Integrated Solutions for Livestock Productivity
Innovation Package

About AIM for Scale Innovation Packages

Advances in agricultural innovation offer unprecedented opportunities to improve productivity, profitability, and resilience. Supported by the International Affairs Office at the UAE Presidential Court and the Gates Foundation, the Agricultural Innovation Mechanism for Scale (AIM for Scale) was established to bridge the gap between pilots and implementation at scale–accelerating the adoption of evidence-based, cost-effective innovations to strengthen the livelihoods of millions of farmers.

AIM for Scale's primary instrument is the Innovation Package, a structured blueprint focused on a single high-potential innovation area. Each Innovation Package is intended to be used as a starting point to guide discussions with governments, multilateral development banks (MDBs), and other development stakeholders regarding where investments should be targeted at the country or regional level to ensure the sustainable scaling of an innovation. They detail the general set of activities required for scale in a particular innovation area and provide technical, financing, delivery, and implementation guidelines. AIM for Scale then works with local partners to conduct country-level assessments to adapt and implement the Innovation Package in line with national priorities. These efforts are complemented by investments in global and regional public goods that improve farmer livelihoods. An Innovation Package is not a comprehensive sector strategy or a fixed implementation plan; it is a prioritized starting point for scaling an innovation area.

The core of the Innovation Package is organized around five thematic components, each representing a distinct area of action needed to achieve scale. For each component, the package specifies:

- **Goal:** The intended outcome this component is working toward.
- **Key Activities:** The concrete actions, investments, or interventions that implementing partners, governments, and MDBs should prioritize.
- **Target Outputs:** Measurable results to be achieved within a defined timeframe (typically three to five years), which provide a shared benchmark for progress and investment.

For more information about AIM for Scale's process of identifying innovation areas and developing Innovation Packages, please visit AIM for Scale's frequently asked questions webpage.

Integrated Solutions for Livestock Productivity

This document presents the rationale and strategic framework for AIM for Scale's Integrated Solutions for Livestock Productivity Innovation Package. AIM for Scale is committed to accelerating the adoption and scaling of cost-effective innovations that improve the livelihoods, resilience, and food security of farmers—particularly small-scale livestock producers—in low- and middle-income countries (LMICs). A growing body of evidence suggests that significant and sustainable gains in livestock productivity can be achieved when nutrition, animal health, and herd management innovations are delivered as an integrated innovation package rather than through isolated interventions. Improved livestock productivity can increase farmer incomes, household nutrition, and rural economic opportunity.

The AIM for Scale Integrated Solutions for Livestock Productivity Innovation Package was co-designed by a Technical Panel comprising experts from the University of California at Davis, Cornell University, Washington State University, the Global Methane Hub, the Climate & Clean Air Coalition of the UN Environment Programme, the International Livestock Research Institute, the Aga Khan Foundation, the Gates Foundation, Soma Mater, the Asian Development Bank, the Inter-American Development Bank, the World Bank, and the International Fund for Agricultural Development. This note builds on the work of the Innovation Commission for Climate Change, Food Security, and Agriculture at the University of Chicago. Final responsibility for the Innovation Package rests with the AIM for Scale Secretariat.

Delivering Bundled Livestock Innovations at Scale in LMICs

Smallholder livestock systems affect food security, income generation, and rural resilience across millions of households in LMICs. In mixed crop-livestock and pastoral systems, livestock also function as financial assets and risk-management tools, serving as living savings and insurance that households can draw on during economic stress, crop failure, or illness, with small ruminants offering poorer households a low-cost, accessible entry point into production.

Demand for animal-source foods continues to rise, with FAO projecting that global consumption of meat, milk, and eggs will increase by 20% by 2050. Yet, livestock systems in LMICs face persistent challenges, especially low productivity, due to inadequate access to quality feed and animal health services, weak market linkages, and vulnerability to climate shocks, among others. Beef and dairy systems merit particular attention because of their importance to rural livelihoods, nutrition, and food security. At the same time these systems account for a large share of livestock methane emissions in LMICs. Investments in these systems can offer some of the greatest scope for strengthening resilience and productivity gains, raising output per animal, lifting incomes, improving resource-use efficiency and food security, and reducing greenhouse gas emission intensity.

