Five Years On, Five Years Ahead:

The Digital Agriculture Ecosystem for Small-Scale Producers in LMICs

Reflecting on progress and envisioning the future - Celebrating five years of Digital Agri Hub

Overall Summary of the 11th eConversation, 2nd series

eConversation framework:

The idea of **digitalisation for the agriculture ecosystem** has emerged gradually, not as a single innovation, but as the result of decades of technological, institutional, and organisational change in agriculture. What began as the mechanisation of farming has evolved into a complex, interconnected system in which data, technologies, and actors continuously interact across the entire agri-food value chain.

In its earliest phase, digitalisation in agriculture was, on the one hand, occurring at a territorial, aggregate level, with the use above all of satellite information for monitoring, early warning and forecasting purposes. One the other hand, it closely tied to efficiency gains at the farm level through mechanisation, irrigation systems, and later GPS-enabled machinery. This has evolved into *precision agriculture*, where sensors, satellites, and geospatial tools enabled more targeted and data-informed decision-making. Yet these innovations largely remained confined to individual farms or specific technologies.

The real transformation began when agriculture started to be understood as part of a broader **digital ecosystem**. In this perspective, digitalisation is no longer about isolated tools, but about i**ntegrating technologies, data flows, and stakeholders into a dynamic, interconnected system.** Today, the "digital agriculture ecosystem" refers to a socio-technical network in which farmers, agribusinesses, governments, researchers, and technology providers are – at least in principle -connected through digital infrastructures and platforms. Data becomes the central resource, continuously generated, shared, and analysed to inform decisions across multiple levels of the system.

Within this evolving landscape, international organisations such as the Food and Agriculture Organization **of the United Nations (FAO)**, the World Bank **(WB)** and t**he Technical Centre for Agricultural and Rural Cooperation ACP-EU (CTA)** have played a foundational role in shaping both the narrative and the practice of digital agriculture. They have emphasised its potential to address global challenges such as food security, climate change, rural poverty and inclusion. Similarly, the OECD has contributed to defining the policy and governance dimensions of digital ecosystems, particularly around data sharing, -interoperability and sovereignty.

Governments and regional institutions, including the European Commission, have further driven this transformation by investing in digital infrastructure, enabling regulatory frameworks, and embedding digitalisation into agricultural and rural development strategies. At the same time, the private sector, ranging from agritech startups to large multinational companies, has developed platforms, advisory services, and digital marketplaces that increasingly structure how agricultural value chains operate.

However, the ecosystem perspective becomes especially critical when considering **low- and middle-income countries (LMICs)**. In these contexts, agriculture is often dominated by **Small-Scale Producers (SSPs)**, and the conditions for digitalisation differ significantly from those in high-income countries. Challenges such as limited connectivity,

lower levels of digital literacy, fragmented markets, and constrained access to finance shape how digital ecosystems can emerge and function.

Rather than replicating models from more industrialised settings, digitalisation in LMICs has followed more **leapfrogging and hybrid pathways. Digital solutions on mobile devices**, for example, have played a transformative role, enabling farmers to access weather forecasts, market prices, financial services, and advisory support without the need for advanced infrastructure. In many cases, intermediaries, such as cooperatives, extension agents, or local service providers, act as crucial bridges between digital systems and farmers, ensuring that even those without direct access to technology can benefit.

In these environments, international development actors and donors have been particularly influential. Programmes supported by the World Bank and implemented in collaboration with governments and local partners have sought to build **digital agriculture innovation ecosystems**, combining infrastructure investments, capacity building, and policy support. Other actors and initiatives also play a critical role in shaping the ecosystem. The Digital Impact Alliance, in partnership with FAO and ITU, fosters collaboration among public and private actors, facilitating knowledge sharing and the scaling of digital innovations, particularly in low- and middle-income countries. Briter provides research and mapping of agritech startups and innovations, helping stakeholders understand trends and identify gaps. Mercy Corps Agrifin supports financial inclusion and digital solutions for smallholders, demonstrating how digital platforms can integrate financial and agricultural services. These actors complement national and global initiatives by linking innovation, financing, and collaboration.

