



Farmer-Centered Weather Forecasts Innovation Package

About AIM for Scale Innovation Packages

Advances in agricultural innovation offer unprecedented opportunities to improve productivity, profitability, and resilience. Supported by the International Affairs Office at the UAE Presidential Court and the Gates Foundation, the Agricultural Innovation Mechanism for Scale (AIM for Scale) was established to bridge the gap between pilots and implementation at scale—accelerating the adoption of evidence-based, cost-effective innovations to strengthen the livelihoods of millions of farmers.

AIM for Scale's primary instrument is the Innovation Package, a structured blueprint focused on a single high-potential innovation area. Each Innovation Package is intended to be used as a starting point to guide discussions with governments, multilateral development banks (MDBs), and other development stakeholders regarding where investments should be targeted at the country or regional level to ensure the sustainable scaling of an innovation. They detail the general set of activities required for scale in a particular innovation area and provide technical, financing, delivery, and implementation guidelines. AIM for Scale then works with local partners to conduct country-level assessments to adapt and implement the Innovation Package in line with national priorities. These efforts are complemented by investments in global and regional public goods that improve farmer livelihoods. An Innovation Package is not a comprehensive sector strategy or a fixed implementation plan; it is a prioritized starting point for scaling an innovation area.

The core of the Innovation Package is organized around five thematic components, each representing a distinct area of action needed to achieve scale. For each component, the package specifies:

- **Goal:** The intended outcome this component is working toward.
- **Key Activities:** The concrete actions, investments, or interventions that implementing partners, governments, and MDBs should prioritize.
- **Target Outputs:** Measurable results to be achieved within a defined timeframe (typically three to five years), which provide a shared benchmark for progress and investment.

For more information about AIM for Scale's process of identifying innovation areas and developing Innovation Packages, please visit [AIM for Scale's frequently asked questions webpage](#).

Farmer-Centered Weather Forecasts

This document provides the rationale for AIM for Scale's Farmer-Centered Weather Forecasts Innovation Package and the details of the package. AIM for Scale is dedicated to scaling cost-effective innovations to improve the livelihoods of farmers, particularly small-scale producers, in low- and middle-income countries. Evidence shows that farmers respond to weather information in a manner that enhances agricultural outcomes and/or incomes. This evidence and advances in AI-generated forecasts present a compelling case for investing in farmer-centered weather forecasts. This Innovation Package aims to deliver high-quality weather services to more than 100 millions farmers by 2028.

The AIM for Scale Weather Innovation Package was co-designed by a Technical Panel comprising experts from the University of Chicago, Tufts University, Khalifa University, the African Center of Meteorological Application for Development (ACMAD), the Asian Development Bank, the Inter-American Development Bank, the Gates Foundation, the World Bank, and the World Meteorological Organization (WMO). Additional input was provided by USAID, the Mohamed bin Zayed University of Artificial Intelligence (MBZUAI), the Systematic Observations Financing Facility (SOFF), and the International Research Institute for Climate and Society (IRI) at Columbia University. This note builds on the work of the [Innovation Commission for Climate Change, Food Security, and Agriculture](#) at the University of Chicago. Final responsibility for the package rests with the AIM for Scale Secretariat.

Disseminating High-Quality, Farmer-Centered Weather Forecasts at Scale in LMICs

Hundreds of millions of smallholder farmers could benefit from greater access to high-quality, relevant, and timely weather and seasonal forecasts. There is evidence that farmers adapt farming practices and investment decisions in response to weather information. For example, the benefits of improving all state-level forecasts of monsoon seasonal rainfall totals in India to the average level of accuracy would exceed \$3 billion for farmers over five years. Randomized trials in [Benin](#) and [Colombia](#) estimate annual benefits of \$103-\$356 per farmer. In [Ghana](#), [India](#), and [Pakistan](#), farmers in communities that received forecasts altered their planting and investment behavior. Investments to produce, procure, tailor, and disseminate high-quality, farmer-centered forecasts could generate benefits that outweigh the costs, perhaps by as much as 100-to-1 in some settings.

Efforts to provide weather and climate information to farmers over the past three decades have shown major promise. However, global coordination and additional targeted funding are needed to reach the hundreds of millions of farmers in need of such services. Recognizing this need, in 2024, AIM for Scale announced an Innovation Package focused on generating and disseminating high-quality weather forecasts to meet these needs. This package was launched by a consortium of partners at the World Leaders Climate Action Summit at COP29, alongside concrete partnerships for its implementation involving international organizations, multilateral and bilateral funders, governments, National Meteorological and Hydrological Services (NMHS), and civil society.

