Accelerating Smallholder Digital Adoption at Scale in ASEAN

Strategic Pathways

GrowAsia

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Executive Summary

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Digital technologies[1] are advancing rapidly across ASEAN's agriculture sector. Governments are investing in innovation, connectivity, digital public infrastructure, and enabling policy frameworks while agritech innovation and investment continue to expand. The region is not short of solutions. Yet smallholder adoption remains uneven and limited.

This report finds that the core constraint is not the availability of technology itself, but gaps in the delivery to adoption pathway.

Evidence from India and Kenya offers insights into proven practices that can deliver meaningful scale. Despite different starting points, both countries achieved sustained farm-gate adoption when four elements advanced together: trusted digital rails, strong last-mile delivery channels, farmer-aligned economics and incentives, and coordinated public–private investment and action. Technology alone did not drive scale; delivery systems did.

ASEAN is already moving in this direction. Regional frameworks such as the ASEAN Food, Agriculture, and Forestry Sectoral Plan 2026–2030, the Digital Economy Framework Agreement, and the ASEAN Digital Masterplan demonstrate clear strategic intent, while Member States are investing in connectivity, registries, and digital innovation ecosystems. The opportunity now is to sharpen delivery so these foundations translate more consistently into farm-level impact at scale. Given diverse starting points across Member States, this should begin with a structured region-wide needs assessment that produces comparable country baselines and directly informs sequenced, costed national digital agriculture roadmaps aligned with the Strategic Thrusts of the ASEAN Food, Agriculture, and Forestry Sectoral Plan 2026–2030.

The report identifies four priority areas to strengthen ASEAN's digital agriculture delivery system:

01

Strengthen foundational digital and data infrastructure, including rural connectivity, interoperable farmer registries, payment rails, and data governance, sequenced to support smallholder use cases.

02

Strengthen delivery capacity all the way to the farm gate by digitally enabling cooperatives and intermediaries, upskilling extension systems, and integrating lead farmers and youth into last-mile delivery networks.

03

Accelerate inclusive adoption by integrating financing and risk-sharing mechanisms and prioritize incentives for digital solutions that directly strengthen climate resilience.

04

Institutionalize public–private–philanthropy partnership ("4P") mechanisms and strengthen regional coordination through a neutral, trusted convening and coordination function that reduces fragmentation, aligns partners and capital, and sustains momentum from planning through early implementation and scale.

Building on this delivery agenda, the report outlines four investment pathways to mobilize greater private and Curated 4P finance[2] into the system. These pathways focus on positioning foundational infrastructure as market-enabling investment and co-investment opportunities; using 4P finance to invest in public infrastructure; institutionalizing a portfolio architect function to build investable programs; and unlocking last-mile capital for the missing middle - the small and medium-sized rural enterprises, aggregators, and service providers that bridge solution providers and farmers but remain constrained by fit-for-purpose working capital. ASEAN's priority now is to drive targeted, coordinated and integrated execution. National implementation plans should embed all four elements of the digital delivery system and be grounded in a structured region-wide needs assessment that translates strong regional ambition into sequenced, costed national roadmaps and investable pipelines capable of delivering scaled smallholder impact.

CPSA PSAV PPSA

1. In this report, we define digital technologies as: Digital tools, platforms, and data-enabled services that support agricultural decision-making, service delivery, market access, financial inclusion, and climate resilience for smallholder farmers. 2. Curated 4P finance: Curated Finance refers to a deliberately assembled financing structure that brings together private capital, public funding, and philanthropic resources to support initiatives that are commercially promising but not yet fully investable.

01

Why Digital Agriculture Isn't Reaching Farmers at Scale:

An Under-developed Delivery System



3. Philippines Digital Report, February 2026; insights from Vietnam study conducted by Grow Asia, February–March 2026; insights from Human Centred Design workshops conducted by Grow Asia and IFAD in the Philippines, Vietnam and Cambodia, 2025. 4. ASEAN Food, Agriculture and Forestry Sectoral Plan 2026-2030 (FAF-SP 2026-2030), Grow Asia and The Sustainable Smallholder analysis. 5. Ibid.

Like the rest of the world, ASEAN is undergoing a massive digital transformation. Digital technologies are reshaping food and agriculture systems across ASEAN at a pace that would have been difficult to predict a decade ago. New tools for productivity, market access, traceability, and climate resilience are reaching farmers at lower cost year by year, and the ecosystem supporting them, including new policies, startups, investors, and development partners has grown substantially[3].

Key regional frameworks, such as the ASEAN Guidelines on Promoting the Utilization of Digital Technologies for the Food and Agricultural Sector (2021), the ASEAN Leaders' Declaration on Strengthening Food Security and Nutrition in Response to Crises (2023), the Action Plan for Sustainable Agriculture in ASEAN (2024), and the Food, Agriculture and Forestry Sectoral Plan (FAF-SP) 2026–2030, reflect a growing commitment to digital innovation as a lever for food security, climate resilience, and rural equity[4].

At the national level, governments are investing in rural connectivity, digital economy blueprints, smart agriculture programs, and innovation ecosystems, increasingly in partnership with private-sector actors, development institutions, and research bodies[5].

The policy and supply side is clearly in motion. Hundreds of agritech startups are active across the region, developing advisory applications, digital marketplaces, precision farming tools, and financial services tailored to agricultural value chains[6]. Agrifood tech investment in Southeast Asia reached approximately USD 1.7 billion in 2022, with cumulative farm tech funding totaling around USD 1.5 billion between 2018 and 2023 despite broader global venture slowdowns[7]. Across Asia-Pacific, agrifood tech investment totaled approximately USD 4.2 billion between January and October 2024, with Southeast Asia accounting for an estimated one-fifth to one-third of that volume[8]. Digital solutions, particularly market-linkage platforms and advisory applications, represent around 40% of total deals[9].

Despite this momentum, farmer uptake remains stubbornly low and uneven[10]. Many solutions demonstrate strong promise at pilot stage but struggle to achieve consistent,sustained use across diverse farming contexts[11].

Digital agriculture in ASEAN does not suffer from a lack of technology or willingness to act. It suffers from an underdeveloped delivery system.

USD

4.2 billion

invested in Asia-Pacific agrifood tech

(Jan–Oct 2024)

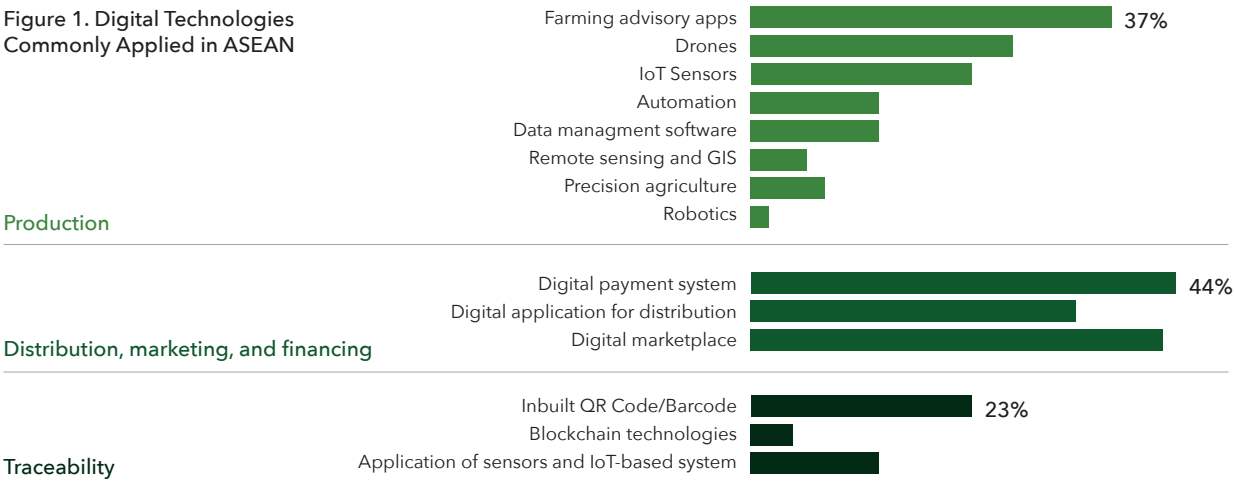
6. AgFunder Asia-Pacific AgriFoodTech Investment Report 2024; Tech for Good Institute: Advancing Digital Sustainability in Southeast Asia, August 2025. 7. Ibid. 8. Ibid. 9. Ibid. 10. Philippines Digital Report, February 2026; insights from Vietnam study conducted by Grow Asia, February–March 2026; insights from Human Centred Design workshops conducted by Grow Asia and IFAD in the Philippines, Vietnam and Cambodia, 2025. 11. Ibid.

Smallholder Adoption

Agriculture in Southeast Asia is fundamentally shaped by smallholder businesses. Millions of families across the region depend on plots of one to two hectares for their livelihoods, with typical farm household incomes averaging USD 500–2,000 per year - often at or near national poverty lines[12].

Figure 1 illustrates where digital adoption is happening and where it is not. The data covers eight ASEAN member states and 824 respondents, mainly farmers and other agricultural value-chain actors who have already used digital technologies in their operations[13].

Figure 1. Digital Technologies Commonly Applied in ASEAN



Source: ERIA Policy Brief, November 2025. Data collected through interviews and surveys conducted between January and May 2025 across eight ASEAN Member States.

The pattern is instructive. Smartphone-based tools, farming advisory apps, digital payments, and digital marketplaces, lead adoption with 37–44% of respondents reportinguse[14]. These are the tools that offer immediate, tangible value and 'return on investment': they reduce costs, improve information access, and facilitate transactions within existing workflows. Traceability technologies, which deliver value further downstream and are typically demanded by buyers rather than chosen by farmers, lag significantly[15].

