



FEED THE FUTURE

The U.S. Government's Global Hunger & Food Security Initiative



State of the Digital Agriculture Sector

Harnessing the Potential of Digital for Impact Across Agricultural Value Chains in Southeast Asia



BEANSTALK



Southeast Asia

ROLE OF AGRICULTURE AND SMALLHOLDER FARMERS IN SOUTHEAST ASIA

The agriculture sector plays a pivotal role in Southeast Asia's economy and society. According to the World Bank, agriculture accounted for about 12% of ASEAN's GDP in 2020, while in countries such as Cambodia and Myanmar, the

number reached 20%. Agriculture is also a major employer in the region: in 2021, it accounted for more than 38% of total employment in countries like Laos, Myanmar, Cambodia, and Timor-Leste. Smallholder farmers form the backbone of the region's agriculture, maintaining the diversity of the food system, preserving traditional farming practices and contributing to regional food security.

Agriculture Sector Contribution to GDP	Agriculture Sector Contribution to Sector Employment	Key Crops
12.23% ⁶⁷	28.18% ⁶⁸	Rice, Sugarcane, Soybean, Coconut, Rubber, Cassava
Average Size of a Smallholder Farm	Number of Smallholder Farmers	Share of Female Workers
<1.5 ha ⁶⁹	~ 100m ⁷⁰	46% ⁷¹

Table 31. Role of Agriculture in Southeast Asia

67 World Bank Data, "Agriculture, forestry, and fishing, value added (% of GDP)", 2021

68 World Bank Data, "Employment in Agriculture (% of total employment)", 2021

69 FAO: Family Farming Knowledge Platform, 2023

70 Climate Focus news report, 2021

71 Asian Development Blog, 2015

D4AG REACH AND ADOPTION PROGRESS IN SOUTHEAST ASIA

The D4Ag landscape in Southeast Asia presents a unique combination of challenges and opportunities. Farmers in the region have demonstrated a strong interest in digital learning, with social media and other digital communication channels, such as Facebook and WhatsApp, playing a significant role in knowledge exchange thanks to the highest levels of internet connectivity across low- and middle-income regions. Peer-to-peer learning through these platforms has become a key

information source for farmers, supplementing traditional methods and filling gaps where extension services may be lacking.

Moreover, large agribusinesses in the region are progressively employing digital tools for diverse functions including record-keeping, traceability, and managing their suppliers and customers. Companies like **CropIn** and **Koltiva** are exemplary of this trend, having gained substantial traction in the region. However, while these developments are encouraging, their impact on smallholder farmers remains limited.

