Weather Index-based Insurance in Agricultural Development

A Technical Guide

WFP
World Food Programme
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IFAD
Enabling poor rural people to overcome poverty

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Acronyms

ARMT	Agricultural Risk Management Team (World Bank)
CPM	Country Programme Manager
CPMT	Country Programme Management Team
FAO	Food and Agriculture Organization of the United Nations
FSP	financial service provider
MFI	microfinance institution
MPCI	multi-peril crop insurance
NMS	national meteorological service
P4P	Purchase for Progress programme
USAID	United States Agency for International Development
WFP	World Food Programme
WII	weather index-based insurance
WMO	World Meteorological Organization
WRMF	Weather Risk Management Facility
WRSI	water requirement satisfaction index (FAO)

Introduction

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Introduction

IFAD has been working on index insurance as part of its commitment to reduce the vulnerabilities of poor rural smallholders and open their access to a range of financial services with a view to improving their livelihoods. With a grant from the Bill and Melinda Gates Foundation, in 2008 IFAD joined forces with the World Food Programme (WFP) to launch the Weather Risk Management Facility (WRMF). The WRMF has conducted global research in government and donor best practice in weather index-based insurance (WII), while supporting WII pilots in China and Ethiopia (IFAD and WFP 2010). This technical guide translates the findings and experience to date into practical decision-making steps for IFAD and WFP country programme management staff and other donors interested in promoting this risk mitigation tool.

Weather index-based insurance: Background

Poor rural people in developing countries are vulnerable to a range of risks and constraints that impede their socio-economic development. Weather risk, in particular, is pervasive in agriculture. Weather shocks can trap farmers and households in poverty, but the risk of shocks also limits the willingness of farmers to invest in measures that might increase their productivity and improve their economic situation.

Nonetheless, formal and informal coping measures have been developed at farmer, community, market and government levels. This technical guide discusses WII, a class of insurance products that can allow weather-related risk to be insured in developing countries where traditional agricultural insurance may not always be feasible.

In developing countries, WII can be considered for two broad purposes (IFAD and WFP 2010):

- **WII for development.** WII can be used as a tool to promote agricultural and rural development. It can help households, financial service providers (FSPs) and input suppliers manage low-to-medium-frequency covariate risks such as drought or excess rainfall.[1]
- **WII for disaster relief.** WII can provide an alternative method of funding disaster recovery assistance or relief programmes.

This technical guide focuses on developing WII programmes for development.

Rationale and structure of the guide

Insurance operates best where it forms part of an integrated approach to risk management, where constraints such as lack of access to finance, improved seed, inputs and markets can be addressed. As such, it is important to understand that WII does not have universal application. Its applicability needs to be considered in context, through case-by-case evaluation.

This technical guide is intended as a practical reference tool to guide IFAD, WFP and other donors' country programme management staff through the steps of implementing a WII programme. It looks at each phase of the process: from the first step of assessing whether WII is the right method of intervention and is feasible, through developing a pilot, to possible future areas that IFAD, WFP and other donors can support through scaling up. The guide includes background information, explanations and resource recommendations to help inform decision-making.

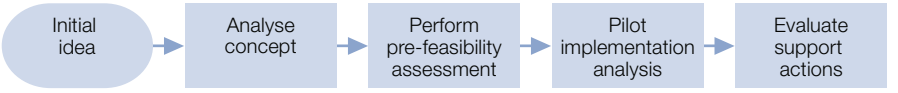
[1] Covariate risks are those that affect many people at the same time (e.g. widespread drought or flood), and are thus more difficult to address with household-level coping strategies or traditional market-based risk transfer than are localized risks such as hail. Since WII policies are characterized by a single premium level per product (i.e. the cost of the policy) and provide the same payout to all insured parties in a defined geographical area, WII works best where risk is covariate (i.e. the insured parties are all affected to the same degree). In addition, in the presence of excessively frequent risks, insurance premiums may be too high to be affordable or efficient, which is why insurance is financially more feasible in the case of medium- or low-frequency events (once every five-to-seven years or less).

Flow charts

The phases and decision points of the WII development process are illustrated using flow charts. The charts are meant to be read from top to bottom, left to right, following the direction of the arrows.

Symbol	Meaning
	Terminator: indicates the beginning or end of a process
	Action: indicates that an action is performed
	Decision point: indicates that a decision is to be made, typically with separate 'YES' and 'NO' paths
	**Direction arrow:** indicates the direction of the process

With this nomenclature in mind, the guide presents the typical decision process as follows:



Each of these actions is discussed in detail in the relevant chapter.

1. Weather index-based insurance: Concepts and characteristics

Photo: ©IFAD/G.M.B.Akash

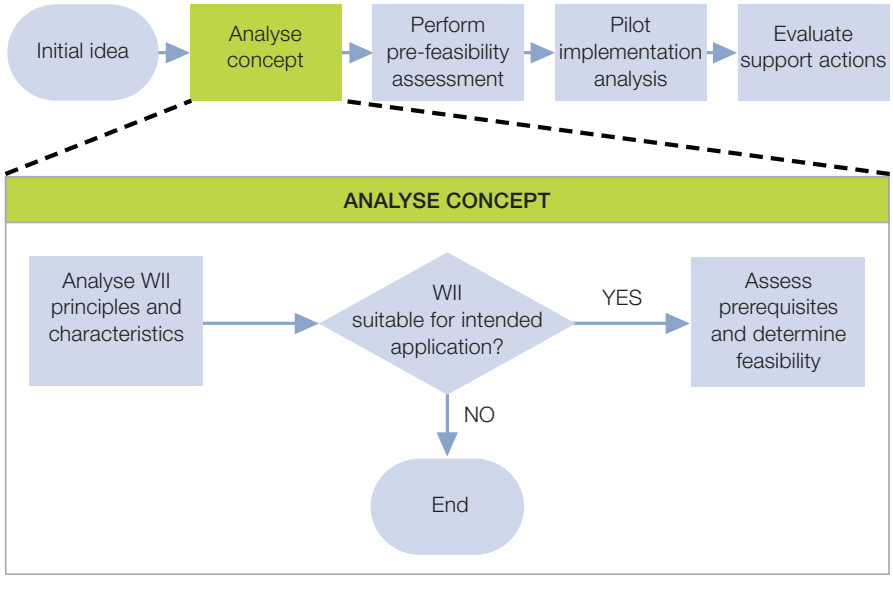
1. Weather index-based insurance: Concepts and characteristics

- **Action**: Understand key principles of WII.
- **Objective**: Determine whether WII is appropriate to a given situation.
- **Key players**: WII consultants guided by the CPM and the CPMT, together with supplementary support from other key industry players.

Weather index-based insurance: Principles

Conventional crop or livestock insurance relies on direct measurement of the loss or damage suffered by the farmer. However, field loss assessment is normally costly or not feasible, particularly where there are a large number of small-scale farmers or where insurance markets are undeveloped.

Figure 1. Concept analysis



The essential feature of WII is that the insurance contract responds to an objective parameter (e.g. measurement of rainfall or temperature) at a defined weather station during an agreed time period. The parameters of the contract are set so as to correlate, as accurately as possible, with the loss of a specific crop type suffered by the policyholder. All policyholders within a defined area receive payouts based on the same contract and measurement at the same station, eliminating the need for in-field assessment.

Typical features of a WII contract are:

- A specific meteorological station is named as the *reference station*.
- A *trigger* weather measurement is set (e.g. cumulative millimetres [mm] of rainfall), at which the contract starts to pay out.
- A *lump sum* or an *incremental payment* is made (e.g. a dollar amount per mm of rainfall above or below the trigger).
- A *limit* of the measured parameter is set (e.g. cumulative rainfall), at which a maximum payment is made.
- The *period of insurance* is stated in the contract and coincides with the crop growth period; it may be divided into *phases* (typically three), with each phase having its own trigger, increment and limit.

WII is not a panacea. It is best suited to weather hazards that are well-correlated over a widespread area and where there is a close correlation between weather and crop yield. The strongest relationships typically involve a single crop, a marked rainy season and no irrigation. To date, most WII efforts have focused on the risk of rainfall deficit (drought).

WII is less useful where more complex conditions exist. Localized risks, such as hail, or where microclimates exist (for example, in mountainous areas) are not suitable for WII. Similarly, the scope for WII is limited where crop production is impacted by many or complex causes of loss (as may be the case in the humid subtropics), or where pests and disease are major influences on yields. For a given environment, other insurance products may be more appropriate (such as *area-yield index insurance* or *named-peril crop insurance*).[2]

[2] Another product widely adopted in high income countries for large scale farm enterprises, is multi-peril crop insurance (MPCI). MPCI establishes an insured yield as a percentage of the historical average yield. If yield is less than the insured yield, an indemnity is paid. Individual farmer MPCI is not suited to smallholder agriculture in developing countries, and is a product which has required significant subsidy where it is operated.

Introducing WII to an area requires willing stakeholders: insurers, national weather services and linkages for distribution and support, including FSPs, agri-chain participants and government, which provides the regulatory environment. WII is best introduced using market-based principles and business practices, but often with an important developmental and social agenda. As such, private/public-sector partnerships are common. There are many opportunities for technical and organizational innovation in WII.