Livestock productivity gains start at the farm level and depend on three core innovation areas: (i) animal nutrition, (ii) animal health, and (iii) herd management. While meaningful learning on what works is still needed, evidence shows that improvements in animal nutrition, health, and management can generate both productivity gains and methane emission reductions. When

bundled, these interventions can often produce synergistic effects that outperform isolated or single-innovation efforts, although potential trade-offs and context-specific effects also need to be considered.

Studies indicate that under the right conditions nutrition is linked to livestock productivity. For example, in a large before-and-after field study in India, ration balancing for dairy cows and buffaloes increased milk yield by 2 to 14% and improved farm income. India's Ration Balancing Program helped smallholders formulate balanced rations from locally available feeds, generating extra income of approximately $81 per animal per lactation while reducing feed costs by 11.8% and enteric methane by 13.7% per kilogram of milk. More broadly, a review of evidence on the use of Black Soldier Fly (BSF) larvae in Ghana shows that byproducts can reduce feed costs by up to 30%.

Strengthening animal health systems offers some of the highest and fastest returns on agricultural investment in LMICs. Thermostable vaccines for priority diseases reduce reliance on cold chains and enable reliable delivery in areas with limited infrastructure. East Coast Fever (ECF) vaccination can reduce calf mortality by up to 95%, based on evidence from Tanzania's mass vaccination campaign. In Kenya, ECF vaccinations are estimated to have generated a net benefit of approximately $28 per household and, in Zambia, reduced total economic costs by 90% compared to no intervention. Likewise, the foot-and-mouth disease (FMD) vaccination has shown benefit-cost ratios of 9.93 for small-scale dairy and 3.02 for beef farms in South Vietnam, and 11.5 for agro-pastoral systems in Southern Sudan. Moreover, integrated reproductive and neonatal care improves young stock survival. Based on evidence from Ethiopia, preventing mastitis cases via improved hygiene can avoid milk yield losses and cut veterinary and treatment expenses in smallholder dairy systems. Across Africa and South Asia, for example, a modeling study estimated that GALVmed's animal health product distribution initiatives generated $37.97 of net economic benefit per small-scale producer.

Improved herd management practices can generate productivity gains at modest cost. Reliable water access and shade can increase production by improving feed intake and reducing heat-stress-related fertility losses. Shade structures can reduce severe heat stress, generating strong returns of $12 –16 per animal based on modeling evidence from five South American countries–after subtracting infrastructure costs. Supporting the biological benefits of shade, a Brazilian experimental study of low- to medium-production dairy cows found that natural shade in an integrated crop-livestock-forestry system increased rumination time by 34% (and up to 1.7-fold when the temperature-humidity index ranged from 79 to 83) and significantly lowered body surface temperatures compared with full-sun pastures. Similarly, consistent record-keeping can raise farm productivity, based on a literature review of studies in Latin America, Africa, and Asia. In Ethiopia, improved genetics and breeding, when supported by training on proper feed and management, have shown potential to increase milk productivity. Well-managed rotational grazing can increase milk output per hectare by 5-10% while improving pasture health and soil carbon. Traceable livestock systems can support market trust and improve access to higher-value markets. These broader activities facilitate on-farm returns to livestock production.

Beyond the farm, supportive input and output markets, enabling policies, access to finance, and community-level interventions are also essential for sustained adoption and impact. Additionally, scale is achieved not through farmer advisory services focused on a single channel but through coordinated investments across multiple delivery systems. When bundled, interventions in nutrition, health, and management can create synergistic effects that outperform isolated efforts. Digital agriculture and artificial intelligence (AI) can further amplify reach and reduce costs. When well designed, farmer training programs — whether in person, digital, or both — remain critical to sustained adoption.