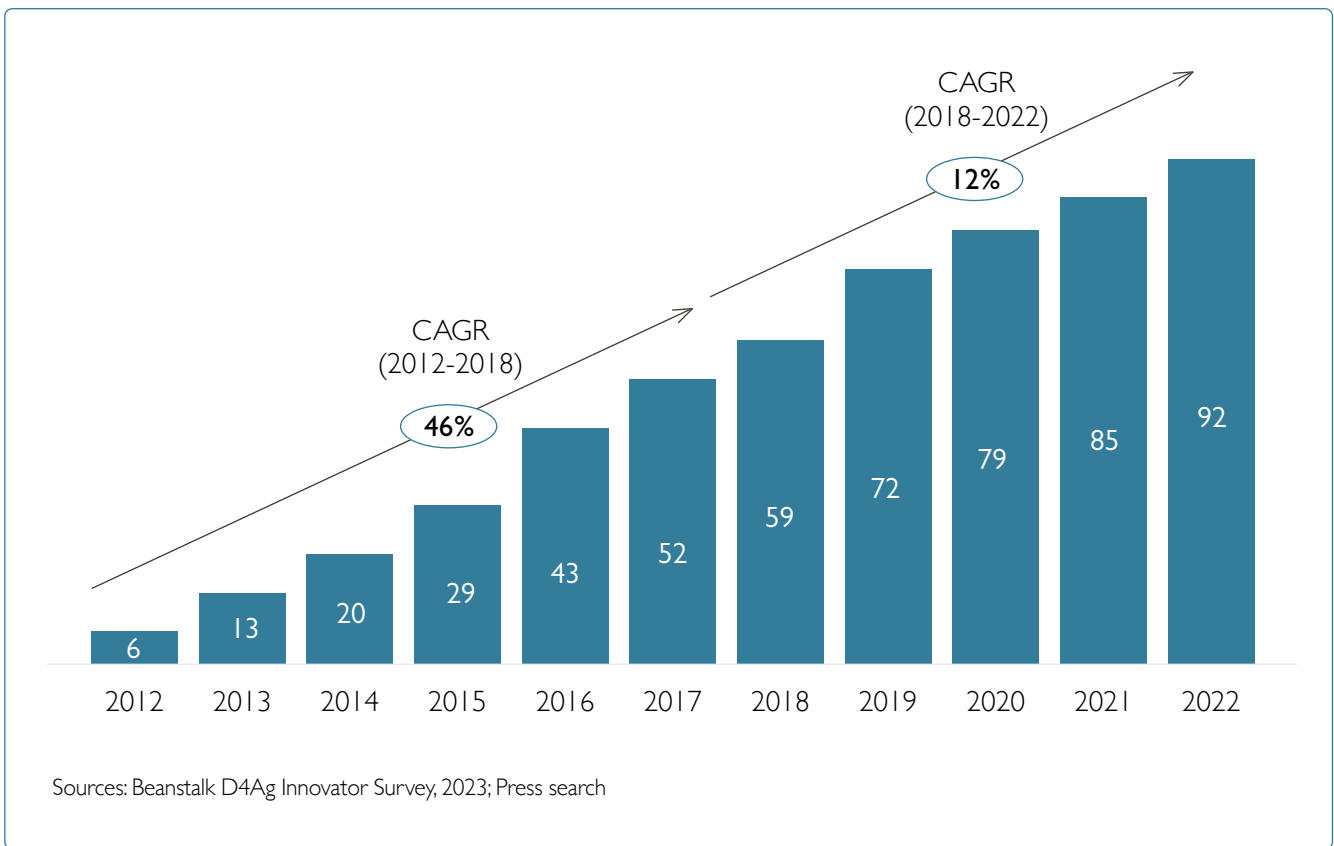


Figure 67. Number of Active D4Ag Solutions in Southeast Asia, 2012-2022

In fact, the penetration of farmer-facing digital tools in Southeast Asia is relatively low. According to a survey conducted by Grow Asia in 2019,⁷² over 90% of farmers have used a phone to call a transaction party, but less than 1% have ever downloaded a farmer service app. This reflects the persistent barriers to technology adoption among smallholder farmers, which may include factors such as

limited digital literacy, infrastructural issues, and a lack of suitable and user-friendly solutions. Our findings further corroborate this reality, with only 7 solutions in the region having reached at least 100,000 registered users as of 2022. Even the largest solutions in terms of reach currently do not serve more than 10-15% of smallholder farming population in their countries.