This reflects a fundamental logic of smallholder decision making: adoption tracks closely with clear, short-term return on investment[16]. Tools that fit existing practices and deliver near-term economic benefits gain traction. Tools that require behavioral change, upfront investment, or deferred value do not, regardless of their technical quality or downstream potential. Understanding this logic is the starting point for designing delivery systems that work [17].

12. Grow Asia article: Unlocking Resilience: How Social Finance Can Help South-East Asia's Smallholder Farmers Adapt to Climate Change, November 2024; Australian Government ACIAR project LS/2018/107 – Southeast Asian livestock futures: what role for smallholders, 2022. 13. ERIA Policy Brief: Digitalization in Agriculture and Food Systems in ASEAN, November 2025. 14. Ibid. 15. Ibid. 16. Grow Asia and The Sustainable Smallholder analysis. 17. Ibid. 18. Ibid.

Translating digital ambition into consistent farm-level adoption is difficult, in part because smallholder farmers are not a uniform, consolidated target group[18]. Across ASEAN, small-scale farms differ considerably in economic resilience, market integration, digital literacy, risk tolerance, production systems, and access to nearby markets/towns, roads and to advisory support and/or extension services[19]. These differences are structural, and they compound.

Evidence from Vietnam, Cambodia, and the Philippines shows that adoption is significantly higher among farmers embedded in cooperatives, connected to trusted intermediaries, or supported through extension networks (whether public or private sector led)[20].

Younger farmers (18–35 years old) consistently emerge as early adopters, while older farmers face greater barriers to initial experimentation, and gender disaggregated data is sparse[21].

In most ASEAN member states, women make up more than half of the agricultural workforce[22] but have lower rates of smartphone ownership, more limited access to digital financial services, and less exposure to extension and training networks[23]. The mobile gender gap in Southeast Asia remains significant. Notably, the difference in mobile internet use between men and women in some markets is growing, not narrowing[24]. Human-centered design work conducted by Grow Asia and the International Fund for Agriculture Development (IFAD) across the Philippines, Vietnam, and Cambodia confirmed that women and men use digital tools differently, face different constraints, and respond to different value propositions[25]. Delivery systems that do not actively account for these differences will consistently underserve the majority of the agricultural workforce while yielding aggregate adoption figures that obscure the gap[26].

One-size-fits-all rollout approaches rarely work in agriculture, especially in Southeast Asia. They do not account for the varied starting points from which farmers engage with digital solutions, and they tend to reach those who are already relatively connected while leaving more marginalized and remote farmers - notably the older, poorer (more likely to be women), further behind[27].

The challenge is not generating more solutions for different farmer segments. It is designing delivery systems that reach diverse farmer realities, including those of women, older farmers, and the most resource constrained - at scale.

19. Philippines Digital Report, February 2026; insights from Vietnam study conducted by Grow Asia, February–March 2026; insights from Human Centred Design workshops conducted by Grow Asia and IFAD in the Philippines, Vietnam and Cambodia, 2025. 20. Ibid. 21. Ibid. 22. https://www.theglobaleconomy.com/rankings/percent_female_population/South-East-Asia/ 23. The ASEAN magazine, article Empowering Women through Digital Technology, December 2024. 24. GSMA Connected Women: The Mobile Gender Gap Report 2024. https://www.gsma.com/r/gender-gap/. 25. Grow Asia and IFAD Human Centred Design workshops, Philippines, Vietnam and Cambodia, 2025; 26. The Sustainable Smallholder analysis Grow Asia and The Sustainable Smallholder analysis. 27. Grow Asia and The Sustainable Smallholder analysis

Three Levels of Constraints

Evidence from across the regiom[28] shows that barriers to adoption emerge from constraints operating simultaneously at three interconnected levels: farmer readiness; delivery capacity; and ecosystem alignment. Treating digital adoption as a purely technological challenge obscures where strategic action is most needed[29].

Farmer readiness encompasses the economic, human, behavioral, social, and operational conditions that determine whether an individual farm household can and/or chooses to engage with a digital tool. It includes income and liquidity, digital literacy and farming experience, perceived usefulness and risk, peer influence, gender dynamics, farm size, and exposure to climate variability[30].

Delivery capacity determines whether solutions can reliably reach farmers in practice. This covers the usability and localization of the technology itself, its cost structure, rural connectivity and its quality, and most critically the human intermediaries who carry solutions to the field the last mile. These are extension agents, cooperatives, lead farmers,and agri-SMEs. Delivery capacity also includes capacity building infrastructure such as onboarding, training, and after-sales/use support. Human intermediaries and capacity building are not optional extras - they are critical must-haves that determine whether initial adoption becomes sustained use[31].

Ecosystem capacity sets the broader conditions within which delivery operates. It covers policy direction and policies implemented, the depth of the financial ecosystem,institutional capacity, the effectiveness of public-private coordination, and the quality of national digital infrastructure, from broadband coverage to interoperable payment systems and digital identity[32].

Adoption in ASEAN is, at its core, a delivery challenge.

Considerable effort has already gone into identifying and addressing individual barriers, and many of the constraints highlighted in this report are well known. Yet progress to scale remains slow and uneven.

The issue is not that the region lacks initiatives or insight; it is that too often the focus remains on addressing constraints one by one, rather than on how the full delivery system needs to function in practice.

This report clarifies what a strong, integrated delivery system looks like: which core functions it must address in an integrated way to solve for farmer readiness, delivery- and eco-system capacity.

Furthermore, the report offers practical pathways to strengthen the design, development,implementation, and investment of delivery systems capable of driving scalable impact.

The chapters that follow explore these questions, drawing on evidence from India, Kenya,and emerging ASEAN direction and experience to illustrate what it takes to move from fragmented progress toward adoption at meaningful scale.

28. Philippines Digital Report, February 2026; insights from Vietnam study conducted by Grow Asia, February–March 2026; insights from Human Centred Design workshops conducted by Grow Asia and IFAD in the Philippines, Vietnam and Cambodia, 2025; The Sustainable Smallholder analysis. 29. Grow Asia and The Sustainable Smallholder analysis. 30. Philippines Digital Report, February 2026; insights from Vietnam study conducted by Grow Asia, February-March 2026; Insights from Human Centered Design workshops conducted by Grow Asia and IFAD in the Philippines, Vietnam and Cambodia 2025; insights from The Sustainable Smallholder. 31. Ibid. 32. Ibid

02

What Scale Requires:

Lessons from India and Kenya



Three questions sit at the heart of this chapter:

01
What foundational conditions need to be in place before digital agriculture can function at scale?

02
What delivery structures carry solutions from platforms to farms?

03
And what incentives make adoption a rational, sustained choice for farmers, rather than a one-season subsidized experiment?

To ground those questions in evidence, this chapter examines two contexts where meaningful scale has been achieved: India and Kenya. They are instructive because they took different paths. In India, government took the first step, investing in foundational digital rails designed to be open so that private actors, cooperatives, and startups could build on top. In Kenya, it was the private sector that moved first, creating the mobile money infrastructure that agricultural platforms then grew on, on top of foundations already laid by government. Two different sequences, two different lead actors - both producing meaningful scale, both still working to reach the most structurally constrained farmers consistently.

The chapter then turns to ASEAN itself. Through the ASEAN Food, Agriculture, and Forestry Sectoral Plan 2026–2030, the Digital Economy Framework Agreement (DEFA), the ASEAN–India digital public infrastructure partnership, and what member states are already building nationally, the region is moving toward an interoperable architecture that shares characteristics with the Digital Public Infrastructure (DPI) model, on its own terms and at its own pace. Understanding where those foundations already stand is the analytical groundwork for the pathways and recommendations that follow.

Case Study Summary



India

India's smallholder digital transformation succeeded not through any single technology, but through a coordinated ecosystem strategy. Six factors were decisive.

Foundational digital infrastructure

The AgriStack—comprising farmer registries, geo-referenced land records, and crop data—created a shared source of truth across subsidies, insurance, credit, and advisory services. Secure data-sharing frameworks extended this to expand formal finance for underserved farmers.

Crowding in private capital

Start-up India and the Fund of Funds reduced early-stage investment risk and signaled policy commitment, catalyzing venture capital beyond traditional hubs and supporting over 1,200 agri-tech startups by 2025.

Farmer aggregation

The national FPO program (targeting 10,000 organizations by 2027–28) converts fragmented smallholders into viable market counterparties—enabling bulk purchasing, reducing intermediaries, and unlocking engagement with buyers, lenders, and digital platforms at scale.

Blended finance

The Agricultural Infrastructure Fund (~USD 1.1 billion) uses interest subsidies and credit guarantees to crowd private bank lending into post-harvest infrastructure—functioning as a catalytic mechanism, not a grant scheme.

Open digital markets

ONDC's open-protocol architecture enables interoperability across buyers, sellers, and logistics providers, lowering transaction costs and preventing digital monopolies.

Cross-sector convergence

Solar electrification, drone service delivery, and a district-level program aligning 36 schemes across 11 ministries ensured that digital tools were viable, accessible, and locally grounded.

(The full case-study including footnotes for references is in Appendix 2)

Case Study Summary



Kenya

Kenya's digital agriculture story differs fundamentally from India's; rather than state-built digital public infrastructure, it was driven by private sector innovation layered on top of mobile connectivity and M-Pesa, which were already trusted and embedded in rural life before any agriculture-specific platform arrived.

