



Multilateral Collaborative Partnerships and Digital Innovation in Agri-Food Systems

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Abstract

The digital transformation of food, land, and water (FLW) systems holds potential for sustainability and resilience but remains hindered by fragmentation, infrastructure deficits, and governance gaps. Unlike fintech and healthcare, where structured digital adoption has flourished, FLW systems require multilateral collaborative partnerships to scale innovations effectively. This working paper examines five case studies from Latin America, Africa, and South Asia, highlighting how strategic partnerships—including those led by CGIAR, IICA, AGRA, and private sector actors—drive digital adoption. Findings reveal that successful collaboration hinges on two interdependent processes: a technical process for identifying digital solutions and an incentive process for aligning stakeholder interests. Trust-building, clear governance, and equitable participation emerge as key enablers. Lessons from fintech and healthcare emphasize the need for regulatory clarity, interoperable data frameworks, and inclusive financing models to scale digital transformation. Moving forward, addressing data sovereignty, power asymmetries, and financing constraints through structured partnerships will be essential for unlocking the full potential of digital innovation in FLW systems.

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Introduction

The food, land, and water (FLW) systems, essential for global economic stability and human survival, face increasing challenges related to food security, climate change, and sustainability (Pawlak & Kołodziejczak, 2020; AGRA, 2023). While digital innovation has been transformative in sectors such as health, fintech, and digital governance, its adoption in FLW systems has lagged significantly (Abate et al., 2023; Khamis et al., 2021; Leyens et al., 2022; Miah, 2023). Given the pivotal role of FLW systems in achieving the Sustainable Development Goals (SDGs)—including ending hunger, eradicating poverty, and fostering climate resilience—the slow pace of digital transformation raises critical questions about the systemic barriers impeding progress and the strategies required to overcome them (Atapattu et al., 2024; FAO, 2018; Paroda, 2018; FAO, UNEP, & UNDP, 2023).

One of the primary obstacles to digital adoption in FLW systems is their inherent complexity and fragmentation. Unlike centralized industries that have benefited from coordinated digital strategies, FLW value chains are highly decentralized, involving dispersed smallholder producers, diverse market structures, and region-specific environmental conditions that necessitate localized solutions (Dibbern et al., 2024; Fuglie et al., 2020; Klerkx & Rose, 2020). This fragmentation has resulted in siloed innovation, where digital solutions remain isolated rather than scaling effectively. In contrast, sectors such as healthcare and fintech have leveraged structured multilateral partnerships to create enabling environments for large-scale digital adoption (Labrique et al., 2018; CGAP, 2024). These examples suggest that accelerating digital transformation in FLW systems requires fostering collaborative frameworks that integrate multiple stakeholders—

including governments, private sector actors, research institutions, and community-based organizations—to co-develop and scale solutions (FAO, 2023; Nagaraji et al., 2023).

However, critics argue that the decentralized and localized nature of FLW systems limits the effectiveness of large-scale collaborations (FAO, 2016; Khan et al., 2024; Conti et al., 2023). They highlight challenges such as misaligned incentives, power asymmetries, and governance complexities that often result in partnerships disproportionately benefiting larger agribusinesses and technology providers while sidelining smallholder producers—the backbone of many FLW systems (World Economic Forum, 2023). Additionally, infrastructural deficits, including poor connectivity and low digital literacy in rural areas, exacerbate barriers to adoption, particularly in the Global South (FAO, 2016; Mhlanga, 2024).

Despite these challenges, emerging evidence suggests that well-structured multilateral collaborations can overcome systemic barriers, creating an enabling environment for digital transformation. By integrating diverse expertise and aligning stakeholder incentives, these partnerships can generate context-specific solutions while ensuring inclusive and equitable digital innovation (FAO, 2016; Nagaraji et al., 2023; Morgan et al., 2022). Case studies from Latin America, Africa, and Asia illustrate how coordinated efforts among private enterprises, research institutions, and policymakers have facilitated the scaling of technologies such as digital traceability, climate-smart solutions, and AI-driven decision support tools (FAO, 2023; Gardeazabal, 2023; FAO, UNEP, & UNDP, 2023). Furthermore, regulatory advancements and targeted capacity-building initiatives are helping address connectivity and digital literacy gaps, enabling greater participation in digital solutions (Deloitte, 2020; Choruma et al., 2024).

This paper argues that multilateral collaborative partnerships are not only viable but essential for achieving meaningful digital transformation in FLW

systems. By fostering trust, aligning incentives, and ensuring equitable participation, these partnerships can mitigate systemic barriers while enhancing sustainability and resilience (Choruma et al., 2024; Fielke et al., 2022; Abiri et al., 2023; Raturi et al., 2022; Sullivan et al., 2024). Drawing on comparative insights from digitally advanced sectors and case studies from diverse FLW contexts, this paper explores how structured collaboration can drive innovation, mitigate risks, and support the widespread adoption of digital solutions.

In doing so, this working paper moves beyond the technological and infrastructural dimensions of digital adoption to examine the socio-political processes that underpin successful collaborations. It highlights the importance of trust-building mechanisms, participatory governance, and shared-value approaches in enabling scalable, inclusive, and sustainable digital transformation. By analyzing real-world cases and cross-sectoral insights, this research contributes to the growing discourse on digital innovation in FLW systems and provides actionable recommendations for designing and implementing effective multilateral partnerships.

Methodology

This work employs a comparative case study analysis of five multilateral initiatives spanning Latin America, Africa, and South Asia. These cases were selected to examine diverse strategies for fostering digital transformation through collaborative models. The Agri-Innovation Roundtable in Mexico, facilitated by The Yield Lab Initiative, focuses on piloting irrigation technologies in maize production through private-public partnerships. CultivateNext, operating in Colombia, Mexico, and Guatemala, is an accelerator fostering regenerative agriculture and renewable energy solutions through structured collaborations between startups, research institutions, and development organizations. The Digital Agriculture Network in Latin America, coordinated by IICA, serves as a regional

platform that integrates AgTech startups, corporate actors, and policymakers to address systemic barriers to digital adoption. The SMART AgTech Integration Facility in Pune, India, is a research-led initiative working with Farmer Producer Organizations to assess digital gaps and promote locally adapted technological solutions. Finally, AGRA and the African Union exemplify multilateral efforts to embed digital governance into FLW system transformation policies across Sub-Saharan Africa. The comparative analysis of these cases explores how partnership structures, governance frameworks, stakeholder incentives, and policy environments shape the effectiveness of digital innovations, while also identifying constraints that limit scalability.

A systematic review of reports, policy briefs, and peer-reviewed literature was conducted to establish a knowledge base on the role of the case study partnerships in overcoming barriers to digital transformation. This review focused on understanding structural constraints such as fragmented value chains, inadequate infrastructure, and the complexities of multi-actor coordination, while also identifying successful models that have enhanced the adoption and scalability of digital solutions. The table below summarized the reviewed documents per case.

