AI + Climate Futures in Asia

A commentary on agricultural digitalisation for climate action in the Philippines

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This brief is produced under the AI + Climate Futures in Asia project, supported by The Rockefeller Foundation.

Copy Editing: The Clean Copy
Design and layout: Nia Thandapani, Gulal Salil
Illustrations: Divya Ribeiro
Production: Avani Tanya

Please cite this brief as Daño, E. 'A commentary on agricultural digitalisation for climate action in the Philippines'. Goa: Digital Futures Lab, 2023.

Thanks to The Rockefeller Foundation and its Asia Regional Office for their support.

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Introduction

Like most Southeast Asian countries, digitalization in general and AI in particular are only starting to gain traction in the Philippines, especially in the agricultural sector.

This is despite sharing borders with countries that are key players in developing AI and digital tools, such as China, Taiwan, Japan, and South Korea, which cumulatively manufacture the bulk of computer chips, sensors, and other components that enable the advancement of digitalization globally.

The Philippines views climate action as the prime motivation to join the digitalization bandwagon. Emissions from the agriculture sector constituted 29% of the country's total emissions in 2020, of which, 44% were emitted from rice cultivation and around 24% from agricultural soils.[1] Yet, of the seven thematic priority areas identified in the country's National Climate Change Action Plan (NCCAP), only food security, water sufficiency, ecosystem, and environmental stability are directly connected to climate actions in the agriculture sector; agriculture is not even included in the key result areas for mitigation. The Climate Change Commission oddly attributed this policy decision to the agricultural sector's "vulnerability for the adverse impacts of climate change".[2] The reality, however, is far more political, as the agricultural sector remains a principal arena in shaping the economic and political landscape and dynamics in the country.

While the more climate-focused concept of "climate-smart agriculture" – which is not necessarily dependent on digital tools – has been on the agenda of the Philippine government for several years now, digitalization is a key component of the more recent vision of "smart agriculture", which involves the use of the internet of things (IoT), smart irrigation, and smart greenhouses. While these two concepts should not be conflated, climate action has increasingly become a key justification for promoting smart agriculture and other variant labels of agricultural digitalization.

1

Key Actors Leading the Conversation on AI and Climate

1 Key Actors

Government

The Philippine government is the principal actor promoting and leading the conversation on AI and climate action. The Department of Agriculture (DA) is actively promoting digitalization in agriculture to boost agricultural productivity.[3]

Over the last eight years, the government launched a series of programmes and policies on digitalization in agriculture during the Duterte administration. Agricultural digitalization has since been incorporated into national development plans as well as investment priority plans, which identify drone technologies and smart farms as investment areas for technologies in agriculture.[4]

The DA has openly embraced the technological transformation of the Philippine agriculture sector through its Agriculture 4.0 agenda, which aims to digitalize the country's agricultural and fishery sector through the use of "modern technologies like hydroponics, genetic modification, blockchain, drones, powerful data analytics, and nanotechnology".[5] These technologies are being promoted primarily to encourage young farmers and agricultural entrepreneurs to engage in agriculture, increase food productivity and quality, strengthen market linkages, and improve rural employment and income. Mitigation of greenhouse gas emissions to address the impacts of climate change on the Philippine agri-fishery sector has also been cited as a rationale behind the Philippine government's push for digitalization in the sector.[6]

Bilateral Scientific and Technical Co-operation

As part of scientific and technological co-operation, the Philippine government has forged partnerships with foreign governments, such as Russia and South Korea, as well as with private companies, to advance agricultural digitalization, which may include the use of artificial intelligence (AI).

Scientific and technical co-operation in agriculture and rural development with countries possessing advanced digital technologies is also attracting private-sector investments in smart farming. Russia's Knowledge Genesis Group company is advocating for the use of AI, drone and satellite monitoring in the Philippines to provide real-time results, playing a key role in smart agriculture.[7] Green Plus, a South Korean company that specializes in the greenhouse business, has piloted "smart greenhouses" in the country to provide an optimal environment for agricultural, livestock, and fishery production. The power requirements of the greenhouses are supplied by the local electric co-operative and stand-by solar panels. Additionally, all components are imported from South Korea, which also provides technical know-how and expertise to the collaboration.[8]

Transnational Companies

Seeds and agrochemical transnational companies are actively promoting their own digital/AI-based technologies and products among Filipino farmers, primarily as vehicles to sell their patented agrochemicals.