DigiFarm

DigiFarm is the flagship example, an integrated platform giving smallholder farmers access to inputs, credit, advisory services, and markets through a single mobile interface,reaching over one million registered farmers in its early years. It has two arms: Kilimo (end-to-end farmer services: extension, inputs, finance, capacity building) and Soko (marketplace connecting farmers to buyers, cooperatives and processors, with M-Pesa payments built in).

The human-centered design

The human-centered design lesson is the most transferable insight. The platform's designers originally assumed credit was the primary need. Research with actual farmers revealed something more nuanced: poor input quality, unreliable markets, and lack of agronomic knowledge were the constraints farmers themselves prioritized; and finance came after. It also surfaced that women, who make up more than half the agricultural workforce, faced structural barriers a credit-first model would have entirely missed.

Two Pathways, Converging Lessons

India and Kenya illustrate two distinct but complementary pathways to digital agriculture scale. India pursued a state-led approach anchored in digital public infrastructure and coordinated institutional strengthening. Kenya, by contrast, saw early momentum driven largely by private-sector innovation built on widely adopted mobile connectivity and mobile money[33].

Despite these different starting points, the conditions required for sustained smallholder adoption show strong convergence. Across both cases, digital agriculture scaled not because of technology availability alone, but because foundational rails, delivery capacity, farmer-aligned economics, and coordinated ecosystem action came together in mutually reinforcing ways.

Strong digital rails are foundational, but their origin can differ
India built government-led DPI; Kenya leveraged privately built mobile money and connectivity. In both cases, scale accelerated only once trusted, widely used digital rails were in place.

Last-mile delivery capacity is non-negotiable
Whether through Farmer Producing Organizations in India or farmer groups and agents in Kenya, credible on-the-ground intermediaries proved essential for sustained farmer uptake.

Adoption follows clear economic value for farmers
In both countries, farmers engaged more consistently when digital tools improved access to inputs, buyers, finance, paired with risk reduction mechanisms, and not when tools were offered as standalone technology solutions.

Financial integrated design strongly shapes uptake
Models that aligned payments, credit, and risk-sharing with smallholder cash flows achieved stronger and more sustained usage across both contexts.

Bundled and connected services outperform single-point tools
Platforms that linked advisory, finance, and market access created stronger adoption pull than fragmented digital offerings.

Public–private partnerships enable integration and accelerate scale
India's experience shows the power of state-enabled ecosystems; Kenya's shows the speed of private innovation. In both, progress accelerated when public enablers and private delivery models reinforced each other.

There is no single pathway to digital agriculture scale. However, the evidence from both India and Kenya reinforces that sustained smallholder impact emerges when trusted digital infrastructure rails, strong delivery channels, farmer-aligned economics, and coordinated public–private action develop in parallel.

33. Grow Asia and The Sustainable Smallholder analysis

03

From Foundations to Delivery:

ASEAN's Current Architecture and the Path Forward



Where ASEAN Stands Today

India and Kenya offer instructive models from outside the region. Within ASEAN, however, a distinct architecture is already taking shape that could propel the region to being a global leader in tropical digital agriculture. Reviewing the current state of play is important to understand the foundations the region is building on and how these efforts relate to the delivery challenges outlined in this report.

Across ASEAN, a growing body of frameworks, legal instruments, and technical standards is beginning to form the region's enabling base for more coordinated and scalable action. This chapter builds on these developments and highlights practical pathways to strengthen and extend what is already underway at the ASEAN Secretariat level.

The Food, Agriculture and Forestry Sectoral Plan 2026–2030: Digital as a critical cross cutting enabler

The Food, Agriculture and Forestry Sectoral Plan 2026–2030 serves as ASEAN's strategic roadmap for the sector[34]. Organized around six strategic thrusts (sustainable and regenerative measures; decarbonization and climate resilience; food security and nutrition; trade and market connectivity; public-private partnerships and digital innovation; and sustainable forest management), the plan embeds digital technologies as enablers across multiple priority areas rather than treating digitalization as a standalone pillar[35].

Digital applications cluster primarily around three reinforcing areas[36]:

01
Developing 'oreal-time digital maps of food insecurity risk zones and strengthening regional data systems

02
Advancing digital financial inclusion by expanding smallholders' access to digital loans, insurance, and payment systems

03
Promoting ecosystem development to deploy digital innovations, empower cooperatives and SMEs, and build capacity at scale

34. ASEAN Food, Agriculture and Forestry Sectoral Plan 2026-2030 (FAF-SP 2026-2030). 35. ASEAN Food, Agriculture and Forestry Sectoral Plan 2026-2030; Grow Asia and The Sustainable Smallholder analysis. 36. ASEAN Food, Agriculture and Forestry Sectoral Plan 2026-2030; Grow Asia and The Sustainable Smallholder analysis

The ASEAN Digital Economy Framework Agreement (DEFA): Legal Rails for a Regional Digital Economy

The ASEAN Digital Economy Framework Agreement (the world's first regional digital economy agreement) has reached substantial conclusion in negotiations and is scheduled for signing by end-2026[37].

On cross-border data flows, DEFA goes beyond voluntary guidelines, harmonizing rules for trusted data movement across member states: an essential prerequisite for any regional crop or farmer registry.

On payments and identity, it mandates interoperability for digital payments and e-identities across all ten member states, providing the payment rails smallholders need to access subsidies, insurance payouts, and trade finance.

These are binding commitments, which is what distinguishes DEFA from the planning documents that preceded it[38].

ASEAN Digital Masterplan 2030

The ASEAN Digital Masterplan (ADM) 2030, formally launched through the Hanoi Digital Declaration in January 2026, elevates the development of regional Digital Public Infrastructure and trusted data connectivity to core pillars of the regional digital agenda[39]. The ADM 2025 envisions "ASEAN as a leading digital community and economic bloc, powered by secure and transformative digital services, technologies and ecosystem". Achieving such a vision will require governments, regulators and market players to work together in complementary ways[40]. A Regional Investment Promotion Plan, adopted in principle in 2024, enables member states to coordinate investment in shared digital infrastructure[41].

ASEAN–India DPI Cooperation

2026 marks the first year of implementation for the ASEAN–India Plan of Action (2026–2030), which includes active technical transfer of India's AgriStack modules to ASEAN member states[42]. India's stack, combining farmer registries, soil health data, and interoperable payment rails, is treated as a reference model. ASEAN and India jointly see DPI as foundational infrastructure, and explicitly name agriculture as one of the sectorswhere DPI should be leveraged[43].

ASEAN Leaders' declaration on the vision for Food,Agriculture and Forestry Towards 2045

Under the ASEAN Vision for Food, Agriculture and Forestry Towards 2045, digital technology is positioned as a key enabler of sector transformation.

The Declaration prioritizes expanding equitable access to digital tools and platforms,such as weather forecasting, flood and drought monitoring, market analytics, and precision agriculture, to improve productivity and farm management.

It further emphasizes large-scale capacity building, particularly for youth and smallholders, to strengthen digital skills and support more informed, resource-efficient decision-making.

In parallel, ASEAN commits to fostering digital innovation ecosystems through hubs, such as the Food Innovation Hub Vietnam[44] (established with Grow Asia, World Economic Forum and United Nations Industrial Development Organization) that connect agritech startups, research institutions, and farmers to accelerate the development and local adaptation of new solutions across the region[45].

37. World Economic Forum: ASEAN DEFA negotiations update, October 2025. https://www.weforum.org/stories/2025/10/asean-defa-digital-economy-pact-negotiations/ 38. Ibid. 39. ASEAN Digital Masterplan 2025. https://asean.org/wp-content/uploads/2021/08/ASEAN-Digital-Masterplan-2025.pdf; Crowell & Moring: ASEAN Digital Ministers Meeting 2026. https://www.crowell.com/en/insights/client-alerts/asean-digital-ministers-meeting-2026-spotlight-on-ai-cooperation-in-asias-rising-markets. 40. ASEAN Digital Masterplan 2025. https://asean.org/wp-content/uploads/2021/08/ASEAN-Digital-Masterplan-2025.pdf; Crowell & Moring: ASEAN Digital Ministers Meeting 2026. https://www.crowell.com/en/insights/client-alerts/asean-digital-ministers-meeting-2026-spotlight-on-ai-cooperation-in-asias-rising-markets. 41. Plan of Action to Implement the ASEAN–India Comprehensive Strategic Partnership (2026–2030). https://asean.org/wp-content/uploads/2025/07/Final-POA-to-Implement-ASEAN-India-CSP-2026-2030.pdf. 42. Ibid. 43. https://www.growasia.org/post/launching-viet-nam-s-food-innovation-hub-a-leap-towards-sustainable-agricultural-transformation.

What Member States Are Doing

Digital maturity varies considerably across the region, but the directional signal is consistent. Indonesia has prioritized digital agriculture within national development planning while advancing regulatory mandates for ICT integration in extension services[46] The Philippines has invested in national connectivity infrastructure and approved its first National Digital Connectivity Plan, with a 2028 access goal covering governance, investment, affordability, and network resiliency[47]. Vietnam has pursued cooperative-based access models, village-level ICT infrastructure, and structured farmer training[48]. Cambodia's Modern Agriculture Cooperatives offer a working model of institutional aggregation at scale[49]. Thailand's Agriculture 4.0 strategy has shifted toward programmatic deployment supported by demonstration and targeted subsidy[50]. In Lao PDR, digital agriculture ambitions are advancing alongside rural broadband expansion and cooperative-based ICT access, though implementation remains uneven[51].

