WEATHER PARTNERSHIP CONVENING REPORT

May 29-31, 2025

AIM for Scale Weather Global Partnership

AIM FOR SCALE

Acronyms and Abbreviations

ACMAD	African Centre of Meteorological Application for Development
ADT	Automatic Weather Station Data Tool
AGRHYMET	Agriculture, Hydrology, and Meteorology
AIFS	Artificial Intelligence/Integrated Forecasting System
ATI	Agriculture Transformation Institute
AWS	Automatic Weather Stations
CIS	Climate Information Services
CONOPS	Concept of Operations
DGA	Chilean Water Directorate
DMC	Chilean Meteorological Directorate
ECMWF	European Centre for Medium-Range Weather Forecasts
EMI	Ethiopian Meteorological Institute
GPU	Graphic Processing Unit
GTS	Global Telecommunication System
IDB	Inter-American Development Bank
INIA	Chilean Agricultural Research Institute
IVR	Interactive Voice Response
KMD	Kenya Meteorological Department
NFCS	Kenya's National Framework for Climate Services
NOAA	United States National Oceanic and Atmospheric Administration
NWP	Numerical Weather Prediction
ODEPA	Chilean Ministry of Agriculture
PSP	Participatory Scenario Planning
RCC	Regional Climate Centers
RCOF	Regional Climate Outlook Forums
WMO	World Meteorological Organization
WRF	Weather Research and Forecasting

Executive Summary

The AIM for Scale Global Weather Partnership Convening, held in Nairobi from May 29–31, 2025, brought together meteorological agencies, ministries of agriculture, multilateral development banks, and technical partners to co-design practical pathways for delivering AI-powered weather forecasts to farmers. Across three days of structured working sessions, participants identified agricultural use cases to inform benchmarking, co-created the structure of a hands-on training curriculum for national meteorological staff, learned about tools to optimize dissemination, and developed country investment plans. The convening also surfaced shared priorities for regional collaboration—such as data-sharing frameworks, infrastructure pooling, and leveraging existing climate centers for training—to ensure that weather innovations translate into scalable, impact-oriented solutions for smallholder agriculture.

The convening opened with technical sessions on AI forecasting, benchmarking, dissemination, and observation systems, followed by two days of collaborative workshops. On Friday morning, Professor Michael Kremer delivered keynote remarks, underscoring the importance of technical assistance for dissemination as a critical link in achieving farmer-level impact. His remarks set the stage for a series of sessions focused on identifying institutional gaps, co-designing investment plans, and strengthening coordination between national meteorological services and agricultural systems.

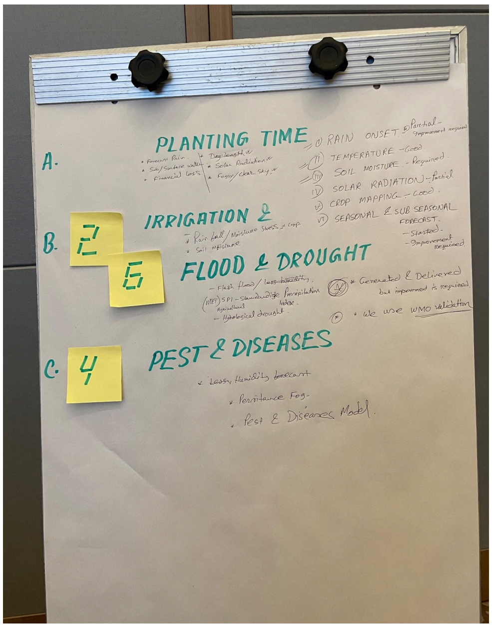
During the final plenary on Saturday, participants voted to prioritize global and regional public goods, highlighting a shared interest in pooled infrastructure and collective approaches to training, data sharing, and model development.

Agricultural Use Cases for Weather Forecasting

This workshop focused on identifying and prioritizing agricultural use cases to guide the design, evaluation, and deployment of AI-based weather forecasts. Delegations from each participating country worked together to define high-priority decisions where forecasts could significantly benefit farmers—such as planting date selection, irrigation scheduling, pest and disease management, and preparation for extreme weather events. Discussions emphasized the need to align forecast products with the timing and format of agricultural decisions, and to translate technical variables (e.g., rainfall onset, heat stress, soil moisture) into actionable insights. The outputs of this session will inform benchmarking efforts and model development by grounding technical work in real-world farmer needs.

Bangladesh

As Bangladesh experiences both slow-onset and rapid-onset climate hazards (e.g., monsoon shifts, drought, flash floods), forecasting plays a critical role in guiding on-farm decision-making. Discussions emphasized the need for better-integrated digital systems and more actionable weather forecasts to support farming across scales.



- **Planting Timing:** One of the highest-priority use cases, driven by the need to anticipate the onset of the monsoon. Accurate seasonal forecasts of monsoon onset are required to inform sowing decisions and align input delivery.

- **Irrigation Scheduling:** Given increasing dry spells and shifts in rainfall distribution, forecasts are needed to optimize irrigation application. This includes integration with irrigation databases and soil climate suitability indices to minimize overuse and improve water-use efficiency.

- **Flood and Drought Management:** Both flood and drought forecasts are key, especially flash flood early warnings during harvest and dry-season planning in drought-prone regions.

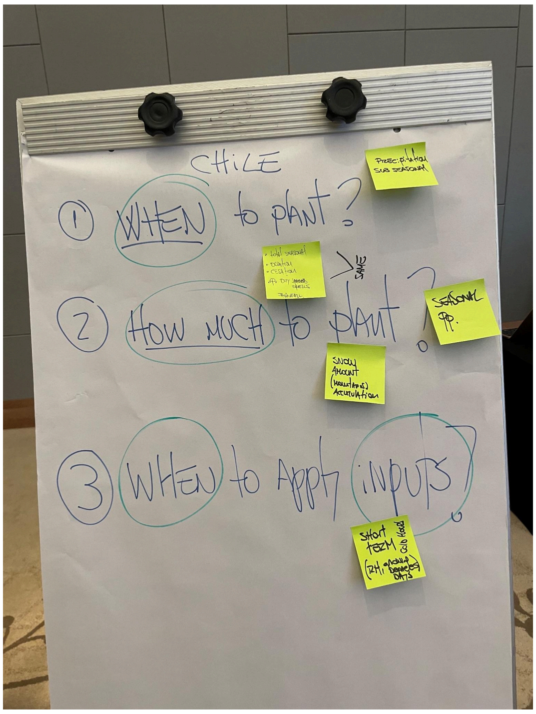
- **Pest and Disease Management:** Rainfall and temperature forecasts are essential for anticipating pest and disease outbreaks. Participants highlighted the need to link this information with existing pest and seed databases.

- **Heat Stress Monitoring:** A rising concern, particularly for dry-season crops and livestock. Participants identified the need to expand forecasting capacity for high-temperature stress events, currently underexplored but expected to become more relevant under climate change.

