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Regional: Agricultural Shock Monitoring Using Remote Sensing and Machine Learning for Real-Time Disaster Impact Assessment

Project Name
Agricultural Shock Monitoring Using Remote Sensing and Machine Learning for Real-Time Disaster Impact Assessment
Project Number
60190-001
Country / Economy

- Regional
- Philippines
- Viet Nam

Project Status
Proposed
Project Type / Modality of Assistance

- Technical Assistance

Source of Funding / Amount
Sustainable Development Goals

- SDG 2.4

Sector / Subsector

- Agriculture, natural resources and rural development /

Gender
Indirect gender benefits
Description
The region faces increasingly severe natural disaster risks, with floods and extreme weather events causing substantial agricultural and socioeconomic losses. Globally, disasters have caused an estimated USD 3.26 trillion in agricultural losses between 1991 and 2023equivalent to roughly USD 100 billion per year or around 5% of total global agricultural output. Asia accounts for nearly half of these losses (around USD 1.5 trillion), reflecting the region's high exposure to floods, storms, and droughts. Agriculture remains one of the most exposed sectors: in developing countries it absorbs around 23% of total disaster damage and losses. Yet many governments still lack accessible tools and reliable evidence to understand where agricultural losses are occurring, which communities and crops are most vulnerable, and how risks vary across regions. Without such subnational evidence, it remains difficult to prioritize and target adaptation and mitigation investments that could most effectively reduce disaster impacts on food systems and rural livelihoods.

Against this backdrop, the proposed technical assistance (TA) addresses critical analytical and institutional gaps by developing a next-generation artificial intelligence (AI)- and satellite-based agricultural risk analytics platform. The platform will integrate hazard, exposure, and vulnerability layers using advanced earth observation (EO) data, AI and machine-learning (ML) models, and a Digital Twin environment to visualize impacts and simulate adaptation scenarios. It will generate high-resolution crop type, crop growth-stage, and yield maps core inputs required to estimate agricultural exposure, quantify yield losses, and evaluate recovery trajectories for both preparedness and post-disaster response applications.

The proposed work will be piloted in the Philippines and Viet Namcountries facing significant climate and disaster risks in agriculturewhile retaining flexibility to adjust pilot locations depending on data availability, institutional readiness, and implementation feasibility. Strong partnerships already established with national counterparts through previous JFPR projects (TA 8369 and TA 6856) provide confidence in successful implementation and sustainability. In Viet Nam, collaboration with the National Statistics Office (NSO) has demonstrated strong ownership in integrating satellite based crop mapping with official statistics and scaling modern survey methods. While implementation will be undertaken in the selected pilot countries, the methodologies, workflows, and tools are designed for scalability and replication across other developing member countries as data access and operational feasibility permit.

Project Rationale and Linkage to Country/Regional Strategy
Rising temperatures and increasingly erratic weather patterns are intensifying natural hazards across Asia and the Pacific, with floods, droughts, and extreme rainfall events disrupting livelihoods, food production systems, and economic stability. These risks are particularly acute in countries where agriculture remains central to employment, income, and food supply, and where weather related shocks quickly translate into welfare losses and setbacks in poverty reduction. Yet policy responses often remain reactive because governments lack timely, spatially detailed, and consistently validated information on the distribution of hazards, how disasters affect

crop conditions and yields, and which farming systems and communities are most vulnerable.

Food security pressures have intensified as climate variability, supply chain disruptions, and rising input prices place additional strain on agricultural systems. Reliable agricultural statistics and disaster impact information are therefore more essential than ever. However, existing data systemslargely based on administrative reporting and periodic surveysface persistent constraints, including time lags, limited geographic coverage, fragmented data sources, and inconsistent methodologies. Many countries struggle to sustain systematic ground truth data collection, encounter difficulties verifying satellite derived flood maps, and lack socioeconomic information needed to refine crop damage and loss estimates. These challenges impede the ability of planning, agriculture, and disaster management agencies to design proactive adaptation measures, prioritize resilience investments, and provide rapid post disaster support.

