

POLICY BRIEF

Progressing Indonesia's Agriculture 4.0 Through Research and Application Towards ASEAN Digitalization Initiatives in the Covid-19 Pandemic

Silvia Uthari Nuzaverra Mayang Mangurai^{1,2}, Achmad Solikhin^{1,3*}, Eti Artiningsih Octaviani^{1,4}, and Anidah¹

¹Southeast Asia Regional Center for Tropical Biology (SEAMEO BIOTROP), Indonesia

²Forest Products Technology and Science, Faculty of Forestry and Environment, Bogor Agriculture University (IPB University), Indonesia

³Indonesia Green Action Forum (IGAF), Indonesia

⁴Forest Engineering, Institut Teknologi Sumatera (ITERA), Indonesia

*Corresponding author email: achmad.solikhin1993@gmail.com

Issues:

How does digital agriculture studies and application progress the embodiment of Indonesia's agriculture 4.0 during the Covid-19 pandemic? How can the ASEAN Digitalization Initiatives be a baseline for achieving Indonesia's Agriculture 4.0 during the pandemic?

Key messages:

1. Digital agriculture research and its applications have long been introduced and limitedly developed in Indonesia in the form of smart farming, precision farming, and decision farming. With the pandemic and the New Normal era, its applications have been massively accelerated to be extended in Indonesia. The emerging technologies, which were studied and applied to disrupt Indonesia's food and agriculture sector, include artificial intelligence (AI), internet of things (IoT), blockchain, smartphone, drone, GIS and GPS, robotics and automation.
2. Most digital agriculture transformation research is disseminated in Java, Sumatera, Kalimantan, and Sulawesi where Java island is observed to produce the highest digital agriculture studies. Similar to the distribution map for digital technology transformation research, its applications are dominantly headquartered in Java island, especially in DKI Jakarta and West Java. In the view of applications, micro, small and medium enterprises (MSMEs), startups, and industries have benefited the technologies as a means to survive in the midst of the pandemic.
3. The Government of Indonesia (GoI) has enacted national strategies that pertain to digital transformation in the food and agriculture sector but there are very limited strategies, which accommodate and interlink the pandemic implications. The GoI has initiated the transformation earlier than the establishment of ASEAN Digital Transformation initiatives.

These strategies and agendas at the regional level were made during the pandemic and one of the recovery measures to deal with the effects of the Covid-19 pandemic.

4. To date, regional "call for action" initiatives on agriculture digitisation and digitalisation are still limited although these initiatives have integrated national strategies and agendas from ASEAN Member States (AMSs), especially Indonesia. ASEAN agriculture 4.0 initiatives need to be more actualized to the ground supported with good management of project lifecycle to achieve the intended deliverables.

Introduction

According to WHO (2021), as of 18 November 2021, about 4,251,945 cumulative Covid-19 cases are identified in Indonesia with total cumulative death of 143,698. The GoI applied restricted human movement measures to curb the transmission of the Covid-19, leading to multiple shocks on agro-food supply chains. The shocks can be identified with the reduced production of agriculture commodities, consumers demand changes, and supply chain disruptions. However, the pandemic has also unfolded great opportunities to digitise and digitalise Indonesia's agriculture sectors. The GoI utilises the momentum to enact regulations and to accelerate actions that support digital transformation of the sector. These strategies are intended to embody goals stipulated in their digitalization initiatives, such as the 2018 Making Indonesia 4.0 Roadmap, the 2019 E-Commerce Roadmap, and the 2020 Go Digital Vision.

In the Covid-19 pandemic era, a dramatic increase in digital technology studies and digitalization practices in the public and private sector are recorded, aiming to support the swift digital transformation in Indonesia's agriculture sector. However, gaps between digital agriculture studies and practices are still widening, and the policies issued by the GoI to support the transformation are still finite, especially in mainstreaming digital agriculture into the pandemic-generated national strategies. In addition, some digital agriculture companies underwent bankruptcy and many of them have been still retained with difficulties during the pandemic. As a result, support of the government is necessarily anticipated in order to accomplish a sustainable digital economy.