- **Crop-Specific Forecasting (e.g., Rice):** Bangladesh emphasized the importance of generating rice-specific forecasts including sowing dates, rainfall quantity, and flood risk, recognizing rice as the dominant crop in both wet and dry seasons.

Chile

Agriculture in Chile spans diverse climatic zones, ranging from the driest desert in the world in the north to some of the rainiest regions in the south. Given the country's pronounced seasonal variations and increasing water scarcity issues—particularly in central regions—agriculture depends heavily on accurate climatic information and forecasts.

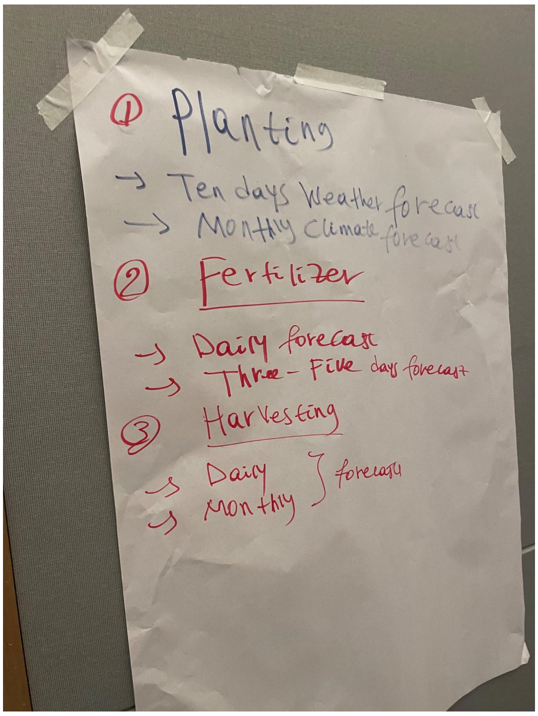


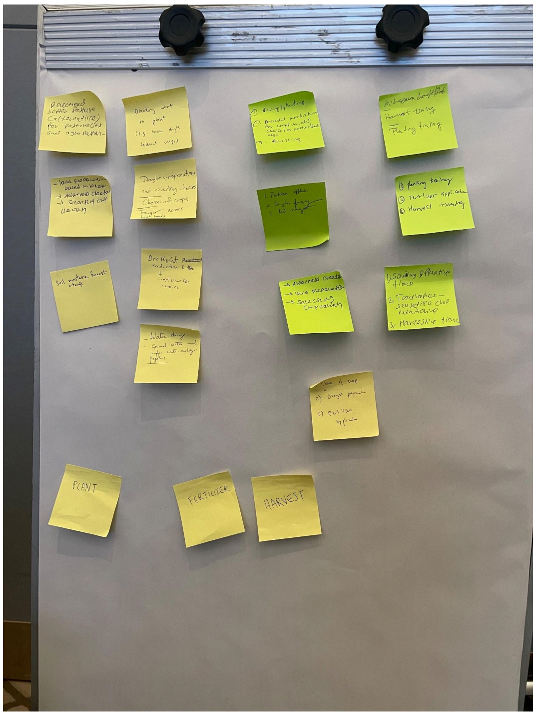
- **Irrigation Management:** Accurate forecasting of rainfall and river water availability to determine optimal irrigation schedules, addressing significant regional variability in water resources.
- **Early Irrigation Decisions:** Timely forecasts to inform early-season irrigation practices crucial for crop establishment and productivity in water-limited regions.
- **Soil Preparation and Fertilizer Application:** Advisories driven by forecasts to guide optimal timing and resource allocation for soil preparation and fertilizer application based on anticipated soil moisture and weather conditions.
- **Pest Monitoring and Management:** Forecasts of temperature and humidity for proactive pest management, recognizing increased pest pressures under drought or irregular precipitation conditions.
- **Harvest Timing:** Accurate short-term forecasts essential for optimizing harvest timing and reducing yield losses due to adverse weather events during critical harvest periods.
- **Snow Conditions:** Monitoring snow accumulation and timing of snowmelt, particularly in mountainous regions (Andes), as these factors critically influence river flows, water availability, and consequently, irrigation planning during spring and early growing seasons.

Ethiopia

Agriculture in Ethiopia is predominantly rainfed and characterized by high climate variability, particularly in rainfall timing, distribution, and intensity. Forecasting services are critical across the agricultural calendar—from land preparation to harvest. Discussions focused on the gaps and requirements for more timely, location-specific, and reliable weather information.

- **Planting Timing:** Determining when to plant is a top priority. Shifts in rainfall onset due to climate change have made historical planting calendars unreliable. Farmers need actionable seasonal and sub-seasonal forecasts—ideally one month in advance—to decide when to begin land preparation and sowing.
- **Fertilizer Application:** Advisories are needed to align fertilizer application with rainfall patterns and soil moisture availability. Inappropriate timing results in both financial losses and environmental inefficiencies.
- **Harvest Timing:** Short-term (5–10 days) and monthly forecasts are critical to help farmers plan harvesting around unseasonal rainfall events during the harvest season, avoiding post-harvest losses.
- **Crop Variety and Input Decisions:** Seasonal forecasts influence the selection of crop varieties, especially for maize and other rain-sensitive crops, based on expected rainfall distribution, temperature trends, and growing season length.
- **Land Preparation and Soil Moisture:** Accurate early-season rainfall predictions assist farmers in scheduling plowing and soil conditioning, especially in areas where rainfall onset is delayed or erratic.



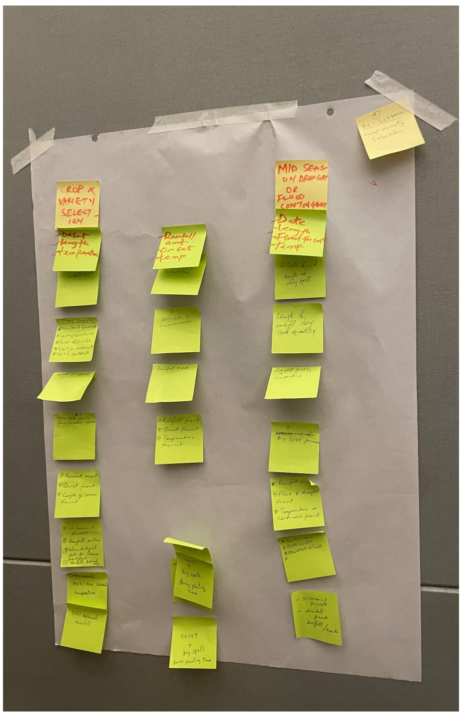


Kenya

Agricultural productivity in Kenya is highly vulnerable to variable rainfall patterns and increasingly unpredictable growing seasons. Farmers have historically relied on predictable planting windows, but recent shifts in rainfall onset and distribution due to climate variability have created a demand for more accurate and actionable weather information. Forecasting needs in Kenya are closely tied to decisions on crop management across the entire agricultural cycle—from variety selection to post-harvest handling.