The Package responds to three premises. First, access to accurate information and the ability to

act on it are essential for farmers. Second, the delivery method and messaging of weather information significantly affects how farmers respond to it. Third, the quality of weather information is vital, and it can be improved through the availability of quality data and advanced techniques, such as artificial intelligence (AI), to generate farmer-relevant weather forecasts. The exact investments and relevant partners will vary based on differing national situations. In undertaking these efforts, a particular focus is on ensuring the range of small-scale producers with productive potential have access to weather services.

In undertaking these efforts, a particular focus is on ensuring the range of small-scale producers with productive potential are provided with access to weather services. Further, in focusing on access to weather services, AIM for Scale recognizes the need for complementary investments with its Innovation Package on Digital Advisory Services for Agriculture. It also recognizes other complementary investments may enhance impact, but seeks to build these complementary investments off a scaled up weather access and digital advisory service.

AIM for Scale is mobilizing support for innovations that address constraints that have historically hindered the dissemination of high-quality weather forecasts in low- and middle-income countries (LMICs). For example, improvements in observation networks can lead to higher quality forecasts by providing data to guide and train prediction systems. These data can also enable the validation of forecast accuracy, further enhancing their usefulness as decision-making tools for actors responsible for information dissemination. Innovations like AI can enable the cost-effective production of timely, location-specific forecasts by National Meteorological and Hydrological Services (NMHS) in areas with limited resources, since current physics-based forecasts are costly to produce and require major computing resources often out of reach for many LMICs. Innovative, user-centered approaches to dissemination can overcome fragmented systems that have led to gaps in trust, usability, and access to information. Finally, generating generalizable lessons from scaling efforts can facilitate local improvements and scalability in other regions.

Innovation Package Components

This Innovation Package addresses investment and coordination gaps along the supply chain of weather services for farmers. It includes upstream and downstream investments to:

- Improve the quality and availability of weather observations and agricultural data
- Develop benchmarking tools to validate the farmer-relevant accuracy of weather forecasts
- Accelerate the production of state-of-the-art farmer-centered forecasts
- Facilitate the dissemination of high-quality forecasts to farmers
- Generate learning to refine dissemination through evaluation and A/B testing

These components should not be treated as sequential steps, but rather as interacting and complementary investments.

AIM for Scale is leading a consortium of partners to ensure the completion and coordination of activities, with the ultimate goal of supporting hundreds of millions of farmers with farmer-relevant weather information. The Innovation Package involves global coordination for the development of guidance, prototyping, and best practices for and from national implementation, as well as regional and local investments involving National Meteorological and

Hydrological Services (NMHS), government agencies, the private sector, and farmers.

1. Observation Networks

Goal: Improve accessibility and availability of meteorological and agricultural data through diplomatic efforts, innovative financing models, and infrastructure enhancement. This component is initiating in 2024, with various timelines for specific activities ranging from 6 months to 3 years.

Activity 1: Mobilize support for countries to generate and internationally exchange essential observation data according to the WMO Global Basic Observing Network (GBON) and to improve access to improved forecasts

Activity 2: Mobilize investments to increase the number and improve the placement of weather data collection infrastructure to improve forecast generation and validation at local scales and maximize the gain in forecast skill for the parameters needed in farmers' decision-making.

Activity 3: Work with governments to identify necessary agricultural data to inform forecast needs and weather advisories for a functioning agrometeorological system.

Activity 4: Generate partnerships to induce non-traditional stakeholders to invest in critical public infrastructure, procurement, and maintenance. This could involve a pilot to determine whether co-locating weather stations at cell phone tower sites is a scalable, cost-effective model to increase the availability of observation data leveraging private-sector funding, or partnerships between meteorological services and other stakeholders for the operations and maintenance of observation stations.

Target outputs:

- 10-15 additional countries sharing data publicly or through a federated system by 2027.
- USD 50 million in additional investments for data collection infrastructure by 2026.
- Agricultural data and farmer needs identified in 3-4 LMICs by 2026.

A consortium of international partners will support outputs 1,2, and 3, and coordinate public-private partnerships to advance 4. These efforts will initially be tested in 2-3 countries to draw scaling lessons.

2. Benchmarking and Validation

Goal: Enhance the transparency of forecast performance and incentivize LMIC focused model innovation through a publicly-available benchmarking and validation system that accounts for local needs, building on and expanding ongoing efforts to reach global scale. This component is initiating in 2024, with a timeline of 2 years for completion.