Within this framework, **National Agricultural Digitalization Initiatives (NAgDI)**, spearheaded by the Commonwealth Secretariat, play a pivotal role. NAgDI address fragmentation by providing a shared national vision, aligning technology adoption with policies, rural development, and digital economy goals. They coordinate diverse actors, foster collaboration, encourage interoperability, and strengthen the enabling environment: digital infrastructure, governance, and capacity building. In LMICs, NAgDI are crucial for **inclusion**, ensuring smallholders, women, and remote communities can access digital solutions, often through intermediaries. They also facilitate the **scaling of innovations**, connecting pilots to national systems for sustainable impact. In this sense, NAgDI, where deployed, act as **ecosystem orchestrators at the national level**, ensuring that the different components of digitalisation—technologies, data systems, institutions, and actors—are aligned and mutually reinforcing. It is within these contexts that platforms such as the **Digital Agri Hub** and the **FAO Agrifood Systems Technologies and Innovations Outlook (ATIO) Knowledge Base (KB),** now part of the broader **FAO Science, Technology and Innovation (STI) Portal**, become particularly relevant.

The Digital Agri Hub – **this year celebrating its fifth anniversary** - exemplifies a shift from documenting isolated deployments of digital solutions to ecosystem-building approaches, especially in LMICs. **The Hub**, as a curated data repository, a knowledge base and data discovery facility, provides community and ecosystem support and advisory services in the domain of digitalisation for agriculture, with a special focus on small scale producers in LMICs. The Hub reaches out to agriculture value chain actors and nurtures the digitalisation for agriculture ecosystem via its D4Ag community of practice, an electronic knowledge network accounting for 2000+ members worldwide. By bringing together governments, private sector actors, researchers, and development partners, it facilitates the sharing of **digital solutions and knowledge tools** tailored to diverse local realities. Importantly, it **showcases digital** solutions that are not only technologically viable but also socially and economically inclusive.

The **ATIO Knowledge Base** is a comprehensive, open-access platform designed to support policymakers, investors, researchers, innovation users, and innovators in making informed decisions to accelerate the transformation of agrifood systems. Powered by AI and enriched through partnerships (Digital Agri Hub is a core partner on the digital solutions component), the ATIO KB bridges grassroots innovations with mainstream innovations.

The experience of LMICs also highlights critical challenges within digital agriculture ecosystems. Issues of data ownership, privacy, and governance are often less regulated, raising concerns about unequal power dynamics between global technology providers and local stakeholders. At the same time, the risk of exclusion - where smallholders, women, or remote communities are left behind - remains significant if digitalisation is not accompanied by deliberate inclusion strategies.

Despite these challenges, LMICs are also spaces of innovation and experimentation. Many successful digital agriculture models, particularly those based on mobile platforms, bundled services, and public-private partnerships, have originated or been refined in these geographies. This underscores an important point: digital agriculture ecosystems are not simply transferred from one context to another; they are co-evolved systems, shaped by local needs, capacities, and institutional environments.

Ultimately, the concept of digitalisation for the agriculture ecosystem implies that transformation in agriculture is not driven by technology alone. It emerges from the interaction between technologies, actors, institutions, and data systems, all embedded within specific socio-economic contexts. In low- and middle-income countries, this interaction is particularly complex, but also particularly important, as digitalisation holds the potential not only to increase productivity, but to enhance resilience, inclusion, and sustainable development.

In this sense, digital agriculture is best understood not as a fixed model, but as an ongoing, adaptive process, a continuously evolving ecosystem shaped by global agendas, local innovation, and the collective efforts of its many stakeholders.