The next step:

Sharpening Delivery for Farmer Impact

ASEAN has articulated a clear strategic direction for digitally enabled agricultural transformation and is progressively assembling the institutional, technical, and ecosystem foundations required for scale, at secretariat and member state level. Digitalization is widely recognized as a significant lever to enhance agricultural productivity, sustainability,and resilience across the region. The opportunity now lies in sharpening delivery so that these foundations translate more consistently into smallholder-level impact.

The case study evidence, the status quo, and the evolving ASEAN policy direction all point to a consistent conclusion: the region is not constrained by a lack of digital solutions. Rather, the central challenge lies in ensuring a strong and coordinated delivery system.

Adoption at scale remains limited and uneven because the surrounding conditions required for farmers to use these tools consistently, have not yet matured uniformly and in an integrated way across market contexts. Strengthening these conditions is therefore less about introducing new technologies and more about aligning and integrating the elements that enable real-world use at scale.



44. The Asean Leaders Declaration for Food Agriculture and Forestry towards 2045 (2-25); ttps://asean.org/wp-content/uploads/2025/10/10.-ASEAN-Leaders-Declaration-for-Food-Agriculture-and-Forestry-Toward-2045.pdf. 45. The Asean Leaders Declaration for Food Agriculture and Forestry towards 2045 (2-25); ttps://asean.org/wp-content/uploads/2025/10/10.-ASEAN-Leaders-Declaration-for-Food-Agriculture-and-Forestry-Toward-2045.pdf. 46. National Medium-Term Development Plan 2020–2024 (digitalization); Law No. 16/2006; Minister of Agriculture Reg. 48/2020. 47. Department of Agriculture, Philippines – National Digital Agriculture Roadmap; Grow Asia Philippines Country Platform analysis, 2025. 48. Vietnam Ministry of Agriculture and Rural Development – National Digital Transformation Programme in Agriculture, 2022. 49. Cambodia Ministry of Agriculture, Forestry and Fisheries – Modern Agriculture Cooperative (MAC) Programme; Grow Asia Cambodia Country Platform analysis, 2025. 50. Thailand Ministry of Agriculture and Cooperatives – Agriculture 4.0 Strategy; National Agricultural Extension Modernization Plan, 2024. 51. Lao PDR Ministry of Agriculture and Forestry – Digital Economy Master Plan 2021–2025; National Rural 2 capacity on ground – delivery capacity and these guys need to be capcityated Broadband Expansion Program.

In this report we refer to this integrated delivery logic as the Digital Delivery System: a practical lens for understanding how this looks like and how its components interact.

The Delivery System consists of three core elements and one key enabler:

01

Foundational infrastructure

Digitalization is now well embedded across ASEAN strategies as a cross-cutting enabler of agricultural transformation. The next step is to ensure that core infrastructure foundations - including connectivity, digital identity, payment systems, interoperable data platforms, and broader digital public infrastructure - are built and sequenced in ways that support smallholder use cases in different country contexts.

Evidence from comparable markets shows that these foundational layers often behave as threshold conditions. Where connectivity, identity, or payment rails remain uneven, downstream investments in services and applications generate limited returns.

02

Delivery Capacity on the Ground

Digital solutions ultimately reach farmers through last-mile delivery channels. Strengthening aggregation structures, including cooperatives, producer organizations, and sourcing networks, alongside extension systems, rural service providers, and last-mile intermediaries will be central to translating digital availability into trusted farmer access.

In many ASEAN contexts, these intermediaries function as the operational bridge between infrastructure and adoption. Where they are fragmented or under-capacitated,even well-designed digital tools struggle to scale. Targeted efforts to build,professionalize, and digitally enable these actors can significantly improve farmer onboarding, service continuity, and sustained use.

03

Adoption Enablement Mechanisms (incentives)

Regional strategies increasingly recognize the importance of digital finance integration, capacity building, inclusion, and risk-sharing mechanisms. Ensuring that solutions are affordable, trusted, and embedded in existing farmer workflows will be critical to accelerate adoption and sustain uptake, particularly among smallholders facing financial and capability constraints.

04

A Trusted Coordination Mechanism

Progress across the three priority areas above depends heavily on sustained alignment among ministries, regulators, private sector providers, cooperatives, and development partners.

The ASEAN Food, Agriculture, and Forestry Sectoral Plan 2026–2030 already recognizes this through its strategic thrust on public–private partnerships and digital innovation. Building on this foundation, a clear implementation plan is now needed to operationalize these priorities—while explicitly accounting for the diverse starting points and realities across Member States. A neutral, trusted regional platform with strong convening power is well positioned to play this orchestration role, helping to align investments, platforms,and implementation actors across the ecosystem[52].

In practice, scale tends to emerge where public, private, and philanthropic actors operate through structured collaboration rather than fragmented initiatives. Strengthening public–private–philanthropy partnership (4P) approaches, alongside continued prioritization of rural connectivity, digital skills, and enabling finance, will be important to ensure that progress across foundations, delivery capacity, and adoption mechanisms reinforces rather than out paces one another[53].

The Delivery System with its four priorities, provide a structured pathway for translating ASEAN's growing digital agriculture momentum into consistent farm-level impact. The chapters that follow examine each priority in turn, outlining practical policy pathways for ASEAN bodies, member state governments, and ecosystem partners.

52. Grow Asia and The Sustainable Smallholder analysis. 53. Ibid

04

Priority Areas and Pathways to Accelerate Digital Agriculture Delivery Agenda in ASEAN



This chapter will unpack in the most pragmatic and detailed way possible the how we can build a stronger delivery system on the ground.

Building on the evidence reviewed and ASEAN's current trajectory, four mutually reinforcing priority areas emerge to translate digital agriculture momentum into sustained smallholder impact. These priorities are designed to strengthen and further build ASEAN's digital delivery system, in alignment with the Strategic Thrusts of the ASEAN Food, Agriculture, and Forestry Sectoral Plan 2026–2030.

Framed as regionally coordinated initiatives, the areas below provide actionable entry points through which the ASEAN Secretariat can play a catalytic brokerage role - working alongside a neutral, trusted regional convening platform to help sequence investments, crowd in partners, and orchestrate implementation across the ecosystem. This approach can accelerate inclusive adoption while building on the strong foundations ASEAN has already put in place.

Priority Area 1: Invest in Foundational (Digital and Data) Infrastructure

Recommendation	Strategic Rationale
Ensure rural connectivity reaches viable coverage levels in priority agricultural zones	Reliable mobile broadband is a prerequisite for digital service delivery
Establish interoperable, regularly updated national farmer registries with gender disaggregated data	A verified farmer registry enables targeted subsidies, credit underwriting, extension tracking, and cross-program interoperability, while reducing duplication and exclusion risks
Strengthen and leverage interoperable digital payment rails for agriculture	Trusted digital payments lower transaction costs, enable bundled services and insurance, and create the financial backbone on which digital agriculture services will scale
Define a regional reference architecture for agricultural data	A common reference approach helps prevent fragmentation of national systems and enables future interoperability without requiring identical country platforms
Adopt regional principles on agricultural data governance, including consent, transparency, and fair value sharing	Clear rules on data use and farmer rights are critical to maintain trust, protect smallholders, and ensure responsible scaling of digital agriculture ecosystems

01. Rural Connectivity at viable coverage

Broad rural connectivity is ideal but a practical first step will acknowledge the different staring points of member states. Aiming for 'sufficient' rural connectivity to enable the majority of farmers in target zones to send and receive data with reasonable reliability is a pragmatic goal. In practical terms, experience from digital health and rural connectivity suggests that once rural mobile-broadband coverage moves well beyond 50% of the population, digital services start to have meaningful uptake; for many ASEAN agricultural zones, aiming for at least around 70–80% reliable 4G coverage is a reasonable working threshold, rather than insisting on full universality[54]. Government's plans to expand rural connectivity can be successfully supported by incentives for private sector participation[55].

02. Interoperable, national farmer registries with gender-disaggregated data

Several ASEAN member states have established some form of farmer registration system. However, few are fully interoperable across programs, consistently updated, or capable of capturing household-level data that distinguishes who farms, who owns, and who makes production and financial decisions. The objective is not to replicate India's AgriStack in full, but to develop verified, regularly updated national digital farmer registries linked to individual digital identification. Such systems should be shareable across government programs and usable by extension services, subsidy administrators, and financial institutions without each actor building parallel databases.

While registries will remain nationally owned and implemented, alignment with an ASEAN reference architecture will be important to support future interoperability. Interoperable systems help move digital agriculture from fragmented, country-by-country efforts toward a more scalable and investable regional opportunity, lowering transaction costs for lenders and platforms, enabling regional portfolio approaches, and making it easier for private and blended finance to participate at meaningful scale.

From the outset, registries should incorporate gender-disaggregated and household-level data. Systems that cannot distinguish who within a household uses services or controls land and income will systematically undercount women's participation and weaken the effectiveness of delivery system design[56].

03. Strengthening and Leveraging Inclusive Digital Payment Rails

One of the strongest predictors of successful digital agriculture uptake is whether farmers are already accustomed to digital transactions. In both Kenya and India, widely used payment systems were established years before agricultural applications began to scale on top of them. This sequencing matters: when trusted digital payment rails are already embedded in rural economies, the pathway for bundled services, credit, insurance, and marketplace participation becomes significantly smoother[57].

Across ASEAN, the (actual and perceived) high upfront cost of digital tools remains a critical barrier for smallholders. Governments, in collaboration with financial institutions, should therefore promote financing ecosystems that enable flexible repayment structures, such as post-harvest repayment, cooperative-mediated deductions, and appropriately safeguarded digital credit, so that payment models better reflect agricultural cash-flow realities. Inclusive and innovative financing approaches can materially improve adoption at scale[58].