Table 1. Documents reviewed

Case Study	Lead Partner	Area of Focus	Docs. Reviewed	Documents
AGRA	N/A	Africa Region	4	<ul style="list-style-type: none"> AGRA and the Commonwealth Secretariat Sign Memorandum of Understanding to Leverage Digital Innovations for Smallholder Agriculture AGRA and Microsoft Extend Their Partnership to Support Digital Agricultural Transformation AGRA and CropIn Partnership Taps into Digital Technologies to Boost Africa's Extension Service Coverage 2023 AGRA Annual Report: Partnerships in Digital Agriculture
African Union	N/A	Africa Region	3	<ul style="list-style-type: none"> African Union Digital Agriculture Strategy (DAS) Comprehensive Africa Agriculture

				Development Programme (CAADP) Toolkit
Agri Innovation Roundtable Mexico	Yield Lab Initiative	Mexico	2	<ul style="list-style-type: none"> • African Digital Compact (ADC) • Kick Off - Segundo Ciclo Mesa Redonda Agri Innovation México • Estatutos Mesa Redonda Agri Innovation México
CultivateNext	Technoserve	Colombia, Mexico, and Guatemala	3	<ul style="list-style-type: none"> • CultivateNext: Agrifoodtech Fundraising 2-Page • CultivateNext AgriFoodtech Accelerator 2024 Pilot Program Overview • Potencia Tu Agroempresa - AgriFoodTech Accelerator
Digital Agriculture Network in LATAM	IICA	Latin America Wide	2	<ul style="list-style-type: none"> • IICA and Its Partners Launch the Third Digital Agriculture Week • Inter-American Institute for Cooperation on Agriculture - Third Digital Agriculture Week. • 2024 Edition: Digital Agriculture Week • Digital Agriculture Week - Inclusive Technologies in Rural Areas.
SMART Agtech Integration Facility	CGIAR	India	1	<ul style="list-style-type: none"> • Digital Needs & Gaps Assessment for Farmer Producer Organizations in Maharashtra, India

To complement the document review, semi-structured interviews were conducted with seven key stakeholders representing public-sector policy institutions, private-sector agribusinesses and technology firms, research organizations, and development agencies. These interviews provided qualitative insights into the mechanisms that drive effective collaboration, highlighting issues of governance, trust-building, incentive alignment, and the operational challenges of implementing digital solutions within FLW systems. Participants were selected based on their active involvement in digital transformation initiatives, ensuring a diverse range of perspectives on the complexities of multilateral collaboration. A thematic analysis of the interviews was conducted to identify recurring patterns, including the conditions under which partnerships succeed or fail, the role of institutional legitimacy in fostering trust, and the extent to which digital solutions align with on-the-ground realities. By drawing on these first-hand accounts, the study seeks to offer a nuanced understanding of how

collaborative partnerships navigate institutional, technological, and financial constraints.

Several limitations must be acknowledged. First, the study primarily captures the perspectives of stakeholders engaged in the design and implementation of collaborative initiatives rather than smallholder producers themselves. While this approach provides strategic insights into partnership structures, it may overlook the realities of adoption and digital literacy at the grassroots level. Second, the reliance on English-language interviews introduces potential biases, as some participants may have encountered constraints in fully articulating their views. Third, although the study encompasses cases from multiple regions, its emphasis on Latin America, India, and Africa may limit the applicability of findings to other FLW systems with different regulatory and market structures. Despite these limitations, the study strengthens its validity by triangulating evidence from multiple sources, ensuring a robust examination of how multilateral partnerships drive digital transformation.

Literature Review

This literature review synthesizes existing research on digital innovation in the agri-food system, centering on the recurring technologies in various studies. To analyze the key drivers and barriers of digital transformation effectively, the material has been sorted into four themes:

1. Digital Innovation in Agri-Food Systems
2. Barriers to Digital Transformation in Agriculture
3. Comparative Sectoral Analysis of Digital Innovation
4. The Role of Multilateral Collaborative Partnerships.

These four themes aim to provide a structure for considering the opportunities and obstacles to Digital Innovation in Agri-Food Systems.

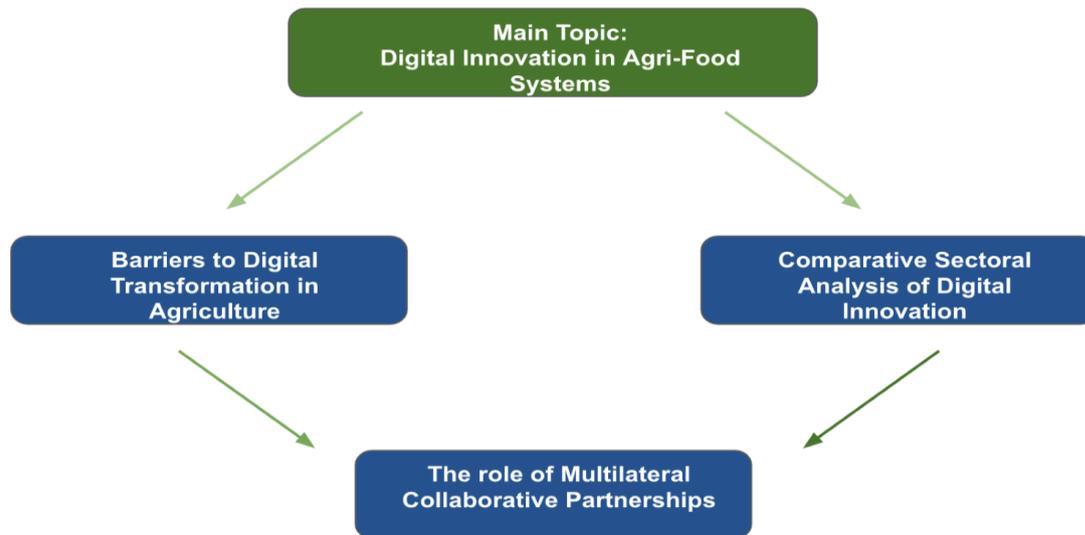


Figure 1: Thematic Framework for Literature Review on Digital Innovation in Agri-Food Systems

Digital Innovation in Agri-Food Systems

Digital innovation holds immense potential for transforming the food, land and water (FLW) sector, particularly through technologies like artificial intelligence (AI), the Internet of Things (IoT), and blockchain (Sridhar et al., 2023; Klerkx, L., & Rose, D., 2020). These tools promise enhanced productivity, resource management, and traceability across value chains (Abiri et al., 2023; Steinke et al., 2024). For example, IoT enables real-time resource monitoring, informing farming practices on decisions about "when," "where," and "why" to act (Wolfert et al., 2017). Blockchain further enhances supply chain transparency, addressing safety and security concerns (Steinke et al., 2024).

However, the literature of Klerkx et al. (2019), Kapari et al. (2023), and Barrett et al. (2020) highlight that digital transformation in FLW systems faces critical barriers, such as fragmented value chains and inadequate infrastructure. These challenges disproportionately affect smallholder

farmers in the Global South, limiting their access to and benefit from these tools (Kapari et al., 2023; Barrett et al., 2020). The sector's inherent diversity and dependency on local adaptation also complicate the adoption of digital solutions (Klerkx et al., 2019).

Incorporating farmer-centered designs is essential to ensure digital tools are practical and accessible. With adequate training, these innovations can be utilized, allowing for more social sustainability, as noted in the research by Rose et al. (2021). Furthermore, while technology is pegged to support the SDGs, it is also well documented that as digital transformation expands, sustainability issues emerge, including the energy demands of data centers and e-waste management (Alojail et al., 2023; Yuan et al., 2023).

Barriers to Digital Transformation in the Food, Land and Water (FLW) Sector

Due to unique systemic challenges, the FLW sector needs to catch up in digital adoption (Hassoun et al., 2021; Choruma et al., 2024). The decentralized nature of the agri-food sector, involving smallholder farmers, intermediaries, and agribusinesses, creates silos that hinder information flow and limit the adoption of digital solutions (Mhlanga & Ndhlovu, 2023; Öztürk, M., 2024). Unlike centralized industries, agricultural value chains require collaboration among diverse stakeholders to scale digital tools effectively (Klerkx et al., 2019; CGIAR, 2022). The fragmented ecosystem slows down the implementation of innovations, as digital solutions depend on efficient, interconnected systems (Aker & Cariolle, 2023). Poor internet connectivity, unreliable mobile networks, and limited electricity infrastructure are significant barriers in rural areas of the Global South (Choruma et al., 2024). These gaps restrict access to technologies that support precision agriculture and climate-resilient solutions (Barrett et al., 2020). Public-private partnerships are crucial for bridging these gaps, as isolated efforts fail to create the connectivity needed for scalable digital

adoption (Deloitte, 2020). Digital tools often fail to consider the practical needs of farmers, leading to low adoption rates (Abioye et al., 2024; Geng et al., 2024; Shelton et al., 2022).