Levels of intervention and business models

Index insurance can be introduced at diverse levels. Various implementation models can be used to benefit IFAD's target group (Table 1). At the *micro* level, the policyholders (the insurer's customers) are farmers, households or small-business owners, who purchase insurance to protect themselves from potential losses caused by adverse weather events. Microlevel policies can also be distributed to farmers by organizations such as FSPs, farmers' associations, input suppliers, processors or NGOs.[3] In addition to having wider outreach to the target group than most insurers, these intermediaries also have vested social or commercial interests in protecting themselves and their smallholder clients against weather risk. For example, insuring farmers can help FSPs, input suppliers and other intermediaries manage their risk of default by farmers. This in turn can help unlock development opportunities for poor smallholders, such as access to credit or higher-quality inputs.

At the *meso* level, these organizations can act as the policyholder. At this level, WII can be structured through a policy issued to the organization, but with payout rules that could either directly or indirectly benefit farmers – for example, to alleviate mass loan defaults in a microfinance institution (MFI).

Finally, index insurance can also be sold at the *macro* level, to aid governments and relief agencies in development and disaster management. While intervening at the micro and meso levels it is also important to analyse how any new WII initiative would integrate with existing risk management policies, and equally how these policies may impact on incentives for WII.

This technical guide focuses on delivery of WII at the micro level.

[3] Intermediaries may be subject to regulatory approval; the potential regulatory implications of such a scheme should be carefully assessed.

Table 1. Micro, meso and macro levels of WII application[a]

Policyholder	Sales or distribution model	Potential benefit(s) of WII
	Micro	
Farmers Households Small businesses	Farmers buy insurance as part of a package (e.g. credit and other financial services, technology, agricultural information) or occasionally as a stand-alone product Note: FSPs, farmers' associations, processors, input suppliers or NGOs can also act as a distribution channel for micro products retailed to individual farmers	WII payout can: Allow farmer to avoid default and restart production Compensate for additional livestock feed costs Provide income support in lean periods Supplement other sources of household income that may be disrupted Facilitate access to credit Encourage investment in higher-quality inputs
	Meso	
FSPs Processors Input suppliers Farmers' associations NGOs	Meso-level institutions buy WII policies (e.g. portfolio or group insurance) to protect their own exposure, and may create payout rules that directly or indirectly benefit farmers	WII opens access to a new client base and helps manage mass defaults caused by weather shocks Meso-level actors can develop innovative linkages along the supply chain (e.g. contract farming, packaging of credit, and inputs) to help manage their risk and open market opportunities
	Macro	
Government (or relief agencies)	Government or relief agency is reinsured	Government receives early liquidity following disasters; relief agency is able to fund operations

[a] Based on IFAD and WFP (2010).

Advantages and disadvantages of index insurance

The advantages and disadvantages of WII are well-documented.[4] Table 2 provides a summary.

Table 2. Advantages and disadvantages of weather index-based insurance

Advantages
Transparency. Index insurance contracts usually allow the policyholder direct access to the information on which the payouts will be calculated. Trust is strengthened by transparency.
No on-farm loss adjustment. This is a primary advantage of index insurance, as on-farm loss adjustment is quite complex and costly and may not be credible in many low-income countries.
Lack of adverse selection. Adverse selection occurs when potential insured parties have hidden information about their risk exposure that is not available to the insurer, who then becomes more likely to erroneously assess the risk of the insured. Traditional insurance encourages high-risk producers to insure, while risk and premium are calculated on the average producer. Index insurance requires that all insured farmers within the defined area have the same insurance payout conditions, regardless of their specific risk exposure. Hence, insurers and clients benefit from reduced adverse selection.
Lack of moral hazard. Moral hazard occurs when individuals engage in hidden activities that increase their exposure to risk as a result of purchasing insurance, or attempt to influence the claims outcome. These hidden activities can leave the insurer exposed to higher levels of risk than had been anticipated when premium rates were established. With WII, there is no benefit in individual producers trying to influence claims. All producers in the defined area are treated equally.
Addresses correlated risks. Index products work best where there are correlated risks. With traditional products, perils such as drought are challenging to insure.
Low operational and transaction costs. Index insurance requires limited individual underwriting (client assessment). It can be distributed, and claims can be settled, at relatively lower cost. Education on the product remains important, both prior to product launch and as an ongoing process.
Rapid payout. Measurement of weather station data, with no field loss adjustment, allows rapid payouts.

[4] World Bank (2005), United States Agency for International Development (USAID) (2006) and IFAD and WFP (2010).

Disadvantages

Basis risk. Basis risk in WII is a key constraint. Basis risk is the difference between the loss experienced by the farmer and the payout triggered. It could result in a farmer experiencing yield loss, but not receiving a payout, or in a payout being triggered without any loss being experienced. Index insurance works best where losses are homogeneous in the defined area and highly correlated with the indexed peril. There are various types of basis risk:

- **Spatial basis risk.** Local variations in the peril occurrence (e.g. rainfall) within the area surrounding a weather station.
- **Temporal basis risk.** Inter-annual variations in seasonal crop phases, meaning that the insurance phases are not temporally aligned with the intended crop growth stage.
- **Product basis risk.** Crop losses can be caused by many factors. Where there is no clear-cut relationship between loss and the indexed weather peril, basis risk can be high. WII is most likely to work for rainfed crops and at severe levels of the event, when losses may be more widespread and homogeneous.

Limited perils. WII normally covers only one, or sometimes two, weather perils. Although this reduces the cost compared with MPCI, the product may not provide broad enough coverage to satisfy risk management needs.

Replication. The triggers, limits and increments of a specific product need to be adjusted to reflect the weather parameters of each weather station. Different product designs are required for different crop types (or at least generic crop types). WII requires considerable technical work in its implementation and sustaining.

Technical capacity and expertise are required, particularly during the initial design phase for new products, in agro-meteorology and in operationalizing the products.

Lack of weather data. WII depends on the availability and quality of weather data, which can drastically vary from country to country. In developing countries, the shortage of historical and real-time weather data is often a major hurdle.

Opportunities and limitations of weather index-based insurance

The majority of WII experience has been with microlevel applications and rainfall deficit (drought). To date, many initiatives have been piloted, but only in India has a market-based scale-up of WII taken place. The IFAD and WFP (2010) review of 36 index-insurance case studies yielded the following lessons on sustainability and scalability:

- Create a proposition of real value to the insured and offer insurance as part of a wider package of services;
- Build the capacity and ownership of implementation stakeholders;
- Increase client awareness of index insurance products;
- Graft onto existing, efficient delivery channels, engaging the private sector from the beginning;
- Access international risk transfer markets;
- Improve infrastructure and the quality of weather data;
- Promote enabling legal and regulatory frameworks;
- Monitor and evaluate products to promote continuous improvement.

One of the key messages from the case study review is that WII must provide added value to the client, beyond the simple financial protection provided by insurance. As a stand-alone product, WII may be seen as an unnecessary cost and have little demand from poor smallholders, who face a variety of risks and productivity constraints in addition to weather risks. Insurance is often more appealing when linked to an existing development programme targeting these constraints or when linked to other market opportunities. One obvious linkage relates to seasonal credit, but can be further enhanced where a package of credit and inputs is provided.

Role in support of agricultural development

WII can support agricultural development when it is part of an integrated approach – being one element in an overall risk management or market-development strategy.

Index insurance helps farmers protect their investments and become part of a wider strategy to escape poverty. In addition to transferring the risk away from the farmer, WII can provide better access to high-value markets, modern technologies and inputs, agricultural information, and credit and other financial services.

WII appears most promising in helping households, FSPs and input suppliers manage low-to-medium-frequency covariate risks such as drought, major pest outbreaks due to weather events and excess rainfall.

In comparison with traditional agricultural insurance, WII lowers the threshold of insurability (the economic size of an insurance transaction that can be reasonably serviced by an insurer). The simplified nature of the product offers additional opportunities to reach a wider range of households – and for innovative design to target the poor. However, the most likely target group will be emergent and commercial farmers, as it is unlikely that the majority of poor smallholders would directly purchase insurance on a sustained basis.[5]

That being the case, a thorough market assessment might suggest entry through an aggregator (e.g. agricultural processors, input suppliers, FSPs, farmers' associations). Aggregators are key to reducing transaction costs and reaching more clients. In this context, index insurance products could be designed to cover portfolios of aggregators (through meso-level products) as well as the household-level risk of individual farmers (through microlevel products distributed by the aggregator). Table 1 presented a framework for various policyholders and sales/distribution channels for WII.

Weather index-based insurance and climate change adaptation

Climate has become an urgent issue on the development agenda. There is a high degree of interest in the potential role of WII in agricultural adaptation to climate change (Hellmuth et al. 2009). Climate change is expected to give rise both to changes in the *average climate conditions* in different regions and to increases in the *variability* of weather, with more frequent or extreme weather events. Adaptation to these changes is built on actions to increase resilience and reduce risk (e.g. appropriate crops, varieties and cropping patterns; irrigation; and soil and farm management techniques). In spite of these actions, risks remain or will increase (particularly to extreme weather events). WII can support appropriate climate change strategies, but it should not be seen as a way to avoid taking proper adaptation measures; nor should WII be seen as replacing other programmes that address the effects of climate change.

[5] Commercial insurance programmes may not always be an appropriate option for targeting the needs of the poorest of the poor, since the repeated cost of purchasing insurance may maintain these farmers in a poverty-trap situation (Chantarat et al. 2009). In such cases, WII applications should be considered in a 'disaster relief' framework.