Importantly, the region does not need agriculture-specific payment infrastructure. What is required is a trusted, accessible, and interoperable digital payment layer that reaches rural populations. In this context, the Digital Economy Framework Agreement's mandate for interoperable digital payments across all ten ASEAN member states

54. FAO – "Digital technologies in agriculture and rural areas: Status report" (2019); UNESCO Broadband Commission Broadband Commission for Sustainable Development – "2025 Advocacy Targets: 'Connecting the Other Half'" (updated 2024). 55. ERIA policy brief Policy Brief Digitalization in Agriculture and Food Systems in ASEAN: Pathways to Its Resilience and Sustainability Masanori Kozono, Ari Aji Cahyono, and Siti Mustaqimatud Diyanah;November 2025. 56. www.pib.gov.in; Outcome of Digital Agriculture Initiatives, 10 February 2026. 57. Grow Asia and The Sustainable Smallholder analysis. 58. ERIA policy brief Policy Brief Digitalization in Agriculture and Food Systems in ASEAN: Pathways to Its Resilience and Sustainability Masanori Kozono, Ari Aji Cahyono, and Siti Mustaqimatud Diyanah; November 2025.

represents one of the most consequential enabling commitments for the agricultural sector[59]. The policy priority now is to ensure these digital financial rails are implemented with clear intent to support agricultural use cases, so that over time, services such as input finance, insurance payouts, subsidy transfers, and digital marketplaces can reliably stack on top of a shared and trusted payment foundation.

04. Regulatory clarity sufficient to enable private investment

If data governance rules are absent, if liability for advisory services is undefined, if drone operations require case-by-case ministry approval, private actors will not invest in delivery models at scale. The threshold is not a perfect regulatory environment, but it is one legible enough that a private sector company can make a credible multiyear business case[60].

Thailand's Agriculture 4.0 strategy and Indonesia's regulatory mandates for ICT integration in extension services represent attempts to create this legibility at national level[61].

05. Define a regional reference architecture for agricultural data

The recommendation is not to create a new supra-platform, but to define a regional reference architecture for core agricultural datasets, for example for farmer and farm identification, production data, crop information, and risk indicators, that national systems can map onto without structural redesign. This is the role India's AgriStack standards played domestically: enabling interoperability without requiring identical state-level systems. ASEAN needs an equivalent regional approach to ensure that national registries being developed today do not become incompatible islands in the coming years[62].

As the region moves toward more interoperable data systems, establishing clear agricultural data governance principles becomes urgent and should precede large-scale rollout. Key questions must be addressed early: who owns the data generated through digital agricultural services, how it can be used, who benefits when it is monetized, and what consent mechanisms protect farmers whose production, financial, and location data are being aggregated.

Experience from other markets shows these risks are real- ranging from data shared with lenders without informed consent to algorithmic credit scoring that disadvantages women and smallholders and platform models that monetize farmer data without transparency. ASEAN should therefore adopt regional principles on consent,transparency, and fair value sharing to ensure trusted and responsible scaling of digital agriculture systems[63].



59. World Economic Forum Article ASEAN takes major step toward landmark digital economy pact, January 2026. 60. Grow Asia and The Sustainable Smallholder analysis. 61. Thailand Ministry of Agriculture and Cooperatives – Agriculture 4.0 Strategy; National Agricultural Extension Modernization Plan, 2024; National Medium-Term Development Plan 2020–2024 (digitalization); Law No. 16/2006; Minister of Agriculture Reg. 48/2020. 62. www.pib.gov.in; Outcome of Digital Agriculture Initiatives, 10 February 2026; ASEAN Food, Agriculture and Forestry Sectoral Plan 2026–2030; Grow Asia and The Sustainable Smallholder analysis. 63. Dalberg. The Farmer Data Dilemma: How Smallholder Data Is Collected, Used and Monetized. 2022.

Priority Area 2:
Strengthening Delivery Capacity on the Ground

Recommendation	Strategic Rationale
Strengthen and digitally enable cooperatives, producer organizations, and trusted rural intermediaries	Digital tools reach farmers through existing institutions. Strengthening aggregation structures improves onboarding, service continuity, and unit economics for last-mile delivery
Digitally upskill existing extension services and formalize lead farmers and rural youth as part of the extension delivery network	Extension systems already reach farmers but often lack digital capability. Upskilling agents and integrating lead farmers and youth into the network strengthens last-mile delivery, builds trust, and improves sustained digital adoption

06. Digitally Enable Trusted Delivery Institutions

A functioning aggregation structure at the local level, cooperative, FPO, or MAC-style cluster, is a prerequisite for viable digital agriculture delivery. In many ASEAN contexts,these structures remain uneven in coverage, capacity, and digital readiness. Where aggregation is weak or absent, the unit economics of serving dispersed smallholders do not work[64].

Farmers adopt digital tools more readily through institutions they already trust[65].

Evidence across Vietnam, Cambodia, and the Philippines shows that cooperatives,producer organizations, and extension networks are often the decisive channel for uptake, yet they remain under built in some systems and underinvested in many others[66].

The priority is therefore twofold: expand viable farmer aggregation where gaps persist,and reposition cooperatives and farmer producer organizations as core digital delivery actors, and not just as aggregators of produce, but as service delivery entities capable of onboarding farmers onto digital platforms, facilitating financial transactions, providing first-line technical support, and linking farmers to input suppliers, buyers, and financial institutions[67].

The objective is to move toward digitally ready cooperative models - similar in intent to Cambodia's MAC approach - that can reliably serve as the last-mile interface between farmers and the digital agriculture ecosystem.

64. IDR India Development Review: IDR Explains – Farmer Producer Organisations (FPOs), August 2023; Cambodia Ministry of Agriculture, Forestry and Fisheries – Modern Agriculture Cooperative (MAC) Programme; Grow Asia Cambodia Country Platform analysis, 2025. 65. India's playbook holds lessons for Southeast Asia's agri-tech moment, MoneyControl, October 2025; Cambodia Ministry of Agriculture, Forestry and Fisheries – Modern Agriculture Cooperative (MAC) Programme; Grow Asia Cambodia Country Platform analysis, 2025. 66. Insights from Vietnam study conducted by Grow Asia, February-March 2026; insights from Human Centred Design workshops conducted by Grow Asia and IFAD in the Philippines, Vietnam and Cambodia, 2025. 67. Grow Asia and The Sustainable Smallholder analysis.

07. Digitally upskill existing extension services and formalize leadfarmers and rural youth as part of the extension delivery network

Public extension systems remain the primary interface with farmers across ASEAN, but their reach and digital capacity are often stretched. Integrating trained lead farmers and rural youth into the extension delivery network provides a practical way to expand last-mile coverage while strengthening digital uptake[68]. In parallel, upskilling existing extension systems in priority zones to effectively use digital tools is essential. Extension agents play a critical role in helping farmers understand why digital tools matter, reducing perceived risk, and building initial trust. Integrating digital functions into already trusted advisory channels, including the use of simple, widely adopted communication tools where appropriate, can accelerate early uptake. Direct farmer training in digital literacy may be useful in some contexts, but in many cases extension agents, lead farmers, and digitally capable rural youth can serve as more scalable and trusted facilitators of farmer readiness. Making this delivery pathway explicit is central to addressing the underlying constraints on farmer adoption[69].

'Lead farmers' serve as local validators in rural community context. When a trusted neighbor adopts a technology and visibly benefits, the perceived risk for others drops sharply. This effect is documented and reliable across agricultural technology adoption literature[70]. India's district-level program explicitly incorporates progressive farmers into planning committees for this reason[71]. ASEAN member states should consider acknowledging and formalizing lead farmer roles within national extension systems, providing them with basic digital facilitation training and leveraging them as an effective"-mechanism" to decrease risk and increase adoption.

Youth are a distinct and 'underused' resource. Younger farmers (18–35) consistently emerge as early adopters of digital tools, and rural youth with secondary or tertiary education often have digital skills that their communities lack[72]. Positioning youth (especially young women) as extension agents and local digital facilitators, connecting them to cooperative structures, agri-SMEs, and formal training systems, creates an additional community embedded delivery channel that is both technically capable and credible to peers. The ASEAN Masterplan on Rural Development explicitly recognizes the potential of rural youth in agricultural transformation[73]. Translating that recognition into funded deployment programs is the immediate next step. This will also help to address ASEAN's aging farmer demographics by encouraging more young people to get excited about a career in farming.



68. Ibid. 69. Grow Asia Forum Singapore 2025, panel insights. 70. GSMA. Agricultural Value-Added Services: Business Models for Inclusive Growth. 2020; Dalberg Advisors. Digital Agriculture: Farmer Adoption and Impact. 2020 [source to verify]. 71. www.pib.gov.in; PM Dhan-Dhaanya Krishi Yojana Transforming Agri-Districts Through Convergence, 19 July 2025. 72. Philippines Digital Report, February 2026; insights from Vietnam study conducted by Grow Asia, February–March 2026. 73. ASEAN Masterplan on Rural Development 2022–2026. https://asean.org/wp-content/uploads/2022/11/34-ASEAN-Master-Plan-on-Rural-Development-2022-2026.pdf

Priority Area 3: Accelerating Inclusive Smallholder Adoption

Recommendation	Strategic Rationale
Promote financing, risk-sharing, and insurance models aligned with smallholder cash flows	Pay-at-harvest structures, bundled finance, and appropriate risk-transfer tools (including insurance) reduce adoption barriers and improve sustained uptake among resource-constrained farmers
Promote digital solutions that strengthen climate resilience	Tools that help farmers manage weather variability and production risk show stronger adoption dynamics and align with ASEAN climate commitments

08. Promote financing, risk-sharing, and insurance models aligned with smallholder cash flows

The financial design of digital agricultural services is as important as their agronomic design — and consistently underinvested[74].