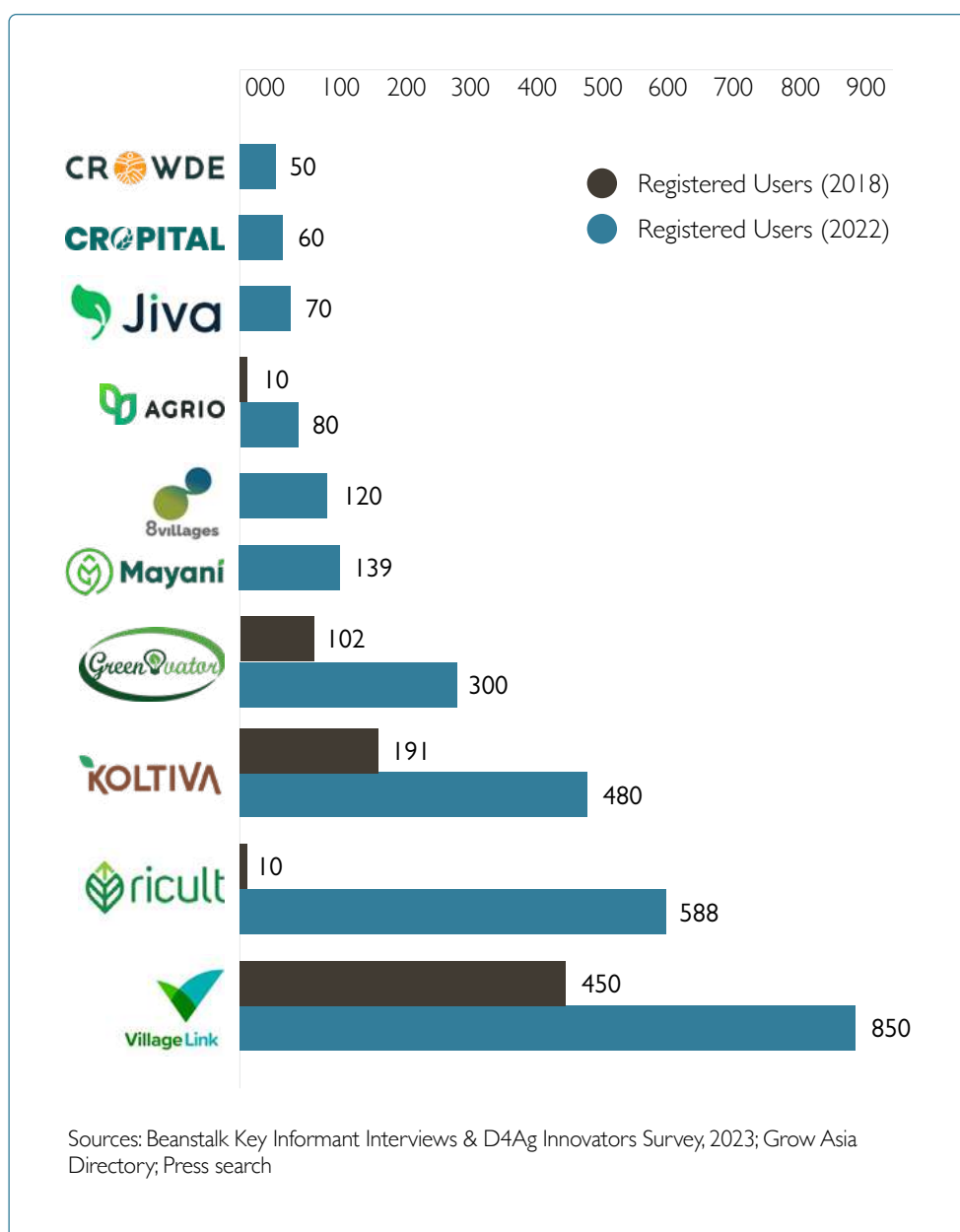


Figure 68. Registered Users of Top-10 D4Ag Solutions. Southeast Asia, 2022

72 GrowAsia: Driving AgriTech Adoption: Insights from Southeast Asia's Farmers, 2019

Number of active D4Ag solutions (2022)	92
Number of active D4Ag solutions (2018)	59
Most commonly observed use case	Advisory & Information (24%)
Median number of users per solution	57,500
Proportion of innovators breaking even	36%

Table 32. D4Ag Reach and Adoption in Southeast Asia
Source: Beanstalk KILs and D4Ag Innovators Surveys, 2023

However, the D4Ag ecosystem in Southeast Asia is not static and has seen some development in recent years, and the adoption is estimated to be on the rise. **As of 2022, there have been at least 96 active D4Ag solutions operating in the region, as compared to 72 back in 2019.** Levels of mobile connectivity have been increasing steadily, with 68% of the region's population now using mobile internet, and only 2% not being covered by mobile broadband—the lowest number across LMICs. Moreover, improving device ownership rate have created additional tailwinds for D4Ag adoption: As of 2022, 68% of Indonesia's population, for example, have owned smartphones, as compared to 60% in 2019.⁷³

According to our interviewees, **only 36% of them are currently breaking even—the lowest number for commercial stability across LMICs,** also demonstrating overall lower maturity of the ecosystem in the region.

While the geographical reach of these solutions is expanding, it remains largely concentrated in countries like Indonesia, Vietnam, and Thailand, which have emerged as regional D4Ag hubs. Besides, Singapore has emerged as a vibrant hub for agritech startups and innovations, even though its agricultural landscape is extremely limited. Startups are not only attracted by the easy access to capital,

but also by the opportunities for collaboration and partnerships with research institutions and established businesses. Singapore's strategic geographic location, positioned in the heart of Southeast Asia, enables it to serve as a gateway to the region's large and diverse agricultural sector. This allows startups based in Singapore to tap into the broader Southeast Asian market, testing and scaling their innovations across different contexts.



Source: Tepbac

⁷³ <https://newzoo.com/insights/rankings/top-countries-by-smartphone-penetration-and-users>