About this eConversation

The objective of this eConversation which included two **e-discussions** and two **webinars** was to engage the D4Ag community of practice in a reflection on the **digitalisation for agriculture ecosystem** both over the last 5 years and on what awaits us in the next 5, with a specific focus on low- and mid-income countries (LMICs) and Small-Scale Producers (SSPs). The events have been organised by the Digital Agri Hub in collaboration with the Commonwealth Secretariat, FAO, IICA, Grameen Foundation, Eastern Africa Farmers Federation (EAFF), Asian Farmers' Association for Sustainable Rural Development (AFA) and Dgroups Foundation

The first e-discussion has been centred around the following questions:

Questions	
Q1:	How would you evaluate the status of the digitalisation for agriculture across low- and middle-income countries (LMICs)?
Q2:	Focussing on adoption and retention of solutions for Small-Scale Producers (SSPs), what has worked and what hasn't when it comes to scaling?
Q3:	What factors of the enabling environments (infrastructure and access, policies and strategies, literacy and skills, business ecosystem, knowledge and networking, etc.) emerged as most critical for the adoption of digital solutions and services by Small Scale Producers in LMICs?

Summary of the 1st e-Discussion (20 April – 4 May 2026) looking back five years

The exchanges reveal a growing consensus that digitalisation in agriculture across low- and middle-income countries (LMICs) has progressed significantly over the past decade yet remains far from delivering the transformational change that many anticipated. While digital tools, platforms, and services are increasingly available, their impact continues to be uneven, fragmented, and often constrained by structural barriers that extend well beyond technology itself.

A recurring theme throughout the discussions was the need for greater clarity in defining and measuring digitalisation. Contributors stressed that assessing progress requires moving beyond broad generalisations and establishing clear metrics and frameworks that can be applied at national and regional levels. While experiences differ considerably across countries and regions, participants observed a common trajectory: digital agriculture has moved beyond the early phase of experimentation and pilot projects toward a more mature understanding of what works in practice.

At the same time, there remains a significant gap between technological innovation and widespread adoption on the ground, often described as a divide between laboratory innovation and real-world implementation.

Many contributors characterised the current state of digital agriculture as a growing ecosystem that has not yet translated into integrated, institutionally embedded, and market-shaping transformation. Digitalisation remains largely informational rather than transformational for many small-scale producers. Farmers may receive information through digital channels, but access to information alone rarely changes outcomes unless it is connected to practical opportunities, services, and markets. This observation became particularly evident in discussions about scaling digital solutions.

The conversation on adoption and retention highlighted that the greatest challenge is not persuading farmers to try digital tools but ensuring that they continue using them over time. Initial adoption can often be stimulated through promotion, project support, or incentives. Sustained engagement, however, depends on whether solutions consistently create value within farmers' daily realities. Retention therefore emerged as a more meaningful indicator of success than adoption alone.

Participants repeatedly argued that successful digital solutions are those embedded within the broader agricultural ecosystem rather than directed solely at individual farmers. Farmers make decisions within networks of agro-dealers, cooperatives, buyers, extension agents, financial institutions, and other actors. Solutions that strengthen and leverage these existing relationships tend to achieve greater sustainability than those attempting to replace them. Trusted intermediaries often play a critical role in lowering barriers to use and increasing confidence in digital services.

The discussions further emphasized that standalone digital advisory services are rarely sufficient. Information becomes valuable only when accompanied by the means to act upon it. As a result, successful approaches tend to combine advisory services with access to inputs, finance, insurance, markets, or other complementary services. Such bundled value propositions create stronger incentives for continued engagement and improve the likelihood that digital tools contribute to meaningful livelihood improvements.

Contributors also stressed the importance of designing solutions that reflect the realities of rural users. In many contexts, low-cost technologies such as USSD and voice-based systems remain more effective than smartphone applications. Simplicity, local language support, and user-centred design were repeatedly identified as essential. Poorly designed solutions not only fail to gain traction but can undermine trust in digital innovation more broadly. Several participants warned against deploying immature technologies in farming communities, arguing that failed interventions may discourage future adoption of digital tools altogether.

The discussions also challenged assumptions about scale. Reaching large numbers of users does not necessarily constitute successful scaling if engagement is short-lived or dependent on subsidies. Participants argued that meaningful scale should be measured through sustained use, long-term impact, and integration into agricultural systems rather than through headline adoption figures alone. Questions of business sustainability were therefore closely linked to questions of scale. Solutions must create sufficient value for farmers or for other actors within the value chain who are willing to pay for the service. These reflections naturally led to the broader question of enabling environments. Contributors agreed that adoption and retention are shaped by a complex system of interconnected factors rather than by any single intervention. At the foundation lies public digital infrastructure, including connectivity, data systems, and digital public goods. Without these shared assets, innovators face higher costs and fragmented markets, limiting both scalability and sustainability.