For instance, through its Xarvio scouting app, BASF enables farmers and crop technicians to detect pests and diseases in their farms through photo recognition and provides recommendations for the company's proprietary pesticides to address the identified problems.[9] The Xarvio app, which the farmers can download on their smartphones, serves a dual purpose. It enables them to capture images and uses a plant-modelling platform powered by algorithms designed by BASF to promote their own "solutions". The app also has a "community-based radar function" for farmers to identify threats in the surrounding fields.

Syngenta and Bayer are also promoting the use of drones for spraying their respective proprietary agrochemicals. Bayer recently launched a strategic partnership with XAG – a leading manufacturer of agricultural drones based in Guangzhou, China – on digital farming technology in Southeast Asia, including the Philippines.[10] The partnership involves the distribution of XAG products, such as spray drones, agricultural utility vehicles, and farm cameras, through Bayer's distribution and marketing channels.

Agriculture Technology (Agtech) Start-ups

Several start-ups in the agricultural sector, especially in agriculture technologies, or "agtech", have sprouted in recent years, especially during the COVID-19 pandemic when digitalization played a key role in the agricultural value and supply chains during one of the world's longest and strictest lockdowns.

Online markets – especially those that claim to provide direct links between farmers and urban consumers – were created mostly by young entrepreneurs. Among the more prominent agtech start-ups is Mayani (literal translation in English: "with harvest"), which is backed by funds from the Asian Development Bank (ADB) and the Japan International Cooperation Agency (JICA). The start-up also received USD 1.7 million in a seed funding round from AgFunder, a Silicon Valley agtech venture capital, and investments from a host of institutional and so-called "angel" investors from across the region and domestically.[11] Like many agtech start-ups in the Philippines that started during the pandemic, Mayani connects small-scale farmers and fisherfolks to consumers through its online and business-to-business (B2B) platforms. Other agtech start-ups operate on a micro-scale, often without a website, but in a similar fashion – they link consumers to producers who provide market linkages to farmers in specific regions that produce specialty products such as upland coffee, as in the case of Sustainable Sagada. This start-up was set up to provide direct marketing channels for small-scale farmers in Sagada, Mountain Province in the northern highlands.

Anihan Technologies (AniTech) manufactures and installs locally made sensors that can monitor temperature, humidity, and other environmental factors in greenhouses and warehouses.[12] The data gathered by its sensors are then sent to the company's web-based centralized platform, which is accessible through a computer or mobile phone and alerts operators or farmers on the status of these factors in the controlled environment.

Financial technology (fintech) start-ups, such as PearlPay, PayMaya, GCASH, etc., offer general payment services at affordable rates and secured end-to-end banking solutions. Further, their platforms are accessible through smartphones, allowing the system to gain popularity as an alternative mode of payment for agricultural transactions, especially in rural areas, where residents have limited access to banking services. GCASH, in particular, has become quite mainstream in recent years since it is a subsidiary of one of the two major players that dominate the country's telecommunications sector, Globe Telecoms, which gives it an advantage over other fintech solutions.

2

Dominant Applications

2 Dominant Applications

While the share of the agriculture, forestry, and fisheries sector in the Philippine economy hovers at only around 10% of the total GDP over the past decade, it remains a critical sector in the archipelagic country since about a quarter of the labour force is employed in agriculture, not including those working in the service and industry sectors which, in turn, may deal with agriculture or products derived from it. This makes the agriculture sector as a whole a promising domain for the application of digital technologies, including AI.

However, the use of AI in the agriculture sector and food system in the Philippines is not yet widespread. This is primarily due to a lack of enabling infrastructures, investments, and unclear regulations. Meanwhile, its potential to improve productivity and efficiency, increase food production, and address the climate crisis is being heralded by proponents in the government. The key digital technologies integral to the deployment of AI in agriculture that are being promoted in the country are as follows:

Sensors

Mainly used in controlled environments, this technology is widely used by many start-up companies, especially the ones led by young entrepreneurs. In the Philippines, there are agtech start-ups that manufacture sensors locally or sell imported sensors for monitoring temperature, humidity, carbon concentration, and other environmental factors, primarily for use in warehouses and greenhouses. The data thus collected is then fed into centralized platforms and stored and processed in commercial clouds such as Amazon Web Services (AWS) and Microsoft Azure.

Drones

Local agricultural offices use drones to capture images and collect data to determine crop health in specific areas to monitor drought, flooding, and pest infestation, and to provide evidence-based strategies for disaster response and risk management in agricultural areas.