Many solutions are developed without adequate farmer input, making them misaligned with local environmental conditions and cultural practices (Eastwood et al., 2019; Kassie et al., 2012). Automation further complicates adoption, as it challenges the traditional expertise of farmers, whose place-based knowledge is undervalued (Legun et al., 2023). Low digital literacy, particularly among smallholder farmers, remains a critical barrier to adoption ((FAO,2016; Mhlanga, 2024; Choruma et al., 2024; Smidt & Jokonya, 2022). Gender disparities and affordability issues exacerbate the problem, limiting farmers' ability to use even basic digital tools (Radovanović, 2024; Ofori & El-Gayar, 2020). Choruma et. al. (2024) stresses the importance of training programs that focus on improving digital skills to empower farmers to engage with these innovations. Furthermore, Dibbern et al. (2024) show that this is made worse by a lack of comprehensive policies on digital innovation, data privacy, and public-private partnerships, exacerbating uncertainty, and discouraging investment and adoption. Farmers often encounter unforeseen challenges, such as data ownership conflicts, only after adopting new technologies (Kaur et al., 2022; Aker & Cariolle, 2023). Regulatory clarity is essential to build trust and foster broader engagement with digital platforms (Abiri et al., 2023; Raturi et al., 2022; Sullivan et al., 2024). Limited access to affordable financing options prevents smallholder farmers from investing in digital tools with high upfront costs (Choruma et al., 2024; Maryono et al., 2024). Shelton (2022) argue that “finance tools can be rigid in how they set interest rates or require farmers to pay back loans... limiting their ability to adopt digital tools” (p.3). This constraint further widens the gap in technology access between small-scale farmers and large agribusinesses (Gaffney et al., 2019; Smidt & Jokonya, 2022). Collaboration

among stakeholders is necessary to create inclusive financial solutions that address these disparities (Maryono et al., 2024). Concerns about data privacy, potential exploitation, and the loss of traditional practices contribute to farmers' reluctance to adopt digital tools Kaur et al., 2022; McGrath et a., 2023. Building trust through transparent data policies and inclusive decision-making can mitigate these fears and foster adoption (Choruma et al., 2024; Fielke et al., 2022).

Comparative Sectoral Analysis

The healthcare and fintech sectors offer valuable lessons for the agri-food sector's digital transformation. Both have faced similar infrastructural challenges but achieved greater success through targeted strategies and partnerships (Labrique et al., 2018; Abate et al., 2023; Khamis et al., 2021; Leyens et al., 2022; Miah, M., 2023; FAO, UNEP, & UNDP, 2023). Sridhar et al. (2023) and Khamis et al. (2021) show how the COVID-19 pandemic catalyzed technology-driven collaborations, with stakeholders integrating digital tools like telecommunication-supported logistics and electronic health systems to address systemic challenges. The BioNTech-Pfizer partnership demonstrated how shared technological expertise can accelerate innovation (Druehl et al., 2021; Sridhar et al., 2023). In contrast to the healthcare sector, the pandemic not only intensified the existing challenges faced by the agri-food sector but also revealed weaknesses within its supply chain (Sridhar et al., 2023). Furthermore, the success of Johnson & Johnson's (J&J) technological transformation highlights the power of top-down investment in technology, enabling infrastructure, and adaptability to complex operational needs—lessons that hold valuable insights for the agriculture sector (Eide, N.,2018; Harvard Digital Initiative., 2018). J&J's leadership prioritized digital transformation, with a clear vision to integrate technology into innovation and operations, exemplifying how organizational buy-in is critical to success (Eide, N.,2018; Harvard Digital Initiative., 2018). The company leveraged its decentralized structure to

implement cloud migration and ERP transformations iteratively, allowing localized adaptations while maintaining an overarching strategy. This agile approach minimized disruption and enabled rapid scalability.

The success of FinTech in scaling financial inclusion lies in enabling policies, supportive infrastructure, and tailored innovations. India's Aadhaar-linked eKYC simplified access to financial services for millions, while Kenya's M-Pesa thrived under light-touch regulation, enabling mobile money solutions, and was driven by how user-centric designs and stakeholder engagement (Labrique et al., 2018; CGAP, 2024). Supporting infrastructure like India Stack's biometric ID and payment API provided a foundation for transformation, while platforms like Alipay in China leveraged digital ecosystems to integrate payments and investments. These examples highlight the power of clear regulation, robust infrastructure, and innovative solutions to drive financial inclusion.

These initiatives focus on familiar technologies and seamless user experiences, ensuring accessibility even in low-resource settings (Arner, D. W., et al., 2018; Labrique et al., 2018; CGAP, 2024). Similar approaches could enhance digital adoption in agriculture, particularly by involving farmers in the design process and tailoring tools to local conditions (Geng et al., 2024). However, agri-food systems remain hampered by a lack of multilateral partnerships and collaborative frameworks. Unlike healthcare and fintech, which have leveraged partnerships effectively, the agri-food sector struggles to build the ecosystems necessary for scaling digital solutions (Ebulue et al., 2024; GSMA, 2017).

Multilateral Collaborative Partnerships

The literature increasingly recognizes multilateral collaboration as pivotal to achieving successful technology adoption in agri-food systems (FAO, 2016; Nagaraji et al., 2023). Effective partnerships among startups, governments, scientists, and development practitioners are

essential for building the innovative ecosystems necessary for digital agriculture (FAO,2016; FAO, UNEP, & UNDP, 2023; Nagaraji et al., 2023). These collaborations allow diverse stakeholders to contribute their expertise, enabling the transdisciplinary approaches required for developing and scaling digital farming technologies (Abiri et al., 2023; Shepherd et al., 2018).

Beneath the call for better collaboration lies a complex socio-technical challenge as explained by the Independent Science for Development Council (2022); there is a need to integrate practices from local and global scales to drive scalability, institutional reform, and civic engagement (Barrett et al., 2020); Keppler, 2019). Tailored to regional needs, these frameworks ensure that solutions are both scalable and contextually appropriate. Collaboration also extends to community involvement. Curry et al. (2021) highlight how socio-cultural and institutional factors influence adoption, showing that technologies must align with local values to succeed. In Nigeria, Aleke, Ojiako, and Wainwright (2011b) demonstrated that informal social networks, such as family and community ties, are crucial for trust-building and knowledge sharing, emphasizing the importance of grassroots collaboration.

Effective partnerships address critical challenges, including poor agricultural productivity, rural poverty, and climate resilience (Wakweya, 2023). Maryono et al. (2024) show that multi-stakeholder collaboration improve the livelihoods of smallholders by providing them with better access to finance, market, and technology. Digital skills initiatives in Brazil and Mexico showcase the benefits of co-designed programs involving local actors and international partners, fostering greater digital inclusion (Radovanović, 2024). These participatory approaches underscore the value of power-sharing between stakeholders to enhance equitable innovation. Power dynamics and responsibility in digital agriculture are also critical. Hidalgo et al. (2023) and Legun et al. (2023) highlight concerns over who

controls digital tools and who is accountable for their impacts, particularly as AI becomes more integrated into farming. Addressing these issues through collaborative frameworks ensures that technologies remain inclusive and sustainable (Gamage et al., 2024). Achieving an equitable digital transformation requires multilateral partnerships that prioritize inclusivity across gender, culture, and geography (Gamage et al., 2024; Vazquez-Brust et al., 2014; CGIAR Gender Equality Initiative, 2024). Closing the digital divide for small-scale farmers necessitates public-private collaborations and governance structures that provide access to critical information (Smidt & Jokonya, 2022). Peer-to-peer learning networks, such as the lead-farmer model in Sub-Saharan Africa, further demonstrate the power of collective problem-solving and knowledge transfer (Takahashi, K et al., 2020). Ultimately, these partnerships drive the inclusive, locally informed transformation needed to overcome systemic barriers and enable the adoption of digital solutions in the agri-food sector. Lastly, Sridhar et al. (2023) state that “Collaboration among key stakeholders is imperative to navigate this evolving landscape and establish a supportive legal framework to facilitate and govern digital transformation in agriculture” p.18).