Alongside infrastructure, coherent policies, governance frameworks, and national digital strategies were identified as critical. Effective digital ecosystems require clear rules governing data, interoperability, and institutional coordination. Yet policy frameworks alone are insufficient if connectivity remains unreliable or unaffordable. Many contributors highlighted that, for large numbers of rural producers, practical constraints such as poor network coverage, limited access to devices, and high costs remain major barriers to participation.

Digital literacy and skills emerged as equally important. Adoption is not achieved through technology itself but through the ability of users to understand and benefit from it. Contributors consistently argued that farmers engage with digital tools when those tools clearly improve outcomes and reduce complexity. This requires solutions that are accessible, intuitive, and adapted to local contexts.

Another important theme concerned trust, incentives, and risk-sharing. Participants argued that successful digitalisation depends on relationships in which stakeholders share farmers' risks and demonstrate long-term commitment. Adoption is strengthened when incentives are aligned across the ecosystem and when solutions genuinely address farmers' priorities rather than imposing external technological agendas.

The role of data systems also featured prominently. Interoperability, data governance, metadata standards, and mechanisms that allow users to capture value from their data were all identified as important components of trusted and efficient digital ecosystems. Participants noted that fragmented and poorly coordinated data systems often contribute to duplication, inefficiencies, and limited impact.

Despite differences in emphasis, the three discussions converged on a common conclusion. The challenge facing digital agriculture in LMICs is not primarily a technological one. Nor is it simply a question of adoption. Rather, it is a systems challenge. Digital solutions succeed when they are embedded within integrated ecosystems that connect infrastructure, policy, finance, markets, data, institutions, and human capabilities. Progress therefore depends less on introducing new technologies than on creating coherent architectures that align actors, incentives, and resources around farmers' realities.

Ultimately, digital transformation in agriculture will be achieved not when farmers adopt more technologies, but when digital tools become reliable, trusted, and largely invisible enablers that help producers make better decisions, access opportunities, reduce risks, and strengthen their resilience over time. The discussions suggest that the path forward lies in moving beyond fragmented pilots and isolated applications toward integrated systems capable of delivering sustained value at scale.

Takeaways from the 1st e-discussion

Question 1:
What about the status of digitalisation for agriculture across LMICs?

- **Lack of clear definitions and measurable frameworks**
  A central challenge is agreeing on what "digitalisation for agriculture" actually means and how to measure it. Without clear definitions and nationally grounded metrics, it is difficult to assess progress across LMICs. Existing frameworks (e.g. from the Commonwealth Secretariat or GSMA indices) are useful but need to be translated into actionable indicators.

- **Uneven and incomplete shift from pilots to systems**
  There is broad agreement that digital agriculture is moving beyond isolated pilots toward more structured systems, including national approaches like NAgDI. However, this transition is uneven, with persistent divides and strong regional variation. Many initiatives still struggle to scale sustainably.

- **From hype to needs - but funding still favours hype**
  The discussion highlighted two competing trajectories: hype-driven innovation versus needs-driven solutions. While the importance of farmer-centered, practical solutions is widely recognised, funding often continues to favour high-visibility, hype-driven approaches, limiting the scalability of solutions that truly benefit farmers.

- **Extractive digitalisation in smallholder agriculture, a recurrent risk**
  Digital agriculture can harm small-scale producers if it is imposed top-down and driven by corporate profit motives, so solutions must be designed inclusively, or not implemented at all if they risk being extractive.

- **Digitalisation remains largely informational, not transformational**
  Despite growth in tools and platforms, digital agriculture has yet to achieve systemic transformation. Many contributors noted that the ecosystem is expanding but not yet fully integrated into institutions or markets. Solutions remain fragmented, insufficiently validated, or poorly integrated, meaning they provide information but do not fundamentally change agricultural systems or farmer outcomes.