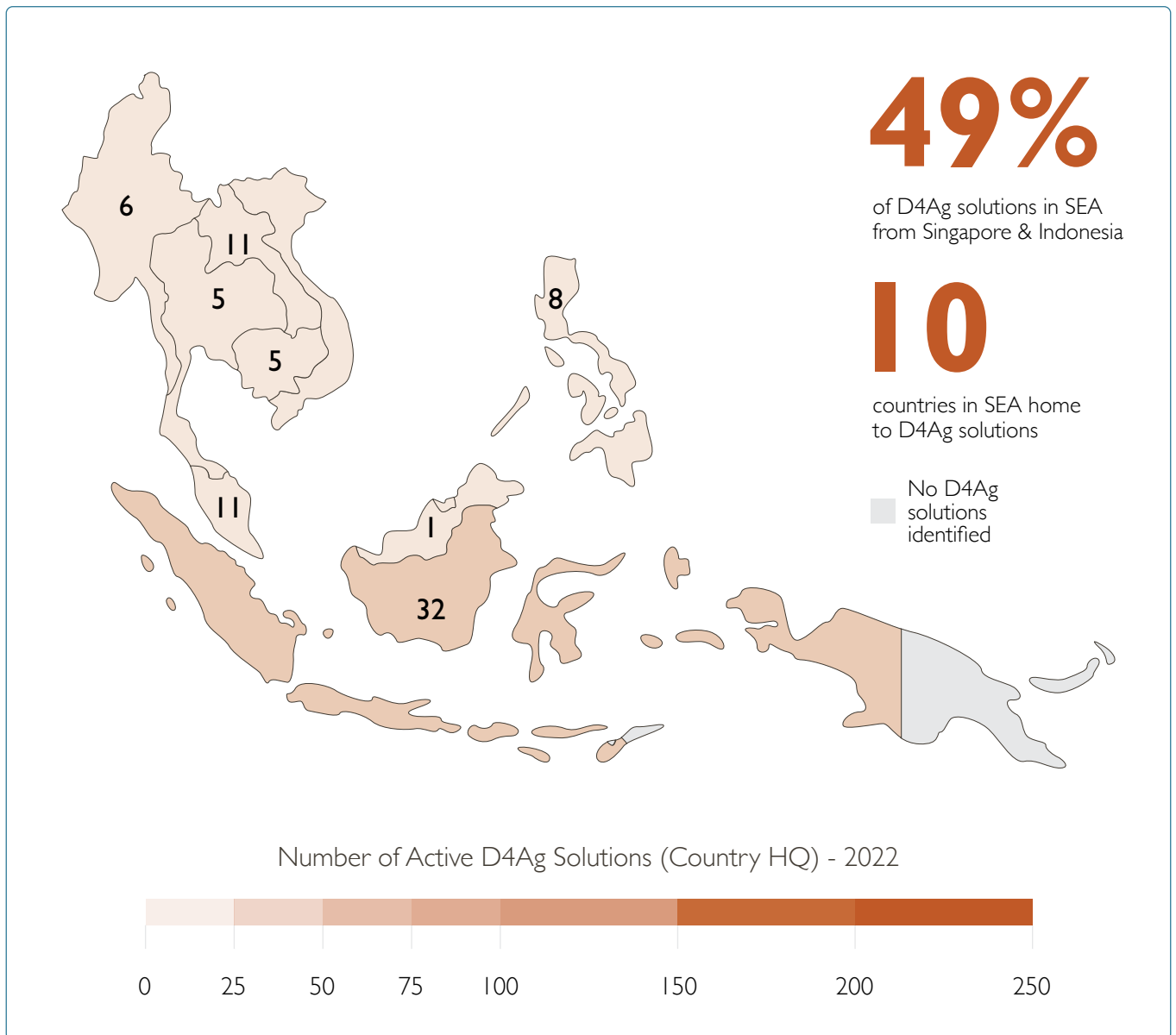


Figure 69. Number of Active D4Ag Solutions, per Country HQ, SEA, 2022

Regarding the most popular use cases, ‘Advisory & Information’ along with ‘Market Linkages & Access’ account for roughly half of solutions currently active in the region, mirroring the global trend. Interestingly, almost a quarter of

innovators are focusing on offering Enterprise Management services, which is probably due to the important role of large corporate agribusiness in the region, as mentioned earlier.