- **Planting Timing:** A top-priority concern. Farmers require early warning on rainfall onset and dry spells to prepare land and inputs and initiate planting. The traditional planting calendar (e.g., around mid-March) is no longer reliable. Onset predictions issued one to two weeks in advance were deemed sufficient for farmers to act.
- **Dry Spell Forecasting:** Anticipating intra-seasonal dry spells is essential for yield protection, especially in areas with unimodal rainfall regimes.
- **Harvest Timing:** Late-season precipitation affects kernel drying and post-harvest losses, particularly for maize. Accurate forecasts on rainfall cessation and temperature during harvest windows are critical to avoid spoilage and manage storage.
- **Rainfall Distribution:** In addition to total rainfall, the spatial and temporal distribution of precipitation is vital for determining when and how crops will respond to inputs and irrigation.
- **Soil Moisture Monitoring:** Understanding soil moisture conditions informs planting decisions and fertilizer application timing. This parameter was noted as needing significant improvement in forecasting systems.
- **Crop Variety Selection:** Seasonal and sub-seasonal forecasts are critical in helping farmers select appropriate crop varieties, particularly in areas where rainfall variability affects yield potential and growing season length.

Nigeria



Nigeria's agricultural sector is diverse, with smallholder farmers operating across varied agro-ecological zones. These farmers face a range of weather-related risks—from prolonged dry spells in the north to seasonal flooding in the south—underscoring the critical need for location-specific, timely, and reliable weather forecasts. National stakeholders identified a clear set of use cases and forecast needs that would support climate-informed decision-making at scale, especially as digital advisory services expand.

- **Temperature Monitoring:** Identified as a key use case for both pre-season and in-season decision-making. Accurate temperature trends are essential for heat-sensitive crops and influence decisions on sowing dates, irrigation scheduling, and pest management.
- **Irrigation Scheduling:** Farmers require daily and weekly rainfall forecasts to manage limited water resources and avoid crop failure due to mid-season dry spells. This is particularly critical in semi-arid regions where irrigation is not yet fully mechanized.

- **Crop Variety Selection:** Seasonal forecasts of rainfall onset, quantity, and temperature ranges are needed to select the appropriate crop variety (e.g., early- or late-maturing), especially for cereals like maize and rice. Forecast information should also guide fertilizer timing based on anticipated growing season conditions.
- **Flood and Drought Risk Management:** Mid-season dry spells and flooding events are common across Nigerian farming systems. Forecasts are essential for planting date adjustments, insurance product design, and public-sector preparedness. Participants emphasized the need for both probabilistic flood alerts and dry spell warnings.
- **Pest and Disease Forecasting:** The group highlighted a lack of weather-informed pest and disease forecasting tools. Forecast data on humidity, temperature, and wind patterns is required to predict outbreak likelihood and inform integrated pest management strategies.

AI Forecasting Training Program: Summary of Planning Discussions

This workshop convened participants from meteorological agencies and partner institutions to review, validate, and improve the proposed curriculum for a hands-on training program on AI-based weather forecasting. The session aimed to ensure the curriculum meets country needs by strengthening local forecasting capacity, supporting the operational adoption of AI tools, and enabling the delivery of actionable agricultural insights. Discussions were organized across two interlinked tracks: a Technical Track, focused on refining technical curriculum content, and a Joint Track, which addressed alignment with national planning processes and agricultural needs.

Technical Track Summary

The Technical Track focused on building a rigorous, hands-on curriculum to equip national forecasting institutions with the tools, methods, and infrastructure to generate and use AI-based forecasts effectively.

Curriculum Design and Structure

A modular training sequence was proposed to scaffold technical capacity, starting from traditional approaches and culminating in applied agricultural use cases:

1. Traditional Forecasting Foundations: Introduction to numerical weather prediction (NWP) models, ensemble forecasting, and limitations for agricultural applications.
2. Data Assimilation and Quality Control: Focused on observational networks and the integration of local data into models for improved accuracy.
3. AI-Based Forecasting Models: Overview of models such as AIFS; exploration of architecture, downscaling capabilities, and data requirements.
4. Model Evaluation and Benchmarking: Emphasis on hindcasting, bias correction, and objective performance evaluation metrics.
5. Impact-Based Forecasting: Application of forecasts to agricultural decisions—planting schedules, irrigation, heat and drought stress, pest outbreaks.

A guiding principle emerged: add value to the AI models using local observations for benchmarking and tuning(improving AI outputs) rather than presenting AI forecasts in isolation, as well as focusing on generating actionable information

Data, Infrastructure, and Computation

- Local Calibration: Emphasis was placed on assimilating national datasets (e.g., ground station archives) to fine-tune model accuracy.
- Forecast Generation Modalities: Participants discussed trade-offs between running models locally vs. using centrally hosted outputs (e.g., European Centre for

Medium-Range Weather Forecasts [ECMWF]). Local model runs were seen as valuable for validation and learning.

- Resource Constraints: Computing capacity, access to cloud platforms, and human resources remain major considerations for curriculum feasibility.

Hands-On Technical Modules

Strong interest was expressed—especially by Chile—in hands-on components such as:

- Running example models (e.g., AIFS)
- Localized output customization (e.g., rainfall onset, temperature extremes)
- Historical testing and bias correction
- Basic coding for simple model tuning and visualization

Tools and packages should be pre-installed to reduce troubleshooting during sessions. Participants should be provided with access to open-source model libraries and code repositories.

Operational Use Case Alignment

Forecasting outputs must be actionable. Participants underscored the importance of:

- Benchmarking AI forecasts against current systems
- Testing forecast utility for specific decision points (e.g., sowing windows, drought risk, pest emergence)
- Ensuring outputs align with advisory timelines and thresholds relevant to farmers

A core message was that even the best models are ineffective if their outputs don't reach end users in usable formats. Training will include:

Joint Track Summary

The Joint Track focused on embedding AI forecasting innovations into national institutional frameworks and ensuring relevance for agricultural users.

Training Framework and Outputs

A two-day format was agreed upon:

- Day 1: Cross-track integration, national diagnostics, development of technical roadmaps.
- Day 2: Presentation of national roadmaps, development of CONOPS (Concept of Operations), and synthesis into a global framework.

Expected Outputs

- National Technical Roadmaps covering:
    - Tools and models for deployment
    - Forecast lead times and agricultural use cases
    - Implementation plans (short-, mid-, and long-term)
- Country-Specific CONOPS outlining:
    - Institutional roles and responsibilities
    - Budget and policy implications
    - Milestones for adoption of operational AI forecasting
- Global Framework to capture shared priorities and identify opportunities for cross-country learning.

Participant Preparation

To maximize value during training, preparatory steps were recommended:

- Distribution of concept notes and pre-read materials
- Pre-training assessments and quizzes
- Pre-submission of roadmap and CONOPS drafts
- Clear role definition within each delegation (e.g., meteorological, agricultural, policy)

A peer learning network—via a shared platform or messaging group—was also proposed to support post-training collaboration.

