

Key points

Ugandan smallholder farmers face significant climate adaptation knowledge gaps that limit productivity and require reliable, accessible, farmer-centred information, technologies, and advisory services to manage growing climate risks and improve livelihoods.

Private sector actors are increasingly important providers of digital extension services, delivering adaptation knowledge through innovative business models that often combine advisory support with products such as seeds and fertilisers. However, these services are frequently shaped by commercial and donor priorities, which can exclude poorer and less organised farmers facing literacy, connectivity and poverty constraints.

To ensure digital extension contributes to equitable climate adaptation, greater investment in blended finance, stronger regulation, interoperable data systems, targeted inclusion measures and effective public-private partnerships is needed to reach underserved farmers.

Making private digital extension services work for Uganda's smallholders

Until the 2000s, Uganda's agricultural extension system relied mainly on a public model in which government staff provided in-person advice to smallholder farmers. While valued by farmers, the system has long struggled with understaffing and limited reach. This has created space for digital extension services, largely provided by private sector actors. Agricultural technology (agritech), telecom and financial technology (fintech) companies, input suppliers and nongovernmental organisations now use such services to provide climate information, advice, inputs, finance and market links. These services can widen access to adaptation knowledge, but their reach is often shaped by commercial incentives and donor priorities rather than smallholders' needs. Low digital literacy, weak connectivity, limited affordability and fragmented delivery further restrict access, especially for poorer farmers. More inclusive and sustainable scaling will require blended finance, better coordination, stronger regulation and interoperable systems.

After several consecutive years showed decreases in global hunger, food insecurity and malnutrition, in 2025 the United Nations reported a concerning reversal in progress across regions worldwide,¹ mainly due to climate variability and extreme weather events.² Smallholder farmers in the Least Developed Countries (LDCs) are particularly vulnerable to climate change, relying heavily on rain-fed agriculture and livestock for income and livelihoods.³ These farmers often have limited access to climate information and technology,⁴ further impacting productivity and exacerbating food insecurity and poverty.⁵

Extension services are therefore crucial for closing gaps in knowledge needed to support climate adaptation. But they face serious infrastructure, institutional and funding

constraints, which influence who creates and accesses this knowledge.

In response to these challenges, the CRAKS project has explored ways to centre marginalised smallholder farmers in locally led adaptation knowledge processes.⁶ Project observations highlight a growing role for private sector actors in Uganda's agricultural adaptation knowledge system.

Drawing on these insights, this briefing analyses private sector actors as connectors, translators and brokers of adaptation knowledge. It examines how the private sector has developed and distributed digital extension innovations for adaptation and explores barriers to scale. A critical question we address is whether private sector

actors can deliver adaptation knowledge that is genuinely shaped by the needs of smallholder farmers, or whether other priorities — such as commercial and funding incentives — will be the drivers, leaving poorer farmers underserved.

Digital extension services: plugging the gap

Uganda's agricultural sector faces mounting climate-related pressures, including erratic rainfall, prolonged droughts, floods and pest outbreaks,⁷ that threaten the quality and quantity of food produced. Smallholder farmers are particularly exposed to these risks, making extension services that deliver timely, reliable, locally relevant knowledge more critical than ever.

In this briefing, 'digital extension' refers to using information and communication technologies to deliver adaptation knowledge to farmers. Such technologies include mobile phones and applications, interactive voice response (IVR) systems, unstructured supplementary service data (USSD) channels, agent networks and digital advisory platforms. The early foundations of digital agricultural extension in Uganda emerged

between the mid-2000s and the early 2010s through information communications technology (ICT)-based pilot initiatives mainly using short message service (SMS) and IVR. Until this point, smallholders had relied mainly on the government's in-

person extension system. While highly valued by farmers, extension ratios were as high as 1:2000 farmers compared to the recommended 1:500.

The emerging ICT-based initiatives evolved into more scalable services and expanded rapidly in the 2020s, with increased private sector participation. Today, innovations such as mobile applications, SMS, video, radio and call centres share climate advisories, input information (including improved seed varieties, fertiliser recommendations, pest and disease control) and market linkages (such as connections to buyers, real-time price information, contract farming opportunities).

The shift towards digital agricultural extension is supported by a broader enabling policy environment. The Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) operates a public digital extension portal, but its reach is limited. Uganda's Nationally Determined Contributions⁸ and National Climate Change Act (2021) prioritise strengthening agricultural extension and climate information services as part of building adaptive capacity in the agriculture

sector. However, public extension cover — both physical and digital — remains limited. This gap has led to the development of the National Agricultural Extension Strategy 2016, which invites private sector and other non-state actors to complement the government's digital extension efforts.