Question 2:
In terms of adoption and retention of solutions for SSPs, what has worked and what hasn't when it comes to scaling?

- **Retention matters more than adoption**
  A central insight is that getting farmers to try digital tools is relatively easy, but keeping them engaged is the real challenge. Sustained use depends on consistent, tangible value in farmers' daily decision-making, making retention the key measure of success.
- **Ecosystem integration drives lasting engagement**
  Digital solutions work best when embedded in existing agricultural ecosystems - agro-dealers, cooperatives, buyers, and financial providers. Rather than replacing these relationships, successful approaches strengthen and digitise them, often through trusted intermediaries.
- **Value bundling and clear economic returns are essential**
  Standalone digital advisory tools rarely sustain usage. Adoption and retention improve significantly when services are bundled (e.g. inputs, finance, insurance, markets), creating a clear "value stack" that directly improves farmers' incomes or reduces costs.
- **Poorly designed scale strategies undermine sustainability**
  Approaches relying on subsidies, "fail-fast" experimentation on farmers, smartphone-only design, or continuous-use assumptions often fail at scale. True scalability requires reliable, well-tested tools, seasonally aware design, and business models aligned with real willingness to pay.
- **Public Sector as the Backbone of Scalable Digital Agriculture**
  Public sector involvement is critical for scaling digital agriculture solutions, if it provides the shared infrastructure (like farmer registries and data systems) and alignment with national programmes that make these solutions easier to integrate, expand, and sustain.

Question 3:
What enabling environments emerged as most critical for digital tech adoption by SSPs in LMICs?

- **Foundational role of digital public infrastructure and governance**
  Adoption depends heavily on strong Digital Public Infrastructure (DPI), clear policies, and data governance frameworks. Without these, costs remain high and solutions struggle to scale.
- **Access and usability are practical constraints**
  Reliable connectivity, affordability, digital literacy, and user-centred design (including local languages and low complexity) are essential for real-world adoption by small-scale producers.
- **Value-driven adoption through integrated services**
  Farmers adopt digital tools when they deliver clear economic value - especially when embedded in value chains or bundled with services like finance and market access.
- **Need for system integration beyond isolated solutions**
  The main barrier is not a lack of digital solutions, but a lack of integrated systems that connect infrastructure, data, markets, and finance. Sustainable adoption emerges when these elements function together.

The second e-discussion has been centred around the following questions:

Questions	
Q4:	How do you see the digital agriculture ecosystem evolving over the next 5 years?
Q5:	How to you see the role of AI in this respect, between opportunities and safeguards
Q6:	How should the Digital Agri Hub embrace this evolution?

Summary of the 2nd e-Discussion (11 – 22 May 2026) looking ahead five years

The 2nd e-discussion explored not only where digital agriculture in low- and middle-income countries (LMICs) may be heading over the next five years, but also how emerging technologies, particularly artificial intelligence (AI), can be shaped to serve the interests of small-scale producers. Across these exchanges, participants moved beyond immediate challenges of adoption and enabling environments to reflect on longer-term trajectories, future risks, and the institutional choices that will determine whether digitalisation becomes truly transformative.

A central theme running through the exchanges was the need to strengthen the foundations upon which digital agriculture ecosystems are built. Contributors repeatedly argued that the next stage of development should not be characterised by rapid technological expansion for its own sake, but by the gradual consolidation of the underlying conditions that allow innovation to generate lasting value. Shared digital infrastructure, robust legal and regulatory frameworks, functioning domestic markets, and stronger local ecosystems emerged as critical prerequisites for sustainable growth.

Participants expressed a strong desire to move beyond the era of pilot projects and short-term interventions that have often characterised digital agriculture initiatives. Success, many argued, should no longer be measured by the number of applications launched or farmers reached during project implementation, but by whether solutions continue to create value long after external funding has ended. Several contributors questioned whether donor-driven models have sometimes distorted priorities, encouraging short-term scaling targets rather than addressing the structural constraints that limit long-term sustainability. In this vision, the future of digital agriculture depends on building systems capable of standing on their own rather than remaining dependent on continuous project support.