Results

This section presents findings from a comprehensive document analysis of existing documentation on key multilateral collaborative initiatives aimed at accelerating digital innovation in agri-food systems. The initiatives reviewed include the Agri Innovation Roundtable in Mexico, CultivateNext operating across Colombia, Mexico, and Guatemala, the Digital Agriculture Network in Latin America and the Caribbean led by the Inter-American Institute for Cooperation on Agriculture (IICA), the SMART Agtech Integration Facility in Pune, India, The Alliance for a Green Revolution in Africa (AGRA), and The African Union (AU). Qualitative interviews with stakeholders directly involved in these collaborations have been

conducted to deepen our understanding of the impact and functioning of these multilateral partnerships. These interviews provide insights into the collaborative dynamics, challenges, and successes of these initiatives, offering a nuanced perspective on how multilateral efforts can drive meaningful digital transformation in often fragmented and complex agri-food systems. Analyzing these initiatives and stakeholder perspectives highlights the importance of coordinated partnerships in addressing systemic barriers and scaling digital solutions to enhance food security, sustainability, and resilience within the agri-food sector.

Agri-Innovation Roundtable (Mexico)

The Agri-Innovation Roundtable in Mexico, facilitated by The Yield Lab Initiative, is advancing technological innovation in the agri-food sector by convening startups, corporations, and research institutions to tackle key challenges in technology adoption. Participants include major companies such as Nestlé, Danone, Bayer, Bimbo, Herdez, and Yara, alongside enablers like CIMMYT/CGIAR, IDB Invest, and Tecnológico de Monterrey. Through nine-month cycles, the Roundtable focuses on sectoral challenges such as financial models for smallholders, digital traceability, regenerative agriculture, and irrigation technology. Monthly meetings and collaborative pilot projects foster knowledge exchange, enabling participants to co-create scalable innovations.

A current pilot project is underway in the Lerma-Chapala-Santiago watershed in Mexico, where technology-based solutions are being tested with maize producers using different irrigation practices. Conservation and regenerative agriculture practices are key variables in the pilot, with KPIs designed to measure water savings and improvements to watershed health. The pilot remains in its early stages, with participant details and sample size to be finalized. This collaboration highlights the Roundtable's commitment to driving impact through innovation and cross-sector partnerships.

Collaboration is motivated by the need to achieve sustainability goals and improve efficiency while addressing the digital divide in Mexico's agri-food sector. The Roundtable leverages the diverse expertise of its participants, using structured workshops and thematic discussions to facilitate knowledge sharing and capacity building. CGIAR and CIMMYT provide global credibility and research-backed insights, fostering trust and ensuring the adoption of industry best practices.

The Roundtable promotes inclusivity by avoiding centralized leadership, with Yield Lab Initiative coordinating efforts. The goal is for all members to contribute equally, supported by pre-meeting one-on-one discussions encouraging open dialogue. However, challenges such as aligning diverse priorities and managing power dynamics do sometimes exist. Larger organizations sometimes dominate discussions, but efforts like pre-submitted proposals and equitable participation models help balance contributions.

Follow-up stakeholder interviews highlighted the Roundtable's success in aligning interests across startups, corporations, and research institutions. For example, the second-edition pilot focuses on irrigation technology for maize production and has successfully obtained the buy-in of nine different stakeholders. Corporate participants, including Nestlé and Danone, view the Roundtable as a means to align their sustainability commitments with actionable, real-world solutions. One participant said, "[Danone and Nestle] have huge sustainability commitments, and they need to ensure that their final products are socially and environmentally friendly."

CGIAR's involvement in the YielLabd Roundtable is considered crucial for providing scientific credibility and aligning stakeholder priorities. A participant stated, "CGIAR and CIMMYT have a global scale... their knowledge, expertise, network, and vision are very important". Despite persistent barriers like underinvestment, fragmented value chains, and an

aging workforce, stakeholder interviews showed how the Roundtable fosters trust and collaboration, driving digital transformation in Mexico's agri-food systems. Lessons from this case study emphasize the importance of inclusive frameworks, trust-building, and shared learning to address systemic challenges effectively.

CultivateNext (Colombia, Mexico, and Guatemala)

CultivateNext, a collaborative program by Seedstars, TechnoServe, and CGIAR-Digital Innovation, focuses on structured partnerships to support technology adoption in Latin America's agri-food sector. The pilot program in Colombia, Mexico, and Guatemala focuses on pre-seed and seed-stage enterprises developing solutions in regenerative agriculture, renewable energy, and generative AI. Through a six-month accelerator, participants receive guidance from agrifood tech experts, to assist innovation and build entrepreneurial capacity. Motivated by the challenges of scaling digital innovations in Latin America—such as structural inefficiencies and environmental vulnerabilities—the program combines Seedstars' global mentorship network, TechnoServe's rural entrepreneurship expertise, and CGIAR's research-backed methodologies. This alignment bridges gaps and hopes to create pathways for startups lacking initial support. Key program elements include legal guidance, tailored mentoring, and an impact scorecard to measure business and environmental progress. Compared to similar programs like AgLaunch365 and Shoots by Syngenta, CultivateNext distinguishes itself through its focus on the Global South, where agriculture constitutes a significant share of economic activity and employs up to 60% of the population in some regions. While AgLaunch365 emphasizes farmer-centric innovation and Shoots by Syngenta connects a broad range of stakeholders globally, CultivateNext's tailored approach targets the specific challenges of agriculture in resource-constrained and climate-vulnerable regions, ensuring its solutions are impactful and context-appropriate.

Stakeholder interviews highlighted how partnerships within the CultivateNext initiative are critical for maximizing impact, one participant from TechnoServe said "for us, to have new alliances means creating the greatest possible impact, not only at the country level but also in LATAM and globally." Interviews showed how programs can address systemic challenges, including food insecurity, climate resilience, and low productivity, equipping startups with tools to scale effectively through mentorship, business development, and an integrated monitoring and evaluation framework. Despite its success, interviews showed that challenges persist; as noted by a participant; "the agri-food tech ecosystem faces challenges like limited infrastructure and connectivity in rural areas, complex regulatory environments, lack of venture capital, and social inequities." Anchor companies like Danone play a pivotal role by validating technologies, scaling them with their smallholder farmers, bridging gaps in the value chain, and fostering equitable participation across the ecosystem. CGIAR's involvement was crucial in providing sustainability expertise and aligning solutions with global goals. One participant noted, "CGIAR holds a unique position that perhaps no other institution can occupy...connected to highly valuable local networks, facilitating meaningful connections and collaborations." CultivateNext has shown how through carefully designed approaches you can foster trust and build inclusive ecosystems that allow all partners to contribute equitably.

Digital Agriculture Network in LATAM - IICA

The Digital Agriculture Week (DAW), hosted by the Inter-American Institute for Cooperation on Agriculture (IICA), is a collaborative platform working to accelerate digital innovation in agri-food systems across the Americas. Engaging AgTech startups, policymakers, financiers, researchers, and practitioners, the event addresses systemic barriers and promotes technology adoption to enhance productivity, sustainability, and climate resilience. The 2024 edition convened 16 AgTech companies from

14 countries, focusing on co-creating and validating digital solutions with larger market actors.

DAW offers thematic sessions on Agtech public policies, financing mechanisms, and innovation ecosystems. These activities align solutions with localized agricultural contexts, tackling key challenges like water scarcity and emissions reduction. Discussions emphasized bridging systemic gaps, including fragmented value chains, limited connectivity, and unclear data governance policies, by pooling expertise and aligning public-private efforts. IICA's role as convener reflects its commitment to digital transformation across the Americas. Originally focused on startups, DAW has expanded to include multilateral organizations, corporations, and venture capital firms. Stakeholder interviews highlight its success in facilitating organic dialogues and aligning diverse actors to address systemic barriers. One participant noted, "The agricultural sector is the most diverse and decentralized, with millions of farmers needing adapted solutions for their unique contexts."