The DA employs drones in post-disaster operations and damage validation, as well as in assessing the extent of pest and disease infestation in key export crops such as coconut and banana. Private companies are deploying drones to spray fertilizers and chemical pesticides. Japan's DMM Corporation Ltd. has pilot-tested the use of drone sprayers in strawberry fields and vegetable farms in the northern highlands of Luzon.[13] Interestingly, DMM.com started as a Japanese e-commerce and internet company that managed an entertainment site for online goods and services[14] and has since diversified into a wide array of high-tech businesses, including 3D printing and manufacturing of drones for the Southeast Asian and African markets.[15]

Drones are more popularly used to spray pesticides, as the cost of these services is often cheaper than hiring farm labour. Syngenta has launched a programme deploying drones for spraying its proprietary pesticides and also for crop monitoring, area mapping, and capturing images in farms to determine plant health and condition.[16] Bayer has partnered with XAG to deploy their combined digital-based technologies in Southeast Asia, including in the Philippines.[17],[18] Apart from fertilization and crop protection, Bayer promotes the use of XAG drones for direct seeding in rice farms, with the claim of reducing labour costs and optimizing the use of hybrid seeds vis-à-vis traditional transplanting methods and manual seeding.[19]

Smartphone Applications for Agriculture

The DA has developed several smartphone apps that are aimed at enabling farmers and agricultural producers to obtain information on weather, marketing channels, and price trends so they can improve farm productivity, increase farm income, and make informed decisions. There are apps developed to help farmers identify weeds (eDamuhan), compute fertilizer requirements of soil (MinusOne-Element Technique), assess the nitrogen status of rice plants based on leaf colour (Leaf Color Computing), and provide information on suitable rice varieties, seed and grain quality, and yield under local conditions (Binhing Palay). Some apps help farmers keep records of their farming activities and expenses (AgRIDOC) and others help policymakers in making evidence-backed decisions (SetLab) based on the status of rice farmers and rice value change through online analytics (Ricelytics).

There is a proliferation of apps designed by government agencies and private companies to provide services, training, and online marketing channels for micro, small, and medium enterprises (MSMEs), co-operatives, and entrepreneurs; linking producers to sellers; and delivering products directly to consumers. Apps with catchy local names, such as BayaniKita (*"Byaheng Digiskarte ni ANI at KITA"*: digital approach in yield and profits), have proliferated the market, while several others have been piloted in limited areas and/or deployed widely, mostly in partnerships between government agencies and private entities.

3

Enablers for Agricultural Digitalization

3 Enablers for agricultural digitalization

To facilitate the deployment of these digital tools and technologies in the food system and agriculture sector, the government launched the country's first state-funded smart farm, designed to develop and promote urban farming and high-tech plant conservation under the PHP 128 million (USD 2.5 million) Smart Plant Production in Controlled Environments (SPICE) programme.[20] Digital tools have also been incorporated into existing efforts and programmes such as the Philippine Rice Information System (PRiSM), which was developed by the International Rice Research Institute (IRRI) and is the first satellite-based rice monitoring system in Southeast Asia. In operation since 2014, PRiSM uses satellite imagery and other new technologies to generate information on planted rice areas, seasonality, yield, and risks to crops.[21] IRRI has also developed and disseminated mobile and desktop applications, such as the Rice Corn Manager, which makes recommendations to farmers on how to increase farm yield. IRRI together with the Philippine Rice Research Institute and the DA developed AutoMonPH, an internet of things (IoT) system for real-time monitoring, reporting and verification of water supply and requirements in rice areas using wireless connectivity.[22]

Together with the IRRI, the DA has implemented the Pest Risk Identification and Management (PRIME) project, which standardizes the process of crop health assessment using smartphones to generate pest risk advisories. This project uses pest surveillance data and provides pest management strategies and tactics to help farmers reduce crop losses due to pests and diseases.[23] Digital tools have also been integrated into the current administration's banner programme in the rice sector – the Masagana Rice Program (masagana means "bountiful"), which intensified the use of hybrid seeds, fertilizers, and pesticides as a strategy to increase rice productivity.

The official push for digitalization in agriculture goes all the way to the provinces through the province-led agriculture and fisheries extension systems (PAFES), which involve partnerships among local government units, DA agencies, state universities and colleges, the private sector, and farmer–fisherfolk organizations through the agriculture value chain.