Bridging Forecasting and User Needs

The joint sessions aim to ensure AI innovations are grounded in agricultural reality. Key priorities include:

- Aligning forecasts with cropping calendars and decision timelines
- Improving input recommendations (e.g., fertilizer timing, irrigation scheduling)
- Integrating advisories into national extension systems and mobile dissemination platforms

The need for user feedback loops was repeatedly stressed to ensure forecasts remain relevant and trusted.

Optimizing Dissemination and Farmer Comprehension of Weather Forecasts

This workshop invited participants from ministries of agriculture and related partners to learn about tools to optimize dissemination. It focused on practical approaches to increase the relevance, effectiveness, and uptake of weather forecasts by farmers, particularly smallholders. Discussions emphasized message framing, communication timing, feedback systems, local language use, and leveraging existing infrastructure for targeted dissemination.

Message framing and behavioral response

Participants explored how different forms of weather forecast messages influence farmer decision-making:

- **Consequences versus Claims:** Messages that explicitly state the consequences of inaction (e.g., “You may lose 30% of your crop if you don’t plant this week”) tend to be more actionable than neutral or generic advisories. Positive framing (e.g., “You could gain 30% yield if you plant now”) was also considered effective in some contexts.

- **Message Layering:** A three-tiered strategy was proposed—starting with plain forecast information, followed by a recommended action, and concluding with a consequence (positive or negative) of not acting.

- **Cultural Variation:** Framing may need to be adapted for specific audiences. For example, some indigenous communities in Chile may prefer neutral information over directive messaging. In Nigeria, informal language like pidgin was seen as more accessible and trusted by farmers compared to formal language.

- **Call to Action:** Messages with clear, action-oriented language improve clarity and drive behavior change. Participants recommended testing multiple phrasings to determine what most effectively promotes adoption.

- **Message Testing:** Several participants proposed designing structured experiments to evaluate different framing approaches (claim-only, consequence-only, claim + consequence), language styles (formal vs. informal), and delivery timing (morning vs. evening).

Hypotheses Raised

- Consequence framing may lead to higher compliance than neutral messaging.

- Different communities respond differently to the same message structure.

- Negative framing could trigger quicker action than positive or neutral framing.

- Tailoring by crop type of farming system could enhance message impact.

- Informal or locally spoken language (e.g., pidgin in Nigeria) increases comprehension and trust.

- Message effectiveness may vary significantly depending on the farming system, crop, or farmer behavior—suggesting a need for context-specific message development.

Communication infrastructure and channels

Participants assessed the effectiveness and limitations of different dissemination channels:

- **SMS and WhatsApp:** Frequently used channels but depend on mobile access, digital literacy, and accurate registries of farmer phone numbers. Group WhatsApp messages were proposed as a tool for ongoing feedback and advisory sharing.

- **Insurance and Credit Systems:** In Chile, farmers enrolled in credit or insurance programs receive alerts via SMS. While coverage is currently low (20–30%), this infrastructure could serve as a foundation for future targeting efforts. These systems often lack geo-referencing and are limited to specific farmer segments, such as men or those with more financial access.

- **Call Centers and Voice Messaging:** Voice messages delivered early in the morning or evening were viewed as more likely to be heard. However, systems to track message delivery, listen-through, or response behavior are underdeveloped.

- **Extension Agents:** Local extension workers can play a critical role in reinforcing messages, collecting feedback, and supporting farmer comprehension. However, coordination challenges arise when agents are managed at the municipal level while dissemination is centralized nationally.

- **Backend Constraints:** Many systems lack the technical infrastructure to monitor whether messages are opened, understood, or acted upon—limiting adaptive learning and effectiveness over time.

Two-way communication and farmer feedback

Participants emphasized the importance of closing the feedback loop between forecast providers and users:

- **Incentivized Data Sharing:** Farmers are more likely to provide data (e.g., sowing dates, crop types) if they receive tailored inputs or recommendations in return.

- **Feedback Loops:** While comprehensive feedback systems are expensive, participants proposed lower-cost alternatives such as in-app surveys, WhatsApp group polls, and structured call center follow-ups. Kenya’s use of independent firms was cited as a promising example of third-party monitoring of message uptake, perceived usefulness, and willingness to pay.

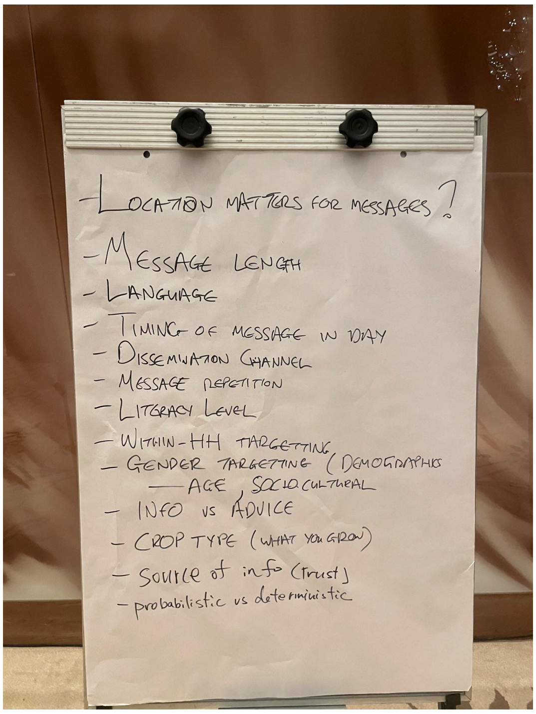
- **Bias Considerations:** While independent assessments are ideal, internal monitoring systems—if carefully designed—can still provide valuable signals on user behavior and trust, especially in resource-constrained settings.

- **Extension Agents and Local Capacity:** Extension agents—especially at the municipal level—can play a key role in delivering and verifying messages, provided they are trained and integrated into national dissemination systems. They can also assist with feedback collection and user support.

Evaluation and iteration

Participants proposed a structured approach to testing and improving forecast message effectiveness:

- **Design Experiments:** A/B testing of different message structures (e.g., claim-only, consequence-only, claim + consequence), delivery timing (morning vs. afternoon vs. evening), and language (formal vs. informal).



- **Outcomes of Interest:**
    - Self-reported use of the forecast
    - Changes in farming practices (e.g., sowing date, pesticide application)
    - Trust in the message and source
    - Yield, input use, or other productivity-related indicators
- **Feasibility Considerations:**
    - Build on existing infrastructure like credit/insurance databases.
    - Partner with telecom providers and fintech firms to deliver and track messages cost-effectively.
    - Coordinate with call centers and extension services to gather data on message use and outcomes.
    - Ensure inclusion of women and marginalized groups who may be underrepresented in formal databases.
    - Testing at scale may require large sample sizes and stratification by crop type, region, and farmer segment—raising cost and complexity.
    - Where possible, leverage existing government or donor-funded platforms (e.g., insurance schemes) as entry points for pilots.
    - Consider using simplified indicators (e.g., self-reported behavior change or message recall) where more rigorous data is infeasible.

