will allow policy makers to formulate a clear policy vision and strategies. Thus, rather than, for example, develop a wide-scope agricultural insurance law from which expensive mistakes may emerge, it is more advisable to develop the enabling environment that will advance the knowledge and expertise about how to develop appropriate products for smallholder farms and the range of extreme weather risks within a country.

This handbook emphasizes a market development process that builds from risk assessment. By developing pilot projects to test new products, policy and decision makers can learn and reduce the likelihood of developing large programs that turn out to be unsustainable. In this chapter, using Vietnam as an example, several steps are reviewed and some alternative institutional structures are investigated. A core objective is to build expertise and to proceed in a structured fashion where government supports core public goods like data, legal and regulatory development, education, and product development. By doing this first, a clear vision for agricultural insurance can emerge. This structure will create the environment for innovation and for development of local solutions that are well-suited to diversity in farms, crops, and weather risk events that create significant hardships.

Appendix A Insuring Contagious Animal Diseases[29]

Significant suffering and hardship is imposed upon farmers when a contagious animal disease is discovered. Government is forced to quarantine or destroy infected animals and their products in the vicinity of the infected herds to prevent spread of the disease. Several disease outbreaks in Europe and recent outbreaks of avian influenza (AI) have prompted many to inquire if insurance could be used to compensate farmers for the losses associated with contagious animal disease. Several papers on this topic have been published in the book, *The Economics of Livestock Disease Insurance: Concepts, Issues and International Case Studies.* Some parts of Chapter 4, "Incentive Compatibility in Livestock Disease Risk Management" are reproduced below. The authors argue that insurance is the wrong public policy solution for contagious animal disease (Gramig et al., 2006).

Livestock disease insurance is usually available only for companion or sport animals, breeding stock, and other high-valued animals. High cost typically precludes the purchase of livestock disease insurance for production animals. The limited availability of insurance for production animals is mostly restricted to named peril coverage (specific diseases). The fact that only limited insurance coverage for production livestock has been offered by the insurance market points to the complexity of disease-based coverage or even the lack of demand for such coverage from producers. In Europe, the traditional type of livestock insurance policy, which is a mortality cover on individual animals (except for poultry, where cover is always on a flock basis), has had limited success in the market. Premium rates are in the range of 5–10 percent of the insured amount, with even higher rates and high deductibles if disease is included as an insured peril. Participation rates are quite low, for example in Germany, at less than 5 percent uptake of this type of insurance product for pigs, dairy cattle, beef cattle, and horses.[30]

It is useful to reflect on the question as to why private insurance for livestock disease has not been forthcoming when considering public policy and insurance designs that will mitigate and prevent contagious disease outbreaks in the livestock sector.

Farmers always know more about their risk exposure and management practices than government or insurance companies. They will also know more about their effort level in the implementation of best practices to mitigate and control their exposure to loss. This asymmetric information creates important challenges for those designing insurance products against contagious animal diseases.

Information hidden from insurers leads to adverse selection in insurance. If insurers are unable to properly classify potential policyholders according to their risk exposure, those who have been classified as having low risk when they actually have high risk will buy the insurance. The converse is also true — those who have low risk but are classified as having high risk will not purchase. As indicated by Shaik et al. (2006) livestock disease insurance poses difficult risk classification challenges. If someone has insurance that is underpriced relative to their risk, they may also expand production to generate further expected benefits from the insurance product. Thus, in addition to inequities that follow hidden action and adverse selection, the availability of an insurance product with misclassification problems can actually increase the risk-taking behavior of individuals. As indicated previously, increased risk taking by the individual can put

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[29] Much of Appendix A is taken from GlobalAgRisk (2006).

[30] Some of this section on livestock insurance is taken from Roberts (2007).

the entire sector at increased risk given the nature of catastrophic animal diseases and the link back to markets.

Moral hazard is another problem caused by asymmetric information. It occurs when, subsequent to purchasing insurance coverage, policyholders change practices so as to increase their risk exposure. For example, they may not be as diligent about using proper risk mitigation procedures (vaccinations, veterinary visits, monitoring, etc.) as they would be if they were bearing the full costs of losses should an outbreak occur. Moral hazard is most problematic when loss risk is highly conditioned on management or production decisions rather than on random events that cannot be influenced by the policyholder. Such is the case with many contagious livestock diseases where loss risk is often dependent on sanitary practices and other disease control measures (see Shaik et al., 2006). If moral hazard cannot be controlled, the actions of the individual could actually compound the problems associated with contagious animal diseases, putting the entire production system at greater risk.