Pay-at-harvest models, cooperative-mediated deductions from sales, input bundling with deferred payment, and group insurance products structured around growing season risk have all demonstrated adoption improvements in specific contexts. None is universally applicable. What is universal is the design principle: the payment structure must match how the farmer receives income, not how the platform needs to receive revenue[75].

In order to remove a small number of binding constraints that currently prevent viable seasonal and risk-sharing models from scaling, ASEAN member states can consider the following: clarifying within existing supervisory frameworks that agricultural lending may use seasonal or pay-at-harvest repayment structures; extending current agricultural or SME credit guarantee schemes to cover qualified smallholder and digital lending portfolios; and using digital finance or regulatory sandboxes to pilot bundled input–credit–insurance models under controlled conditions. Time-bound premium support and results-based incentives - mobilized through development partners, philanthropic capital,and blended finance facilities alongside national programs - can further help insurers and financial institutions reach underserved farmer segments without creating long-term subsidy dependence. Implemented through existing institutions and tested via structured pilots, these focused actions can materially improve provider willingness to serve smallholders and support more sustained uptake of digital agriculture services[76].

74. IFAD. Digital Financial Services for Smallholder Farmers. International Fund for Agricultural Development, 2023. 75. Grow Asia and The Sustainable Smallholder analysis; IFAD. Digital Financial Services for Smallholder Farmers. International Fund for Agricultural Development, 2023. 76. Grow Asia and The Sustainable Smallholder analysis; IFAD. Digital Financial Services for Smallholder Farmers. International Fund for Agricultural Development, 2023; ERIA policy brief Policy Brief Digitalization in Agriculture and Food Systems in ASEAN: Pathways to Its Resilience and Sustainability Masanori Kozono, Ari Aji Cahyono, and Siti Mustaqimatud Diyanah;November 2025.

09. Promote digital solutions that strengthen climate resilience

Digital tools that address climate risk, such as real-time weather advisory, soil health monitoring, index-based insurance linked to digital platforms, access to drought-resistant variety information, have stronger adoption dynamics because they address a constraint farmers experience as immediate and primary. Climate resilience should be embedded in digital service design as a value proposition, not added as a compliance requirement. Digital solutions that demonstrably support climate-smart practices and lower-emission value chains should be explicitly prioritised in public procurement and blended finance structures[77].



77. Grow Asia and The Sustainable Smallholder analysis.

Priority Area 4: Promote Public–Private-Philanthropy Partnerships and Innovation Ecosystems

Recommendation	Strategic Rationale
Translate ASEAN guidelines into budgeted, sequenced national digital agriculture roadmaps	Moving from regional ambition to country level execution requires clear timelines, budgets, and prioritization aligned with the Strategic Thrusts of the ASEAN Food, Agriculture, and Forestry Sectoral Plan 2026–2030. A practical starting point would be a region-wide needs assessment that undertakes a structured deep dive into each Member State's specific challenges, digital readiness, and opportunity landscape. This would help avoid a one-size-fits-all approach and provide the evidence base needed to sequence investments, tailor implementation pathways, and target support where it can deliver the greatest smallholder impact
Establish an ASEAN Digital Agriculture Sandbox	A structured regional testing environment can reduce pilot duplication, generate comparable evidence, and accelerate procurement of solutions that work in ASEAN contexts
Institutionalize public–private–philanthropy partnership (4P) mechanisms for digital agriculture delivery	Scaled adoption requires coordinated action across government, private sector, and development partners to align investments, standards, and delivery models

10. Develop costed national digital agriculture roadmaps

Under the ASEAN Food, Agriculture, and Forestry Sectoral Plan 2026–2030, ASEAN has agreed what needs to happen; the next step is for Member States to translate these guidelines into costed national digital agriculture roadmaps. These should be explicitly positioned under the Strategic Thrusts of the Plan, with defined targets for smallholder impact[78].

As a practical first step, this process could be anchored in a structured, region-wide needs assessment that generates a robust country-level evidence base, covering digital readiness, priority value chains, delivery bottlenecks, policy enablers, and investment gaps. This would help ensure national roadmaps reflect differing starting points and system realities, rather than applying a one-size-fits-all approach, while also creating a comparable baseline across the region.

78. ASEAN Food, Agriculture and Forestry Sectoral Plan 2026-2030; ERIA policy brief Policy Brief Digitalization in Agriculture and Food Systems in ASEAN: Pathways to Its Resilience and Sustainability Masanori Kozono, Ari Aji Cahyono, and Siti Mustaqimatud Diyanah;November 2025; Grow Asia and The Sustainable Smallholder analysis.

There is a clear opportunity for a neutral regional convening and orchestration function to support this process. Such a platform could coordinate the assessment across countries,ensure methodological consistency, and aggregate insights at regional level. Critically, it could also help translate diagnostics into sequenced, investable national roadmaps, broker partnerships between governments, technology providers, and financiers, and maintain momentum from planning through early implementation, helping ASEAN move from strategy to execution at scale.

11. Establish a Regional Digital Agriculture Sandbox

ASEAN's digital agriculture ecosystem is experiencing strong innovation momentum, with a growing pipeline of solutions emerging across member states. As this landscape matures, a practical opportunity is emerging to further strengthen how governments systematically identify, evaluate, and scale the most effective solutions. At present, similar technologies are often piloted across multiple countries without a shared evidence base,making it more difficult to compare performance across contexts and to accelerate the transition from promising pilots to scaled deployment.

A regional Digital Agriculture Sandbox would address this by providing a structured environment for testing high-potential solutions, including AI-powered extension, remote sensing applications, and predictive climate tools, against real farmer realities under common evaluation structures that make outcomes comparable across member states[79]. The sandbox could connect to a potential ASEAN Science, Technology and Innovation Portal for digital agriculture, allowing innovators to register solutions and governments to discover and commission validated tools[80].

The sandbox can function as a (regional) fast track to scale and to attract private sector investment. For private sector actors with proven solutions, it provides a clearer and more predictable pathway than navigating separate processes across multiple member states. By reducing uncertainty and signaling coordinated regional demand, a well-designed sandbox can significantly strengthen the investment case for digital agriculture and crowd in greater private and blended capital across the ASEAN agritech ecosystem[81].

12. Institutionalize public–private–philanthropy partnership (4P) mechanisms for digital agriculture delivery

Public–private–philanthropy partnerships (4P) are a critical enabler of the digital delivery-bridge because they provide the integration layer needed to connect infrastructure,delivery capacity, and farmer adoption. Digital agriculture transformation does not sit within a single ministry or actor group; it requires sustained coordination across governments, technology providers, financial institutions, cooperatives, research bodies,and development partners. Well-structured 4P models help break down institutional silos, align incentives, and crowd in both public and private investment toward shared delivery outcomes[82].

Institutionalizing 4P solutions means moving beyond ad hoc (pilot) collaborations and moving towards a formal and repeatable model embedded within ASEAN Secretariat–supported coordination mechanisms and member state implementation processes[83].

Regional and national innovation hubs can serve as practical workstreams within the institutionalized 4P architecture, supporting solution testing, partner matchmaking, and knowledge exchange and closely linked to the proposed ASEAN Digital Agriculture Sandbox, creating a coherent pathway from innovation validation to scaled deployment[84].

79. ASEAN digital masterplan 2025; [78] ASEAN Food, Agriculture and Forestry Sectoral Plan 2026–2030; ERIA policybrief Policy Brief Digitalization in Agriculture and Food Systems in ASEAN: Pathways to Its Resilience and SustainabilityMasanori Kozono, Ari Aji Cahyono, and Siti Mustaqimatud Diyanah;November 2025; Grow Asia and The SustainableSmallholder analysis; Grow Asia and The Sustainable Smallholder analysis. 80. Ibid. 81. Grow Asia and The Sustainable Smallholder analysis. 82. Grow Asia and The Sustainable Smallholder analysis. 83. Grow Asia and The Sustainable Smallholder analysis. 84. ERIA policy brief Policy Brief Digitalization in Agriculture and Food Systems in ASEAN: Pathways to Its Resilience and Sustainability Masanori Kozono, Ari Aji Cahyono, and Siti Mustaqimatud Diyanah;November 2025; Grow Asia and The Sustainable Smallholder analysis.

For ASEAN entities and national governments, promoting these solutions means using existing policy and financing levers to signal demand and reduce early-stage risk.
In practice, this includes incorporating climate-risk functionality into national digital agriculture strategies and public procurement criteria; prioritizing climate-smart digital tools within innovation challenges, sandboxes, and accelerator programs; and working with development partners and blended finance facilities to channel catalytic funding toward solutions that demonstrably improve smallholder climate resilience[85].

Where public demand signals and targeted catalytic support are aligned, solution providers are more likely to invest, and climate-relevant digital services scale more credibly across smallholder systems[86].



85. Ibid 86. Ibid

05

Pathways to Mobilize Investment for ASEAN's Digital Smallholder Delivery



Recent momentum across Southeast Asia signals a shift in how the smallholder transition is being financed. Across the region, stakeholders are moving beyond fragmented project support toward more structured approaches that combine digital infrastructure, delivery strengthening, and blended capital to unlock scalable investment and put small ticket loans into the hands of farmers and SMEs. The direction of travel is clear: the constraint is no longer a lack of pilots or innovation at the margins, but the absence of delivery architectures capable of translating sustainability ambition, including the effective uptake of digital tools, into bankable pipelines at scale[87].