Closely linked to this perspective was the growing importance attributed to sovereignty and local ownership. Contributors argued that countries, communities, and local innovators should have the capacity to determine their own digital development pathways rather than simply adopting externally designed technologies and models. This emphasis on sovereignty extended beyond governance to include control over data, technological choices, and the broader evolution of national digital agriculture ecosystems.

At the same time, participants recognised that technology itself will continue to evolve rapidly. Some anticipated significant advances in automation, drones, robotics, and AI-enabled services over the next five years. Yet the dominant view was that technological sophistication alone will not determine success. Rather, future progress will depend on the ability to integrate technological innovation into coherent ecosystems that combine technical, institutional, governance, legal, and social dimensions. Contributors repeatedly called for a more systemic understanding of digital agriculture, one that acknowledges the multiple layers required to support effective and sustainable innovation.

Within this broader vision, digital literacy emerged as a foundational requirement. Participants argued that digital literacy should no longer be treated as a secondary capacity-building activity but as a core element of ecosystem development. Importantly, this extends beyond farmers themselves to encompass extension workers, agro-dealers, cooperatives, service providers, and public institutions. The future effectiveness of digital agriculture will depend not only on access to technology but also on the ability of all actors within the ecosystem to understand, interpret, and use digital tools effectively.

The discussion on artificial intelligence built directly upon these themes. Contributors broadly agreed that AI has the potential to become an important component of digital agriculture, but they consistently rejected narratives portraying it as a standalone solution or technological revolution. Instead, AI was viewed as an additional analytical layer that can strengthen existing digital systems by processing complex information, supporting decision-making, and generating insights from large datasets.

However, participants repeatedly stressed that the benefits of AI depend fundamentally on the quality of the surrounding ecosystem. Without reliable data, interoperable systems, and robust digital public infrastructure, AI is unlikely to deliver meaningful benefits for farmers. Several contributors warned against becoming distracted by the latest technological trends while neglecting the investments required to build strong public data ecosystems and national agricultural data infrastructures. In this perspective, AI should be seen as dependent upon, rather than a substitute for, foundational digital investments.

The practical realities of smallholder farming also featured prominently in the discussion. Contributors questioned assumptions that small-scale producers will rapidly adopt sophisticated AI applications in the coming years. Challenges related to connectivity, affordability, literacy, and trust remain significant barriers even for relatively simple digital tools. As a result, many participants argued that the most realistic role for AI in the near future is not as a farmer-facing technology but as a backend capability supporting advisory services, research, planning, extension systems, and other intermediaries.

Trust emerged as a particularly important consideration. Contributors observed that many farmers continue to place greater confidence in fellow farmers and trusted advisors than in external digital platforms. This reinforces the importance of human intermediaries who can interpret, contextualise, and communicate AI-generated insights. Rather than replacing people, AI is expected to enhance the capacities of extension agents, agro-dealers, researchers, and policymakers, helping them provide more relevant and timely support.

The discussion also highlighted important questions of localisation and technological appropriateness. Contributors advocated for AI systems that are adapted to local contexts, languages, and realities, rather than relying exclusively on large, centralised models developed elsewhere. There was considerable interest in decentralised and resource-efficient approaches capable of operating closer to end users, particularly in environments where connectivity, computing resources, or energy availability may be limited. Localisation was viewed not only as a technical necessity but also as a means of strengthening ownership, relevance, and inclusion.

Alongside the opportunities offered by AI, participants devoted considerable attention to governance, ethics, and safeguards. Concerns were raised about the risks associated with opaque algorithms, proprietary business models, and unequal power relationships in data ecosystems. Contributors argued that farmers should not become passive sources of data while control and value creation remain concentrated elsewhere. Transparency, accountability, data sovereignty, and open approaches were therefore presented as essential principles for future AI deployment in agriculture.

These concerns became particularly important when considering farmer agency. Across the discussion, there was broad agreement that AI should strengthen rather than diminish farmers' ability to make informed decisions. Automation should support human judgement, not replace it. Contributors repeatedly stressed that successful digitalisation should reduce complexity, lower costs, and simplify decision-making rather than transferring additional burdens onto producers.