3 Enablers for agricultural digitalization

In 2019, the DA launched the Digital Farmers Program, a ladderized capacity-building programme to empower farmers through basic digital tools such as smartphones, social media, agricultural applications, and e-commerce. The government is in collaboration with Smart Communications, the other major telecommunications company that dominates the Philippine market besides Globe Telecoms, which provides the digital infrastructure for the programme.[24] A related programme – the FutureRice Farm – was launched in 2015 to prepare Filipino farmers for future farming scenarios – such as farm automation and knowledge-based competition – through GPS technologies, information and communication technologies (ICTs), agritourism, and agripreneurship.[25]

The Philippines' farmer registry and information systems are also being digitalized with the help of funds from the World Bank. The Farmers Interventions Monitoring System (FIMS) contains a digital registry of farmers and fisherfolk which is used by the DA to determine the beneficiaries of its programmes.[26] It also contains the list of previous and current projects of the agency, along with a geolocation app-based real-time monitoring and evaluation system. The government is currently digitalizing farm information, including but not limited to information regarding landowners, tenants, or farmers, lot numbers, land areas, irrigation facilities, payment information, and geographic locations, through the Enhanced Farmland Geographic Information System (eFGIS). The government's long-term plan for the digital transformation of the food and agriculture systems includes an integrated crop management system called PalayCheck, which will cover the entire rice value chain and organizational processes and operations, as well as the establishment of a big data analytics centre. The DA is currently fast-tracking the development of a digital roadmap for the agri-fishery sector to enhance coherence among its array of programmes and initiatives in the digitalization of the sector.

Public research and development institutions are also investing in developing AI-based technologies for agriculture. In 2021, the Department of Science and Technology's Advance Science and Technology Institute (DOST-ASTI) launched a project called ROAMER (Robot for Optimized and Autonomous Mission-enhanced Responses), which aims to develop prototypes of unmanned ground vehicles that can help increase agricultural productivity by improving farmers' day-to-day operations and on-farm decision-making through the use of AI-based methods in computer vision, sensing, and navigation.[27] DOST-ASTI has also launched the Gul.ai Project (from the Filipino word gulay which means "vegetable") to make farming attractive for the youth by utilizing ICT, IoT, and AI in developing agricultural projects and experiments in crop nutrition, collecting farm data, and monitoring environmental factors.[28]

Project SARAI (Smarter Approaches to Reinvigorate Agriculture as an Industry) is a multi-million and multi-year action-research programme funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD), which is working towards reducing climate vulnerabilities in agriculture and rebuilding the sector as an industry.[29] The project components include digital systems for agricultural monitoring, water management, drought forecasting, crop assessment and forecasting, pest identification, soil profiling, crop nutrient assessment, weather monitoring and forecasting, web-based applications, and capacity building.

3 Enablers for agricultural digitalization

As a public financier, the DA's Agricultural Credit Policy Council (ACPC) extends loans to the sector's young entrepreneurs through a dedicated programme called Kapital Access for Young Agripreneurs (KAYA) to finance working capital and/or fulfill the fixed asset requirements of start-ups or existing business projects of young entrepreneurs and agri-fishery graduates.[30] Landbank in the Philippines launched a lending programme for rural banks to digitalize their banking operations to reach and provide services to more Filipinos in the countryside.[31]

It is important to note that as of now no independent studies demonstrate the actual impact of the current applications of AI and digital technologies that are being adopted and deployed in the Philippines by government agencies, transnational corporations, agtech start-ups, and other players in the food industry and agricultural sector on climate action, agricultural productivity, or farmers' incomes.

4

Emergent and Potential Socio-economic Impacts

4 Emergent and Potential Socio-economic Impacts

With the current poverty incidence among farmers and fisherfolk increasing to 30% vis-à-vis the national rate of 18.1% in 2021, ensuring that small-scale farmers and fisherfolk have access to AI/digital-enabled technologies remains a critical issue in the Philippines.[32]

The ability of individuals to afford AI-enabled digital tools and services will determine who benefits from the advantages and potentials offered by such technologies. As has been the case for emerging technologies introduced in the food industry and agricultural sector over the decades, AI and digitalization could potentially aggravate the wide income and wealth gaps in the rural areas of the Philippines.

Connectivity or access to digital infrastructures, even to a basic internet connection, is crucial in determining access to AI-enabled digital tools and services. There is a wide urban–rural disparity in internet connectivity in the Philippines, with only 22.7% of households in rural areas having access to the internet, compared to 42.5% of households in urban areas.[33] This disparity, in effect, could be wider across income groups in rural areas, with smallholders, subsistent farmers, tenants, and agricultural workers having much less connectivity than farmers with larger landholdings – something that may not be captured in official statistics. A similar disparity may also be expected in connectivity among rural women compared to rural men, as well as across income groups. The Philippines is among the countries with the slowest internet speeds globally – this ground reality could be far worse in rural communities, farms, and upland communities where the presence of digital infrastructures is much weaker than in cities and towns. The motivation to penetrate potential smartphone users in rural and upland areas could explain

why most government programmes encompass digital apps and services and why their agtech counterparts are collaborating with either of the two dominant telecom providers in the country. However, rather than working towards the actual needs of the marginalized and disadvantaged communities, such a commercial drive will depend largely on the density of potential users in identified service areas, which determines the profitability of setting up internet infrastructure for telecom companies. Commercial access to internet connectivity and digital tools could present an additional financial burden on farmers, especially smallholders and subsistence farmers who mostly live below the poverty line.