Private sector actors are expanding access to climate-resilient inputs (for example, drought-tolerant seeds, improved livestock breeds and water-saving irrigation technologies), improving risk management (for example, weather-indexed insurance, early warning systems and climate forecasting innovations), strengthening financial inclusion (for example, mobile money services, digital credit and bundled input loans), and delivering more tailored extension services to smallholders. As a result, the private sector is becoming an important component of the adaptation knowledge system. It is crucial to understand how it operates, how it meets farmers' adaptation needs and what limits it.

How the private sector meets smallholder farmer needs through digital extension

Private digital extension services are playing an increasingly important role in Uganda's agricultural adaptation knowledge system. By providing climate information, advisory services, financial products, inputs and market linkages through digital platforms, they help fill gaps left by an overstretched public extension system. However, their reach and impact are shaped by the business models that underpin them, raising questions about who benefits and who is left behind.

Private actors include agritech firms, fintech providers, telecom companies, agro-input suppliers and social enterprises. Together, they use mobile apps, USSD, IVR systems, mobile money platforms and agent networks to deliver adaptation knowledge and related services to smallholder farmers. Agritech firms such as M-Omulimisa and EzyAgric provide weather forecasts, farm management tools, digital profiling, and AI-enabled advisory services, while fintech providers facilitate savings, credit and input financing. Telecom providers supply the connectivity and payment infrastructure on which many of these services depend.

These services are delivered through a range of business models.

- **Subscription-based platforms** charge farmers for advisory services, weather information or market intelligence. Uptake is often constrained by low and irregular incomes, and expectations that extension should be free.

It is crucial to understand how the private sector meets farmers' adaptation needs and what limits it

- **Input-bundling models** cross-subsidise advisory services through the sale of seeds, fertilisers and other inputs but risks prioritising commercial interests over farmers' needs.
- **Digital finance models** generate revenue through transaction fees, software services and data-enabled lending, but affordability limits poorer farmers.
- **Data-driven models** monetise farmers' data and partnerships that connect users with buyers, insurers, or financial providers. This favours resource-rich farmers.
- **Commission-based agent networks** combine digital tools with local support, helping farmers access inputs, finance, markets and advisory content. However, low income limits remote coverage.
- **Embedded-service models** integrate advisory services into contract farming arrangements and organised value chains, ensuring support for participating farmers but often excluding those outside commercial networks.

These business models expand access to adaptation knowledge but do not reach all farmers equally. Models that depend on subscriptions, commercial transactions, farmer data or established value chains favour farmers that are better resourced, connected and organised into groups and cooperatives. As a result, women, poorer households, older farmers and those outside cooperatives or formal markets are less likely to benefit. Commercial incentives therefore shape both the services offered and farmers prioritised.

Additional barriers, including poor rural connectivity, limited smartphone ownership, low digital and financial literacy, high data and transaction costs, and low awareness of services, continue to restrict equitable access. Donor dependence, fragmented platforms and weak coordination also undermine sustainability and scalability. Together, these constraints risk reinforcing inequalities in access to agricultural knowledge and climate adaptation support.

Private digital extension services help close critical knowledge gaps for smallholder farmers. Yet the business models that support growth and financial sustainability often favour commercially attractive users. Unless inclusion is incentivised through policy, financing and service design, the services that lend themselves to scaling up may not be those that would best serve Uganda's most marginalised smallholder farmers.

Addressing barriers to scale

While digital extension services have expanded in Uganda, demand, supply, finance and policy-related barriers continue to limit scale. These barriers shape which business models persist, which farmers are reached and the types of services delivered.

On the demand side, more inclusive and user-friendly interfaces — such as IVRs, hotlines, and blended models that combine digital tools with human support — can improve access. These help address low smartphone penetration (just over 20%) and low digital literacy. They can also complement SMS-based services that are often insufficient for climate advisories. Flexible pricing, subsidies and bundled services can improve affordability, while trusted intermediaries like farmer groups and local agents can strengthen uptake.

Supply-side constraints require more coordinated delivery models. Solutions such as USSD services, hotlines, solar-powered Wi-Fi kiosks and improved network infrastructure can function in low-connectivity settings. High input costs and counterfeit products need stronger quality assurance systems, transparent supply chains and trusted input-advisory bundles that build farmers' confidence. Reducing platform fragmentation (nearly 30 digital agriculture initiatives were identified in 2022,⁹ many overlapping or unsustainable) requires better coordination, integration and a shift away from short-term, donor-dependent models towards more sustainable models.

Financing constraints highlight the need for diversified funding. Uganda's agritech sector remains heavily reliant on short-term grants. Expanding access to patient capital through blended finance and greater domestic investment is key to long-term growth. Achieving commercial viability will require revenue diversification, cost optimisation and partnerships to share operational costs. Without this, platforms risk collapse, as seen with Inputi and Wefarm, which struggled to achieve financial sustainability and scale.

Finally, accelerating government adoption of digital tools, alongside clearer frameworks for agritech, e-credit, insurance and data governance, can support innovation. Promoting interoperable public platforms and shared data systems would reduce duplication, lower costs and enable more coordinated service delivery.