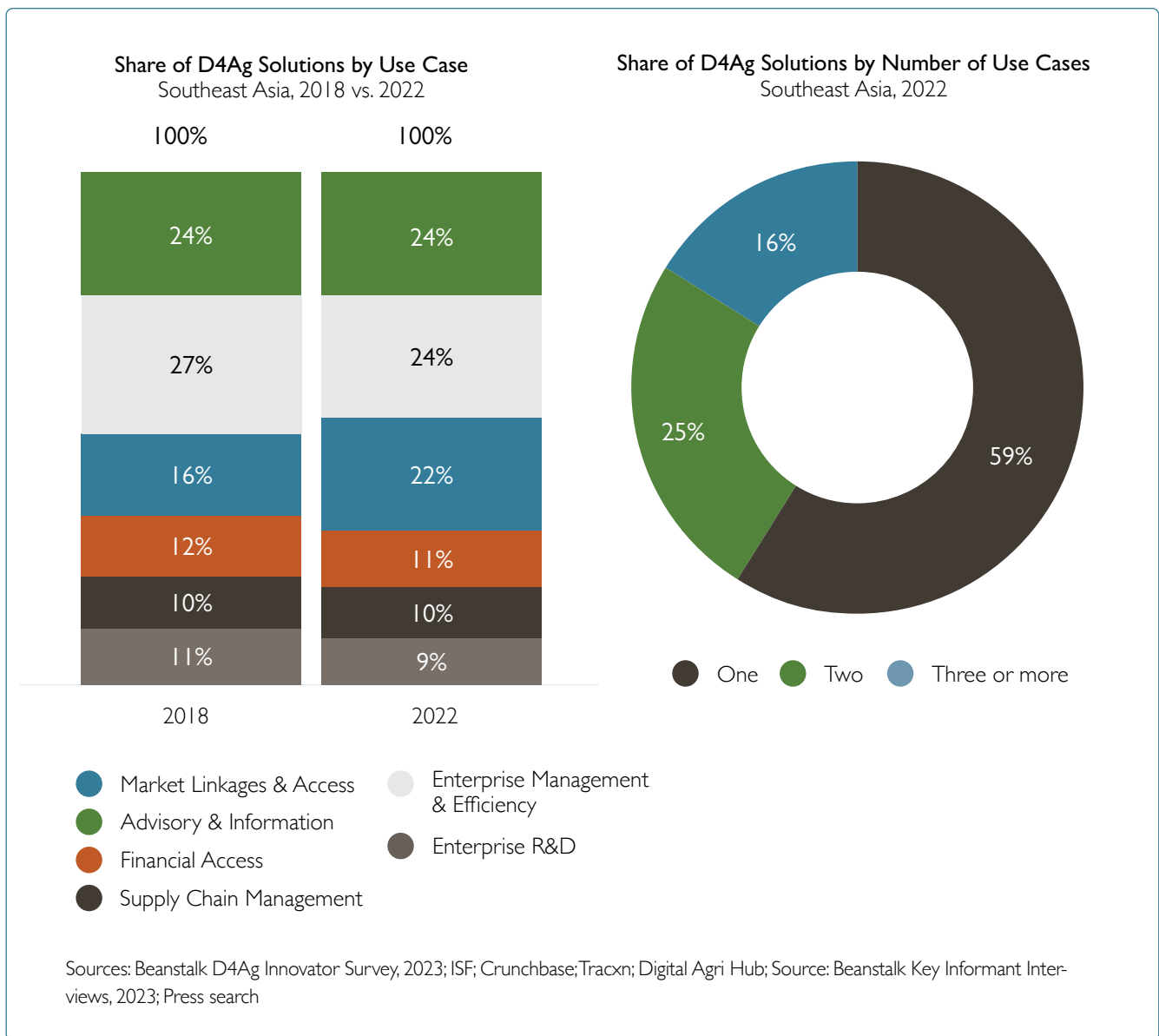











Figure 70. Number of Active D4Ag Solutions, Per Country HQ, SEA, 2022.

Investments in D4Ag in Southeast Asia have been growing steadily, and Indonesia has particularly stood out as an undisputed regional investment hub: All top-10 largest investment rounds of D4Ag startups in the region went to the Indonesian innovators. **In total, innovators**

in LMICs of APAC (outside China and India) have raised around US\$765 million in funding from private investors in 2021.⁷⁴ This promising trend could potentially lead to an acceleration of innovation and growth in the region’s D4Ag sector.

74 AgFunder APAC 2021 Investment Report (data for D4Ag innovators in LMICs, ex-India and China – Beanstalk estimates)

	Solution Name	Total Funding (US\$, Mn)	Stage	HQ Country	Operations
1	eFishery	\$ 342.9	Series D		
2	Sayurbox	\$ 139.2	Series C		
3	Aruna	\$ 100	Series A		
4	Tani Hub [shut down]	\$ 94.5	Series B		
5	AgriAku	\$ 46	Series A		
6	EdenFam	\$ 34.2	Series B		
7	Pitik	\$ 14	Series A		
8	Jala Tech	\$ 12	Series A		
9	CROWDE	\$ 10	Series B		
10	KedaiSayur	\$ 8.8	Series A		

Source: Crunchbase

Table 33. Top 10 Solutions by Total Amount Of Private Funding Raised, 2022, SEA, (US\$, Mn)

Outside of Indonesia and Singapore, the investment activity has been much more modest: for example, Vietnamese **Tepbac** and Philippines-based **Mayani** have managed to raise US\$ 2.3 and US\$ 1.7 million Seed rounds respectively.

HARNESSING SOUTHEAST ASIA'S DIVERSITY FOR EFFECTIVE D4AG DEPLOYMENT

Southeast Asia presents a distinct landscape of opportunities and challenges for D4Ag due to its diverse culture, geography, and the infrastructural disparities across the region.

Language Barriers: Southeast Asia is a linguistic

tapestry with hundreds of languages spoken across the region. Only in Indonesia there are more than 700 living languages, making it one of the most linguistically diverse countries in the world. This presents a significant challenge for the deployment of D4Ag technologies. For these tools to be effective, they must be adapted to local languages to reach the intended recipients and to be understood. Designing linguistically sensitive D4Ag solutions is not just about translation, but also requires contextual understanding and relevance. Technologies must be designed and implemented with a deep understanding of local idioms, agricultural terminology, and cultural nuances; and ongoing support and training must be multilingual to engage with a wider farming community effectively.

Myanmar-based **Greenovator** faced the problem of language barriers in rural communities of the country, where more than 100 languages are spoken across its 135 ethnic groups. After meeting with the minorities representatives, the team has decided to convert the content into a voice-based format in Burmese; even though many minorities are not able to read in it, they understand the spoken language, and this was a more cost- and time-effective approach to improving the inclusivity of their solution.

Cultural Differences: The region's rich cultural diversity also introduces complexities in the adoption and effectiveness of D4Ag technologies. Different ethnic and indigenous communities often have unique agricultural practices rooted in their traditional knowledge systems that vary considerably from mainstream techniques. For D4Ag to be effective and

adopted widely, it needs to recognize, respect, and incorporate these unique practices rather than attempting to replace them. Prevailing cultural and gender norms, access to technology, and differing perceptions of technology need to be taken into account when introducing digital tools.

Vietnam The Smart Village, Connected Commune initiative is a community of villages and communes in rural areas using digital platforms to improve lives of ethnic minority and isolated communities in the country.

The development of digital agriculture strategies helps ethnic minorities and mountainous, remote and isolated areas to improve agricultural and labour productivity, competitiveness and community welfare compared to more favourable regions. People and co-operatives in ethnic minority and mountainous areas have been trained on how to sell their products online, improve their sale skills and how to close applications. They are also being trained on how to pack and preserve agricultural products before sending them to distributors. Best practice for sustainable agriculture and farming is being shared between communities to minimise impacts of droughts, soil erosion and sea-level rise.

Source: Civil Service Modernisation in Asean Study Survey Response, Viet Nam, 2020.