At regional level, as a part of the ASEAN Member States (AMSs), the GoI also have provided recommendations and inputs for the development of ASEAN digitalisation initiatives. These initiatives are consummated into statements, framework, masterplan, roadmap, guidelines, strategies, and projects. Adopted initiatives can be a baseline or reference for AMSs to achieve ultimate regional goals towards ASEAN Fourth Industrial Revolution (ASEAN 4IR) that is in accordance with ASEAN Community Vision 2025, to set national strategies for digital transformation in certain sector, and to provide multiple benefits in the boost of a nation's economy, society, and environment. In agriculture sector, smart farming and precision farming has been adopted in national arena but regional agriculture 4.0 initiatives are still observed very limited to proliferate. With the presence of the pandemic, the GoI and other AMSs are expected to become more agile than predictive in staging the regional "call for actions", which support their respective national digital agriculture strategies and regional initiatives.

Trend in digital agriculture studies and practices

Digital divide, which comprises access, use, and quality divide, is one of the challenging issues for revolutionizing Indonesia's agriculture sector from conventional into advanced and digitized. The phenomenon is due to lack of digital literacy, accentuated social differences, age and gender discrimination, and geographic conditions. That is similar to the study reported by the Katadata Insight Center (2020), reporting that Indonesia's digital literacy score was 3.47 out of 5.00 (average to good) in which gender, age, quality access, education, and geography were correlated with digital literacy score. Utilization of digital technologies in the sector has been continuously researched and applied in Indonesia (Figure 1). An interactive map is also available at this link: <http://agriculture40research-companies.gis.co.id/>, providing information about both digital agriculture studies and their application in startups and public purposes.