The heterogeneity of smallholder livestock systems means that innovations vary in their scaling potential across herd species, herd size, market orientation, production environments, and socioeconomic conditions. Very poor households may adopt low-cost, low-risk innovations first, while market-oriented farmers may adopt bundled or capital-intensive practices more readily. Gender considerations also influence adoption: women often manage small ruminants and milk-related tasks but have less control over household assets and income. Advancing effective livestock development strategies, therefore, requires understanding livestock systems at regional scales within local conditions while generating insights broad enough to inform policy, investment, and development programming.

This Innovation Package responds to four premises. First, farm-level integration of three core innovation areas: (i) animal nutrition, (ii) animal health, and (iii) herd management are essential for impact and cost-effectiveness. Second, existing livestock advisory services have shown promise, but have not consistently reached scale and could be augmented by digital tools and AI. Third, farm-level action must be complemented by supply-side efforts to enhance access to inputs, such as adequate feed combinations, vaccines, and improved breeding. Fourth, the heterogeneity of livestock production systems and the need for new integrated approaches indicate the importance of creating a learning agenda to generate additional evidence.

In undertaking these efforts, a particular focus is on ensuring that small-scale livestock producers, including those who have historically been underserved or are in marginalized or hard-to-reach contexts, with productive potential, have access to farm-level advice and inputs to enhance livestock productivity. Further, by focusing on integrated solutions for livestock productivity as an entry point, AIM for Scale recognizes that farmers often face multiple, interconnected constraints, and that complementary investments in areas like finance, inputs, and infrastructure may be necessary to increase livestock productivity. Rather than attempting to bundle all interventions upfront, AIM for Scale prioritizes scalable innovation entry points while remaining responsive to the need for complementary investments as part of broader national efforts. AIM for Scale offers a platform to help realize these opportunities by serving as an independent broker and convener; coordinating efforts across the public sector, private sector, and development partners; facilitating collaboration among countries and donors; supporting project implementers with expert guidance; and identifying and employing global resources for local impact.

Innovation Package Components

The Innovation Package proposes investments across five interconnected and complementary investment areas:

1. Better advisory services covering nutrition, health, and herd management that are locally grounded, practically actionable, and delivered through integrated farmer-facing systems rather than fragmented innovation-specific channels.
2. Leveraging and strengthening existing livestock advisory services to deliver bundled livestock innovations through trusted, context-specific channels rather than creating parallel systems.
3. Digital services and AI investment to complement existing advisory systems and accelerate the delivery, adoption, and sustained use of livestock innovations.
4. Better inputs to ensure that livestock producers have reliable, affordable access to feed materials, vaccines, genetic services, and other inputs.
5. Understanding behavioral response and learning from and within the scaling process to identify what works, for whom, and under what conditions.

These investment areas are the basis for the components below. They should not be treated as sequential steps, but as interacting and complementary investments, with the mix of activities varying by country and production system according to local context.

1. Better Advice

Goal: Ensure that livestock advisory services covering nutrition, health, and herd management are locally-grounded, practically-actionable, cost-effective, and delivered through integrated farmer-facing systems rather than fragmented innovation-specific channels, recognizing that farmers require coordinated support rather than separate advisory silos.

Activity 1: Deliver integrated livestock advisory services through trusted local channels

- Build or strengthen existing integrated, farmer-facing advisory systems covering nutrition, health, and herd management. Package nutrition and health advice together where it is delivered, for example, pairing ration-balancing guidance with vaccination calendars and herd-health protocols at a single advisory touchpoint, so farmers receive complementary advice as one bundle.
- Integrate advisory content into a common training curriculum for different types of advisory services including community-based individuals, agrovets, extension agents, and dairy-cooperative field staff, supported by periodic refresher training modules.

Activity 2: Provide actionable, locally-grounded nutrition advice centered on ration balancing

- Harmonize existing tools into a consolidated, mobile-enabled, ration-formulation platform linked to national feed libraries. Provide ration balancing advice integrating forages, byproducts, silage, and novel feeds into nutritionally balanced diets
- Develop advisory content on stage-specific feeding strategies, including pre-calving supplementation, lactation management, and feeding of growing stock, as well as the use of high-protein forages such as *Calliandra*.
- Explore the potential of advisory support for silage, and integrate silage planning into ration-formulation tools so farmers can match preserved feed supplies with herd requirements during dry seasons.
- Develop guidance on safe inclusion levels for byproducts and BSF larvae meal within balanced ration formulation, produce product fact sheets for major byproducts (including fruit residues, oilseed cakes, and BSF larvae meal), and address farmer perceptions that waste-derived feeds are inferior through demonstration trials, peer learning, and farmer testimonials.