2. Performing the pre-feasibility assessment

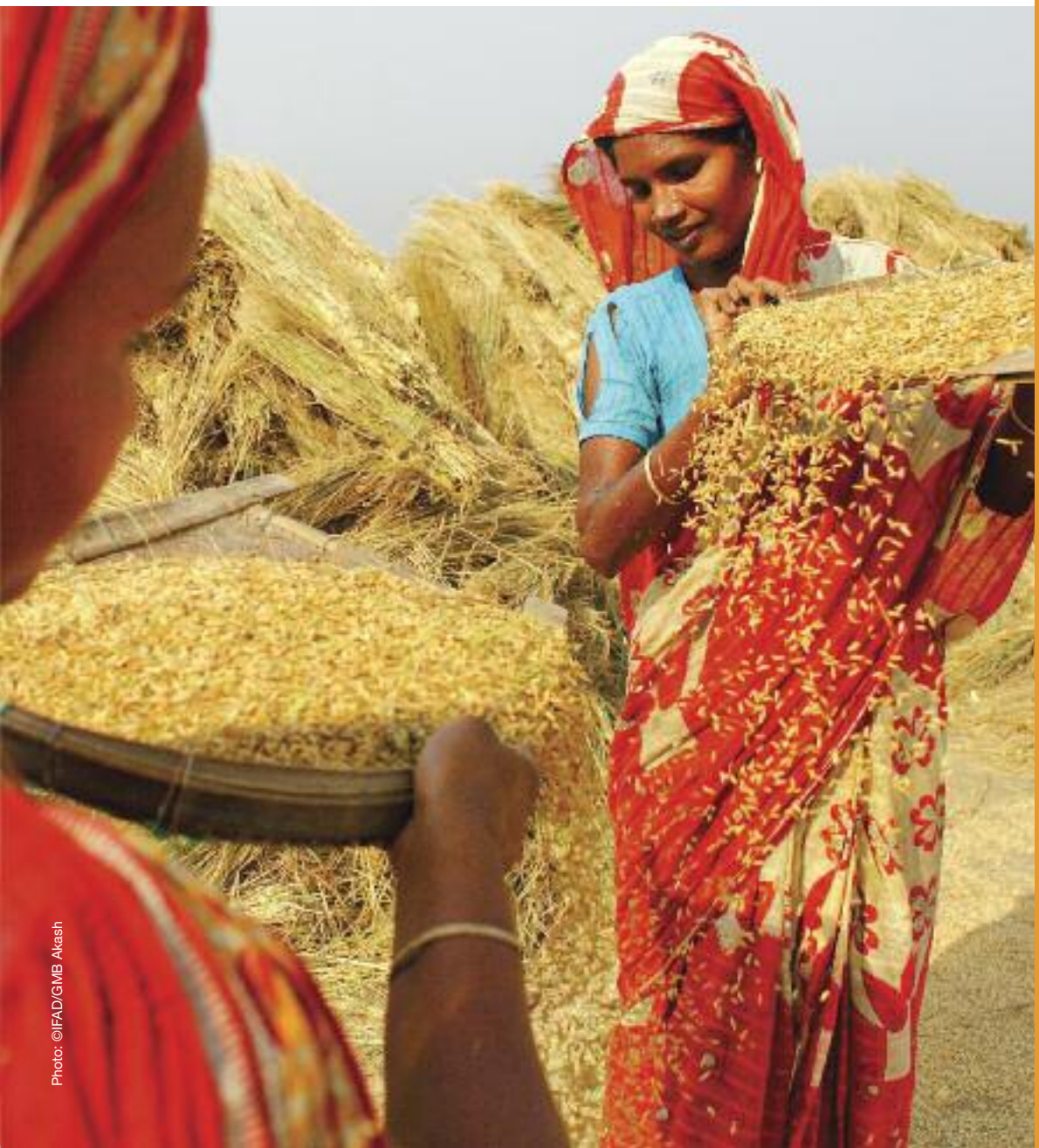
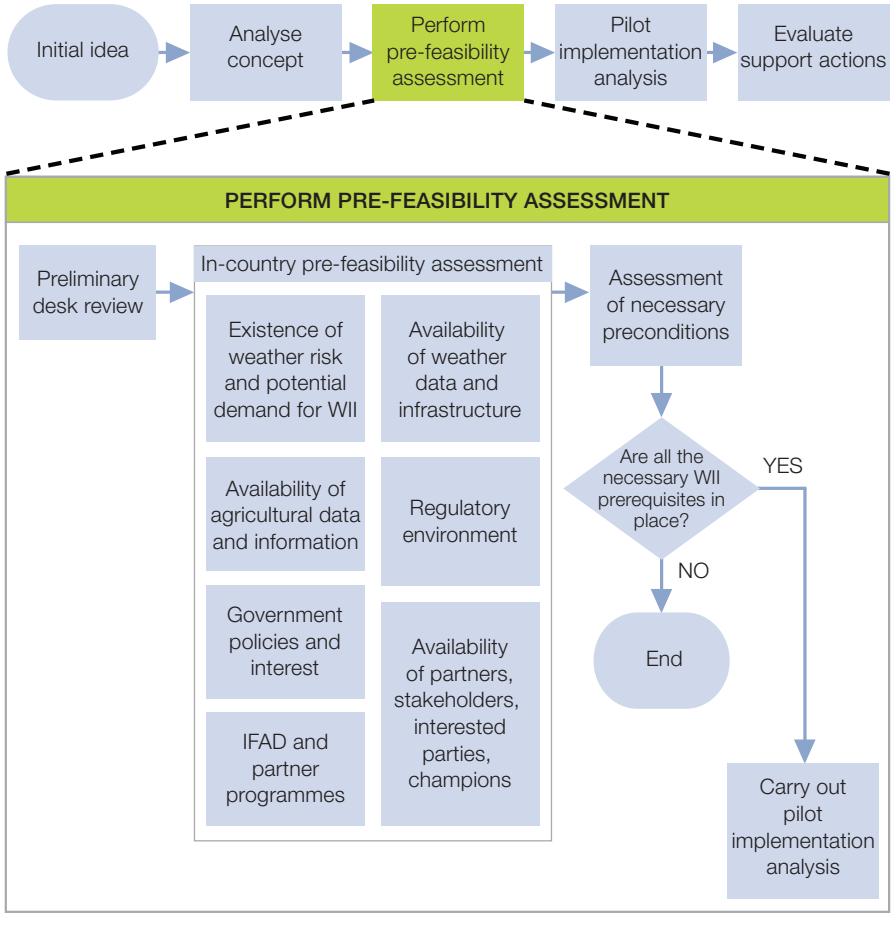


Photo: ©IFAD/GMB Akash

2. Performing the pre-feasibility assessment

- **Action**: Assess the existence of the basic prerequisites for a successful implementation of WII.
- **Objective**: Determine whether developing a WII pilot is appropriate.
- **Key players**: CPM, CPMT, WII consultants and local stakeholders (relevant ministries, weather service, insurance industry, etc.).

Figure 2. Pre-feasibility assessment



Not every context is suited to WII. In addition to a strong correlation between a single crop yield and a particular type of adverse weather event, there are other necessary prerequisites for developing and delivering a product. The next phase assesses the pre-feasibility of the target area(s). Such an assessment involves three stages: preliminary desk review; in-country interviews and assessment with key stakeholders; and assessment of the necessary preconditions.

Stage 1: Preliminary assessment

The preliminary assessment analyses the general conditions of a country/area in relation to the potential feasibility of WII. There are six key areas of research to consider before moving on to the next stage:

- **Country context.** What is the rural development context? What are the policy, governance, political and economic issues? Perform financial-sector and agriculture-sector analyses.
- **Weather.** Review the existing natural hazard vulnerability profile.
- **Insurance.** What types of insurance exist in the country? Microinsurance? Crop insurance? Index insurance? Are there any other donor initiatives in index insurance or WII? If so, what are the key features of the programme and who are the key players? Are there any current issues that should be considered, such as the government regulatory framework?
- **Intermediaries.** Who are the intermediaries? Consider existing delivery channels, microfinance institutions, input suppliers, etc.
- **Potential clients and users.** Who would use the product?
- **IFAD operations.** What are the current and planned operations, with their relevant components (e.g. rural finance – IFAD [2010])?

Stage 2: In-field pre-feasibility assessment

The objective of the in-field pre-feasibility assessment is to understand whether WII would be appropriate in the country/area under discussion. A number of factors need to be taken into account, as addressed in the following subsections.

Box 1
In-field pre-feasibility assessments – overall assessment aims

An in-field pre-feasibility assessment involves discovering, verifying and understanding many different data points, including:

- Findings of the preliminary assessment (including a basic diagnosis of access to financial services in the country);
- Overall natural-hazard vulnerability profile of the country;
- Vulnerability and risk profile of smallholders in the country (e.g. numbers, income levels, sources of income, crops, rainfed/irrigated agriculture);
- Availability of relevant historical and real-time weather data and infrastructure, including capacity and technology gaps;
- Availability of relevant historical agricultural data;
- General demand and supply of financial services;
- Insurance culture in rural areas – particularly for agriculture;
- Potential cost-efficient delivery channels (e.g. banks, rural finance institutions, farmer organizations) for reaching poor farmers;
- Legal and regulatory framework for WII;
- Potential target areas and target clients where demand exists;
- Key public- and private-sector partners (e.g. primary insurers) and in-country champions and project coordinators;
- Government interest in and commitment to supporting and partnering with initiatives in WII; and
- Overall market potential for WII.