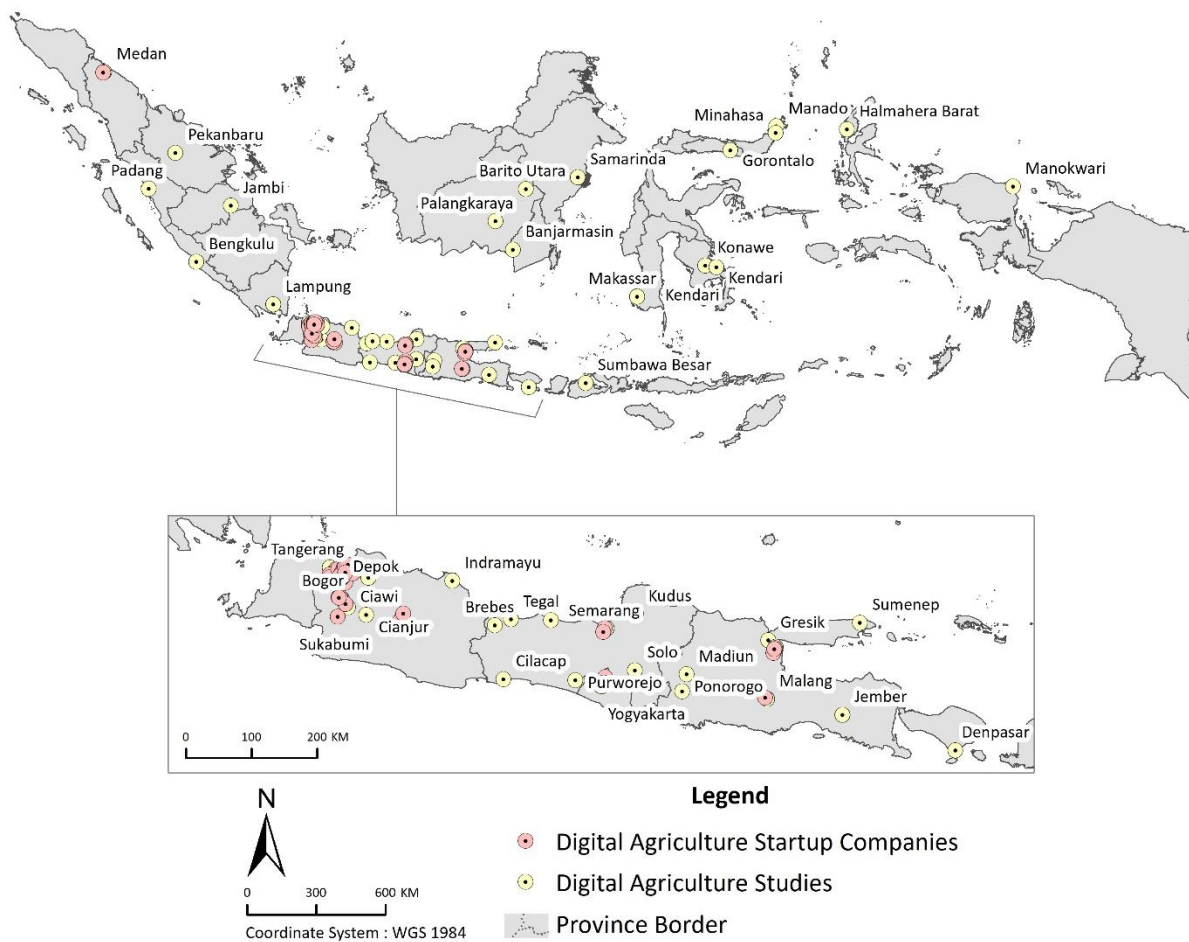


Figure 1. Digital agriculture studies and applications in Indonesia

It can be seen that digital agriculture studies in Indonesia are aggregated in Java Island, and are unevenly distributed in Sumatera, Borneo, Sulawesi, and Papua. However, their applications are mostly concentrated in Java Island and are not detected in Kalimantan, Borneo, and Papua. It can be surmised that the centered digital studies in Java Island have a positive effect on the

development of the converging agriculture 4.0 applications. However, as both the studies and applications are only concentrated in Java Island, digital divide will become a real threat for agriculture 4.0 development. As a result, the GoI is suggested to ensure equal internet penetration, individuals using the internet, and digital literacy throughout the islands in Indonesia.

Big data, cloud computing, AI, IoT, blockchain, smartphone, mobile apps, drone, GIS and GPS, robotics, and automation are the examples of emerging digital technologies that have been studied and applied in Indonesia. These technologies are applied in startup companies and other industrial purposes as a baseline technology, which stirs the business (Table 1). Such purposes include fintech (peer-to-peer lending), farmer advisory, e-commerce, digital marketplace, mechanization platforms, traceability, and food delivery.

Table 1. Startup companies in Indonesia using digital agriculture technologies

Purpose of digital technologies	Type of digital technologies	Examples of company
Fintech (peer-to-peer lending)	Mobile apps, smartphone, IoT, and blockchain	Eragano, TaniFund, InFishta, and Crowde
Farmer advisory	AI, IoT, smartphone, and mobile apps	Karsa, NuraFarm, and eFishery
E-commerce	Smartphone, mobile apps, cloud computing, and website	Aruna, Shopify, and Warung Pangan
Digital marketplace	AI, smartphone, mobile apps, and website	Tokopedia, Agromaret, Pasar Tani, Eden Farm, Chilibeli, 8Villages
Mechanization process	IoT, digital software, drone, smartphone, and GIS	Jala, AgroDrone, Biops Agrotekno Indonesia
Digital tools marketing	IoT, digital software, website, and smartphone	Tunas Farm, Jala, Biops Agrotekno Indonesia
Traceability	Big data, AI, blockchain, and mobile apps	Hara, Koltiva, MSMB
Food delivery services	AI, IoT, smartphone, and mobile apps	Grab, Gojek, and Shopee

Strategies in digital agriculture transformation

The GoI has developed digitalization and digitization strategies, which cover various economic development sector, such as food and agriculture, energy, industry, and tourism. These strategies include program initiatives, policies, action plans, and vision. The GoI has commenced to issue digital agriculture strategies since 2013, and strategies on digital agriculture transformation are continued to enact. Two national initiatives were established to bolster digital agriculture revolution, namely National Movement of 1000 Digital Startups and Making Indonesia 4.0 (Toward 2030). These initiatives, which are interoperated by interministerial agencies, facilitate agriculture startups, and food and beverage industries on supporting 4IR implementation.