Geographical Remoteness: In Southeast Asia, the geographical landscape varies significantly from archipelagos with thousands of distributed islands, such as Indonesia and the Philippines, to landlocked countries like Laos. For archipelagos, reaching remote islands is a significant challenge due to limited connectivity, both physical and digital, and difficult terrains, often leading to unequal access to D4Ag technologies and exacerbating the digital divide. Given the infrastructural and logistical barriers, scaling D4Ag solutions even within the country is challenging, often causing innovators to focus only on the largest islands. The challenging terrain of remote areas also often obstructs

the delivery of training or support services for D4Ag tools, affecting their understanding, adoption, and utilization. The specific languages, needs, and contexts of different communities, enhancing their relevance and effectiveness.

On the other hand, the region's cultural, agricultural, and experiential diversity provide a unique conduit for knowledge exchange between the regions. Digital platforms can expedite this process, enabling farmers to learn from each other and disseminate innovative solutions and practices enhancing agricultural productivity and sustainability. Acknowledgment of the region's linguistic and cultural diversity can

potentially culminate in a robust, decentralized knowledge base and stimulate the development of bespoke D4Ag solutions.

Addressing these challenges requires investment in infrastructure, targeted training, and policies that ensure digital technology affordability and accessibility. D4Ag solutions designed with these issues in mind might need to incorporate offline functionalities or use alternative communication forms. Moreover, an active involvement of underrepresented groups and respect for the region's cultural, linguistic, and ethnic diversity should be at the heart of the design and implementation process.

HARNESSING D4AG TO SECURE SOUTHEAST ASIA'S RICE FUTURE

In Southeast Asia, agriculture—and particularly rice farming—plays a crucial role in the economy and food security. Rice is the single most important staple in the region, providing 50% of calorie intake for its population, and the region's rice areas comprise almost 30% of the world rice harvest.⁷⁵

The region faces significant climate change threats, including rising temperatures, changing rainfall patterns, and an increase in extreme weather events, which pose significant risks to its rice agriculture. Digital technologies like remote sensing and geographic information systems (GIS) can assist in monitoring crop health, identifying pest and disease infestations, and managing irrigation, all crucial aspects in rice farming. Data-driven agronomy, backed by ML and AI, can provide personalized advice to farmers about the right variety of rice to grow, optimal planting times, and effective use of inputs.

The International Rice Research Institute (IRRI)

has developed a set of digital tools specific for this crop. **IRRI's Rice Crop Manager (RCM)** enables extension workers to use a computer or smartphone to provide farmers with crop management recommendations matching their field conditions. RCM recommendations are provided to farmers through a one-page printout and SMS. According to IRRI, “use of RCM recommendations provided an average yield increase of 0.4 tons (400 kg) per crop per hectare equivalent to about US\$100/ha/cropping season added net benefit in the Philippines.⁷⁶ IRRI offers a suite of many other digital tools, such as **EasyHarvest**—an Android mobile application that links farmers with machinery service providers in the Philippines, India, Cambodia, and Thailand; **WeRise**—a web-based data driven climate advisory (Laos, Indonesia, and the Philippines); a weed management tool called **WeedSmart**; **Rice Doctor**, an app-based disease diagnostics tool; and a digital extension service called **Rice Knowledge Bank**.

⁷⁵ International Rice Research Institute

⁷⁶ [IRRI Crop Manager](#)

Singapore-based **AgriG8** is integrating digital agriculture with financial services to empower smallholder rice farmers in Southeast Asia. The company is pioneering an innovative, agronomy-based risk assessment approach to bridge the gap between these farmers and financial institutions.

This approach involves predictive forecasts that only facilitate loan origination and credit assurance but also incorporate sustainability metrics. By doing so, it creates an opportunity for lenders to contribute positively to climate change mitigation.

For the farmers, AgriG8 offers a unique experience centred on enhancing their agricultural practices. The company provides tools and advice that can help farmers increase their yield and nutrient efficiency. At the same time, it aids them in reducing their carbon footprint and achieving sustainability certification.

Overall, AgriG8's approach aims to disrupt the destructive cycle of farmers simultaneously being victims of and contributors to climate change. By combining digital solutions, financial accessibility, and a strong focus on sustainability, AgriG8 is striving to build climate resilience among rice farmers in Southeast Asia.

FUTURE OUTLOOKS

The unfolding decade presents both challenges and opportunities for the D4Ag sector. As the world grapples with rapid technological advances, climate change, and evolving socioeconomic dynamics, the D4Ag stands

poised to play a transformative role, especially in LMICs. To capture this potential, we have meticulously analyzed and projected the future course of the sector and its impact across three impact vectors: economic, social, and environmental.