For private capital, the signal is straightforward. Investment flows where the cost to serve is falling, early risk is manageable, and a credible pipeline of opportunities exists. Strengthening these conditions is also central to accelerating meaningful digital adoption among smallholders, particularly where digital tools support more resilient, traceable, and sustainable production systems[88].

The pathways that follow therefore focus on how ASEAN can reinforce the investment fundamentals of the delivery system itself, rather than multiplying stand-alone digital or sustainability pilots.

Priority 1: Position Foundational Digital Infrastructure as Market-Enabling Investment and Co-Investment Opportunity

The priority is to recognize that foundational delivery rails, including farmer data, aggregation capacity, digitally enabled extension, and traceability, are not only public goods – they are investment opportunities. These same elements form the backbone that allows digital solutions to reach farmers at scale and to translate into commercially viable service models[89].

Experience from more mature digital ecosystems shows a consistent pattern. Where governments establish credible delivery rails, private providers often follow by co-investing in services that build on top of this infrastructure, from fintech and advisory platforms to digitally enabled sourcing and input distribution models. At the same time,even where the public sector leads the initial build-out, investor appetite tends to strengthen once farmer segments become visible, aggregated, and digitally reachable, because the cost to serve declines and risk becomes easier to price[90].

For ASEAN, the implication is primarily a mindset shift. Foundational investments should be positioned deliberately as market-enabling infrastructure that both accelerates digital adoption and invites private co-investment over time. As these rails mature, they progressively crowd in commercial capital while enabling more resilient and sustainability-linked service delivery to smallholders[91].

87. New IDH-Grow Asia Alliance to De-risk Investments in Sustainable Trade and Climate Finance Across Southeast Asia, May 2025; WWF repot Unlocking smallholder finance for sustainable agriculture in Southeast Asia; 2021. 88. Grow Asia and The Sustainable Smallholder analysis. 89. World Economic Forum, Advancing Digital Public Infrastructure for the Agriculture Sector, 2024; World Economic Forum, How digital public infrastructure could transform farming, 2 June 2025. 90. World Economic Forum, Advancing Digital Public Infrastructure for the Agriculture Sector, 2024; World Economic Forum, How digital public infrastructure could transform farming, 2 June 2025. 91. World Economic Forum, Advancing Digital Public Infrastructure for the Agriculture Sector, 2024; World Economic Forum, How digital public infrastructure could transform farming, 2 June 2025; Grow Asia and The Sustainable Smallholder analysis.

Priority 2: Use Platform-Based Curated 4P Finance to Accelerate Market Build-Out

The second priority is to move beyond fragmented financing toward more structured,platform-based investment approaches that can mobilize capital at scale for shared delivery capacity.

ASEAN is not starting from zero. Finance pooled together from private, public and philanthropic sources is widely discussed but still nascent in its design. Public–private platforms are common but successful and implemented forms of 4P capital is not common yet.

In more mature markets, notably the EU, programs such as Invest EU demonstrate how pooled vehicles and public risk-sharing mechanisms can mobilize private capital into sectors characterized by fragmentation and high coordination costs[92].

What remains uneven in ASEAN is the strategic coordination and institutionalization of these elements specifically to support smallholder digital and regenerative and sustainable digital agriculture delivery systems. Financing still tends to be characterized by project-by-project approaches, donor-led pilots, fragmented blended facilities, and limited portfolio aggregation[93].

Platform-based blended finance offers a way forward. By pooling opportunities and using catalytic capital selectively, ASEAN actors can accelerate investment into shared delivery infrastructure that underpins both digital adoption and sustainability transitions, including traceability systems, first-mile logistics, and climate Monitoring Reporting and Verification (MRV) tools. Properly structured and curated, such platforms can crowd in private capital while building reusable system capacity that benefits multiple value chains.

Priority 3: Institutionalize the Portfolio Architect Function

The third priority is to ensure that strengthened delivery systems and platform financing translate into a steady flow of investment-ready opportunities that can support scaled digital uptake at scale in the smallholder sector.

Across ASEAN, a persistent bottleneck is the absence of a clearly mandated entity responsible for curating and maintaining investable pipelines. Without such a function,investors face fragmented deal flow, high search costs, and inconsistent investment quality, even where underlying system conditions are improving[94].

Institutionalizing a dedicated portfolio architect - whether within a national platform, a specialized facility, or a trusted public–private delivery unit, would materially strengthen the region's ability to package opportunities, align actors, and maintain investment readiness over time. What matters most is not the specific institutional form, but the clarity of mandate, continuity of pipeline development, and accountability for results[95].

92. Invest EU: https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/investeu_en;https://commission.europa.eu/strategy-and-policy/eu-budget/performance-and-reporting/programme-performance-statements/investeu-performance_en#contribution-to-strategic-technologies-(step). 93. Grow Asia and The Sustainable Smallholder analysis. 94. New IDH-Grow Asia Alliance to De-risk Investments in Sustainable Trade and Climate Finance Across Southeast Asia, May 2025; WWF repot Unlocking smallholder finance for sustainable agriculture in Southeast Asia; 2021; Grow Asia and The Sustainable Smallholder analysis. 95. Grow Asia and The Sustainable Smallholder analysis.

Priority 4: Unlock Last-Mile Capital for the Missing Middle

A fourth priority is to close the persistent financing gap facing the "missing middle": the Small and Medium sized Enterprises, aggregators, and service providers that translate digital and sustainability solutions into farmer-level adoption. Across much of ASEAN, the binding constraint is no longer early-stage innovation capital, but access to appropriately structured growth and working capital that enables these mid-layer actors to scale[96].

These businesses play a pivotal role in bridging solution providers and smallholder farmers, yet many remain under capitalized. Their risk profiles, ticket sizes, and cash flow patterns often fall between traditional bank lending and venture capital expectations, creating a structural bottleneck in the delivery system. As a result, promising digital and sustainability solutions struggle to reach farmers at meaningful scale[97].

There is growing momentum around more flexible instruments, including revenue-based financing and structured working capital that better match the cash flow realities of these enterprises. Properly designed, such mechanisms can expand service delivery capacity while maintaining financial discipline and crowding in commercial lenders over time [98].

Importantly, these approaches can increasingly be linked to emerging ecosystem and sustainability credit markets, creating performance-based incentives that reward actors who successfully support smallholder transitions. This helps align commercial returns with farmer adoption, resilience, and sustainability outcomes[99].

For ASEAN, mobilizing capital at scale will therefore require not only continued support for innovation finance, but also deliberate expansion of fit-for-purpose debt and revenue-linked instruments that strengthen the middle layer of the delivery ecosystem and accelerate last-mile impact[100].

In Summary

Strengthening foundational infrastructure reduces the cost to serve and creates the conditions for private co-investment. Platform-based transition finance can accelerate the build-out of shared system assets that underpin both digital and sustainability outcomes. Institutionalizing the portfolio architect function ensures that these improvements translate into a continuous pipeline of bankable opportunities.

Taken together, these shifts move the region beyond pilot-driven progress toward a more mature delivery system capable of attracting sustained and integrated 4P investment while enabling meaningful digital adoption for a resilient and sustainable agriculture system.

96. https://www.fao.org/investment-centre/solutions/innovative-finance/en; ISF Advisors: The case of missing middles: Gaps in the development finance landscape, and UNCDF's positioning in it, July 2025; ADB report: Asia Small and Medium-Sized Enterprise Monitor 2025: Global Uncertainty, Trade, and Private Sector Businesses in Asia and the Pacific, November 2025. 97. Ibid. 98. Ibid. 99. Ibid. 100. Ibid.

06

Call to Action

ASEAN has reached a pivotal moment. The region has articulated a strong strategic direction for digitally enabled agriculture through the ASEAN Food, Agriculture, and Forestry Sectoral Plan 2026–2030, alongside emerging regional commitments on data, payments, and digital integration. The constraint is no longer ambition. It is the performance of the digital delivery system.



This report has argued that sustained smallholder adoption depends on a functioning digital delivery system composed of four mutually reinforcing elements: foundational digital and data infrastructure; delivery capacity on the ground; adoption enablement mechanisms aligned with farmer economics; and effective coordination and orchestration across public, private, and philanthropic actors. Strengthening any single element in isolation will not be sufficient. Scale emerges when these components advance together in a deliberate and sequenced manner.

The implication for Member States is practical and immediate. National digital agriculture implementation plans should explicitly incorporate all four elements of the digital delivery system: foundational digital and data infrastructure, last-mile delivery capacity, farmer aligned adoption mechanisms, and effective orchestration.

In many contexts, elements of this system are already under development. Recognizing the diverse starting points across Member States, the acceleration and implementation process should begin with a structured region-wide needs assessment. Such a diagnostic can provide a clear evidence base on digital readiness, priority value chains, delivery bottlenecks, and investment gaps at country level. Anchoring national roadmaps in this shared analytical foundation will help avoid one-size-fits-all approaches while enabling regional comparability and coordinated partner support.

As ASEAN moves from strategy to execution, the importance of sustained coordination will only increase. Strengthening delivery systems with countries and across value chains, whilst coordinating with different actor groups is inherently complex. Experience from comparable markets suggests that progress accelerates when there is a neutral, trusted 40 convening and orchestration function that helps maintain alignment across the ecosystem.

Within the ASEAN context, such a function can play a catalytic enabling role alongside the ASEAN Secretariat and Member States. By supporting partner alignment, pipeline visibility, and the translation of diagnostics into investable opportunities, regional orchestration can help reduce fragmentation and crowd in Curated 4P finance more effectively. Crucially, this role operates in support of ASEAN leadership and national ownership, reinforcing, rather than duplicating, existing governance structures.