The final discussion on the future role of the Digital Agri Hub brought many of these themes together. Participants envisioned the Hub as more than a platform for information exchange. Instead, they saw it as a space capable of shaping collective intelligence, facilitating dialogue, supporting research, and helping define the future direction of digital agriculture. Contributors argued that the Hub's unique value lies in its ability to bring together diverse perspectives while maintaining a strong focus on the realities and aspirations of farmers.

Several participants suggested that the Hub should play an active role in exploring emerging technologies through research, experimentation, and structured discussions, including AI-focused learning spaces and innovation sandboxes. Equally important, however, is ensuring that technological debates remain grounded in practical realities. Contributors emphasised that the Hub should help amplify farmer perspectives, identify real-world priorities, and encourage evidence-based reflection on both opportunities and risks.

A particularly strong message concerned the need to move beyond simply consulting farmers toward genuinely involving them in the design and evaluation of digital innovations. Contributors argued that technologies should be judged not by their novelty but by whether they reduce costs, lower complexity, improve resilience, and deliver tangible value to producers. Farmers are willing to embrace innovation, but only when systems recognise their constraints, distribute risks fairly, and work reliably in practice.

This focus on shared responsibility generated one of the most significant insights emerging from the discussions. Participants challenged models in which technology providers, investors, or project implementers bear little consequence when digital innovations fail, while farmers absorb most of the risks. The future of digital agriculture, they argued, depends on creating arrangements where responsibility, accountability, and rewards are more equitably distributed among stakeholders.

Taken together, the discussions paint a vision of digital agriculture that is both ambitious and grounded. The next five years are likely to bring significant technological advances, particularly in artificial intelligence and automation. Yet participants consistently argued that technology alone will not determine success. What matters most is the creation of strong public foundations, digitally literate ecosystems, trusted institutions, equitable governance arrangements, and meaningful farmer participation.

The future of digital agriculture will depend not on how advanced technologies become, but on whether they are embedded within systems that are locally owned, ethically governed, practically useful, and capable of delivering lasting benefits to small-scale producers. In this vision, AI is not the destination. It is one of many tools that can help build more resilient, inclusive, and farmer-centred agricultural systems if guided by the right principles, institutions, and collective choices.

Takeaways from the 2nd e-discussion

Question 4:
How do you see the digital agriculture ecosystem evolving over the next 5 years?

- **The future of digital agriculture depends on building stronger foundations, not just deploying more technologies**
  Participants consistently stressed that D4Ag solutions will only thrive if the underlying enabling environment is strengthened. This includes shared digital infrastructure, supportive legal and regulatory frameworks, functioning local markets, and institutional capacity. The discussion highlighted the importance of "having the basics in place" before expecting digital agriculture solutions to scale sustainably.

- **The ecosystem is expected to evolve more gradually and sustainably, moving away from the "scale fast" mindset**
  Contributors challenged the conventional expectation of rapid growth and scaling commonly associated with technology innovation. Instead, there was broad support for a slower and more sustainable approach focused on long-term farmer engagement and measurable impact beyond pilot phases and donor-funded projects. Success should be judged by whether farmers continue benefiting from services after projects end, rather than by short-term adoption metrics.

- **Sovereignty and locally driven development are becoming central priorities**
  A recurring theme was the importance of countries, communities, and local innovators being able to shape their own digital agriculture trajectories. Contributors highlighted the need for locally rooted ecosystems that are resilient, independent, and aligned with local realities rather than overly dependent on external agendas or imported models. Grassroots transformation and community-driven approaches were seen as particularly important for ensuring that technology serves local needs.

- **Building a robust digital agriculture ecosystem requires coordinated action across multiple interconnected layers**
  The discussion emphasised that sustainable D4Ag development depends on collaboration across technology, governance, legal systems, institutional arrangements, and human expertise. Participants argued that digital agriculture ecosystems cannot be built through isolated solutions alone but instead require co-construction of shared ecosystem layers and stronger coordination among stakeholders.