Activity 1: Build a platform to enable users (e.g. governments, private sector farmer-facing organizations, and farmers) to assess weather forecast performance against evaluation datasets with scientific metrics, facilitating comparisons of forecast quality based on region-specific, agriculturally-relevant, and time-sensitive benchmarks. This platform aims to also drive innovation to address accuracy gaps.

Activity 2: Integrate open or federated data on both meteorology and agriculture into validation of forecast output and benchmarks.

Target output:

- Prototypic visualization and evaluation system designed for users to evaluate a range of weather forecasts based on regional, agricultural, operational, and meteorological criteria to drive organizational decision-making for adoption, operationalization, and interpretation.

A consortium of partners with expertise in agronomy, computer science, climate science, and social sciences will co-develop these outputs in close coordination with AIM for Scale.

3. Forecast Production

Goal: Democratize the production of farmer-centered weather forecasts in LMICs by leveraging advances in AI. This component will begin in 2024, with various timelines for specific activities ranging from 1 year to 3 years.

Activity 1: Operationalize AI-based 1-10-day forecasts tailored for high-priority use cases, such as specific crops and locations.

Activity 2: Pioneer and operationalize AI-based subseasonal-to-seasonal (S2S) forecasts in the service of agricultural needs.

Activity 3: Develop a training program and invest in infrastructure for the production of agriculturally-relevant AI-based weather predictions in NMHS and agencies responsible for the dissemination of information to farmers. In addition to AI-based forecasts, the curriculum will include training in the communication and co-production of climate services in agriculture for enhanced stakeholder uptake and feedback on products.

Target outputs:

- Operational AI-based forecasts for high-priority use cases in 2 countries by 2025, 4 countries in 2026, and 6 countries in 2027, run on NMHS infrastructure
- Pilot training program launched with 2 representatives from 10 countries in 2025.
- Scalable training program rolled out to representatives from 20 countries in 2026 and 30 countries in 2027, designed to account for lessons learned in the pilot stage.

A partnership of NMHS agencies, government agencies, research institutions, and technology companies will lead these 3 outputs.

4. Dissemination

Goal: Broker partnerships to strengthen digital systems and co-produce and deliver advisory services, using weather information as an entry point. This component will begin in 2025, with various timelines for specific activities ranging from 6 months to 2 years.

Activity 1: Conduct comprehensive and participatory assessments of farmer needs, public and private agriculture advisory services, data availability for weather and agriculture, and forecasting capabilities across Asia, Latin America, and sub-Saharan Africa. This process will build on previous efforts and take into account varying needs and readiness across countries, as well as gender equity and inclusion considerations.

Activity 2: Coordinate access to high-quality forecasts in response to country demand to address farmers' immediate need for climate information.

Activity 3: Strengthen public digital systems to disseminate agricultural information, using weather forecasts as an entry point that can be complemented over time.

Target outputs:

- Standard assessment template to identify farmer needs, as well as data collection and forecasting capabilities across 8 countries by 2026.
- Monsoon onset forecasts delivered to more than 50 million farmers through government channels in India in 2025.
- Farmer-centered forecasts delivered to more than 100 million farmers in Asia, Latin America, and sub-Saharan Africa in 2026.

Multilateral development banks will lead efforts and work with implementing partners to identify local needs and capabilities, and subsequently provide guidance and support to governments in setting up or strengthening their digital advisory systems. AIM for Scale will coordinate the procurement of high-quality weather forecasts, when needed.

5. Learning

Goal: Facilitate testing and evaluation to effectively scale dissemination efforts. This component will begin in 2025, with various timelines for specific activities ranging from 3 months to several years.

Activity 1: Test and continually improve dissemination activities to help ensure that farmers understand forecasts and information is achieving maximum benefits. This may include measuring behavior change and will produce generalizable insights of benefits to other countries.

Activity 2: Test approaches to train agriculture sector stakeholders (from extension workers to government staff and others) on how to best apply and operationalize weather predictions for the benefit of farmers.

Activity 3: Conduct cost-benefit analyses to assess the value of investing in improvements along the value chain of weather services, including observation networks, benchmarking, AI-based forecast generation, and dissemination.

Target outputs:

- Lessons about effective and cost-effective strategies for disseminating forecasts, changing behavior at scale, and complementing weather forecasts with additional

advisory services.

- Lessons on how to best train stakeholders in the agriculture sector to operationalize forecasts for the benefit of farmers.
- 1-2 cost-benefit analyses assessing the potential benefits of improvements along the value chain of weather forecasting for LMICs.

Partnerships of research institutions and implementers—including governments, MDBs, private sector, and NGOs—will conduct these activities in countries where dissemination activities are taking place in cooperation with AIM for Scale.