For any livestock insurance program, essential first steps include building on experience over many years, and installing control measures for losses from various perils. Even then, the special case of disease epidemics such as BSE (bovine spongiform encephalitis), FMD (food and mouth disease), and AI present particular problems for insurers, many of whom regard these problems as being more appropriately addressed by governments to make compensation payments to farmers whose stock is compulsorily slaughtered, and who suffer accordingly.

Public policy for livestock disease has several key components:

- An active prevention policy that focuses on vaccinations and veterinary services;
- A program of that supports early detection, eradication, and quarantine; and
- A program that pays adequately for the first animals that must be destroyed but reduces payments as the number of animals that must be destroyed increases.

The question of how to finance the compensation payments to farmers is in large part the motivation for many to seek an answer in insurance markets. Even if it were not for the incentive problems created by insuring animals against contagious disease, insurance providers would likely be unable to provide adequate financing for these highly correlated losses. Both the frequency and severity of losses from diseases like AI are too high to make insurance a viable option. Systems that reduce the risk must be implemented and these systems require government action. If governments wish to finance the compensation for animals that must be destroyed, building reserves via a check-off system (a flat tax on the price of animals sold in the market) would likely provide a better solution. Careful consideration should be given for how to ensure that the check-off systems have some relative risk reflected in their implementation. Implementing effective check-off programs may be quite difficult if the animals are not sold in an active market. Furthermore, there may not be enough knowledge to know what regions are more risky than others to attempt to use relative risk as the base for implementing differential check-off rates.

External Effects

For contagious livestock disease insurance, the implications of asymmetric information problems are more significant than they are for crop insurance. This is because of the high external effects associated with livestock disease, especially those that have human health implications.

Unlike crop insurance for most risk events, livestock producers with contagious disease in their herds are not the only individuals affected by an outbreak. With the exception of contagious crop disease problems, when crop insurance policyholders act in ways that increase expected losses, the production losses (reduced yields) incurred as a result of the change in behavior are generally confined to the policyholders' farms or ranches. Once again, moral hazard by a producer can increase the risk of a disease outbreak where both economic losses and risk to humans extend well beyond the individual producers.

Incentive Compatibility in Disease Management Systems

When designing risk management mechanisms for contagious livestock diseases, a goal is to encourage individual producers to improve management in ways that facilitate herd health and bio-security measures, while also providing incentives for early disclosure in the event of a suspected disease occurrence. Attaining this goal is complicated by the presence of information asymmetry. Frequency and severity of disease outbreak are heavily dependent on individual behavior, which is costly for regulators or insurers to monitor and correct. Disease transmission characteristics and the effectiveness of containment efforts once an outbreak is discovered are sources of uncertainty in determining the extent of a disease event. Livestock disease epidemics represent a unique agricultural risk that poses major challenges for public-sector decision makers and the risk management industry alike.

If it is economically feasible to design public policy and market (insurance) mechanisms that are incentive compatible, the negative external effects from an outbreak may be minimized and society is likely to benefit. If, however, insurance is introduced that is incompatible with the incentives provided by public policy (regulation and *ad hoc* disaster payments), the effect of a disease outbreak could be exacerbated and result in a larger problem than would occur in the absence of insurance. In addition to incentive compatibility, society must consider whether the transaction costs involved in operating any social arrangement (not just the availability of indemnification for producers) justify the benefits provided.

It is very important to take a careful and deliberate approach to mechanism design for public policy and market instruments to ensure that it is well-suited to addressing incentive compatibility issues. The goal of animal health public policy has been to reduce the risk of livestock disease outbreak and have measures in place that will effectively limit the spread of disease if an outbreak does occur. If either policy or insurance is designed without consideration of the full scope of incentives present in the livestock production system, the possibility exists to increase risk. Successful *ex ante* risk mitigation must take into account the incentive effects of public and private mechanisms that influence producer behavior and could reduce incentives for individual producers to improve their health management and bio-security, and worsen the effect of an outbreak rather than fostering early disclosure for timely containment and eradication of a disease or suspected disease. The economic risks of contagious livestock disease extend far beyond livestock producers and processors, and could potentially affect a number of seemingly unrelated economic sectors, including tourism. Government- and market-based solutions that can improve the effectiveness of risk mitigation are desired, but care must be taken so that the combination of risk management tools available to producers are incentive compatible and feasible in the presence of potentially very high transaction costs.