Feedback from country counterparts further highlights the need for more integrated climate risk analytics, especially in regions facing complex hazard profiles. For example, highly exposed deltassuch as those in Southeast Asiagrapple simultaneously with rainfall driven internal flooding, tidal and storm surge inundation, salinity intrusion, and coastal erosion. Local agencies often face limited digital capacity, modest access to analytical tools, and difficulty converting raw satellite and climate model outputs into operational insights for planning, monitoring, and extension services. These constraints underscore the importance of building national capabilities to integrate satellite observations, hazard models, crop monitoring data, and vulnerability indicators into coherent, decision ready systems.

Advances in EO technologies, AI, and geospatial analytics now offer transformative opportunities to address these gaps. High resolution satellite data enable routine monitoring of crop development, flood extents, soil moisture, and land use change at increasingly fine spatial and temporal scales. Machine learning models can rapidly process these data to detect early crop stress, estimate yields, and consistently quantify disaster impacts. Yet many countries still lack integrated platforms that bring together hazard, exposure, and vulnerability information in formats suitable for operational planning. Existing tools often rely on coarse or non validated datasets, and outputs are not tailored to the needs of statistical systems, agricultural ministries, or disaster management agencies.

To address these challenges, the proposed technical assistance (TA) will develop a harmonized geospatial agricultural risk database, an analytical and simulation engine, and an operational Digital Twin platform that visualizes hazards, models crop exposure, and simulates climate adaptation scenarios. By integrating satellite based hazard mapping, crop monitoring data, vulnerability indicators, and yield loss analytics, the TA will generate consistent, comparable, and scientifically grounded risk metrics that inform agricultural planning and climate resilience decision making. The TA will also strengthen ground truth data systems through improved sampling protocols, sustained field data workflows, and alignment with national geospatial and statistical processesensuring long term sustainability and ownership.

The TA complements regional initiatives such as the Association of Southeast Asian Nations Food Security Information System (AFSIS) and builds on lessons from recent regional assessments highlighting the need for more timely, standardized, and interoperable agricultural damage data. By generating open source, high resolution agricultural risk analytics, the TA will reinforce regional cooperation while equipping national agencies with practical tools for disaster preparedness, food security monitoring, effective water management and climate informed agricultural planning. Targeted capacity building activities will enable ministries, statistical offices, and geospatial agencies to adopt and operationalize modern EO and AI enabled monitoring systems, while helping address digital capacity constraints identified across multiple countries.

Overall, the TA leverages advances in satellite technology, big data, and machine learning to shift agricultural risk analytics from fragmented, retrospective assessments toward proactive, forward looking decision support. By enabling governments to detect risks earlier, evaluate resilience options, and respond more effectively to climate shocks, the TA will strengthen agricultural resilience, improve food security planning and water management, and support evidence based policymaking amid increasing climate uncertainty.

Impact
Outcome
Outputs
Geographical Location
Regional

Poverty Reduction and Inclusion

Poverty Reduction and Inclusion Classification
Summary Poverty and Social Analysis
The intervention contributes to indirect poverty reduction by strengthening governments capacity to anticipate, assess, and mitigate disaster impacts on agriculture, thereby reducing income shocks and livelihood losses among poor and vulnerable rural households. Improved, timely evidence on crop losses and recovery supports better-targeted public investments, disaster response, and risk financing decisions that help stabilize food supply and rural prices.

Summary of Environmental and Social Aspects

Environmental Aspects
Involuntary Resettlement
Indigenous Peoples

Project Participation and Engagement

During Project Design
During Project Implementation

Contact

Responsible ADB Officer
Masaki, Takaaki
Responsible ADB Department
Economic Research and Development Impact Department
Responsible ADB Division
Data Division (ERDD)
Executing Agencies
Asian Development Bank

Timetable

Concept Clearance
10 Jul 2026
Fact Finding
06 Apr 2026 to 10 Apr 2026
MRM
-
Approval
-
Last Review Mission
-
Last PDS Update
10 Jul 2026

Funding

Project Page	https://www.adb.org//projects/60190-001/main
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