    - Account for gaps in data systems and farmer registries, which may constrain efforts to target or personalize messages.

This session reinforced that optimizing dissemination requires iterative testing, user feedback, and a strong understanding of social, linguistic, and infrastructure contexts. Even small, well-designed investments in message design and delivery systems could significantly improve forecast adoption and agricultural outcomes for smallholder farmers.

Country Investment Plans

This workshop invited participants to review gaps and opportunities in their current weather forecasting and advisory systems, with the goal of informing future investment planning. Country teams reflected on institutional, technical, and operational challenges and identified areas where targeted improvements could deliver greater impact for farmers. These discussions laid the foundation for a collaborative planning session the following day, where delegations presented their proposed investment plans. The process was supported by engagement with multilateral development bank representatives and technical partners, who provided feedback and explored opportunities to align on implementation support. Country teams from Bangladesh, Chile, Ethiopia, Kenya, and Nigeria presented draft investment plans structured around five categories: observation networks and data, AI-based forecast production, benchmarking and validation, dissemination, and learning.

Bangladesh

Identified Gaps and Opportunities

During Workshop 3, the Bangladesh delegation engaged in a detailed review of current forecasting and advisory systems, highlighting both significant advancements and persistent gaps.

1. **Observation and Forecasting Infrastructure:** Bangladesh has made major strides in surface and upper-air observations, including the recent installation of 285 automatic weather stations (AWS) and 61 manual observatories, backed by World Bank support. Upper-air observations now occur at six sites twice daily, with additional pilot balloon stations in place. However, the delegation emphasized a major gap in marine observations. Despite the country's extensive coastline along the Bay of Bengal, there are no buoy stations or robust marine monitoring systems, which severely limits forecast accuracy. The team also noted that only a fraction of AWS data is shared via the World Meteorological Organization's (WMO) Global Telecommunication System (GTS), reducing access to real-time data for global models.

2. **Forecast Production:** Bangladesh currently relies on the Weather Research and Forecasting (WRF) model, with boundary conditions from ECMWF, but lacks in-house AI-based forecasting capabilities. Participants expressed strong interest in integrating AI models, noting that such tools would require high-quality handcast validation and benchmarking using the country's extensive historical datasets.

3. **Data Dissemination and Advisory Services:** Agrometeorological bulletins are disseminated weekly via the Department of Agricultural Extension, reaching farmers through hand microphones, loudspeakers, and sometimes mosque-based announcements. However, the sustainability of these systems post-project remains a concern, with discussions highlighting the risk of drop-off in dissemination once external support ends. There was debate over optimal dissemination channels, with some advocating for expanded use of mobile apps, voice, SMS, and cell broadcasting while others cautioned that segments of the population—especially

older farmers—might be excluded. Participants agreed on the need for a multi-channel strategy tailored to user segmentation.

4. **Localized Advisory Services:** The team emphasized that Bangladesh's topography—characterized by variations in elevation within small areas—creates significant challenges for delivering generalized advisories. The timing of planting can vary by up to 45 days depending on land elevation, affecting the relevance of agromet recommendations. A major gap identified was the lack of data on individual farmers' transplanting dates, which would be necessary for localized advisories. Suggestions included using farmers' mobile numbers as unique identifiers in a national database linked to land records.

5. **Policy and Institutional Gaps:** The delegation flagged issues of fragmentation across the Ministry of Agriculture, including multiple uncoordinated applications and lack of interoperability. They noted the potential to leverage recent investments in agro-meteorology training to create a digital incubator or startup ecosystem that could offer customized services based on foundational datasets.

6. **Other Identified Gaps:**

    a. Lack of AI forecast capability and probabilistic forecast communication.

    b. Insufficient early warning systems for extreme agricultural events.

    c. Inadequate flood and drought forecasting, especially for flash floods and saline intrusion.

    d. Weak alignment between agro-advisories and environmental factors like soil type and water retention capacity.

Investment Plan

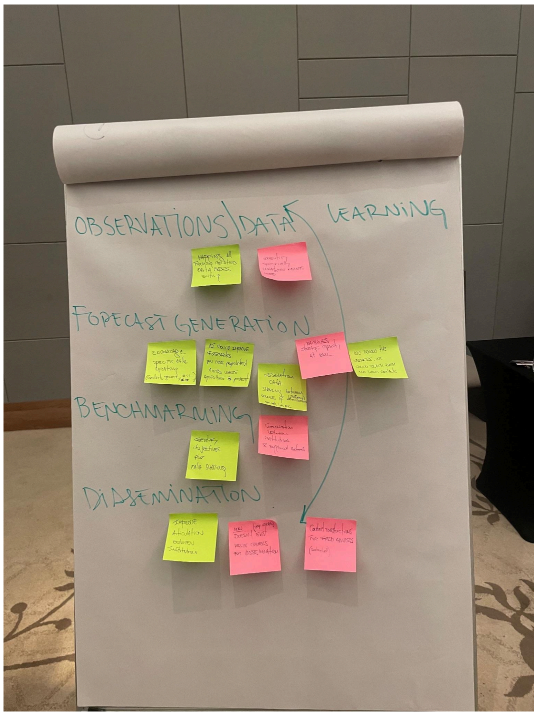
The proposed investments build on the 2025 baseline study and stakeholder workshop conducted by ADB, and aim to strengthen early warning systems, integrate weather data into agricultural decision-making tools, and enhance delivery through extension systems. A central focus is the development of a one-stop digital infrastructure to streamline and scale access to agricultural and climate information.

- **Observation:** Establish a marine observation system; install evapotranspiration sensors; invest in calibration and maintenance infrastructure.
- **Forecast Production (AI):** Strengthen flood and drought forecasting systems, including a storm surge inundation model; build AI-based forecasting capacity.
- **Benchmarking and Validation:** Align agronomic advisories with agro-ecological zones, including lowland/highland distribution.
- **Dissemination:** Improve near real-time alerts (e.g., flash flood, lightning); leverage interactive voice response (IVR) and SMS linked to mobile towers.
- **Learning:** Deepen integration with extension services; enhance farmer training and feedback.

Chile

Identified Gaps and Opportunities

During Workshop 3, the Chile delegation presented a clear overview of the current challenges facing the country's agrometeorological services, while outlining opportunities for targeted investments and institutional coordination to strengthen early warning and forecasting systems.



1. **Fragmented Institutional Landscape:** Chile's climate services are spread across several institutions, with no single body designated as the lead for agrometeorological forecasting. The Chilean Meteorological Directorate (DMC), Ministry of Agriculture (ODEPA), Ministry of the Public Works, and the Agricultural Research Institute (INIA) all manage relevant data and tools, but with limited coordination. This fragmentation results in duplicative systems, inconsistent standards, and unclear mandates. The delegation emphasized the need for a national strategy to integrate climate information across institutions and define roles more explicitly.
2. **Observation Network and Data Access:** Chile has multiple observation networks, including those operated by DMC, INIA, and the Water Directorate (DGA), but these are often incompatible. There is no centralized platform or protocol for harmonizing or sharing data across networks. Participants noted that, while there is a relatively dense network in some regions, gaps remain in agricultural zones and highland areas. Many of the existing stations are not well-calibrated or maintained, reducing confidence in the resulting forecasts.