	Economic Projections (Additional LMIC income per annum enabled by D4Ag)	Social Projections (% of potential user base actively using D4Ag)	Environmental Projections (D4Ag-enabled farm-gate GHG change per annum)
Thriving Scenario	US\$ 91 billion	35%	-78 CO ₂ eq megatons
Derailing Scenario	US\$ 11 billion	11%	+9 CO ₂ eq megatons

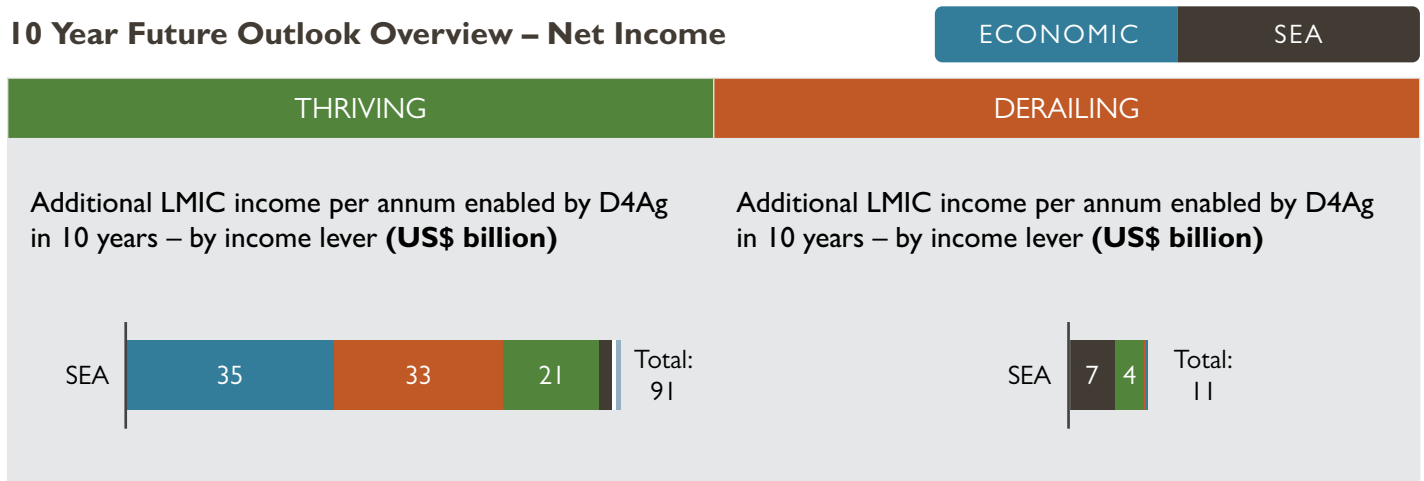
Table 34. 10 Years' Outlook for the Sector: Southeast Asia

Economic Projections:

Southeast Asia may generate an additional income of US\$91 billion from D4Ag in the next 10 years if conditions thrive predominantly from reduced crop and animal loss, improved

labor efficiency, as well as increased quality and bargaining powers of produce in the region. However, the “derailing” scenario might see this number drop to less than 10% of the thriving potential.

10 Year Future Outlook Overview – Net Income



- Reduced crop & animal loss
- Labour efficiency (indirect income)
- Increased quality & bargaining power
- Animal feed and fertiliser efficiency
- Revenue from carbon credits
- Machinery maintenance savings

Source: USDA ERS International Agricultural Productivity indices, Beanstalk analysis

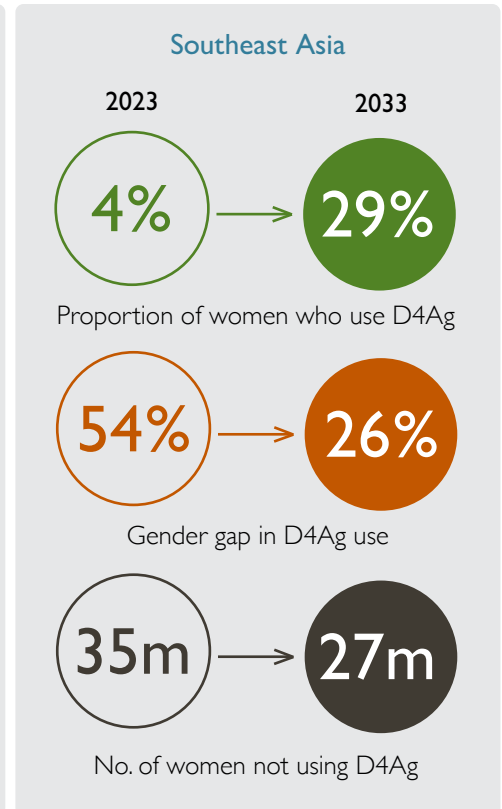
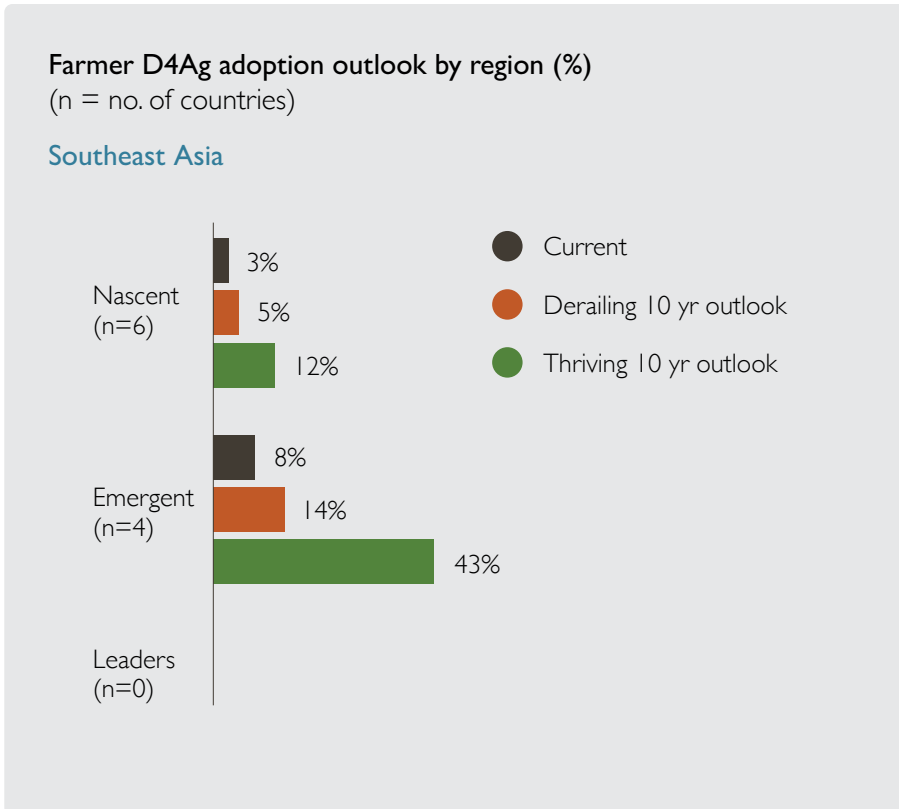
Figure 71. Economic Projections Southeast Asia