These strategies are continuously strengthened with the presence of policies and national plan. Policies released under the GoI are such as: 1) Decree of Ministry of Agriculture No. 259 Year 2020 on Ministry of Agriculture Strategic Plan 2020-2024, 2) Ministry of Agriculture Regulation No. 16 Year 2013 on Guidelines for Agricultural Extension Information Management System in Ministry of Agriculture, 3) Law of the Republic of Indonesia No. 11 of 2020 on Job

Creation (Omnibus Law on Job Creation), 4) Ministry of Agriculture Regulation No. 4 Year 2019 on Guidelines for Agricultural Human Resources Development Movement Towards World Food Barns 2045, 5) President Regulation No. 39 Year 2019 on One Data Initiative (Satu Data Indonesia); and 6) Presidential Regulation No. 74 Year 2017 on Road Map of the National Electronic-Based Trading System (e-Commerce Road Map) 2017-2019. Ancillary national strategic plan, STRANAS KA: National Strategy for Artificial Intelligence 2020-2045, was also published that integrates food security as a major agenda for AI application. All these activities of these strategies are coordinated by interministerial bodies, especially under the Ministry of Agriculture.

Through these strategies, ultimate deliverables to the achievements of the Digital Energy of Asia by 2020 and Making Indonesia 4.0 by 2030 have been progressively made. That also occurs, for instance, as of 22 November 2021, the Digital Energy of Asia initiative has accomplished its goal in which there were more than 1,160 startups that printed more than 85,000 founders with a geographical distribution in 20 cities. Supported with good digital ecosystem, Indonesia continues to make a “big bang” as the the fifth largest startup in the world as notified by the Startup Ranking. As of 23 November 2021, the Startup Ranking registered about 2,311 startups. Besides digital startups, Indonesia also has a target to digitalize 30 million MSMEs by 2024, and to date, there have been 8 million MSMEs that have been digitally transformed. In 2021, Indonesia is also ranked as the top four (80%) of the percentage of internet users who have made at least one purchase online in Southeast Asia after Singapore, Thailand, and Malaysia. A report from AlphaBeta projected that digital flows will enable Indonesia's digital trade to gain around more than USD 160.8 billion in economic value by 2030 (Ministry of Communication and Information 2021). In term of agriculture sector, digital agriculture studies are already distributed equally in Indonesia, and the trend of the research tends to increase. In addition, the number of Indonesia's digital startup companies on food and agriculture sector has increased since 1999, and these companies are mostly based in DKI Jakarta and West Java.

Covid-19 pandemic implications on digital agriculture

It is well-noted that the Covid-19 has brought about setbacks and opportunities for Indonesia's food and agriculture system. The pandemic has prompted the Gol to issue some national strategies to transform the agri-food system through digitization and digitalization. However, limited strategies that integrate both digital agriculture and the pandemic, such as a) National Movement of 1000 Digital Startups: The Digital Energy of Asia, b) Satu Data Indonesia regulated under the President Regulation No. 39 Year 2019 on One Data Initiative, and c) STRANAS KA: National Strategy for Artificial Intelligence 2020-2045. These strategies have contributed to economic recovery caused by the pandemic implications. Although some of the planned activities under these strategies are also hampered and suspended to commit during the pandemic, cyber-physical systems of digital technologies can be benefited from progressing the goals of each strategy.