3. **Forecast Production and Modeling:** Currently, there is limited national capacity for producing AI-based forecasts or high-resolution sub-seasonal models. DMC and other agencies rely heavily on external sources, such as ECMWF and the U.S. National Oceanic and Atmospheric Administration (NOAA), without local downscaling or contextualization for Chilean microclimates. Participants expressed strong interest in adapting these tools using local datasets, but flagged the need for training, infrastructure, and benchmark assessments to support this transition. The ability to validate AI models with localized ground truth data was cited as a prerequisite for building credibility and utility.

4. **Dissemination and Advisory Services:** The delegation highlighted that Chile lacks a structured advisory system for farmers. While some bulletins and online platforms exist, they are not regularly updated, user-centered, or well-integrated with extension services. In addition, there is limited use of SMS or voice-based dissemination, which could increase reach, particularly in rural areas. The group emphasized the importance of co-producing advisories with end users and conducting segmentation to tailor information for diverse farmer profiles.

Investment Plan

Chile's team emphasized the need to improve weather and climate services in the face of increasing drought and water scarcity. Their proposed investments focus on enhancing seasonal and sub-seasonal forecasting, with particular attention to snowpack monitoring and its role in water and agricultural planning. The group also prioritized strengthening coordination across institutions, and tailoring services to the needs of small and medium-scale producers through improved training and capacity-building.

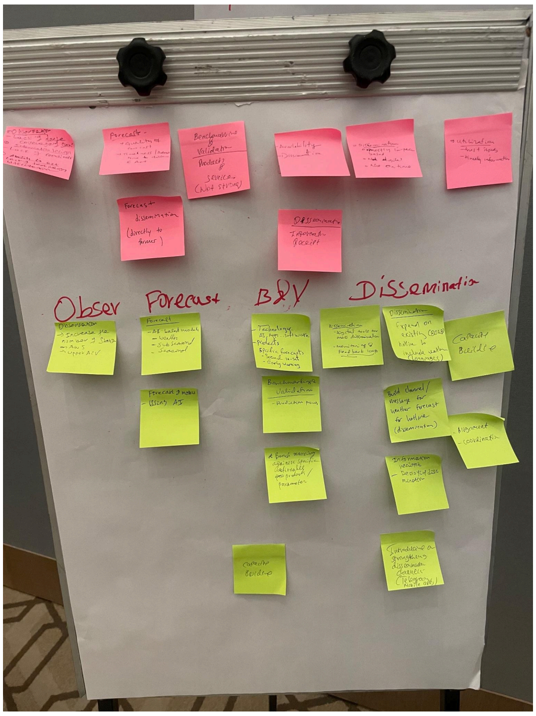
- **Observation:** Conduct national network assessment using WMO methodology; improve data infrastructure and integration.
- **Forecast Production:** Develop a national strategy for agri-climatic services, including an assessment of farmer needs.
- **Benchmarking and Validation:** Invest in computing capacity (currently maxed out).
- **Dissemination:** Build dissemination platforms; leverage trusted intermediaries like extension agents; adjust subsidies to encourage uptake.
- **Learning:** Employ A/B testing to refine advisories.

Ethiopia

Identified Gaps and Opportunities

Participants from Ethiopia highlighted several opportunities to enhance the country's weather forecasting and dissemination ecosystem, building on strong interest from national research institutions and user-facing agencies. Across the observation-to-action value chain, stakeholders noted the following priorities:

- **Data availability and quality:** There is a need to scale up the deployment of local weather stations and sensors to improve data availability and input quality for AI-based forecasting. Investments in localized observational infrastructure would also support more granular and timely forecasts tailored to farmers' needs.



- **Forecast accuracy and usability:** Ethiopia is actively exploring the use of AI to improve forecast accuracy and usability, with particular interest in nowcasting, seasonal forecasts, and early warning systems. Participants emphasized the value of incorporating user feedback into model development to ensure relevance to end-users.
- **Validation:** Stakeholders noted the importance of systematic validation of model performance and service delivery. There is an opportunity to develop a benchmarking system that assesses global and local model accuracy and evaluates key parameters relevant to

Ethiopian agroecological contexts. Capacity constraints—particularly in cross-border modeling and validation—were also flagged as an area requiring targeted support.

- **Limited destination capacity:** A major gap identified is the limited capacity to translate forecasts into actionable information for farmers. Participants underscored the need for a co-created dissemination strategy that builds on existing channels while introducing new, regionally symmetric approaches.

Investment Plan

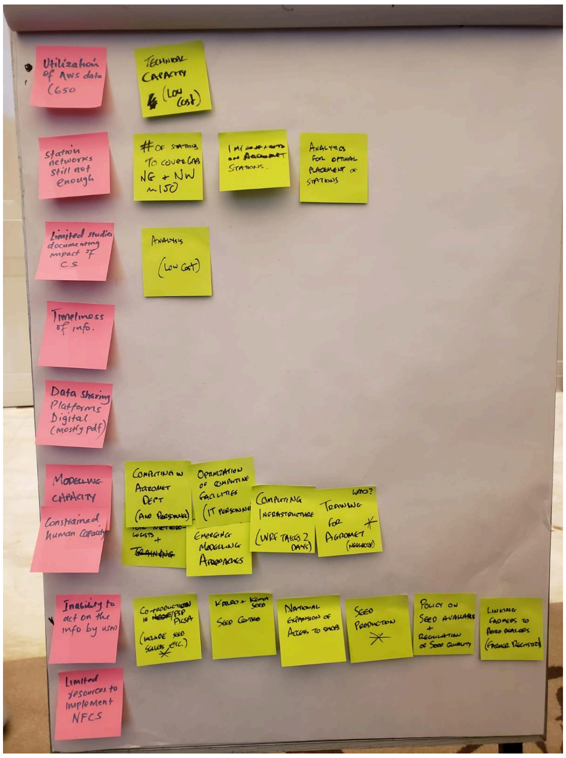
Ethiopia's group emphasized the importance of strengthening coordination between the Agricultural Transformation Institute, the Ministry of Agriculture, and Ethiopian Meteorological Institute, and leveraging existing extension systems to deliver weather-informed advisories. Their proposed investments reflect a focus on improving last-mile delivery of forecasts, building institutional capacity, and developing early warning systems that are responsive to farmer needs.