Social Projections:

D4Ag adoption, which averages 6% across Southeast Asia in 2023, may see varying levels in the future. Emerging champions in the region can see the adoption rates skyrocket up to 40%,

while nascent countries are expected to see up to a 20% adoption rate. In the positive scenario, improving gender inclusivity could result in one in three females in agriculture adopting D4Ag tools, potentially halving the gender gap.

INCLUSION SEA



Note: Available data was extremely limited. Available country data was extrapolated to represent the entire progression status per region. Where data was not available, the 2016 Digital Adoption Index (DAI) was utilized to estimate current adoption levels. The thriving scenario was projected by using the internet adoption curves of each country with an adjustment factor. Relative to internet adoption, the following lag was assumed for D4Ag adoption: Leaders – 10-year lag, Emergent – 12-year lag, Nascent – 15-year lag.

Source: Various, World Bank World Development Indicators (Individuals using the Internet (% of population)), Beanstalk analysis

Figure 72. Social Projections Southeast Asia

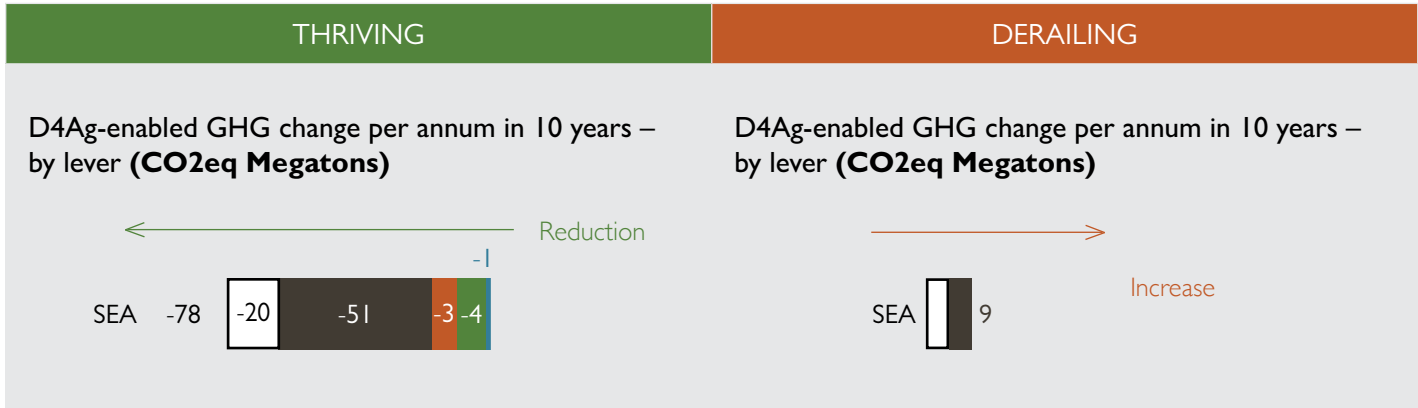
Environmental Projections:

With a focus on rice farming, Southeast Asia, in a thriving scenario, might achieve a reduction of 78 megatons CO₂eq annually, with 65% (51 megatons CO₂eq) resulting from improved rice

cultivation practices. In the negative scenario, increased use of farm machinery and synthetic fertilizer might lead to an increase in GHG emissions by 9 megatons CO₂eq per annum.

10 Year Future Outlook Overview – GHG gases

ENVIRONMENTAL SEA



- Regenerative forestry & soil practices
- Reduced animal gases
- Increased synthetic fertiliser usage
- Improved rice cultivation
- Greater fuel efficiency
- Increased farm machinery usage
- Efficient synthetic fertiliser usage

Source: FAOSTAT domain Emissions Totals (last updated 22 May 2023), Beanstalk analysis

Figure 73. Environmental Projections Southeast Asia