AgTech startups leveraged DAW to connect with larger organizations, fostering partnerships for adapting and scaling solutions. Corporates like Bayer and Microsoft identified collaborative opportunities to address shared challenges, including fragmented value chains and rural connectivity gaps. A participant emphasized, "To reach an understanding between private and public actors is one of the most important challenges—making their interests and timelines compatible." Interviews showed how agriculture in the Americas lags in digital adoption due as one participant said "limited infrastructure and connectivity in rural areas, complex regulatory environments, lack of venture capital, and social inequities." DAW shows how structured matchmaking and multilateral dialogue can reduce the impact of power dynamics. In terms of concerns around privacy and data ownership while those interviewed acknowledged that this will likely become a concern, the feeling was that

the industry and the current adoption in the AMericas is still nascent and farmers are not yet vocalising these concerns, it is more focused on finding solutions to their problems CGIAR's involvement was pivotal, providing global expertise and strengthening stakeholder trust. A participant highlighted that "CGIAR holds a very unique position that perhaps no other institution can occupy."

SMART Agtech Integration Facility (India, Pune)

The SMART Agtech Integration Facility in Pune, India, led by CGIAR's Initiative on Digital Innovation, aimed to address digital needs among Farmer Producer Organizations (FPOs) in Maharashtra. The workshop convened FPO representatives, digital innovators, and value chain stakeholders in partnership with Agricultural Technology Management Agency (ATMA) and the Gokhale Institute of Politics and Economics (GIPE). Interactive sessions, including marketplace exchanges and breakout discussions, identified digital gaps, showcased innovations, and explored collaboration models for disruptive agricultural technologies. The initiative emphasized aligning digital tools with FPOs' objectives to foster inclusive digital transformation. Key challenges identified included pricing disparities, low digital literacy, and resource constraints in rural areas. Stakeholders advocated for socio-technical frameworks tailored to FPOs' needs and recommended transparent communication, clear performance indicators, and consortium-based collaboration models. Customization was deemed essential to ensure digital tools delivered tangible benefits to farming communities.

Stakeholder interviews highlighted diverse motivations. FPOs sought tools to enhance productivity and market access, while digital innovators aimed to expand their market presence with demand-driven solutions. The Government of Maharashtra contributed regulatory insights, aligning agricultural value chains with sustainability goals. One participant said "The purpose of our collaboration is to bring stakeholders together to solve

systemic challenges in agriculture. Each partner adds unique value, whether it's technical expertise, funding, or market connections." Despite shared goals, aligning diverse priorities posed challenges. FPOs struggled to articulate needs, and digital innovators needed help adapting solutions to fragmented rural contexts. Trust deficits and power dynamics further complicated collaboration, but having a wide ray of stakeholders present helped to neutralize these dynamics. "Power dynamics in Indian agriculture are deeply tied to caste and socioeconomic structures, influencing who gets access to opportunities and resources," remarked one stakeholder. Privacy concerns and resource disparities also hindered progress. Structured discussions and transparency helped foster trust, with one participant emphasizing, "Transparency and open dialogue are essential in navigating trust issues, especially when working with smallholders." As summarized by one participant, "The agricultural sector is fragmented, with millions of farmers operating in diverse contexts, making it hard to scale uniform digital solutions." In terms of concerns around privacy and data ownership all participants highlighted that this is not yet becoming a concern of farmers because they have not yet sufficiently used the technology at scale to experience these challenges. CGIAR was considered pivotal, offering research-backed socio-technical frameworks and neutrality that bridged gaps and fostered alignment.

The Alliance for a Green Revolution in Africa (AGRA)

Document analysis conducted through desk research showed that The Alliance for a Green Revolution in Africa (AGRA) is increasingly embedding digital innovation into its strategic framework, as evidenced by its recent hire of George Marechera as Head of Digital Systems and Solutions for Agriculture. This newly created position underscores AGRA's recognition of the transformative potential of digital technologies in addressing agricultural challenges in Sub-Saharan Africa (SSA), as articulated in Marechera's article, *Digital Agriculture Providing New Frontiers in Sub-*

Saharan Africa. The article highlights the benefits of digital tools such as IoT devices, drones, and AI in optimizing resource use, increasing crop yields, and reducing environmental impact. However, it also identifies systemic challenges, including uncoordinated data collection and limited access to digital tools for farmers.

AGRA's approach to digital transformation includes key partnerships, such as its collaboration with the Commonwealth Secretariat, which focuses on harmonizing agricultural data systems through a Digital Public Infrastructure model and building capacity for National Digital Agriculture Strategies in selected African countries. Similarly, its partnership with Microsoft aims to advance digital agricultural ecosystems by leveraging tools like AgriBot, which delivers localized extension and advisory services to farmers. AGRA's 2021 Annual Report further highlights collaborations with CropIn and other entities to digitalize Village-Based Advisors (VBAs), addressing last-mile delivery of agricultural services and boosting efficiency. Moreover, its partnership with CropIn specifically trained over 10,000 VBAs to serve millions of farmers using centralized digitalization platforms.

While these initiatives showcase AGRA's commitment to integrating digital tools into agriculture, the evidence on the role of collaboration in driving these innovations remains to be limited. Partnerships are highlighted, yet the broader strategic emphasis on fostering collaboration for scaling digital adoption across SSA's diverse agricultural landscapes is less clear. This gap suggests that while digital transformation is becoming a critical component of AGRA's strategy, the collaborative frameworks essential for maximizing digital adoption may need further articulation and prioritization in its initiatives.

The African Union (AU)

Document analysis conducted through desk research on The African Union (AU) show that it has established a robust emphasis on collaboration as a mechanism to drive digital adoption, with evidence of this approach visible in cross-sectoral frameworks encompassing agriculture. The African Digital Compact (ADC), aligned with Agenda 2063 and the Digital Transformation Strategy for Africa (2020-2030), shows the AU's commitment to fostering partnerships among governments, private enterprises, and civil society. While agriculture is identified as a key sector within the ADC, its collaborative frameworks, such as multi-stakeholder engagement and interoperability systems, apply broadly across various domains rather than being agriculture-specific.

The AU's Digital Agriculture Strategy (DAS) focuses directly on agriculture, providing a framework that integrates multi-stakeholder task forces, national and regional collaboration, and knowledge-sharing platforms. The DAS emphasizes harmonized policies and private sector engagement to address barriers such as limited digital infrastructure and insufficient financial inclusion. However, the scope of these efforts suggests a reliance on broader digital initiatives rather than agriculture-targeted frameworks alone. The Comprehensive Africa Agriculture Development Programme (CAADP) further reinforces collaboration through its toolkit, which mobilizes African leaders and stakeholders across multiple sectors to achieve food security and agricultural transformation. Although agriculture is central to CAADP's mission, its toolkit and knowledge compendium also serve as cross-sectoral resources, fostering digital adoption holistically rather than isolating agricultural applications. Overall, the AU consistently focuses on collaboration to advance digital adoption, with agriculture benefiting as part of a broader digital transformation agenda. However, agriculture-specific strategies, while present, often draw upon frameworks designed for cross-sectoral application, underscoring

the potential for more targeted collaboration to address the unique challenges of digital adoption in agriculture.

Discussion

Through the literature review, document analysis and stakeholder interviews presented in this discussion paper it is evident that multilateral collaboration is a critical element of digital adoption in the agri-food sector. This study identifies two essential processes for successful collaboration: the technical process and the incentive process. These processes operate simultaneously but interdependently, requiring thoughtful planning and sustained alignment among stakeholders. The technical process identifies and agrees on the technology needs to address specific challenges, while the incentive process aligns diverse stakeholder motivations and goals.

The technical process is relatively straightforward, involving technical stakeholders to define challenges and agree on solutions. For instance, the Yield Lab Initiative Round Table in Mexico facilitated discussions on water scarcity, leading stakeholders to pilot irrigation technologies. This example underscores the need for a clear technical roadmap to initiate collaboration.

The incentive process, however, is more complex, requiring reconciliation of diverse priorities. For example, in CultivateNext, equitable participation and trust-building ensured value from all stakeholders, while in SMART, structured discussions and transparent communication addressed power dynamics. These approaches helped align goals among farmer organizations, digital innovators, and government actors, overcoming systemic barriers.

While farmer-centered design is often emphasized as key to digital adoption in agriculture (SOURCE XX), interestingly the Yield Lab Initiative in Mexico showed that some collaborations are more effective without direct farmer involvement. In this case, competing FMCG conglomerates

streamlined discussions to address systemic issues on water scarcity. Farmers' perspectives were indirectly represented by CGIAR's research, which informed the selection of technologies while balancing efficiency and inclusivity in the collaboration efforts.