- **Observation:** Expand the meteorological station network; increase deployment of weather radars.
- **Forecast Production (AI):** Implement AI-based seasonal and sub-seasonal models; build capacity within national meteorological institutions.
- **Benchmarking and Validation:** Focus on actionable indicators (onset dates, rainfall totals, dry spells).
- **Dissemination:** Strengthen and scale up ATI's 8028 farmer hotline with actionable weather and climate information, automatic text-to-voice conversions, and more local languages. Coordination between producers and disseminators of forecasts was cited as a key enabler for scaling.
- **Learning:** Introduce structured feedback loops and A/B testing to evaluate forecast performance.

Kenya

Identified Gaps and Opportunities

In Workshop 3, the Kenya delegation discussed the challenges impeding the delivery and uptake of climate services. The team reflected on technical, institutional, and policy-related gaps, as well as opportunities for near-term investment.



1. **Institutional Coordination and Policy Implementation:** A key theme was the underimplementation of Kenya's National Framework for Climate Services (NFCS). While the NFCS clearly outlines roles for various government ministries and establishes an inter-ministerial coordination mechanism, limited financial and human resources have made it difficult to deliver on these mandates. Participants noted that although Kenya Meteorological Department (KMD) is responsible for dissemination, collaboration with other ministries (e.g., Agriculture, ICT) is uneven and responsibilities are not always reflected in policy.

2. **Timeliness and Dissemination:** The group expressed concern over delays in disseminating seasonal forecasts. Participatory Scenario Planning (PSP) workshops often occur after the onset of rains, rendering forecasts ineffective for agricultural decision-making. These delays stem from procurement constraints and institutional bottlenecks across implementing partners. The group stressed that dissemination should align with lead times, and simplification of institutional processes is urgently needed.

3. **User Uptake and Capacity:** Participants emphasized that even when forecasts are delivered on time, farmers often lack the capacity to act. This is due to several interrelated factors:

    a. Limited access to necessary inputs such as seeds that align with advisories.

    b. Low penetration of extension services to interpret forecasts and support behavior change.

    c. Inadequate financial services, including credit and insurance, to enable farmers to respond to information.

d. Gaps in education and digital literacy, particularly in understanding probabilistic or technical forecasts.

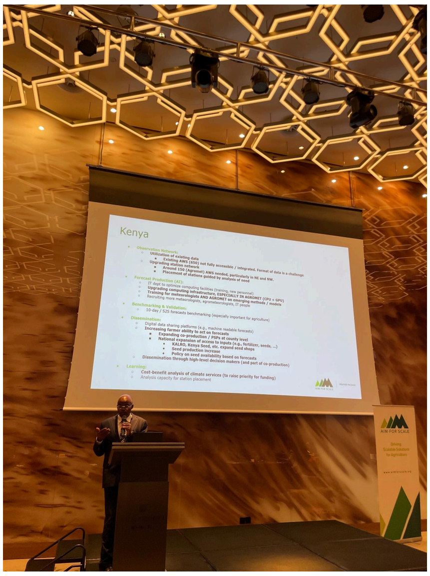
4. **Observation Infrastructure:** Kenya's current observation network is sparse and unevenly distributed. There is a particularly acute need for expansion in the Northeast and Northwest regions. The group estimated that an additional 100–150 automatic weather stations—ideally agrometeorological—would be needed to provide adequate coverage. These stations should include sensors for soil moisture, temperature, and other variables critical to agricultural advisories.

5. **Data Harmonization and Technical Capacity:** Incompatibility across existing station networks and fragmented datasets limit their utility for modeling and prediction. Participants flagged the outdated Automatic Weather Station Data Tool (ADT) as a barrier. Though the ADT was intended to integrate and manage climate data, it has not been updated since 2015 and lacks openness for adaptation. Upgrading or replacing the ADT with support for harmonized, real-time datasets would enable more effective use of AI models and ensure accurate validation and benchmarking.

Investment Plan

Kenya's discussion highlighted ongoing efforts to digitize agricultural advisory services and scale public-private collaboration. The group underscored the need for sustained investment in local forecasting capacity, improved digital dissemination tools, and integration of weather services with national programs.

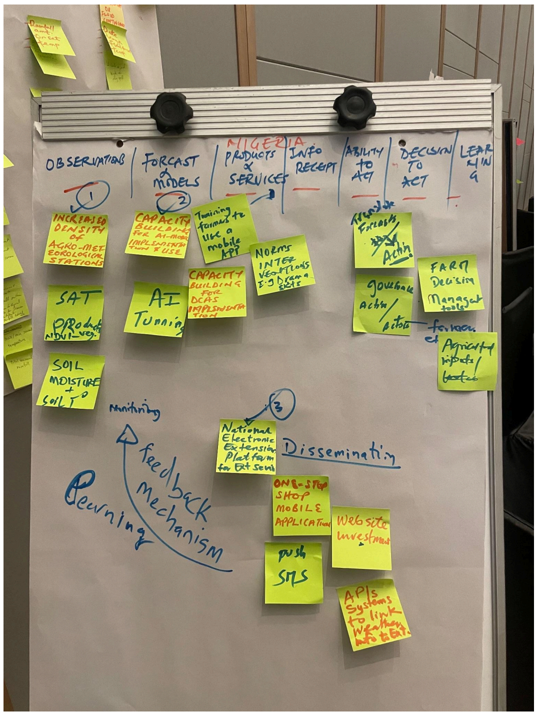
- **Observation:** Integrate and expand AWS (targeting 800 stations); prioritize underserved regions in the northeast and northwest.
- **Forecast Production (AI):** Upgrade agrometeorology computing infrastructure (CPU/GPU); hire and train technical staff.
- **Benchmarking and Validation:** Improve quality of 10-day and sub-seasonal forecasts for agriculture.
- **Dissemination:** Expand co-production mechanisms; improve farmer access to advisories and inputs (e.g., fertilizer, seed); align national seed policy with forecast insights.
- **Learning:** Conduct cost-benefit analysis to support increased government investment in climate information services.

Nigeria

Identified Gaps and Opportunities

In Workshop 3, the Nigeria delegation focused on the full value chain of climate services—from model development to dissemination—and highlighted critical needs and opportunities to improve forecasting for farmers. Their discussion emphasized integration, localization, and capacity building as cross-cutting priorities.



1. **Observation Network and Forecasting Models:** A key gap identified was the limited density of the national observation network. Participants agreed that expanding the network—particularly with agrometeorological stations—was essential for generating reliable forecasts. This would also enable more effective model validation and tuning. The team strongly supported the development and deployment of AI-based forecasting models, but emphasized that localization was critical. Local tuning and contextualization using Nigerian datasets were seen as necessary for credibility and impact.
2. **Extension Services and Community Training:** The delegation underlined the role of extension agents as the first point of contact for farmers. However, many agents lack the tools and training to support the interpretation and use of forecasts. The group proposed joint training for both extension agents and lead farmers, recognizing that these actors often live in or near the communities they serve.

Equipping them with accurate information and clear guidance would help close the gap between forecast delivery and farmer action.