- **Digital literacy is emerging as a foundational requirement for inclusive digital agriculture ecosystems**
  Contributors stressed that digital literacy should no longer be treated as a secondary capacity-building issue, but rather as a core enabling condition for inclusive and sustainable digital agriculture. Strengthening the digital capabilities of all ecosystem actors — including farmers, extension agents, agro-dealers, and institutions — was viewed as essential for the next phase of D4Ag development, although participants also recognised that achieving this at scale remains a major challenge.

Question 5:
How do you see the role of AI in this respect, between opportunities and safeguards?

- **AI is only as strong as the surrounding digital ecosystem**
  Participants agreed that AI has significant potential to improve agricultural analysis, planning, and advisory services. However, its effectiveness depends on reliable data systems, interoperable infrastructure, and robust public digital ecosystems rather than on algorithms alone.

- **In the short term, AI is likely to deliver more value behind the scenes than directly to farmers**
  The discussion suggested that the most realistic near-term applications of AI lie in supporting extension agents, researchers, agro-dealers, and policymakers through analytics and decision support, while trusted human intermediaries remain essential for contextualisation and farmer engagement.

- **Digital inclusion requires more than connectivity**
  Contributors highlighted that adoption barriers are not only technical but also social and institutional. Trust, digital literacy, affordability, local relevance, language accessibility, and sustained engagement all shape whether farmers meaningfully benefit from digital and AI-enabled services.

- **Localised, frugal, and decentralised AI models may be more appropriate for smallholder contexts**
  There was strong support for context-specific and energy-efficient AI systems, including edge-based and small language models adapted to local realities. Contributors also stressed the importance of open approaches, data sovereignty, and safeguards to prevent farmers from losing control over their data and decision-making.

- **Governance, ethics, thrust building and human agency are central to responsible AI in agriculture**
  The exchanges consistently emphasised that AI should augment rather than replace human capacities. Effective safeguards - including transparent governance, human oversight, inclusive design, and protections for vulnerable groups - were seen as essential to ensure that AI contributes to equitable and sustainable agricultural development.

Question 6:
How should the Digital Agri Hub embrace this (the ongoing, largely AI-driven) evolution?

- **The Hub should remain anchored in farmers' realities while looking ahead.**
  Participants argued that the Hub's products and services should focus on combining forward-looking thinking with a deep understanding of farmers' needs and aspirations. Rather than being driven by technology trends alone, it should help shape a vision for digital agriculture that starts from the perspectives of farmers and informs broader policy- and investment decisions.

- **The Hub should become a space for experimentation, learning, and evidence generation.**
  As AI rapidly evolves, the Hub can play an important role by fostering research, encouraging open discussions, and creating opportunities to test and evaluate new approaches. Safe environments for experimentation, knowledge exchange, and collective learning can help stakeholders understand both the opportunities and limitations of emerging technologies before they are deployed at scale.

- **The Hub should strengthen collective intelligence rather than simply promote technologies.**
  AI offers opportunities to improve how agricultural data are analysed, interpreted, and transformed into actionable insights. Contributors suggested that the Hub should support collaboration among researchers, practitioners, policymakers, and farmers, helping them identify trends, generate evidence, and make better-informed decisions while ensuring that the farmer perspective remains visible throughout the process.

- **The Hub should facilitate farmers' representation to be embedded in both innovation processes and sector dialogue.**
  Participants argued that farmers should not only be consulted about digital innovations but should help shape them. The Hub can support this by ensuring that farmers and their representative organisations have a visible and meaningful role in e-discussions, webinar panels, and innovation processes, allowing their perspectives to inform priorities, design choices, and assessments of success. This would help move digital agriculture from a technology-driven model to one that is genuinely farmer-centred.

Some statistics

Email-based exchanges

Question	Number of contributions	Question	Number of contributions
Q1	24	**Q4**	14
Q2	14	**Q5**	13
Q3	19	**Q6**	8
Total	**57**	**Total**	**35**

Top contributors to the 1st e-discussion (exceeding 2):

- Nixon Gecheo with 7 contributions
- Fadi Mujahid with 5 contributions
- Gupta-jee with 3 contributions

Top contributors to the 2nd e-discussion (exceeding 2):

- Fadi Mujahid and Gupta-jee with 4 contributions