Effective collaboration is particularly crucial in agriculture due to the sector's complexity and fragmented value chains. Multilateral organizations like IICA, CGIAR, and AGRA play a central role in fostering digital transformation by bridging local and global expertise. Their neutral agenda allows for the alignment of collaborative frameworks with regional needs while ensuring research backed approaches for scalability and sustainability. For example, the AU's Comprehensive Africa Agriculture Development Programme (CAADP) supports cross-border collaboration, while initiatives like IICA's Digital Agriculture Week connect local actors with global expertise, fostering trust and contextual relevance. However what came up in the literature review and further in the stakeholder interviews is how farmers are only encountering challenges such as data rights and privacy concerns after they have invested and adopted technology. (Kaur et al., 2022; Aker & Cariolle, 2023). This is concerning as we know that this challenge has presented itself in other areas of the world where digital adoption is more developed. It is essential that players in the global south see regulatory clarity and build trust and foster broader engagement with different players. Multilateral collaboration presents a huge opportunity to avoid the challenges that other contexts are already facing (Abiri et al., 2023; Raturi et al., 2022; Sullivan et al., 2024).

The private sector continues to be a pivotal player in driving digital innovation (FAO, 2016; Nagaraji et al., 2023; Bowen, 2009). Startups and large agribusinesses often lead the development of tailored solutions for agricultural challenges (Kroff, 2019). During IICA's Digital Agriculture Week, stakeholders emphasized integrating startups into collaborative frameworks to amplify their impact. Similarly, in India, the Ministry of

Agriculture showcased private companies' roles in funding and piloting digital innovations. Anchor companies like Danone and Nestle, through initiatives like CultivateNext and the YieldLab Roundtable Mexico, bridged value chain gaps and scaled technologies to smallholder farmers. AGRA's initiatives highlight the importance of harmonizing agricultural data systems and capacity building to overcome systemic barriers such as fragmented data collection and limited farmer access to technology. However, private-sector efforts must align with governments, NGOs, financial institutions, and producers to ensure inclusivity and sustainability as well as an alignment in incentives (FAO,2016; FAO, UNEP, & UNDP, 2023; Nagaraji et al., 2023a; Nagaraji et al., 2023b; Morgan et al., 2022).

Collaboration must address not just technology development but also practicalities of implementation and scaling (FAO,2016; FAO, UNEP, & UNDP, 2023;Pawera et al.,2024) For instance, the Roundtable in Mexico demonstrated how competitors united to tackle water scarcity by piloting irrigation technologies. However, success required clearly defined roles and resource-sharing plans. Private companies funded pilots, but additional support from development banks ensured full financing, illustrating the importance of collaborative planning and shared funding. This is essential given what was evident by Gaffney et al. (2019) and Smidt & Jokonya (2022) research on how Rigid financial tools hinder small-scale farmers from adopting digital tools, widening the technology gap with large agribusinesses.

The rapid evolution of digital technologies in agriculture also shapes collaborative dynamics (Pausching & Klauser, 2022; Glaros et al., 2023). Agri-food stakeholders must anticipate and adapt to this fast pace, maintaining alignment despite changing landscapes(Sridhar et al., 2023; Klerkx, L., & Rose, D., 2020). For example, the urgency of addressing climate change and water scarcity in the Mexico Roundtable drove collective action. Collaborative frameworks, such as shared data systems, reduce

duplication and accelerate scaling of digital innovations (Wakweya, 2023; Maryono et al., 2024; Radovanović, 2024).

Trust and transparency are foundational to successful collaboration (Choruma et al., 2024; Fielke et al., 2022; Abiri et al., 2023; Raturi et al., 2022; Sullivan et al., 2024). Building trust requires ongoing efforts, such as structured workshops, transparent data-sharing agreements, and equitable distribution of benefits. For instance, the Yield Lab Initiative in Mexico fostered trust through pre-meeting discussions that allowed participants to voice concerns, align expectations, and build a shared understanding of objectives. These pre-meeting engagements minimized miscommunication and set the stage for effective collaboration during formal discussions. Similarly, the SMART Agtech Integration Facility in India employed interactive sessions with Farmer Producer Organization (FPO) representatives, ensuring all stakeholders had opportunities to contribute their perspectives. This approach not only promoted transparency but also strengthened inclusion by valuing input from typically underrepresented groups.

Institutionalizing trust and transparency in collaborative models involves embedding these mechanisms into the design and operation of partnerships. This could include formalizing pre-meeting consultations, establishing transparent reporting and accountability systems, and creating clear, accessible data-sharing protocols. As demonstrated by the IICA Digital Agriculture Week, such institutionalized practices, where transparent data-sharing frameworks were emphasized, help optimize resource allocation and scalability. By making trust-building and transparency integral to collaboration, partnerships can foster long-term stakeholder engagement and commitment, enabling sustainable and inclusive outcomes.

Collaboration thus requires not just technical alignment but also trust to sustain long-term partnerships. Emerging challenges such as data

ownership and privacy require proactive attention to ensure the sustainability and inclusivity of trust in these collaborations. Lessons from the fintech sector, where regulatory frameworks like GDPR in Europe have established clear data governance protocols, can provide valuable guidance for agricultural collaborations. For example, initiatives like CultivateNext in Latin America could integrate these lessons by drafting localized data-sharing agreements that prioritize farmer consent and safeguard their interests. Such proactive measures would address privacy concerns and reinforce trust among stakeholders, paving the way for equitable and sustainable large-scale adoption of digital solutions.

The healthcare sector, particularly during the COVID-19 pandemic, highlighted the transformative potential of collaborative platforms such as the BioNTech-Pfizer partnership, which accelerated vaccine development through effective alignment of technical expertise and shared incentives. Similarly, the fintech sector, exemplified by platforms like M-PESA, underscores the importance of designing user-centric solutions that are both accessible and contextually relevant. These sectors provide valuable lessons for the agri-food process, where farmer-friendly digital interfaces, designed with input from end-users, can enhance accessibility and adoption. Leveraging local networks and integrating user-centric design principles can build trust among stakeholders while addressing systemic barriers like digital literacy and low adoption rates. By adapting these approaches, agricultural collaborations can create inclusive ecosystems that facilitate the equitable scaling of digital technologies.

Ultimately, successful collaboration in the agri-food sector hinges on aligning diverse stakeholders around shared goals (FAO,2016; FAO, UNEP, & UNDP, 2023). Key elements include clear communication, equitable resource sharing, and adaptability to technological changes (FAO, UNEP, & UNDP, 2023). Inclusive and structured partnerships enable faster adoption of digital technologies, addressing critical agricultural challenges while

contributing to sustainability goals (AGRA, 2023; Atapattu et al., 2024; FAO, 2018; FAO, UNEP, & UNDP, 2023; Paroda, 2018; Pawlak & Kołodziejczak, 2020). By fostering these partnerships, stakeholders can unlock the transformative potential of digital innovation in agriculture.