Appendix B Index-based Livestock Insurance in Mongolia[31]

Livestock herding has played a vital role in the culture of Mongolia for thousands of years and continues to contribute significantly to its economy. Herding accounts for 17 percent of the GDP of Mongolia and employs 33 percent of its workforce. The population of Mongolia totals 2.6 million, and according to the 2007 livestock census, there are close to 40 million head of livestock.

The dissolution of the Soviet Union in 1991 had a significant effect on Mongolia. Mongolia's government changed from a socialist system to a democratic enterprise economy. Herder households shifted from collective farming to family-based herding. Due to lack of jobs in the cities, many families also moved to the countryside to take up herding. From 1990 to 1997, the number of households engaged in herding doubled and the overall livestock population grew from 25 million to 31 million.

While episodic drought and harsh winters have always been a fact of life for herders in Mongolia, conditions happened to be largely benign during the early years of economic transition in the 1990s. From 2000 to 2002, however, severe winter conditions created *dzud* – sudden-onset winter storms that include bitterly cold temperatures and can create ice that prevents livestock from foraging. These events occurred during an important transition where many novice herders were placing increased pressure on the natural resource base at precisely the same time that state-supported risk mitigation systems (forage and groundwater wells) broke down. Some 11 million animals perished during the winters of 2000, 2001, and 2002. Weak insurance companies defaulted on payments to herders, families returned to the city, the general economy was adversely affected, and a national debate was initiated regarding implementing mandatory livestock insurance.

Even before the crisis, the World Bank was actively involved in Mongolia, developing a program on sustainable livelihoods that emphasized pastoral risk management. This included improved early warning systems and risk preparedness actions, access to supplementary feed and grazing reserves, coordination of pasture-land use, and conflict management. These measures were combined with efforts to extend the outreach of micro-finance services to herders, and community-prioritized investments in basic infrastructure. Taken together, these complementary interventions strengthened the wider risk management framework, thereby reducing herders' vulnerability to climate and non-climate hazards.

As part of its support for the Sustainable Livelihoods Program, the World Bank was invited to assist the government of Mongolia in their debate regarding mandatory livestock insurance. It was clear that it would be impossible to implement a traditional livestock insurance program that performed a loss assessment on animals in the vast space of Mongolia in the midst of harsh winter conditions, therefore alternative methods for measuring livestock losses were sought. Mongolia had been conducting a census of animals every December since the early 1920s, which provided estimates of mortality rates of animals by species and by *soum* (rural districts). It was proposed to use these data as the basis of payment for a new insurance program. Policy makers and others understood that paying based on *soum*-level mortality rates would retain the incentives for herders to work hard to save their animals during the midst of a *dzud*.

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[31] Appendix B is a case study written by Jerry Skees and Robin Mearns in Hellmuth et al., 2009

In 2005, the government of Mongolia entered into a credit agreement with the World Bank to begin a pilot program on Index-based Livestock Insurance (IBLI). The first sales season was 2006. The goal of the IBLI is to provide an insurance product for catastrophic livestock mortality events within a region, recognizing that smaller, individual livestock mortality risks are better addressed through appropriate household-level risk management strategies.

The IBLI pilot program consists of a public–private partnership and includes a commercial insurance product, the Base Insurance Product (BIP), and a Disaster Response Product (DRP) to compensate herders when major livestock losses occur. The BIP pays when *soum* livestock mortality rates exceed 6%. Losses beyond 30 percent are managed by the DRP and paid currently with a contingent loan from the World Bank, with the intention that these will be financed by the government of Mongolia after the pilot ends. Thus, the commercial exposure (BIP) is for the layer between 6% and 30% mortality and the social component (DRP) is for losses exceeding 30 percent mortality. Herders are allowed to select their sum insured based on an aggregate value of all of their animals for the specific species. Typically, herders have been insuring about 30 percent of the estimated value of their animals. Herders have the option to pay a small fee to obtain the DRP product at 50 percent of the value of their animals. They can do this whether or not they purchase the BIP policy.

The sales seasons begins in mid-March and ends in mid-summer to prevent herders from adversely selecting on the insurance. If sales were extended into July and August, the knowledge herders have about pasture conditions and the health of the animals could cause them to buy only when the likelihood of a loss increases. Payments are based on estimates of soum-level livestock mortality rates from January through May. Indemnities will generally be paid in late July or early August after the estimates of mortality are obtained from a newly developed mid-year livestock survey (conducted in late May and early June). As of 2009, the IBLI program is being piloted in four provinces: Bayankhongor, Khentii, Uvs, and Sukhbaatar.