Existence of weather risk and potential demand for WII

The most basic prerequisite for WII is the existence of a weather risk that affects crop yields in a targeted area. That is to say, that the justification for WII must include a clear, verifiable need, as well as strong potential demand from the micro and/or meso level.

A risk assessment of an enterprise, or a farming system, aims to identify and quantify the risks faced by farmers. It can be extended to include other actors in the agricultural value chain, such as buyers, processors, packers, service providers, marketers and FSPs. The assessment can be carried out on a macro, meso, or microlevel, depending on the intention of the programme.

Preliminary existence of weather risk can be assessed through a combination of the following:

- Analysis of yield data;
- Damage statistics for a pre-identified crop or variety of crops;
- Weather data;
- Farmer interviews; and
- Expert opinion, especially of local extension officers.

WII can best be applied where there is a strong correlation between crop losses and adverse weather events. Strong relationships are likely where there is single cropping, a marked rainy season and no irrigation (e.g. drought risk in maize crops in Southern and Eastern Africa). Direct correlations are less likely where pest and disease play a major role, where climates are humid, where rainfall is high and not markedly seasonal, or where crops are irrigated. For example, much of South-East Asia suffers losses as a result of a combination of pests, disease and excess rain and flooding.

Floods are a special case. While excess rainfall can be indexed, flooding is a very localized hazard, and it is difficult to index because there is no one-to-one relationship between amount of rainfall at a specific location and amount of flooding (Lotsch, Dick and Manuamorn 2010). Further details on indexable crop types, perils and practical analytical approaches are included in training course material produced by the Agricultural Risk Management Team (ARMT) of the World Bank (www.agrisktraining.org).

Interpreting potential demand for WII through focus groups can be problematic, given low insurance awareness and the need to demonstrate a product and price – the details of which have not yet been researched. Experience suggests that farmers are more interested in WII when they see that it could ease the immediate constraints they face, such as lack of access to improved seed or credit. Nevertheless, focus groups can also assist in a preliminary assessment of potential demand for WII, as well as help identify the wider constraints faced by farmers.

Availability of weather data and infrastructure

WII relies on historical and current weather data. Historical data are used as the basis for data analysis in product design and pricing. Current data – as measured by local weather stations – provide the information needed in the operational phase.[6]

Unfortunately, both historical and current data are not always plentiful. The completeness of the historical dataset is highly variable for different areas, particularly for daily data, which are needed for index design. Similarly, the density of weather stations forming the national network (which could include WMO reporting stations, national core stations and localized rain gauges) varies considerably from country to country. In order to meet requirements for a commercial WII insurance and reinsurance transaction, it is recommended, as a guideline, that there be at least 20 years of historical daily data and that missing data should not exceed 3 per cent of the total daily dataset.[7]

During operation, network density will likely need to be enhanced through installation of automatic weather stations with dataloggers[8] and daily reporting to headquarters via telecommunications networks. Where there are no previous station data, a methodology to generate artificial datasets for new station locations can sometimes be used.

The national meteorological service (NMS) supervises data and related information on past and present weather recording. The NMS can normally provide a summary of data availability, a history of current and past networks and the terms under which access to data may be permitted. Obtaining this information may involve fees, as many NMSs are required to generate income. The active involvement of the NMS in any ongoing project is critical, not only for access

[6] Annex 1 provides a list of elements of information on weather measurement infrastructure.

[7] The 3 per cent guideline is not a binding rule. Reinsurers may agree to use datasets that have a higher percentage of missing data. See subsection ‘Collect agricultural data’, page 43, for detailed requirements for weather data.

[8] A datalogger is a device that can read various types of electrical signals and log the data in internal memory for later download to a computer.

to data and knowledge of weather patterns and risks, but also for capacity-building (especially in relation to agro-meteorology). Agricultural research stations may have also analysed meteorological data and be well informed. In rare cases, as in India, there may be private weather data providers that fill in the gaps in public weather data on a for-profit basis.[9]

Availability of agricultural data and information

Agricultural data are necessary for a pre-feasibility assessment, including:

- Rapid assessment of crop area;
- Production techniques and yield data (as disaggregated as possible in targeted areas);
- Official loss or damage data (if available);
- Information on mechanization and intensity;
- Cropping patterns and varieties;
- Soil types; and
- Basic water-balance parameters (e.g. from the Climate Information Tool of the Food and Agriculture Organization of the United Nations [FAO]).[10]

Official statistics on crop loss or damage, information on food or cash crop loss and risk mapping[11] are all contributors to understanding the spatial distribution of weather risk. Assessment of this risk involves a mix of data, broad information sources, expert opinion on agronomic practices, and agro-meteorology.

National or regional agricultural research institutes may be needed as stakeholders in WII. Their existence and capacity can be researched and assessed simultaneously through data- and information-gathering. International linkages can also be sought in order to bring additional key expertise to the collection and assessment of agricultural data. Within these institutes, it is important to seek out individuals with applied knowledge of crop production, crop modelling, agro-meteorology and crop losses.

Regulatory environment

Index insurance is different from traditional indemnity insurance. In particular, claims involve no measurement of loss and agreed value payouts may be higher

[9] Profits come from the sale of data not just for WII, but also to clients such as newspapers, agricultural processors and input suppliers.

[10] www.fao.org/nr/water/aquastat/gis/index3.stm

[11] For example, food-security agency mapping, such as the Famine Early Warning Systems Network (FEWS NET) of USAID.

or lower than actual loss sustained. In addition, it may be difficult to demonstrate an 'insurable interest' in the conventional sense (e.g. demonstration of an established crop). These matters are of interest to insurance regulators, who are typically an arm of Ministries of Finance. Their commitment to creating an enabling legal and regulatory environment is important in ensuring that the sale and management of products are fair to both buyers and sellers.

As the result of pilot projects in many countries, most regulatory bodies have developed some experience in legal and regulatory issues. Regulators have taken a positive view towards approving index insurance, due to its importance to the agricultural sector and because most initiatives start as pilots, which can be granted preliminary approval on a trial basis.

Some countries classify index insurance as microinsurance; others classify it as property insurance; but few countries mention index insurance specifically in their regulations, and few have special agricultural insurance laws. Generally, legal and regulatory approval by national authorities has not been a constraint in pilots launched to date, although this situation is not universal.

The first step in understanding the regulatory environment is to find out whether regulators have already addressed WII. For example, if the current regulation requires loss adjustment to be carried out, this requirement may be a bottleneck in implementing WII, which does not have loss adjustment procedures. It is normally useful to inform the regulator regarding the laws and procedures in other countries with similar economic contexts, providing supporting materials and experiences, of which increasing amounts are available. Discussions with a regulator are often best handled in partnership with a domestic insurer interested in becoming a stakeholder.

Government policies and interest

In addition to understanding the regulatory environment, the pre-feasibility study should also assess current government policies relative to agriculture and insurance, typically in coordination with the Ministries of Agriculture and of Finance.

It is important to understand how index insurance might blend in with existing risk management policies and how these policies impact incentives for index insurance. For example, in China and India, the government already provides heavily subsidized crop insurance alternatives to index insurance, and these programmes inevitably act to crowd out privately provided index insurance.

The analysis should determine whether governments are interested in and committed to supporting WII and whether they may be willing to take extra steps (if not already in place), such as supporting and investing in weather data and agricultural statistics.

Availability of partners, stakeholders, interested parties and champions

The existence and commitment of key stakeholders, especially local entities, is one of the critical success factors in a successful WII programme. The pre-feasibility study should assess which 'local champions' might be willing to enter into partnerships. Assessing capacity, interest and commitment is key to overcoming initial set-up challenges, and champions can act as a common thread for all stakeholders involved.

Insurers. Insurers play a key role in designing and underwriting the product. It is important to assess whether a trustworthy insurer exists, which is willing to issue the policy, accept some risk and play an administrative role. In an early pilot stage, sometimes insurers will join as a pool, and an association of insurers can play a facilitating role. In some pilots, the insurer has been the key champion driving the pilot. In these cases, insurers have committed themselves to participating in technical education on the design of WII products. The pre-feasibility study should assess their experience with similar products, their capacity needs, and their level of interest should the project develop into a pilot.

Intermediaries and delivery channels. As insurers normally have limited or no business (or offices) in rural areas, distribution is best organized through a party with existing links to farmers or farmer groups (e.g. a bank, processor, cooperative or MFI). What is more, embedding WII into a development programme, or into a package linked with credit, inputs or contract farming, can strongly add value to the proposition for farmers and other stakeholders and make it easier to sustain and eventually scale up.

Key stakeholder linkages for product delivery, product training and extension can include:

Financial service providers. The existing client base of MFIs and rural banks, and their interest in protecting both their clients and themselves against weather risks, make rural financial institutions a natural partner for WII distribution.

Cooperatives and farmer organizations are a natural focus for any new product development and as delivery channels.

Input suppliers and processors are both wary of and vulnerable to covariate risks facing producers, which in turn trap smallholders in a cycle of small-scale production. These entities can thus have a vested interest in acting as an intermediary for WII. For example, inputs such as good-quality seed or fertilizer could be sold on credit if the risk were to be transferred through index insurance.

IFAD and possible partner programmes

The project team should look for opportunities to leverage work already being done in the region. The pre-feasibility assessment should investigate possible linkages with other IFAD, WFP and partner programmes in the selected area. Existing rural finance programmes or components may be particularly relevant, as WII initiatives could link with participating financial institutions. The promotion of risk management services such as WII could encourage access to credit – by transferring risk away from either borrower or lender – and/or the development of savings services.