Criteria for Successful Collaboration

Eight recurring themes emerged from the research as critical for successful collaboration:

Theme	Description
Involvement of Multilateral Organizations	Multilateral organizations act as neutral conveners and knowledge repositories, providing critical resources and fostering trust. For example, CGIAR’s participation in the Yield Lab Roundtable in Mexico lent scientific credibility and ensured that solutions were evidence-based and scalable. Similarly, IICA’s Digital Agriculture Week connected local startups with global experts, fostering partnerships that addressed systemic barriers such as poor connectivity and regulatory uncertainty.
Identifying a Common Incentive	Shared incentives form the foundation of effective collaboration. Whether addressing water efficiency in Mexico, scaling regenerative agriculture in CultivateNext, or creating a collaborative data ecosystem in Guatemala, aligning stakeholders around a common goal is paramount.
Establishing Trust	Trust is both a prerequisite and an outcome of successful collaboration. CGIAR’s involvement in various initiatives underscores the importance of credible, neutral facilitators in fostering trust. Structured dialogues, transparent communication, and tiered data-sharing models are effective mechanisms for building confidence among stakeholders.
Agreeing on Action Plans	Action plans are essential for translating discussions into tangible outcomes. From irrigation technology pilots in Mexico to accelerators and scorecards in CultivateNext, clearly defined frameworks enable stakeholders to align their efforts and measure progress.
Ensuring Equitable Contributions	For collaborations to be sustainable, all stakeholders must feel they are contributing meaningfully. Balancing power dynamics and resource disparities is critical to fostering a sense of shared ownership. In the Mexico Round Table, Yield

		Lab’s coordination and one-on-one discussions exemplified efforts to create a balanced contribution framework.
Causes of Collaboration Breakdown	of	Despite the potential benefits, multilateral collaborations often falter due to misalignment, hidden agendas, or unclear incentives. Hidden agendas can erode trust, while misaligned priorities can stall progress. The Guatemala Data Lab, for example, faced challenges due to legal ambiguities and perceived inequities in data sharing, underscoring the importance of clarity and transparency.
Power Dynamics in Agri-Food Collaborations	in	Power dynamics are an inherent feature of multilateral collaborations, particularly in the agri-food sector. Rather than attempting to neutralize these dynamics, aligning them around shared objectives offers a more sustainable approach. For instance, the SMART Agtech Integration Facility in India aligned the interests of Farmer Producer Organizations (FPOs) and digital innovators, enabling productive collaboration despite resource disparities.
Regional Variations in Collaboration	in	Regional differences also influence the dynamics of multilateral collaborations. For instance, government roles in India are far more influential compared to Guatemala, where private sector players often take the lead. Recognizing and adapting to these regional nuances is crucial for designing effective collaboration frameworks.
Overcoming Systemic Barriers		The agri-food sector’s slow adoption of digital technologies stems from systemic barriers such as fragmentation, underfunding, and connectivity challenges. Unlike more centralized sectors like health or fintech, agriculture’s diversity requires localized solutions, complicating standardization and scalability. Collaborative approaches that leverage the unique strengths of multilateral stakeholders are essential for overcoming these barriers and accelerating digital transformation.

Conclusion

The ongoing digital transformation of food, land, and water (FLW) systems represents both an opportunity and a challenge. While digital solutions have the potential to enhance efficiency, climate resilience, and market integration, the sector's inherent fragmentation and infrastructural limitations have hindered widespread adoption. This discussion paper has demonstrated that multilateral collaborative partnerships serve as an essential enabler for scaling digital solutions, helping to align stakeholder

incentives, reduce transaction costs, and bridge systemic gaps in governance and infrastructure.

The case studies analyzed in this research—spanning Mexico, Latin America, Africa, and South Asia—illustrate that effective collaboration requires more than just technical alignment; it also depends on trust-building, transparent governance structures, and equitable stakeholder participation. Initiatives such as the Agri-Innovation Roundtable and CultivateNext highlight how public-private partnerships can generate scalable innovations, while CGIAR’s engagement in multilateral efforts ensures scientific rigor and legitimacy in decision-making. However, challenges remain, including power asymmetries between corporate actors and smallholder farmers, inadequate regulatory clarity on data governance, and the slow pace of institutional adaptation to emerging digital technologies.

This study identifies two critical processes for ensuring successful multilateral collaboration in digital transformation: the technical process and the incentive process. The technical process involves the identification, testing, and scaling of digital solutions, while the incentive process ensures alignment between stakeholders, balancing competing interests and mitigating structural inequities. For instance, the SMART AgTech Integration Facility in India demonstrated that engaging farmer organizations in technology co-design can lead to more inclusive digital adoption, whereas the Yield Lab Roundtable in Mexico showcased how corporate actors can drive system-wide change without direct farmer participation—provided that research institutions play a role in safeguarding evidence-based decision-making.

Despite notable successes, data governance, financing constraints, and regional disparities in digital literacy remain pressing challenges. As adoption scales, concerns about data ownership, privacy, and regulatory oversight will become increasingly critical. The experiences of fintech and

healthcare—where frameworks such as regulatory sandboxes and interoperable data systems have accelerated technology diffusion—highlight the need for more proactive governance models in FLW systems. Lessons from mobile money platforms like M-PESA and decentralized health data initiatives suggest that clear data governance structures and participatory policy frameworks can drive more inclusive and sustainable digital adoption.

Moving forward, several key areas require further research and policy focus. First, collaborative governance models should be refined to address power imbalances, particularly between agribusinesses, governments, and smallholder farmers. Second, data-sharing frameworks must be developed with a focus on farmer agency, ensuring that digital transformation does not replicate existing inequalities. Third, innovative financing mechanisms, such as blended finance and social impact investments, should be explored to reduce entry barriers for smallholders adopting digital tools. Finally, multilateral organizations must play a more active role in preemptively addressing regulatory gaps, particularly concerning AI-driven advisory services and blockchain-enabled traceability.

Ultimately, this study underscores that digital transformation in FLW systems is not just a technological challenge but a socio-political and economic one. Addressing it requires structured, inclusive, and adaptive multilateral partnerships that prioritize equitable access, sustainable scaling, and farmer-centered innovation. By leveraging lessons from both FLW and non-FLW sectors, stakeholders can design collaborative frameworks that unlock the full potential of digital innovation, ensuring that technological advancements enhance resilience, improve livelihoods, and contribute to broader sustainability goals.

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Annex 1: Summary of evidence per Case Study