Financing structure

The IBLI pilot program has a unique financing structure that was designed to account for the lack of access to commercial reinsurance, the large financial exposure associated with correlated livestock losses, and the insurers' and the regulator's lack of experience with this class of insurance. This is the first time an index insurance product has been used in Mongolia (and the first time for livestock anywhere). The structure follows best practices by structuring layers of risk financing. Insurance companies retain some portion of the risk, pool risk with other companies, pay reinsurance premiums to the government, and are protected from the most extreme losses by a combination of (1) the BIP reinsurance reserve (that accumulates from reinsurance premiums paid using the herder premium) and (2) a contingent loan from the World Bank for the most severe losses. To be clear, the BIP reinsurance reserve is only used to pay for losses from the commercial layer of risk. It is used at the first line of defense before the World Bank contingent loan is used.

The Livestock Insurance Indemnity Pool (LIIP) is the foundation of the risk financing structure. The LIIP represents a risk-sharing arrangement through which insurance companies pool their risk: all insurance companies participating in IBLI pay into the insurance pool, and the indemnities from all BIP policies are paid from the aggregate funds in the pool.

The LIIP has a regulatory structure to ensure that insurance companies have their complete capital at risk available for quick payments should there be losses. Participating insurance companies are required to deposit their capital at risk into the LIIP account to replace reinsurance that is paid by herders. The government owns the LIIP account. This ensures that herders will be paid even if an insurance company goes bankrupt. Insurance companies own the right to a share of underwriting gains from the LIIP account. Shares are based on the premium sales by the insurance company.

Pilot performance

In general, the IBLI program has performed above the expectations and performance goals that were developed when the project started. Two insurance cycles have been completed, the third is ongoing, and the sales season for the fourth has been launched. Four insurance companies are currently participating. In 2006, 2400 policies were sold; over 3700 policies were sold in 2007; and 4100 policies were sold in 2008, representing 14 percent of herders in the pilot provinces. In mid-August 2008, following high livestock losses, MNT 389 million (USD 340,000) was paid out to 1783 herders. All financing systems worked as planned; a small amount was drawn from the contingent debt facility.

Lenders have offered lower interest rates and better terms for loans to insured herders; and the National Statistics Office has successfully implemented a mid-year census to facilitate timely payments after most losses which occur in the first five months of the year.

Lessons learned and challenges ahead

Mongolia represents a novel approach for a public–private partnership using index insurance. Insurance for the most extreme events is generally quite costly. In the case of Mongolia, the most extreme events (above 30% mortality) are completely financed by the government. If these risks had to be priced in the market, they would be too expensive for herders. Index insurance products provide the unique opportunity to layer risk for individual policies in this fashion. Mongolia represents one of the strongest cases in mixing social and commercial insurance with a carefully constructed project that can serve both. This form of subsidy can promote the market for the commercial layer of risk, and yet does not provide poor incentives that may make this layer of risk unsustainable in the absence of government support. Should the government of Mongolia decide it can no longer afford to take the extreme risks, a commercial product is still firmly in place. It may also be possible for the insurance companies to increase some of the extreme risk exposure with reinsurance markets at that stage.

The IBLI program is designed to pay for market development and to create a public–private partnership that avoids many of the incentive problems often faced by government efforts to support agricultural insurance. The financing and regulatory structure of the project can have wide application with other index insurance products. It is carefully constructed to pool risk among insurance companies. The structure is designed to strengthen trust among herders, participating insurance companies, the government and the global reinsurance market.

Among the most significant challenges for IBLI is to make it a sustainable program with a system for data, delivery and administration that can be paid from herder premiums. Performing a mid-year survey has an added cost. Delivering insurance products to herders in the vast countryside of Mongolia is also proving to be costly. These are micro-products with small premiums on a per policy basis. Linking the products to herder loans will be an important next step to reduce the delivery cost. Despite these challenges, the administrative costs should be manageable as the premium base grows.

Above all, it is important to view this initiative as being one element within a wider risk governance framework. Mutually supportive interventions across a number of areas — including disaster risk preparedness, reduction and response, financial intermediation, supporting infrastructure and social safety nets — are all needed to address the interlocking forms of vulnerability that herders face in an unpredictably varying environment.

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