Linkages with WFP activities in an area could also be relevant, given their focus on food security and their in-country presence. One example is the Purchase for Progress (P4P) programme, which uses innovative approaches to increase smallholders' productivity and offers them access to agricultural markets (Box 2).

Box 2
P4P

P4P is a WFP-led pilot initiative that aims to address key hurdles in procuring food locally in emergencies through cost-efficiency, quality commodities and timeliness of deliveries. P4P supports the development of agricultural markets and smallholder farmers' access to these markets. WII could be useful in some circumstances or regions as part of a wider package of risk management and agricultural development tools.

Complementary agricultural development or risk management programmes in which WII can be added as a component are good candidates for partnership, because training and extension facilities may already exist. NGOs in particular could play an important and independent role in extension of information to farmers, possibly in conjunction with official extension services.

The assessment should also determine whether there are any other WII initiatives, or other types of crop insurance in the country. If an index insurance programme already exists, it would be pertinent to understand the key actors: implementers, funders, insurers and reinsurers. The role of reinsurers is further discussed in the subsections on piloting and scaling up ('Develop product distribution channels', page 39 and 'Facilitate initial access to reinsurance', page 54).

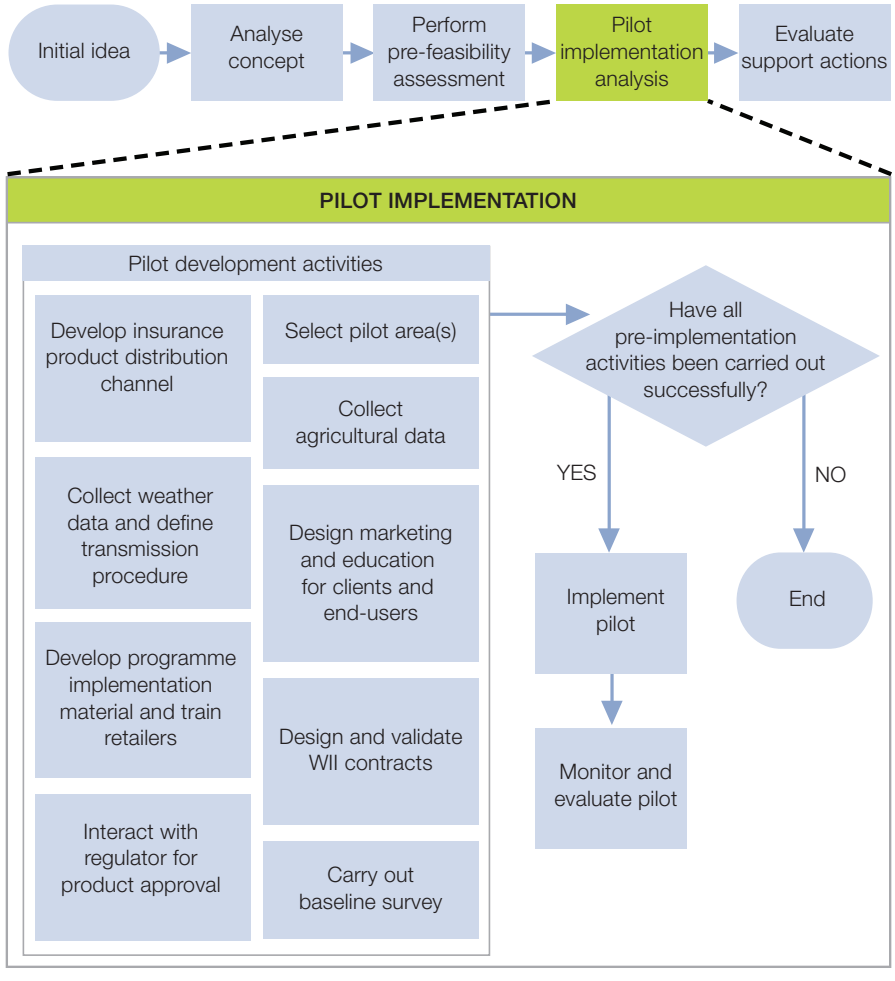
3. Roadmap for piloting and implementing weather index-based insurance

Photo: Raniel Jose Castañeda

3. Roadmap for piloting and implementing weather index-based insurance

- **Action**: Carry out the necessary steps to develop and roll out a pilot programme.
- **Objective**: Development and roll-out of pilot programme.
- **Key players**: CPM, CPMT, WII consultants, local stakeholders (relevant ministries, weather service, insurance industry, etc.).

Figure 3. Pilot implementation



Preparing for the pilot

While every pre-feasibility assessment will yield different information based on the local context, at a minimum the following should be completed before moving into the pilot:

- A feasibility study has been undertaken;
- The meeting of preconditions has been carefully assessed;
- Potential programme benefits verified; and
- Relevant stakeholders have been identified.

Piloting weather index-based insurance

Private insurers face a number of barriers to entering the market, such as high initial investment costs in research and development. Such insurers are often wary of financing these start-up costs themselves, as they may be difficult to recoup, and competitors can more easily replicate such products if they prove profitable. Because of this 'first mover' problem, in most cases WII pilot programmes have been initiated by organizations with a social mission, namely bilateral and multilateral institutions, NGOs and private foundations.

As with other innovative financial products, WII needs appropriate testing before it can be marketed on a large scale. Assessing the real potential of WII can take time, and setting up an appropriate pilot is recommended. With a relatively small budget, and through a real learning-by-doing experience, pilots can provide useful indications about acceptance of the product, willingness to pay and product design alternatives. They can also allow market participation and stakeholder capacity to develop organically (USAID 2006).

The project team should develop a workplan for setting up the WII pilot. The plan should include the following stages, some of which can be carried out independently:

- Develop product distribution channels;
- Interact with regulator for product approval;
- Select pilot areas;
- Collect weather data and define data transmission procedure;
- Collect agricultural data;
- Design and validate WII contracts;
- Develop programme implementation materials and train retailers;

- Design marketing and education for clients and end-users;
- Carry out and analyse baseline survey;
- Monitor and evaluate pilot.

These activities are addressed in detail in the following subsections.

Develop product distribution channels

In planning implementation of a WII pilot, the first step is to set up the market arrangement of the risk transfer and distribution proposition. Possible key insurers and distribution channels may have already been identified during the feasibility assessment.

Figure 4 summarizes the most frequent arrangements applied in WII for microlevel products. In general terms, these arrangements can be classified as (a) insurance policies retailed through an intermediary, such as a credit institution (bank, credit cooperative, MFI) or an agribusiness firm; or (b) contracts directly distributed by the underwriting insurance company, often through the company's agents.[12]

The most suitable option will depend on local conditions, such as the nature of the supply chain for which WII will be developed and the business interests of the various stakeholders.

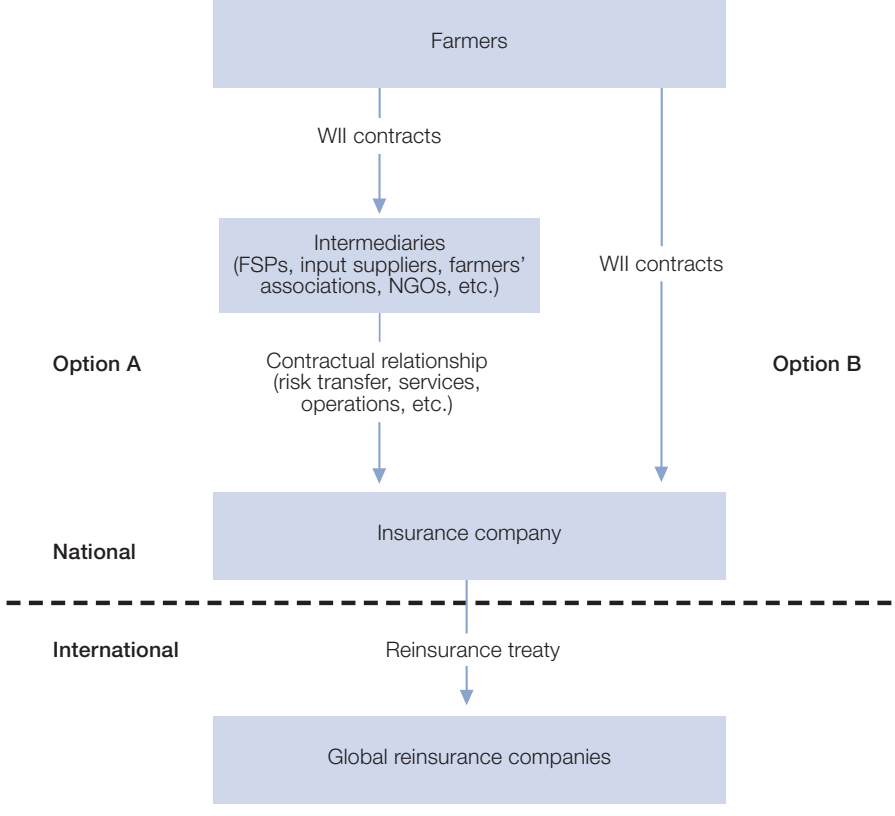
Using an intermediary may provide access to existing retail networks, potentially reaching a larger number of clients. Such business partners may be strongly motivated to facilitate the distribution of WII. For example, credit institutions may be interested in linking WII to their lending operations in order to reduce default rates generated by adverse weather events, while agribusiness firms may see offering WII as a competitive advantage for their products.