Organisation	Collaborative Initiative Description	Motivation for Multilateral Collaboration by Open Data Initiative	Multilateral Collaboration in Agri-Food Systems	Digital Innovation in Agri-Food Systems	Equitable Contributions and Power Dynamics in Partnerships	Policy Challenges in Digital Innovation	Barriers to Adoption in Agri-Food Systems	Regional Challenges	Value of CGIAR/CIMMYT Involvement
AGRA	Through document analysis only, it was found that AGRA had multiple efforts to achieve collaboration in digital and agriculture, including partnerships with the Commonwealth Secretariat to harmonize agricultural data systems, Microsoft to integrate stakeholders across value chains using tools like AgriBot, and CropIn to digitalize Village-Based Advisors and enhance last-mile service delivery to farmers.	Leverage digital innovations and partnerships to address systemic agricultural challenges, enhance efficiency, and improve access to tools for farmers in Sub-Saharan Africa.	AGRA achieves collaboration by forming strategic partnerships with organizations like Microsoft, the Commonwealth Secretariat, and CropIn to harmonize data systems, train advisors, and advance digital agricultural ecosystems.	Digital innovation in agri-food systems enables optimized resource use, increased crop yields, and reduced environmental impact through tools like IoT devices, AI, and centralized platforms.	No evidence of explicitly addressing power dynamics in AGRA's collaborations but highlights the importance of partnerships in scaling digital adoption and improving access for farmers.	Policy challenges include uncoordinated data collection and the need for harmonized digital public infrastructure to effectively implement and scale digital agriculture strategies across diverse African contexts.	Limited digital literacy, inadequate access to digital tools, and insufficient infrastructure hinder the widespread adoption of digital technologies among smallholder farmers in Africa.	Fragmented agricultural value chains, uncoordinated data collection, and limited access to digital tools, which hinder the effective adoption of digital agriculture solutions across Sub-Saharan Africa.	N/A
Agri Innovation Roundtable Mexico	A collaborative platform facilitated by The Yield Lab to advance technological innovation in Mexico's agri-food sector through pilot projects, structured dialogue, and partnerships with startups, corporates, and academia.	To foster ecosystems enabling agri-tech startups to scale, address sustainability challenges, and accelerate innovation through partnerships with corporates, investors, and academia.	Collaboration is facilitated through structured peer-to-peer learning, startup validation, and pilot programs with corporates like Nestlé and Danone.	Focused on technology-driven solutions for precision agriculture, irrigation systems, and emissions reduction to align with sustainability goals.	Tailored facilitation and pre-submitted proposals ensure equitable participation while addressing power imbalances and confidentiality concerns.	Unclear data privacy policies, rural connectivity challenges, and demographic barriers limit effective technology adoption in Mexico.	Systematic underinvestment, fragmented smallerholder rural connectivity challenges, and insufficient financial security hinder sector growth and digital innovation.	The Mexican agricultural sector is highly fragmented, with scattered producers and limited connectivity, complicating technology deployment and coordination.	CGIAR provides scientific credibility, global expertise, and coordination to align diverse stakeholders across the continent and foster trust within the collaboration.
African Union	Through document analysis only, it was found that the African Union has actively fostered collaboration in digital and agriculture through frameworks like the African Digital Compact (ADC) and the Digital Agriculture Strategy (DAS), which emphasize multi-stakeholder engagement, partnerships with governments, private sector, and NGOs, harmonization of policies, creation of knowledge-sharing platforms, and integration of digital technologies to address systemic barriers such as infrastructure gaps and limited digital literacy.	The African Union prioritizes multilateral collaboration to leverage digital technologies for sustainable agricultural development, food security, and climate resilience across Africa.	The AU fosters multilateral collaboration through initiatives like the Digital Agriculture Strategy (DAS), which engages governments, RECs, private sector actors, and civil society in developing harmonized policies and joint national strategies.	The AU promotes digital innovation through frameworks like the Digital Agriculture Strategy (DAS), emphasizing knowledge hubs, e-agriculture forums, and private sector engagement to scale sustainable agricultural technologies.	equitable contributions by involving diverse stakeholders—including governments, private enterprises, research institutions, and multi-stakeholder taskforces and collaborative frameworks.	The AU faces policy challenges such as the need for harmonized governance frameworks and interoperability across member states to enable effective data sharing and equitable access to digital resources.	Barriers include limited digital infrastructure, low digital literacy, and insufficient financial inclusion, which hinder widespread adoption of digital agriculture technologies.	The AU acknowledges the diversity of agricultural systems, climatic conditions, and digital readiness across the continent as major regional challenges for digital adoption.	N/A
CultivateNext	An accelerator program by Seedstars, TechnoServe, and CGIAR focused on supporting early-stage agritech entrepreneurs in Colombia, Mexico, and Guatemala with mentorship, legal guidance, and tools for scaling regenerative agriculture and AI-based solutions.	leveraging alliances to maximize global impact, foster innovation, and address critical challenges like food security, climate change, and socio-economic inequality through ecosystem-building and partnerships with diverse actors.	Partnering with organizations like Seedstars, CGIAR, and private sector entities to provide mentorship, resources, and investment opportunities, fostering innovation and addressing critical challenges in agri-food systems through a systematic and inclusive ecosystem approach.	Digital innovation in agri-food systems drives productivity, sustainability, and resilience by supporting agritech startups with cutting-edge technologies, fostering sustainable practices, and bridging investment gaps to address challenges like food insecurity and climate change.	addressed by ensuring all ecosystem actors—small producers, SMEs, corporates, and governments—contribute value, fostering equitable partnerships and reducing barriers for smaller entities to engage fairly with larger organizations.	policy challenges in agri-food systems stem from diverse and complex regulatory environments across countries, creating barriers to scalability and market entry for digital innovations and startups.	limited internal access and infrastructure in rural areas, disparities in pricing and business models, low digital literacy, resource constraints, and insufficient venture capital and specialized knowledge in the agritech sector.	Climate change, unsustainable agricultural practices, socio-economic inequality, and the need to grow agricultural production by 80% by 2050 to meet population demands, alongside fragmented value chains and systemic inefficiencies and aligning global goals with local needs.	Leveraging its research expertise, socio-technical frameworks, and strong partnerships to support sustainable digital transformation, alongside fragmented value chains and systemic inefficiencies and aligning global goals with local needs.
Digital Agriculture Network in LATAM - IICA	A convening platform by IICA, showcased through Digital Agriculture Week, fostering partnerships among AgTech startups, policymakers, and multilateral organizations to address systemic barriers to digital innovation in agriculture across the Americas.	IICA's motivation for collaboration is to boost technology adoption in agriculture and facilitate partnerships between agtech innovators and key stakeholders, enhancing knowledge sharing, resource pooling, and coordinated efforts to drive sustainable agricultural development.	Digital Agriculture Week fosters multilateral collaboration by bringing together ag-tech companies, venture capital firms, corporates, and multilateral organizations to build partnerships, share insights, and address shared challenges in agricultural digitalization, laying a foundation for sustained progress in the sector. This event enables mutual understanding and connectivity among key players, supporting long-term alliances in agri-food systems.	Digital innovation in agri-food systems holds immense potential to increase productivity, sustainability, and inclusion, though it is still in its infancy, particularly in the Americas. Events like Digital Agriculture Week play a crucial role in bridging gaps by fostering partnerships, adapting solutions to local needs, and building capacity to accelerate the adoption of digital technologies in agriculture.	IICA fosters collaboration by bringing stakeholders together and facilitating introductions, allowing partnerships to form organically without imposing any structure, thus promoting equitable contributions. This approach builds familiarity and confidence among participants, but the success of each collaboration depends on the willingness and initiative of the involved parties.	Currently, data privacy and ownership rights are not seen as significant policy challenges in digital innovation within the agri-food systems of the Americas, as digitalization is still in its early stages and smaller ag-tech companies are primarily involved. However, concerns around data management may grow as large corporations begin acquiring smaller firms, potentially impacting farmer trust and collaboration unless addressed through future policy development.	limited user capacity, the need for demand generation, and challenges in aligning public and private interests. Additionally, the diversity of regional contexts, a lack of robust data on technology adoption, and the early stage of digital transformation, especially in the Americas, limit the effective use and scalability of digital solutions.	The interview highlights that agri-food systems across the Americas face unique regional challenges due to environmental, cultural, and regulatory diversity, with differences in crops, pests, languages, and farming practices complicating the scalability of digital solutions. This decentralized and varied landscape limits the effectiveness of a one-size-fits-all approach, necessitating tailored adaptations for each region.	CGIAR's unique position as an international research consortium enables it to leverage a vast network of specialists, valuable local connections, and strong ties with private sector actors and NGOs, amplifying the impact of initiatives and addressing digitalization challenges.
SMART Agtech Integration Facility (India Pune)	A CGIAR-led workshop in partnership with ATMA and GIPE, aimed at bridging gaps between Farmer Producer Organizations (FPOs) and digital innovators in Maharashtra, promoting tailored digital solutions to enhance agricultural productivity and resilience.	CGIAR's motivation for collaboration as a convening partner is to accelerate innovation, leverage diverse expertise, adapt solutions to regional needs, influence policy, build capacity, enhance data insights, and expand its global impact in sustainable agriculture and food security.	This collaboration involved assessing digital needs for farmer producer organizations in Maharashtra, where roles were distributed across partners to address digital literacy and advocate for digital transformation. The government's involvement and engagement with the local ecosystem were pivotal in driving joint initiatives and supporting digital adoption.	The organization's focus on technology adoption includes advocacy for infrastructure improvements, digital literacy, and the creation of supportive digital ecosystems. This has involved integrating social and technical enablers to ensure farmers benefit from digital tools, enhancing their productivity and connectivity.	Power dynamics are addressed by fostering mutual respect, setting clear expectations, and ensuring that all partners contribute meaningfully. Practices such as inclusive decision-making and transparent communication help maintain balance and equality in collaborative efforts.	Policy gaps hinder public-private partnerships in agri-food digital innovation, causing trust and collaboration challenges. Solutions include clear data-sharing frameworks, farmer training on data rights, and shared IP agreements to build trust and foster collaboration.	Isolated pilots, shifting tech trends, and fragmented efforts. A collaborative ecosystem with coordinated strategies is key to driving scalable and impactful digital transformation.	Limited localized data, skill gaps, and integration with traditional practices. A decentralized ecosystem with balanced power dynamics is needed to ensure digital tools complement existing resources for transformation.	Providing research-backed insights, socio-technical frameworks, and a neutral platform that fosters trust, alignment, and effective collaboration among diverse stakeholders in driving inclusive digital transformation in agriculture.