During the pandemic, it is also recorded that agriculture 4.0 studies still forward to increase, and as seen in Figure 1, the studies are almost carried out throughout Indonesia although the studies are mostly agglomerated in Java Island. In line with the agriculture 4.0 research distribution map, digital agriculture startup companies observed were established within the

pandemic period between 2019 to now, such as AgroDrone, Chilibeli, E-Jaring, Stelina, MDPL Farm, and so forth. However, as reported by the Startup Ranking, there has been a decrease in startup companies from 2019 (2,400 companies) to 2021 (2,311 companies). Startup companies are also observed in bankruptcy, and have carried out some changes in work performance and behavior management, digital technology features, business model, and organizational and financial arrangements. For instance, customers are preferable to use contactless digital food delivery features of these companies, such as GrabFood, GoFood, ShopeeFood, for avoiding the spread of the Covid-19. Google, Tamasek, and Bain&Company (2021) reported that food delivery and e-commerce in 2021 are stronger than 2020. In 2021, transport & food and online media grew by 36% and 48% YoY respectively, while e-Commerce remains the main growth driver at 52% YoY (\$35B to \$53B). The GoI also progress economic recovery as an impact of the Covid-19 pandemic through MSMEs digitalization, and as of May 2021, there were a tremendous increase in digitalized MSMEs of 13.5 million business actors (21%).

Indonesia agriculture strategies in ASEAN digitalization

During the pandemic, AMSs produced strategies or initiatives that provide guidance, recommendations, and action plans to expedite digital transformation for economic recovery from the pandemic effects and for digital economy embodiment (Table 2). These initiatives were enacted to support each other initiatives without overlapping, and are mostly adopted by AMSs as immediate term strides within a certain period (about 5-year implementation) for ASEAN’s digital transformation for economic recovery from the pandemic and digital economy integration. These initiatives are also anticipated to carry sustainability for their exit strategies after their implementation are settled.

Table 2. Regional digital initiatives developed by AMSs

Name of digital initiatives	Adoption date and by	Content of regional digital initiatives	Relations to food and agriculture
ASEAN Digital Master Plan 2025	N/A	This Master Plan provides guidances for AMSs through five-year actions to achieve both a digital economy and a digital society.	Digital technologies, services, and ecosystem powering ASEAN are used to address agriculture issues interlinked with climate change.
ASEAN Declaration on Industrial Transformation to Industry 4.0	02 November 2019 by ASEAN Leaders	This declaration is intended to optimize and accelerate the use of industry 4.0 for startups, MSMEs, e-Government, smart cities, and vocational Educations with ultimate goals to achieve economic growth, inclusive and equitable economic development, ASEAN centrality maintenance.	N/A (not directly mentioned)
Consolidated Strategy on the Fourth Industrial Revolution for ASEAN	26 October 2021 by ASEAN Leaders	This strategy provides guidance for AMSs within building the ASEAN Digital Community in the field of political and security, economy, and socio-culture.	Food and agriculture sector is included in form of smart agriculture adoption.
ASEAN Leaders’ Statement on Advancing Digital Transformation in ASEAN	26 October 2021 by ASEAN Leaders	This statement is addressed to advance digital transformation and integration in ASEAN with engaging community pillars, sectoral bodies, and external partners.	N/A (not directly mentioned)