Looking ahead to 2030, the opportunity for ASEAN is clear; but so is the narrowing window to act. The region already possesses strong policy foundations, expanding digital infrastructure, and an increasingly dynamic innovation ecosystem. What will determine success over the next five years is not ambition, but execution: disciplined, coordinated,and integrated. National pathways must be grounded in country realities, the full digital delivery system must be strengthened in a coordinated manner, and investment flows must be aligned with credible pipelines and last-mile capacity.

The call to action is therefore immediate

Embed the full digital delivery system at the heart of national implementation, ground pathways in rigorous country diagnostics, and build the regional orchestration required to translate strong ambition into scaled farmer impact.

Appendices

Appendix 1: the constraint levels

Constraint Level	Components	Parameters / Elements Included (non-exhaustive)
Farmer Readiness	Economic capacity	Farm income; household/off-farm income; liquidity; access to
	Human capital	Education; digital literacy; farming experience; technical skills
	Behavioral readiness	Perceived usefulness; perceived risk; effort expectancy; openness
	Social context	Social influence; peer dynamics; gender roles; decision-making
	Operational realities	(small) farm sizes; labor availability; overall rural
	Agro-climatic exposure	Climate variability; rainfall; temperature; production risk
Delivery Capacity	Technology design and usability	User interface simplicity; language localization; relevance to farmer
	Commercial viability of solutions	Upfront cost; pricing structure
	Access infrastructure	Smartphone ownership; connectivity quality; data
	Human delivery channels	Availability and capability of human delivery actors –
	Farmer onboarding and continuous support	Training; troubleshooting; aftersales service; technical assistance;
	Production-system fit	Compatibility with farm size; cropping systems; local agronomic
Eco-system capacity	Policy and regulatory environment	Clarity of national digital agriculture strategies; regulatory
	Policy Tools	Competitive provider landscape; incentives for private-sector
	Financial ecosystem depth	Presence of agri-focused lenders; blended finance; guarantees;
	Institutional capacity	Strength of public agencies; extension system maturity;
	Eco-System coordination	Alignment between government departments, financiers, private
	National digital infrastructure	Broadband expansion; mobile penetration; digital ID; payment

Appendix 2:
Case Studies: India and Kenya

Case Study I: India

India is frequently cited as a reference point for smallholder digital transformation for a specific reason: rather than focusing primarily on promoting individual technologies, policymakers prioritized the creation of public digital infrastructure and the financial, market, and institutional reforms that together enabled innovation to move beyond isolated pilots[101].

Foundational Digital Public Infrastructure

India's digital public infrastructure (DPI) was designed to unify data flows across subsidies, insurance, credit, and advisory services[102].

India's DPI, referred to as the 'AgriStack' comprises several core components: a Farmers Registry that assigns unique IDs to support direct benefit transfers, geo-referenced village maps, and a Crop Sown Registry. Maintained by state governments, these datasets create a shared source of truth that can be used across programs and providers. A specific framework extends this DPI architecture by enabling farmers with limited credit histories to share real-time financial data securely with lenders - improving access to formal finance for those previously dependent on collateral or informal borrowing[103].

Crowding In Private Capital

A decade ago, venture capital outside India's primary technology hubs was limited. The government launched Start-up India alongside a Fund of Funds for Startups to amplify early-stage financing and reduce risk for private investors[104]. By 2025, more than 1,200 startups had benefited, many in agri-tech. This expanded capital base signaled policy commitment and helped crowd in private investment, allowing firms to test and scale solutions in supply chain digitization, advisory services, and farm management[105].

Farmer Aggregation: The Farmer Producer Organization Program

The central-sector scheme launched in 2020 to create 10,000 Farmer Producer Organizations by 2027–28 aims to improve smallholder incomes through collective action, economies of scale, and stronger market access[106]. FPOs increase bargaining power, reduce reliance on intermediaries, and facilitate direct marketing, with financial assistance,credit guarantees, and five years of professional management support provided per organization[107].

Operationally, FPOs enable bulk purchasing of inputs at lower cost while improving access to digital trading platforms such as the Open Network for Digital Commerce (ONDC). Crucially, they create counter parties with balance sheets,allowing startups, buyers, and financial institutions to engage at scale rather than transacting with fragmented producers[108].

Curated 4P Finance: The Agricultural Infrastructure Fund

India's Agriculture Infrastructure Fund (AIF) is a government-backed credit facility that uses interest subsidies and credit guarantees to crowd private bank lending into post-harvest and farm-gate infrastructure; it functions as a blended-finance instrument, not a stand-alone grant scheme[109].

The fund totals ~ ₹1 lakh crore (approximately USD 1.1 billion) and is deployed through banks and financial institutions, lowers borrowing costs, provides credit guarantee coverage, and reimburses guarantee fees for farmers, FPOs, cooperatives, agri-entrepreneurs, startups, self-help groups, and local governments[110]. Beyond asset creation, the fund illustrates how blended finance can be used strategically to reduce investment risk and enable digital platforms and farmer collectives to operate at scale.

101. McKinsey: How digital innovation is transforming agriculture: Lessons from India, May 2019. 102. www.pib.gov.in; Outcome of Digital Agriculture Initiatives, 10 February 2026. 103. Reserve Bank of India. Account Aggregator Framework, 2021. 104. India's playbook holds lessons for Southeast Asia's agri-tech moment, MoneyControl, October 2025. 105. Ibid. 106. IDR India Development Review: IDR Explains – Farmer Producer Organisations (FPOs), August 2023. 107. Ibid. 108. India's playbook holds lessons for Southeast Asia's agri-tech moment, MoneyControl, October 2025. 109. Agricultural Infrastructure Fund Posted On: 11 FEB 2025 5:29PM by PIB Delhi. 110. Press Note: Agricultural Infrastructure Fund (AIF) Scheme – Enhancing & Strengthening Agri Infrastructure, 28 August.

The Open Network for Digital Commerce: ONDC

The Open Network for Digital Commerce, operating on open protocols, allows buyers, sellers, logistics providers, and technology firms to transact across platforms without being confined to proprietary ecosystems[111]. Rather than acting as a marketplace, ONDC provides shared digital infrastructure that standardizes cataloguing, inventory management, order processing, and fulfillment. The policy intent is explicit: openness and interoperability are deliberate choices to lower transaction costs, expand market access, and stimulate competition[112].

Breaking Silos: Energy, Technology, and Local Planning

Solar irrigation and rural electrification have reduced reliance on diesel, lowering operating costs while making digital tools more viable in remote areas[113] . The Namo Drone Didi initiative positions advanced technologies as practical service delivery tools rather than assets accessible only to large operations, while explicitly addressing gender equity in technology access[114].

The PM Dhan-Dhaanya Krishi Yojana program accelerates agricultural development in 100 low-performing districts through convergence-based delivery, aligning 36 schemes across 11 ministries[115] District Agriculture Plans are prepared by committees that include progressive farmers as members, embedding local knowledge in formal planning. A digital dashboard, dedicated farmer application, and district ranking system support implementation and accountability[116].

Case Study II: Kenya

Kenya illustrates a different pathway. Unlike India's approach, which was anchored in national digital public infrastructure, Kenya's digital agriculture trajectory evolved primarily through private-sector innovation built on mobile connectivity and mobile money which was infrastructure that was already deeply embedded in rural life before (private) agri-specific platforms appeared[117].

DigiFarm

Launched in 2017, DigiFarm is an integrated digital agriculture platform developed by Safaricom in partnership with Mezzanine, providing smallholder farmers with access to inputs, credit, advisory services, and markets through a single mobile interface[118]. The platform surpassed one million registered farmers within its early years[119].

The platform has two principal components. Kilimo, the agricultural arm, addressing the end-to-end needs of smallholder farmers: digital extension services, input access, financial inclusion, and capacity building. The second component is Soko, the marketplace arm, which connects farmers directly to buyers, cooperatives, and processors, offering digital sales tracking and integrated instant M-Pesa payments[120].

Human-Centered Design

Early assumptions held that farmers primarily needed credit. Human-centered design research used to design and implement DigiFarm, revealed a more complex picture: low-quality inputs, unstable markets, and limited agronomic information were the constraints farmers themselves prioritized, before access to (affordable) finance[121].
It also revealed that women — more than half the agricultural workforce — faced additional constraints that a credit-first model would not solve for[122].

111. Revolutionizing Digital Commerce: The ONDC Initiative, www.pib.gov.in, 4 January 2025. 112. Ibid. 113. India's playbook holds lessons for Southeast Asia's agri-tech moment, MoneyControl, October 2025. 114. www.pib.gov.in; Implementation of Drone Didi Scheme, 29 July 2025. 115. www.pib.gov.in; PM Dhan-Dhaanya Krishi Yojana Transforming Agri-Districts Through Convergence, 19 July 2025. 116. Ibid. 117. FAO. The State of Digital Agriculture in Kenya. Food and Agriculture Organization, 2022. 118. MercyCorps Agrifin: Building the DigiFarm Innovation Platform – The Journey to One Million Farmers, May 2019. 119. Ibid. 120. Ibid. 121. MercyCorps Agrifin: Building the DigiFarm Innovation Platform – The Journey to One Million Farmers, May 2019. 122. Ibid.

This example matters beyond DigiFarm. Human-centered design consistently surfaces what survey data misses: the actual risk perceptions, household decision-making dynamics, and trust architectures that determine whether a farmer will try a digital tool and keep using it.



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