Space and AI: Shaping the Future of Food Security in ASEAN

Ysa Marie Cayabyab

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By Ysa Marie Cayabyab

SYNOPSIS

Climate change and population growth are worsening global food security challenges, threatening stable access to safe and affordable food. Space and AI technologies offer innovative solutions by enabling more accurate climate forecasting, data-driven agricultural planning, and timely disaster preparedness. Through regional cooperation, ASEAN is well-positioned to leverage these technological tools to strengthen food security, reinforce climate resilience, and advance sustainable agricultural development across the region.

COMMENTARY

Food security remains one of the most urgent global challenges of the 21st century, with many nations struggling to secure stable access to safe, nutritious, and affordable food. Climate change is a key driver of this crisis, increasingly undermining agricultural productivity, as demonstrated in last year's drought in Thailand and severe flooding in Vietnam.

These events caused food supply shortages not only in the region but also in global markets, further exposing vulnerabilities in international food systems. Looking ahead, this crisis is likely to worsen as the world's population is projected to reach 9.1 billion by 2050, necessitating a 70 per cent increase in overall food production to meet global demand.

These interlinked challenges highlight the pressing need for innovative, resilient, and sustainable solutions that go beyond traditional agricultural practices. The recent advances in space technologies and artificial intelligence (AI) are stepping into this role, opening new frontiers for strengthening food security through smarter monitoring and more accurate predictive insights.

Space and AI: Advancing Innovation

A key strategy for managing the impacts of agricultural disruptions is climate forecasting. Climate forecasting relies on satellite observations, remote sensing technology, and climate models to project long-term climate trends, thus enabling strategic crop planning, efficient resource allocation, and better mitigation of risks from extreme weather events.

The first significant use of satellites for climate forecasting began in 1972 with the launch of the Earth Resources Technology Satellite (ERTS), later renamed [Landsat 1](#), by the United States' National Aeronautics and Space Administration (NASA). Launched as the first satellite dedicated to monitoring Earth's landmasses, Landsat 1 provided multispectral imagery that enabled scientists to assess vegetation health, soil moisture, and land use changes – critical information for agricultural planning and climate forecasting.

Since then, satellite observations and remote sensing have become essential tools for [crop monitoring](#), [yield prediction](#), [disaster management](#), and [resource management](#). The precision and scope of these capabilities have also expanded substantially with technological advancements and the increasing number of orbiting satellites. For instance, in July 2025, NASA and the Indian Space Research Organisation (ISRO) jointly launched the [NASA-ISRO Synthetic Aperture Radar (NISAR) satellite](#), which was built to monitor Earth's surface movements with centimetre-level precision.

NISAR is expected to deliver data on farming patterns, climate shifts, and sea levels, as well as natural hazards such as earthquakes, landslides, and floods. These insights provide unprecedented visibility into environmental and agricultural conditions, supporting both resilient farming practices and timely disaster response.

In parallel, advances in AI have transformed the way satellite datasets are analysed. Machine learning (ML), a subset of AI, now enables [real-time analysis](#) of vast and complex data streams that were previously difficult to interpret. Although ML's initial application in agriculture during the 1990s was primarily on [soil analysis](#), it has expanded considerably over the [past decade](#), driving innovations in domains such as plant breeding and robot-assisted harvesting.

With recent advances in computing power, data storage, and access to agricultural datasets, these technologies can now deliver more accurate forecasts and enable more proactive, efficient agricultural planning. Together, space and AI technologies form a powerful system that strengthens food security and enhances climate resilience.

Strengthening Regional Cooperation

In modern agriculture, the integration of satellite imagery and AI-driven machine learning has proven to be a game-changer. These technologies generate valuable insights that enable farmers, researchers, and industry professionals to make data-driven decisions, enhancing agricultural planning and productivity.

At the regional level, their impact can be amplified through stronger cooperation. In

particular, by fostering partnerships in climate data sharing, research, and policy alignment, ASEAN countries can collectively enhance forecasting accuracy and develop more effective climate adaptation strategies, ultimately building more resilient food supply chains.

Several ASEAN countries, including Singapore, Malaysia, Vietnam, Thailand, Indonesia, and the Philippines, have already developed notable space and AI capabilities through national space agencies, satellite programmes, national AI strategies, and digital infrastructures. With growing technological capabilities and strong regional partnerships, ASEAN is well-positioned to leverage space and AI to strengthen food security, reinforce climate resilience, and advance sustainable agricultural development throughout the region.

Challenges to the Use of Space and AI Technologies

However, harnessing the full potential of space and AI technologies also brings a range of challenges that must be carefully addressed, especially as the world races towards the 2030 Agenda for Sustainable Development.

Lack of Technical Capacity

The first challenge is that the vast majority of farmers, who are the main stakeholders, are not experts in these emerging technologies. This knowledge gap prevents them from accessing or interpreting satellite data and from understanding how ML algorithms can be applied to make informed decisions.

To bridge this knowledge gap, governments, academia, and industry must collaborate to implement capacity-building programmes that equip farmers with the digital literacy and practical skills necessary to effectively integrate these tools into their agricultural practices. Such initiatives would not only promote adoption but also foster greater trust in the accuracy and usefulness of these advanced forecasting systems.

At the same time, user-friendly systems should be developed to reduce technical barriers. For example, intuitive visualisation tools can enable non-specialists to interpret forecasts accurately without requiring advanced data science expertise.

Lack of Expertise and Infrastructure

The second challenge is that many countries, particularly in Southeast Asia, where the effects of climate change are often most severe, lack the technical expertise and infrastructure needed to develop and implement these technologies. Building and applying ML algorithms to quickly process satellite-derived datasets require highly skilled professionals and scalable computing resources that are often concentrated in wealthier nations.

Addressing this gap requires the development of educational and training programmes that can cultivate local expertise in AI, remote sensing, and data analytics. Given the transboundary nature of climate change, regional collaboration is also beneficial. Neighbouring countries would greatly benefit from pooling resources, expanding

satellite coverage, and sharing data and best practices through knowledge exchange networks and public-private partnerships (PPPs).

High Cost

The third challenge, closely related to the previous one, is the high cost of infrastructure, data acquisition, and system maintenance. This is particularly problematic in low- and middle-income countries where financial resources are limited.

To address this, bilateral and multilateral agreements should prioritise shared technological infrastructure and open-access data exchange, making satellite and AI tools more affordable and widely accessible. Jointly funded, collaborative research initiatives can also further enhance the use of regional satellite data and AI models, maximising their impact while strengthening cross-border forecasting, disaster preparedness, and agricultural resilience. In addition, PPPs can co-invest in scalable infrastructures, ensuring that both costs and benefits are shared equitably.

Going Forward

Beyond these measures, policies must also address equity and governance concerns in the application of satellite and AI for climate forecasting and agricultural development. Issues of data ownership, privacy, and equitable access to digital tools should be governed by transparent regulatory frameworks that protect small-scale farmers from exclusion or exploitation.

Governments and regional organisations must facilitate the creation of platforms for open dialogue to establish common grounds for information exchange, with particular emphasis on supporting vulnerable groups. Ensuring that marginalised communities in the region have equal access to climate-smart technologies will not only strengthen agricultural resilience but also enhance systemic food security.

In the long term, integrating these emerging technologies into agricultural and climate policies should be framed as part of a broader sustainability agenda, one that aligns technological innovation with inclusivity, equity, and regional cooperation.

Ysa Marie Cayabyab is an Associate Research Fellow with the Future Issues and Technology (FIT) research cluster at the S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University (NTU), Singapore.

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