3. **Digital Integration and Dissemination Platforms:** Participants highlighted fragmentation across digital tools and systems. A core opportunity lies in building a unified platform that integrates all steps in the climate service pipeline: from model generation to dissemination through extension agents. An API could allow different tools to connect, ensuring seamless updates and real-time information sharing. Investments in website modernization and digital infrastructure were flagged as prerequisites for this integration.

4. **Local Content and Communication Channels:** Nigeria's diversity in languages, cultural norms, and farming practices makes the localization of forecasts and advisories essential. The team proposed using culturally relevant formats—such as animations, skits, and dramas—to increase comprehension and engagement. Dissemination through SMS, mobile apps, and local broadcast systems should be tailored to specific user groups, taking into account digital literacy and access constraints.

5. **Capacity Building:** The delegation identified a dual focus for training: (1) technical staff, including modelers and meteorological officers, who require support in AI tools and probabilistic forecasting, and (2) intermediaries such as extension agents and lead farmers, who serve as trusted messengers to farmers. Capacity building should also emphasize digital literacy and the ability to use and interpret digital platforms.

6. **Farm-Level Decision Support:** Participants expressed interest in farm decision management tools that could help farmers track, plan, and adjust agricultural practices based on forecast information. These tools should be integrated into dissemination platforms and include features for local input and feedback.

Investment Plan

Nigeria's team highlighted the opportunity to build on recent innovations in digital advisory services and reach more smallholder farmers with timely, tailored weather information. Their priorities include improving last-mile dissemination, strengthening national forecast capacity, and enhancing collaboration between agriculture and meteorological stakeholders.

- **Observation:** Increase density of agro-met and hydro-met stations, including real-time data collection sharing (e.g. servers); develop radar networks; automate soil temperature/moisture monitoring.

- **Forecast Production (AI):** Build national capacity in AI modeling and local tuning; integrate with digital climate services and mobile platforms.

- **Benchmarking and Validation:** Establish robust validation techniques for both hydro- and agrometeorological forecasts.

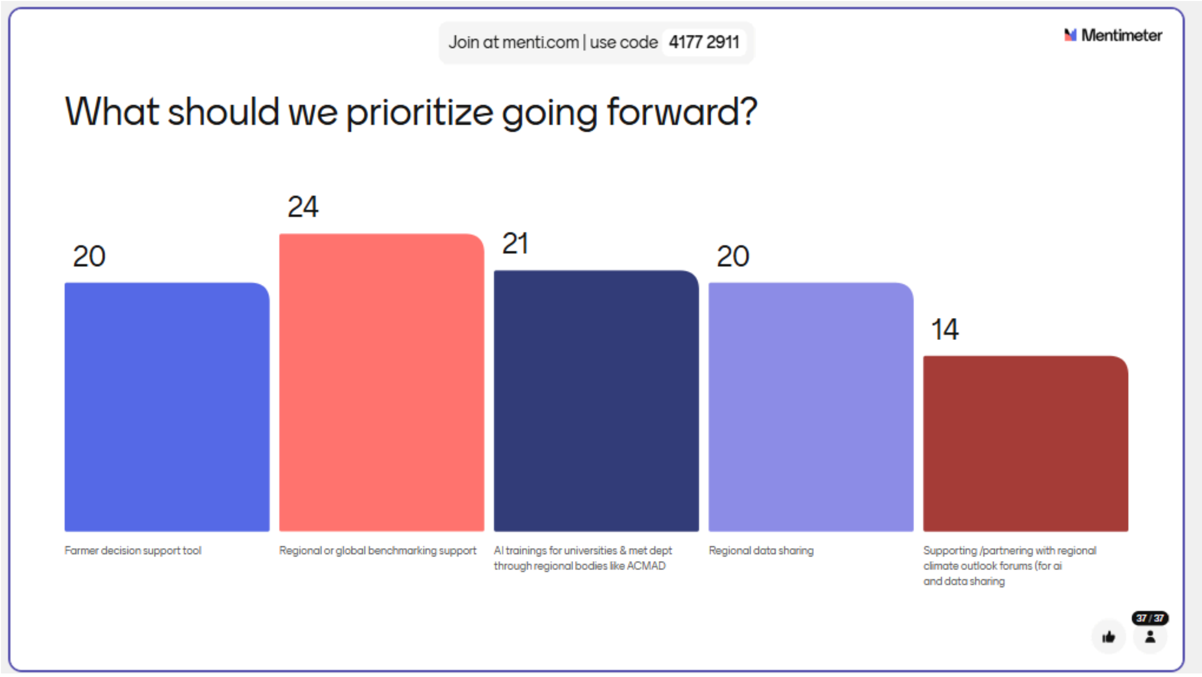
- **Dissemination:** Develop a national extension platform and one-stop mobile app; use SMS, jingles, and apps in multiple languages; establish APIs for seamless integration; implement Digital Climate Advisory Services.

- **Learning:** Conduct stakeholder feedback meetings and impact evaluation studies at national and sub-national levels.

Plenary on Regional and Global Public Goods

Participants took part in an open plenary to propose and discuss regional and global public goods to enhance weather services for farmers, as a complement to national investment plans. They emphasized the importance of investing in regional public goods to complement national-level efforts and ensure more efficient, scalable delivery of weather and climate services. Several key themes emerged:

- **Benchmarking and model comparison tools**: There was strong support for developing shared tools to help national meteorological agencies evaluate different AI-based and conventional forecast models. These tools would allow users to compare model performance—both against each other and against local ground truth—and tailor decision thresholds for national or sub-national use.
- **Shared regional datasets**: Participants called for high-quality, longitudinal datasets that can be used across countries, especially in regions like East and West Africa. Open and standardized data infrastructure was seen as essential for AI model training, downscaling, and benchmarking.
- **User-friendly interfaces**: Beyond technical users, several speakers highlighted the value of creating intuitive, lay-accessible platforms to help decision-makers—including those in ministries of agriculture—understand forecast reliability and apply the information more confidently.
- **Leveraging existing regional institutions:** Several speakers recommended building on the work of Regional Climate Outlook Forums (RCOFs), WMO Regional Climate Centers (RCCs), AGRHYMET, ACMAD, and climate-agriculture platforms already in place. These bodies can play a central role in data sharing, AI capability expansion, and coordinated investment.
- **Regional infrastructure and compute capacity**: To support AI modeling at scale, participants proposed establishing shared computing infrastructure and storage at the sub-regional level. This would reduce duplication, lower costs, and allow institutions to build and adapt AI models collaboratively.



- **Institutional Contributions**:
    - **African Centre of Meteorological Application for Development (ACMAD)**: Expressed willingness to coordinate regional data access and capacity-building; highlighted gaps in current AI training scale.
    - **IGAD Climate Center**: Stressed its role in training member states; suggested expanding coverage beyond IGAD countries.
    - **WMO**: Emphasized need to benchmark AI models, semi-automate forecast generation, and leverage WMO RCCs.
    - **Inter-American Development Bank (IDB)**: Proposed pooling resources to establish shared GPU infrastructure (e.g., regional compute hubs in the Southern Cone).