ASEAN Comprehensive Recovery Framework (ACRF) and its Implementation Plan	12 November 2021 by ASEAN Leaders	This Framework and its Plan serve as a consolidated exist strategy and comprehensive recovery efforts from the pandemic, which consists of five broad strategies.	The ASEAN Guidelines on Promoting the Utilization of Digital Technologies for ASEAN Food and Agricultural Sector was developed.
ASEAN Digital Integration Framework Action Plan (DIFAP) 2019-2025	06 September 2021 by ASEAN Economic Ministers	This Framework provides solutions to overcome critical barriers and to accelerate existing ASEAN platforms on realising digital integration.	N/A (not directly mentioned)
ASEAN Comprehensive Framework on Care Economy	26 October 2021 by ASEAN Leaders	This Framework provides strategic priorities for ASEAN’s development of the care economy in response to complex crises and challenges.	N/A (not directly mentioned)
ASEAN-U.S. Leaders’ Statement on Digital Development	26 October 2021 by US-ASEAN Leaders	This Statement articulates the US-ASEAN partnership and commitments in supporting digital development in ASEAN.	N/A (not directly mentioned)
ASEAN Plus Three Leaders’ Statement on Connecting the Connectivities Initiative	04 November 2021 By ASEAN Plus Three Leaders	This Statement emphasizes the importance of interdependence and connectivity among ASEAN Plus Three in realising collective efforts for regional integration and cooperation.	N/A (not directly mentioned)
The Bandar Seri Begawan Roadmap: An ASEAN Digital Transformation Agenda to Accelerate ASEAN’s Economic Recovery and Digital Economy Integration	21 October 2021 by ASEAN Economic Ministers	This Roadmap provides guidance for AMSs to take immediate term steps for digital transformation intended to accelerate economic recovery and digital economy integration.	N/A (not directly mentioned)
ASEAN Guidelines on Promoting the Utilization of Digital Technologies for ASEAN Food and Agricultural Sector	27 October 2021 by ASEAN Agriculture and Forestry Ministries	The Guidelines provides five key guidelines for AMSs and various stakeholders in the field of food and agriculture sector in making data driven decisions for digital technologies choices, utilization and assessment.	The Guidelines provide five guidelines to achieve agriculture 4.0.

In term of food and agriculture sector, four regional initiatives are identified to push forward to accomplish agriculture 4.0 during the pandemic, namely: ASEAN Digital Master Plan 2025, Consolidated Strategy on the Fourth Industrial Revolution for ASEAN, ASEAN Comprehensive Recovery Framework (ACRF) and its Implementation Plan, and ASEAN Guidelines on Promoting the Utilization of Digital Technologies for ASEAN Food and Agricultural Sector.

In issuing these initiatives, the GoI had a strategic position to propose their recommendations on digital agriculture issues that are relevant to its country's condition. In terms of food and agriculture sectors, the GoI has been represented by sectoral and sub-sectoral working groups under the ASEAN Ministers on Agriculture and Forestry (AMAF) so that their recommendations can be conveyed to the high-level panels for adoption. These initiatives also can be a milestone for the GoI to collaborate with other ASEAN countries and external parties in the embodiment of agriculture 4.0. For instance, digital agriculture investment, joint cooperative projects, digital enterprenurship exchange, and innovative digital technologies introduction and adoption can be carried out as regional milestones of these initiatives between the GoI and other ASEAN countries or external parties. Furthermore, through these digital initiatives in the agriculture sector, national economic recovery can be swiftly progressed.

Recommendations

1. Digital agriculture studies and applications are still not equally distributed throughout Indonesia, resulting in digital divide and gaps within realizing agriculture 4.0 transformation. Research institutions and universities that contribute for digital agriculture studies; and MSMEs, startup companies, and industries that offer digitalization practices can be a forerunner for addressing digital agriculture literacy problem and digital divide.
2. The Gol is recommended to integrate digital agriculture studies with their applications so that digital transformation practices can be benefited by Indonesia citizens, especially during the pandemic. The integration can be mainstreamed into national policies, action plans, and other agendas supported by various stakeholders since, at the national level, these mainstreaming are very limited to identify.
3. The Gol should provide support for stakeholders who are active to progress agriculture 4.0 studies and applications during the pandemic. The support can be in form of 1) accelerating the digital infrastructure development, 2) creating a healthy digital ecosystem and connectivities, 3) increasing investment in digital agriculture, 4) mainstreaming digital technology into national narratives, and 5) strengthening public-private partnership for agriculture 4.0.
4. Regional "calls for action" on digital initiatives are expected to run sustainably without limiting the period of implementation. Exit strategies need to be developed upon the completed implementation, and these need to tailor with the digital ecosystem in Indonesia. The Gol is also suggested to take synergic actions with ASEAN digitalization agendas, and to harness regional partnership with other AMSs and external parties to advance digital agriculture transforming during the pandemic.

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