Should insurance companies have a large outreach in rural environments (e.g. mutual or cooperative insurance companies), the underwriter can also plan to retail the policies directly. In this case, it is useful to carefully evaluate the interest of farmers in purchasing the stand-alone insurance product, because experience shows that selling may be easier when linked to a loan or input product.

[12] At the meso level, WII contracts can also be purchased by intermediary institutions wanting to protect against their own exposure to weather risk (e.g. protect a loan portfolio) – see Table 1. However, this kind of transaction has not been very common.

When setting up the risk transfer proposition, it is critical that the insurers have access to appropriate reinsurance coverage. WII transactions are highly exposed to covariate risk, and in the case of a triggering event, payouts tend to be significant. Regardless of the retailing model adopted, the insurance company must have access to the reinsurance industry, usually at the international level (Figure 4).

Figure 4. Options for insurance organization and distribution of microlevel WII



Interact with regulator for product approval

The pilot programme must receive approval from the regulatory authority responsible for the area in which the pilot is to be implemented. This stage ensures that the pilot complies with local regulations. Because the approval process may take considerable time, the project team should engage regulators as soon as feasible. Additionally, the regulator's requirements may affect the actual design of the WII products.

Select pilot areas

The success of the WII pilot depends heavily on the area in which it is implemented. Consider the following criteria when selecting a pilot area.

The area should be:

- Exposed to relevant (but not excessive) weather risk for crop production;[13]
- Covered by a suitable weather station with an acceptable history of weather data collection;
- Relevant to the partnering insurers and delivery channels in terms of business development; and
- Significant in terms of the policy objectives of the development programme.

Collect weather data and define data transmission procedure

The data used to construct the underlying weather indices should adhere to quality requirements, including:

- Reliable and trustworthy ongoing daily collection and reporting procedures;
- Periodic checks and quality control;
- An independent source of data for verification (e.g. surrounding weather stations, the WMO Global Telecommunication System).

Areas without access to weather data satisfying the above criteria or areas with poor spatial coverage may not be able to benefit from weather risk management products, and another pilot zone should be considered.

[13] In the case of excessive levels of weather risk, insurance premiums (i.e. the cost of the policy) may be too high for insurance to be affordable or efficient. In such cases, insurance is probably not a good option and alternative risk coping solutions should be found.

The following list provides general criteria for weather data requirements for WII applications:[14]

- At least 20 years of historical weather data;
- Limited missing values and out-of-range values (preferably less than 3 per cent missing data from the entire historical dataset);
- Availability of a nearby station for fall-back verification purposes;
- Consistency of observation techniques – manual versus automated;
- Limited changes in instrumentation/orientation/configuration;
- Integrity of weather-data recording procedure;
- Little potential for measurement tampering.

Beyond the quality of data, definition of the boundaries of the area(s) covered by the weather station(s) is critical, so that WII contracts can be written for specific areas tied to a specific station. In some cases, national weather services can assist with dedicated maps. A general rule of thumb is to consider a specific WII contract marketable within a 20-km radius of the weather station; but in many cases the applicable area is smaller. The more the terrain varies, the more the acceptable distance from a station decreases.

Modalities must be defined for weather data collection and dissemination during the contract coverage period. Insurance and reinsurance industries tend to require the use of automated weather stations and availability of fallback verification measurements from nearby stations with comparable weather patterns. Manual measurement of weather variables (e.g. through manual rain gauges) is usually not regarded as sufficiently reliable and secure.[15] As a result, low-cost, automatic weather stations are being implemented in some WII initiatives. However, any installation of new weather stations must be accompanied by a comprehensive plan to build the supportive capacities of the NMS for monitoring and maintenance. Ways to support NMSs are further discussed in chapter 4: 'Beyond the pilot'.

[14] Adapted from ISMEA (2006), but originally presented by Brian Tobben at the Annual Meeting of the International Task Force on Commodity Risk Management, jointly sponsored by FAO and the World Bank, at FAO, Rome, 5-6 May 2004.

[15] Measuring different weather parameters at the same time (i.e. rainfall, temperature, pressure, humidity, etc.) makes attempts to tamper with weather data collection more evident, as the various weather variables are linked by specific relationships.

Collect agricultural data

Agricultural information is the second part of the contract design equation. The most relevant information to be collected is data on productivity (yield), but a clear description of the agricultural production practices carried out in the areas of interest is also necessary. Unfortunately, the availability of quality yield-data series of adequate length and at the appropriate level of disaggregation is not common. However, lack of quality yield data does not pose as large a problem as lack of good weather data, since it is still possible to find alternative approaches to estimating yield variability. One possibility is to simulate synthetic yield-data series through plant-growth models. For WII drought applications, a particularly simple and effective modelling approach has been developed by ARMT based on FAO's water requirement satisfaction index (WRSI). In balancing incoming and outgoing water resources in the plant/soil system, the WRSI model can robustly predict the impact of rainfall (or lack of it) on yield (Box 3).

Box 3
WRSI approach to weather risk assessment

Since yield data of appropriate quality and disaggregation are not always accessible, the World Bank's ARMT has developed a contract design methodology based on the generation of synthetic (modelled) yield series for the crop under study. This methodology has been adopted in an extended number of transactions globally.

The methodology is based on the water requirement satisfaction index developed by FAO and used in many early warning systems that monitor plant growth as an indicator of potential food crises. This method takes into account the distribution of rainfall over the season and the water stress affecting plant development.

The WRSI approach is particularly useful in supporting the structuring of index contracts that insure against drought events. The water balance index captures yield reductions generated by lack of water availability that, in rainfed agriculture, are mainly driven by insufficient precipitation and/or excessive evapotranspiration.

The fact that the WRSI approach does not account for other sources of yield reduction (e.g. pests and diseases) is useful when analysing the impact of reduced precipitation on crop yield. Where other risks are also important to the final yield, the WRSI approach can be valuable in determining the yield variation dependent on rainfall alone.

Whether data on productivity are collected by official sources or generated by a crop model, specific information must still be collected from potential WII end-users on local cultivation practices and procedures. Information such as crop varieties adopted, planting periods, modalities used (e.g. dry planting), management practices, related costs, risk profiles, historical recollection of the impact of the peril, and the most sensitive phases in crop life are essential in designing a meaningful WII contract.[16]

Design and validate weather index-based insurance contracts

The objective of contract design is to define a structure that effectively captures the relationship between the weather variable and the potential crop loss and to select the index that is most effective in providing payouts when losses are experienced, eliminating basis risk as far as possible.

The set of possible index combinations is unlimited, and numerous structures have been developed in the relatively short history of WII. Weather index-based contracts can be classified according to many different parameters (Table 3).

Table 3. Examples of parameter possibilities for contracts

Contract parameter	Options
Triggering measurement for weather variable	Cumulative
	Average
	Maximum
	Minimum
Period covered by index	Entire life cycle of crop
	Fractions of crop life cycle
Number of phases into which covered period is divided	Typically 1 to 3 phases
Start of coverage period	Fixed
	Dynamic
Payout structure	Incremental
	Lump sum (single value payout)

[16] Annex 2 presents a sample questionnaire for collecting agricultural information for drought coverage for maize.

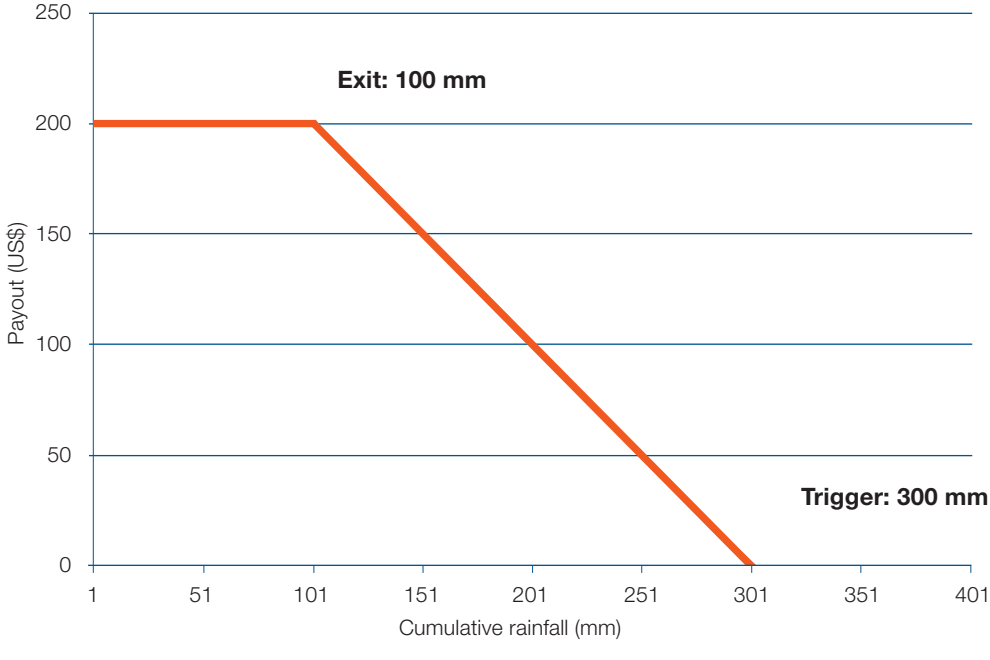
One of the most commonly adopted structures is that of a continuous payout triggered and limited by a cumulative measure of the weather variable (e.g. rainfall) for each of the different crop growth stages (Box 4 and Figure 5).