Uganda's leading agritech platforms show strong potential for regional expansion

Opportunities for growth

Emerging opportunities are creating potential for increased private-sector engagement in Uganda's agricultural adaptation knowledge system.

Advances in AI and machine learning, illustrated by USSD-based advisory engines such as ManyA AI on M-Omulimisa and AI-enabled crop diagnostic tools like PlantwisePlus — offer significant potential to scale and personalise climate extension services, especially as local-language processing improves. Alongside this, the integration of digital farmer profiling with weather-index insurance and seasonal credit is creating commercially viable bundled climate-finance products, with actors such as M-Omulimisa, Ensibuuko and EzyAgric well positioned to expand into these offerings.

The digitisation of Farm Africa's Village-based Advisor network, linking advisors and district agricultural officers to M-Omulimisa and the African Forum for Agricultural Advisory Services (AFAAS) — signals the emergence of scalable hybrid extension systems that combine public endorsement with private delivery capacity. Specific value chains, including coffee, dairy, horticulture and cattle corridor systems, offer further commercial entry points given their climate sensitivity, existing market structures and strong donor interest.

Uganda's leading agritech platforms also show strong potential for regional expansion into East African markets, where comparable smallholder profiles and more developed digital infrastructure favour proven low-connectivity models. Better-organised farmer groups could further amplify this reach.

Finally, public-private partnerships — including with agribusinesses, input suppliers and produce buyers can strengthen market linkages and reduce last-mile distribution costs. The World Bank-financed Uganda Climate Smart Agricultural Transformation Project (UCSATP) represents a significant opportunity in this regard, funding agro-climatic information systems and encouraging collaboration among research institutions, private actors and farmer

organisations, providing a subsidised pathway for aligned agritech platforms.

Conclusion and recommendations

Private digital extension services in Uganda are steadily expanding access to climate information, agricultural advice, inputs, finance and markets. However, this growth remains uneven, with many farmers, especially those in more vulnerable or remote contexts, not fully benefiting. Without deliberate efforts, expansion risks reinforcing existing inequalities in access to agricultural knowledge and services.

Achieving inclusive adaptation requires:

- Combining digital tools with in-person support through community-based agents, farmer groups and public extension to reach low-literacy and low-connectivity users.
- Expanding blended, predictable and patient funding to help platforms move beyond donor dependence and develop viable smallholder business models.
- Strengthening regulation for agritech, digital finance, insurance and data governance, and building interoperable digital infrastructure to reduce duplication and costs and increase trust among smallholders.
- Using targeted subsidies, flexible pricing and trusted local intermediaries, and investing in offline and low-bandwidth solutions such as farmer hotlines and USSD services, supported by disaggregated data to reach women, poorer, older and remote farmers.
- Aligning digital platforms, government systems, research institutions and farmer organisations around co-creating knowledge responsive to farmers' adaptation needs, rather than commercial or donor priorities.

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Notes

¹ FAO et al. (2025) The State of Food Security and Nutrition in the World 2025: Addressing high food price inflation for food security and nutrition. Rome. doi:10.4060/cd6008en. / ² Academy of Scientific Research and Technology and UK Universities Climate Network (2022) Achieving Food Security under Climate Change. / ³ Mbow, C et al. (2019) Food Security, in Shukla, PR et al. (eds) Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems. Intergovernmental Panel on Climate Change. doi:10.1017/9781009157988.007. / ⁴ Kandel, GP et al. (2024) Food security and sustainability through adaptation to climate change: Lessons learned from Nepal, *International Journal of Disaster Risk Reduction*, 101, 104279. doi:10.1016/j.ijdrr.2024.104279. / ⁵ Touch, V et al. (2024) Smallholder farmers' challenges and opportunities: Implications for agricultural production, environment and food security, *Journal of Environmental Management*, 370, 122536. doi:10.1016/j.jenvman.2024.122536. / ⁶ IIED (no date) Building community resilience through the locally led adaptation knowledge system in Uganda, www.iied.org/building-community-resilience-through-locally-led-adaptation-knowledge-system-uganda / ⁷ Von Loeben, S et al. (2023) Policy brief: Climate risk analysis for adaptation planning in Uganda's agricultural sector: An assessment of maize and coffee value chains. Potsdam Institute for Climate Impact Research. / ⁸ Ugandan Ministry of Water and Environment (2022) Uganda's Updated Nationally Determined Contribution. / ⁹ Niras International Consulting and DAI (2022) USAID Digital Agriculture Ecosystem Assessment – Uganda.

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Our work on building community resilience in Uganda is being undertaken as part of IIED's project, 'CRAKS: Accelerating adaptation to climate change', run with partner ACTADE. Find out more about this work at www.iied.org/building-community-resilience-through-locally-led-adaptation-knowledge-system-uganda