The issue of control over data collected from farmers and their farms through digital apps and platforms is generally glossed over in the deployment of such digital tools and services. There is practically no information available on the websites of government agencies involved in the development and deployment of these technologies regarding where the data they collect are stored and processed, and whether there are agreements on data ownership between these government agencies or agtech start-ups and the commercial providers of cloud services. Some government officials have recently acknowledged these gaping holes that are not covered under the country's data protection regulations and declared that the government will aim to address these by pushing for a law on agricultural digitalization in Congress.[34]

Until the issues on control over agricultural data are addressed, the digital tools and services deployed by the government that extract data from farmers and their farms as well as the digital solutions powered by algorithms designed by companies to push for their proprietary products will only reinforce corporate stranglehold over farmers and the agricultural sector.

4 Emergent and Potential Socio-economic Impacts

None of these so-called digital solutions is likely to address issues in climate change, since they mostly involve the continuous use of and reliance on agrichemicals, synthetic fertilizers, and long value chains – which are key contributors to greenhouse gas emissions in agriculture.

Additionally, the proponents of agricultural digitalization do not discuss the environmental and climate footprints of the manufacture and widespread adoption of digital tools and technologies, including the extraction of critical minerals for the production of efficient batteries to power digital technologies, land competition around the operation of data centres, and the water and energy use in the production of microchips that serve as the "brain" of digital technologies.

5

Future Prospects

5 Future Prospects

Policy, regulations, and public participation in the societal evaluation of AI technologies are key in aligning AI trajectories with positive climate action in the Philippines. The DA acknowledges that the country's current regulations on data privacy and data flows are not very relevant and appropriate in the context of food systems and the agricultural sector and are not adequate to protect the interests of farmers.

The agency has drafted a bill on agricultural digitalization, which will be submitted to the Philippine Congress for deliberation and eventual adoption. According to an agriculture official who presented the plan in a forum with civil society organizations, the bill, among other things, will have provisions for the protection of data privacy of farmers and their farms, address issues on data control, and make it less bureaucratic to operate digital tools, simplifying the arduous licensing requirements from various agencies as currently required.[35] However, having dedicated legislation on agricultural digitalization will not spontaneously result in benefits for all stakeholders in the agricultural sector – especially smallholders and marginalized producers who have traditionally been squeezed out of agricultural programmes deploying new technologies – nor will a law on agricultural digitalization result in meaningful climate actions in agriculture.

For AI and digitalization in agriculture to align with climate action, there should be explicit provisions in laws, policies, and regulations that orient the use of these technologies towards adaptation in agriculture and reduction of greenhouse gas emissions across the agricultural value chain.

5 Future Prospects

AI-based technologies can only be useful to farmers in marginalized areas if they are accompanied by solidly grounded extension services and local infrastructures that can translate such data into accessible knowledge that enhances local realities, capacities, and experiences. Public investments should focus more on ensuring that agricultural extension services are effective vehicles for capacitating, supporting, and enabling farmers and agricultural producers – particularly smallholders, subsistent farmers, and agricultural workers. AI and digital technologies should not be regarded or pushed as the default technological solution to problems and challenges in the agricultural sector. Policies and laws should be oriented towards enabling smallholders and subsistent farmers to access appropriate AI and digital tools, as well as to impart knowledge about how these technologies operate, who owns them, and the issues that surround them. This will serve as a basis for making critical and informed decisions on whether to adopt and adapt these technologies.

The usefulness and relevance of AI and digitalization to smallholders, subsistence farmers, and agricultural workers can best be utilized by recognizing, supporting, and incentivizing local and endogenous capacities and innovations, which will allow marginalized communities to adopt and adapt these technologies based on their needs and circumstances.

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About the Project

Commissioned in early 2023 by The Rockefeller Foundation, this project explores the intersection of Artificial Intelligence and Climate Action in Asia. It examines opportunities, challenges and risks across three domains – agriculture and food systems, energy transitions, and disaster response in nine countries - Bangladesh, China, India, Indonesia, Malaysia, Singapore, Thailand, The Philippines and Vietnam.

We assembled a network of regional experts to help guide our investigation and provide context specific insights.

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Digital Futures Lab is an interdisciplinary research collective that interrogates the complex interaction between technology and society in the global South. Through evidence-based research, public engagement and participatory foresight, we seek to realise pathways toward equitable, safe and just digital futures.

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