Box 4
Payout parameters in a WII contract – an example

Using the drought coverage case represented in Figure 5 as an example, the parameters that characterize an incremental payout structure can be defined as follows:

- **Trigger.** Threshold above or below which payouts are due. In this example, payments are due when the calculated value of the index is below the trigger level (300 mm).
- **Limit.** Threshold above or below which no additional incremental payout will be applied. The maximum payout is paid if the calculated value of the index is equal to or below the exit threshold (100 mm).
- **Tick.** Incremental payout value per unit deviation increase from the trigger. With a maximum payout (the insured sum) of US$200, a trigger of 300 mm and an exit of 100 mm, the monetary value of each deficit mm of rainfall below the trigger is: US$200 /(300 mm-100 mm) or US$1 per mm.

Figure 5. Payout structure of a WII drought contract



From a technical point of view, contract design is probably the most challenging part of developing a pilot programme, and the local insurance company may not have the expertise to carry out the necessary research and development activities. Facilitating this part of the WII pilot development with the involvement of specialists could be one of the most useful support activities that a development organization can provide. It should be performed with a view towards simultaneously building the technical capacities of the local insurer for future contract adjustment and design.[17]

Develop programme implementation materials and train retailers

The local insurance company may also need support in developing the programme implementation materials needed to carry out the transaction. Should this be required, the workplan should include help for the underwriter in structuring the product manual, which describes the different elements of the transaction (i.e. treatment of weather data, customer eligibility, contract features, underwriting processes, product pricing, and contract monitoring and settlement processes), and the client information sheet, which explains the WII product to the client.[18]

The workplan should also include dedicated training sessions for WII retailers to ensure that the information on the type of coverage provided by WII is delivered correctly and that the intermediaries understand the product.

Design marketing and education for clients and end-users

Marketing and education sessions for prospective clients, end-users and intermediaries must be carefully structured. This communication is important even if the end-users are not purchasing the policies directly from the insurer. Many rural communities of the developing world are not familiar with insurance practices. They need to be exposed to the basic concepts of insurance transactions and to the specific features of WII in order to understand aspects such as the claims process and to hold realistic expectations regarding payouts. Such sessions can also foster general financial literacy and awareness of risk reduction options.

[17] ARMT has made online technical resources for WII available, including courses in contract design (www.agrisktraining.org).

[18] ARMT online technical resources also include guidance in this area (www.agrisktraining.org).

Of particular importance is communicating the idea that the insurance payout is not triggered by losses occurred on individual farm plots, but rather by the measurement of the indexed weather variable. It is also important to make sure that the clients are aware of the exact location in which the weather variable is measured and whether their operations are carried out in locations with similar weather patterns.

Carry out and analyse baseline survey and monitor and evaluate pilot

A baseline survey should be included in the workplan to collect the initial information that will allow evaluation of any changes in policyholders' behaviour once the pilot has been implemented. After the pilot, a monitoring and evaluation exercise can take place to compare results against baseline indicators and more broadly monitor performance, identify any additional constraints and opportunities, and make any necessary adjustments from previous steps.

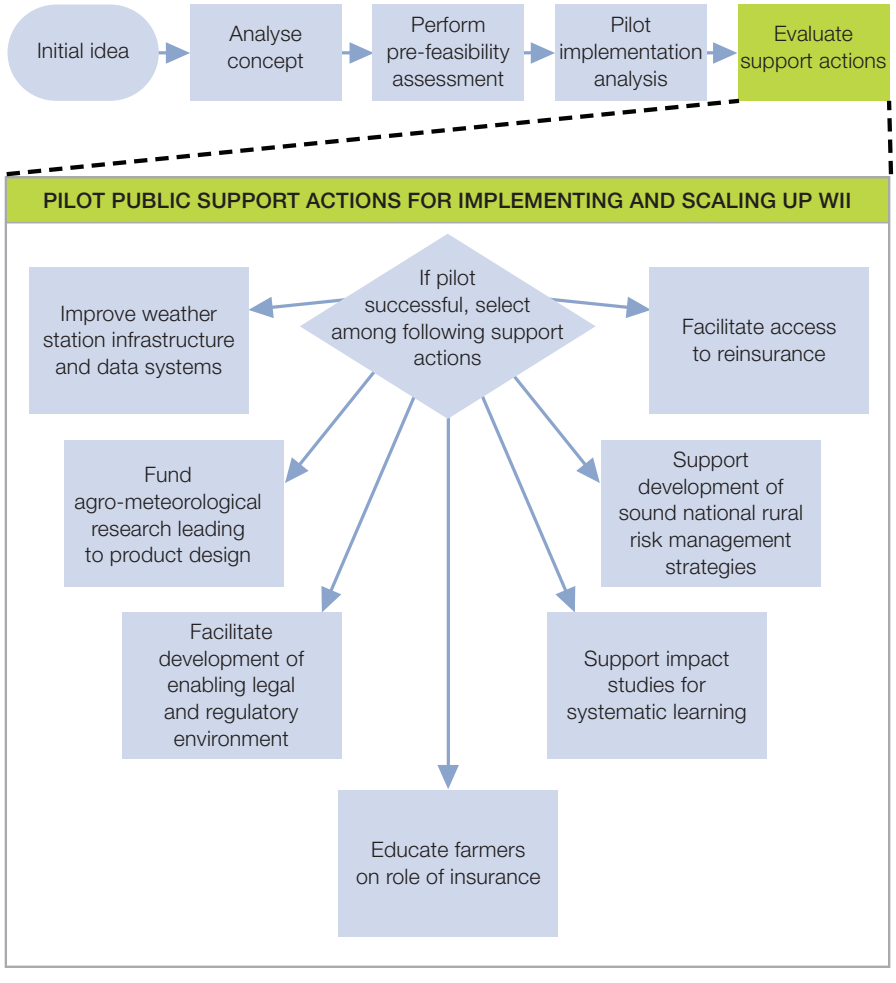
4. Beyond the pilot: Scaling-up and sustaining weather index-based insurance

Photo: ©IFAD/Nana Kofi Acquah

4. Beyond the pilot: Scaling-up and sustaining weather index-based insurance

- **Action**: Choose one or a combination of options to focus support.
- **Objective**: Contribute to the sustainable scaling up of WII.
- **Key players**: CPM, CPMT, local public and private stakeholders, government, donors, development organizations.

Figure 6. Evaluation of support actions



If the pilot(s) indicate(s) that there is viable demand and supply for WII in the local market, then the project team should consider scaling up. In the interests of sustainability, stakeholders should continue applying the expertise they developed in the pilot, while IFAD focuses on support for enabling activities.

If index insurance is to be scaled up, governments and donors will need to intervene more actively – playing enabling and facilitating roles. WRMF research into 36 index insurance programmes globally identified key areas in which donors and governments could aid development of the sector in order to help initiatives become sustainable.

Key public and donor roles are discussed in the following subsections.

Build weather station infrastructure and data systems

Many national weather services have very limited budgets, but scaling up can only be achieved if there is systematic coverage of the territory, with weather stations sufficiently close to the insured parties. In addition, data must be collected, maintained, archived and made available on a timely basis in relation to insured events. Working more closely with the NMS might help address these needs. Given this, a thorough capacity and needs assessment of the NMS, including a mapping of the current weather recording infrastructure on the ground, would be a crucial step in supporting scaling up.

Investment in weather infrastructure can have benefits beyond the development of index insurance products – including the development of other weather risk management tools for agriculture, food security, early warning systems and extension services.

Provide technical assistance, training and product development

Technical assistance in product development and management is one area in which government and donor support can have added value. The pilot product will need to be continuously reviewed and developed, but there may also be a demand for new products, for example those addressing different crops. Some level of government and/or donor support for product development can be justified (for example with regard to new agro-meteorological research or risk profiling of smallholders) in order to overcome the 'first mover' problem mentioned earlier: development of new WII products requires upfront initial investment in research and development, but private actors may be hesitant to take this step by

themselves, as it substantially lowers the entry costs for competitors and thus they might not be able to recoup the initial investment costs. This can perpetuate a cycle in which nobody will take the first step without the support of properly directed external investment from governments and donors, and thus the market can stagnate. Government/donor investments should be targeted in the most costly start-up phases (i.e. the feasibility studies and technical assistance for piloting of new products) – with the involvement of local private-sector partners – but they should use an extremely cautious approach with direct subsidies for premiums.

In addition to support for product development, relationships should be cultivated that help build the skills and experience of local insurers and FSPs to effectively identify client needs, estimate demand and deliver effective risk management services. Other actors in the supply chain (e.g. farmers' associations, input suppliers and others) may also benefit from capacity-building. Promotion of international exchanges (for example, with other insurers) can help nascent initiatives learn from each other and avoid costly delays and mistakes.

Fund innovation

Donors can also push the frontiers of index insurance by funding innovations that may open new directions in the market. Innovative approaches such as using new technologies or satellite-based indices can help lower the entry barriers for insurers and farmers alike.[19]

Facilitate development of an enabling legal and regulatory environment

Gaining the support of regulators for a pilot product is normally fairly straightforward, but facilitating development of an enabling legal and regulatory environment for index insurance is a broader issue. Enforceable contracts that both buyer and seller can trust are a fundamental prerequisite for index insurance. Additionally, laws and regulations must harmonize with international standards to improve the chances of insurers gaining access to global markets for risk transfer. Unfortunately, in many countries, laws and regulations are simply not in place to accommodate the development and use of weather insurance products. Human capacity-building and technical assistance at the macro level are essential in developing the legal and regulatory environment to govern index insurance programmes.

[19] Interesting examples of new technology and satellite-based applications in index insurance are presented Hellmuth et al. 2009; Vargas Hill and Torero 2009; Chantarat et al. 2009; IFAD and WFP 2010 and Rosema et al. 2010.

Educate farmers on the role of insurance

While private insurers will invest in marketing their products, they are unlikely to invest at socially optimum levels in educating farmers – and intermediaries generally – on the appropriate role of insurance. Support from governments and donors can increase the likelihood that information is presented in a balanced way and that sufficient investments are made in a broader educational effort for untested insurance products.

Facilitate initial access to reinsurance

Reinsurers (which almost always operate internationally) primarily provide financial risk transfer capacity, but they can also provide some technical support to the insurer. In many cases it is important to have at least the interest of a reinsurer in order to promote the necessary enabling environments at the macro level jointly with the government.

Established insurers have relationships with reinsurance companies for existing lines of business, although IFAD may be able to assist in gaining the interest of an international reinsurer to partner on a comprehensive index insurance programme. Recent expansion of WII has also encouraged some major international reinsurers to devote resources to the development of reinsurance for index insurance, including in developing countries.

Such reinsurers will want to understand the business development plan, as well as the prospects for long-term business and relationship development. However, the initial stages in establishing reinsurance can be a barrier if underwriting research or assistance needs to the insurer are high, but anticipated premium volumes are still relatively low.

Even with reinsurance in place, it may be necessary to develop catastrophe protection layers involving government and/or donor intervention, or through contingent loan arrangements (Mahul and Stutley 2010).

Support regular monitoring, evaluation and impact studies

Beyond the monitoring and evaluation activities suggested in the pilot phase, if the product is rolled out on a longer-term basis, the project team is advised to carry out systematic monitoring and evaluation exercises in order to assess potential technical and operational issues (e.g. price, delivery channels), as well as any impact of WII on farmers' welfare and decision-making.

Impact studies are needed to ensure effective learning from programme investments and to demonstrate that – over time – insurance has the potential to generate real benefits. Positive results can in turn attract and maintain the support of donors and governments for scaling-up activities.

Impact assessment needs to extend well beyond demonstrating a demand for the uptake of insurance. The project team is encouraged to assess whether the insurance has contributed to household socio-economic development, not only through risk transference, but also through increased access to financial services such as credit and savings. Beyond this, any assessment should aim to demonstrate whether the existence of a WII policy has modified traditional risk management behaviour, replacing it with forms of development, such as investment in higher-quality inputs and/or technology for agricultural production, keeping children in school, or reduced migration away from rural areas.

Further resources

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ANNEX 1

Information on weather measurement infrastructure

General questions

1. How many weather stations does the national weather service (NWS) manage across the country?
2. Are there other relevant weather station networks in the country (e.g. stations maintained by agricultural extension services or similar)?
3. Does the NWS receive and store data from all other networks as well?
4. How many stations in the country are fully automated weather stations?
5. How many stations are part of WMO networks?
6. What classifications of weather stations are adopted in the country? If possible, it would be useful to have the number of stations per level of classification.
7. What are the data transmission modalities for the more advanced weather stations? Do they have GSM/ GPRS connection to NWS headquarters?
8. How many lysimeters (devices for measuring actual evapotranspiration) does the NWS operate?
9. How many stations measure temperature in addition to rainfall?

Questions on index insurance

1. Would the NWS be prepared to provide historical and real-time data for insurance purposes?
2. In order to manage insurance contracts effectively and transparently, would the NWS be prepared to set up periodic data transfer (every one-to-two weeks) to the parties involved in the transactions?
3. Should international donors or private entities support the purchase and installation of automatic weather stations to replace rain gauges, would the NWS be prepared to maintain them?

ANNEX 2
Questionnaire for collecting agricultural information for WII contract design – an example for maize[20]

Information for drought coverage for maize

General information

Date: _____

Location: _____

Country: _____

Crop: _____

Type of coverage: _____

Other information: _____

Production

1. What variety of maize is the most common in the area?
2. What is the average farm size for maize farmers?
3. What is the typical planting period for maize (month/week)?
4. What is the earliest date that maize can be planted?
5. What is the last date that maize can be successfully planted (month/week)?
6. Can you provide more details on the crop calendar of maize, highlighting the main plant growth phases?

[20] *Source:* ARMT, World Bank, www.agrisktraining.org.

Phenological phases	**Period** (approximate starting date of phase following a reference planting date)	**Length of period** (days)
Planting		
Establishment (germination & leaf development)		
Vegetative (stem elongation)		
Flowering		
Maturation		

7. Is maize production in this area rainfed or irrigated (if both, indicate relative proportion)?
8. What is the average cost of production in the area? Total cost of inputs per hectare (or other area unit; if different, specify); specify if it includes labour costs and/or land rent.
9. What type of inputs are used by maize growers? When are they applied during the season? What are the specific costs of these inputs per hectare?

Items	**Type**	**Amount** (litres, kg/hectare)	**Value** (currency units)	**Month inputs applied**
Seed				
Fertilizer				
Chemicals (specify)				
Other				

10. What is the optimal yield in the area?
11. What is the average yield in the area?
12. Which years in the past 10 to 20 years do you recall having the best yields?

Year	Size of land	Yield	Notes

13. Which years in the past 10 to 20 years do you recall having the worst yields?

Year	Size of land	Yield	Notes

Income

1. Do farmers in the area have alternative sources of income? What percentage of farmers rely only on farm income?
2. How relevant are maize revenues for households' incomes in the area?
3. Is maize produced for commercial purposes or for self-consumption?
4. What are the main sales markets for maize?
5. On average, what are the prices for maize? Recent years' highs vs. lows.
6. Is there any forward contracting for maize?
7. During which month do most farmers normally sell their production?

Risk

1. What are the main risks for farmers' incomes?
2. What are the primary production risks?

Pests?	
Diseases?	
Weather?	
Lack of access to inputs?	
Other?	

3. What are the specific weather risks that production faces?

Drought?	
Excess rain?	
Temperature?	
Other?	

4. If farmers are exposed to weather risks, how do they currently manage them?
5. In how many years out of 10 are yields reduced because of drought?
6. Which years in the past 10 do you recall having the most favourable weather for production?

Year	Size of land	Yield	Notes

7. Which years in the last 10 do recall having the worst weather for production?

Year	Size of land	Yield	Notes

Rainfall contract parameters (if drought or excessive rain risks apply)

1. Do farmers in the area practice dry planting or do they wait for the onset of rain?
2. How do farmers judge when rainfall is sufficient for planting?
3. What do they do if rainfall is insufficient for planting? Plant a different crop versus plant anyway? Do they ever not plant if rainfall is not adequate?
4. (a) In which periods in the growing season is rainfall most critical for a successful harvest?

Planting	Establishment (germination & leaf dev.)	Vegetative (stem elongation)	Flowering	Maturation

KEY: Not important, somewhat important, very important, critical

b) Are there periods during the growing season when too much rain has destroyed or damaged the harvest?

Planting	Establishment (germination & leaf dev.)	Vegetative (stem elongation)	Flowering	Maturation

KEY: Not important, somewhat important, very important, critical

5. (a) In drought years, at which growth stage(s) was the crop most affected?
   (b) In excess rainfall years, at which growth stage(s) was the crop most affected?

Phases	Year				
	Type of event (Drought: D or Excessive Rainfall: ER)				
	Occurrence of events				
Planting					
Establishment					
Vegetative					
Flowering					
Maturation					

6. Does rainfall at XXXX station reflect the rainfall pattern of the area? Do parts of the area have diverse rainfall patterns?

Access to finance

1. How do farmers normally finance input costs?

Do not buy inputs	Own finances	Loan from bank	Money-lenders	Other sources	Interested in financing, but no access

2. What type of financing? What are the terms?
3. What time of year is the financing received? What time of year is financing needed?
4. What types of collateral do they normally provide?
5. In which month are they expected to pay back loans?
6. Would having access to some form of insurance improve farmers' access to credit?
7. Have there been experiences with rescheduling and/or default? If so, when and why?

Contact information

IFAD

Francesco Rispoli
Technical Adviser
Rural Finance
Policy and Technical Advisory Division
Telephone: +39 06 54592725
E-mail: f.rispoli@ifad.org

Emily Coleman
Consultant
Rural Finance
Policy and Technical Advisory Division
Telephone: +39 06 54592590
E-mail: e.coleman@ifad.org

www.ifad.org/ruralfinance/wrmf

WFP

Niels Balzer
Policy Officer
Climate Change
and Disaster Risk Reduction
Policy and Strategy Division
Telephone: +39 06 65132033
E-mail: niels.balzer@wfp.org

Richard Choularton
Senior Policy Officer
Climate Change
and Disaster Risk Reduction
Policy and Strategy Division
Telephone: +39 06 65132908
E-mail: richard.choularton@wfp.org

www.wfp.org/disaster-risk-reduction

International Fund for
Agricultural Development
Via Paolo di Dono 44
00142 Rome, Italy
Telephone: +39 06 54591
Facsimile: +39 06 5043463
E-mail: ifad@ifad.org
www.ifad.org
www.ruralpovertyportal.org

World Food Programme
Via C.G. Viola 68
Parco dei Medici
00148 Rome, Italy
Telephone: +39 06 65131
Facsimile: +39 06 6590632
www.wfp.org

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