Activity 3: Strengthen vaccination advisory, calendars, and farmer awareness

- Develop disease-specific vaccination calendars and SMS/interactive voice response (IVR) reminder systems integrated with national animal health information systems.
- Produce and distribute simple farmer-facing materials, including visual aids and audio messages, that explain the benefits of vaccination, particularly for diseases with longer-term economic returns, such as ECF and peste des petits ruminants (PPR).
- Embed vaccine-handling, cold-chain management, reconstitution, and dosing protocols into standardized training curricula for livestock advisory providers.

Activity 4: Integrate herd-health guidance into unified protocols

- Develop integrated best-practice packages covering pregnancy management, hygienic birthing, colostrum feeding, neonatal hygiene, mastitis prevention, and strategic deworming as unified herd health protocols rather than isolated interventions.
- Provide simple pregnancy-tracking tools and seasonal deworming calendars via SMS, IVR systems, and icon-based notebooks adapted for low-literacy users.

Activity 5: Equip farmers with practical guidance on heat-stress management, water access, and shade

- Develop locally adapted guidance on heat-stress management, including ventilation, feeding schedules, water-trough placement, and shade-tree species selection.
- Provide practical heat-stress monitoring tools, including temperature-humidity index-based SMS alerts, panting-behavior observation, and water-intake monitoring, along with basic water-quality testing guidance.

Activity 6: Provide farmers with information support on pasture and rangeland management

- Provide grazing and rangeland-management guidance, including rotational grazing, pasture and fodder conservation, and communal rangeland practices, prioritized for pastoral and communal systems.

Activity 7: Strengthen farmer capacity to use artificial insemination, record keeping, and breeding services

- Develop simple, mobile-enabled animal performance record-keeping systems that cover parentage, milk yield, growth performance, and calving intervals to support breeding decisions and improve access to genetic merit information.
- Integrate artificial insemination and breeding advice into herd-health bundles by linking oestrus synchronization with vaccination, nutrition, and reproductive health interventions to improve conception rates.
- Communicate the long-term benefits of genetic improvement through trusted intermediaries, demonstration farms, and visible local success stories.

Targeted Outputs:

- Country-specific feed databases linked to a harmonized mobile ration-formulation and/or record-keeping applications, delivering locally grounded nutrition advice in at least five target countries by 2030.
- Integrated advisory packages covering nutrition, herd management, and health-specific advice including vaccination calendars, reproductive and neonatal care, mastitis prevention, and deworming, delivered as unified protocols in at least five target countries by 2030.
- Grazing, rangeland-management, and heat-stress guidance (including water access and shade) prioritized for at least four pastoral and agropastoral target countries by 2030.

2. Leveraging Existing Advisory Services

Goal: Strengthen and expand existing livestock advisory and service delivery systems by building on public extension services, cooperatives, agrovets, and community-based advisory systems to deliver bundled livestock innovations through trusted, context-specific channels rather than creating parallel systems.

Activity 1: Map and strengthen existing delivery channels and integrate bundled livestock service delivery with inputs

- Map existing advisory and delivery networks across public, private, cooperative, and digital channels to identify opportunities for coordination, integration, convergence, and expanded service coverage.

- Where appropriate, integrate advisory services with input supply, finance, and market access systems to create coordinated livestock service ecosystems. This potentially includes training agrovets and agrodealers to provide guidance on feed, animal health, ration balancing, and basic herd management practices alongside product distribution.
- Support cooperative and hub-level data collection, record keeping, and information sharing to facilitate the use of data across advisory networks.

Activity 2: Strengthen livestock advisory services networks as primary service platforms

- Implement national training, certification, and continuing education programs for livestock extension agents informed by World Organisation for Animal Health guidelines and expanded to cover livestock nutrition, husbandry, and preventive animal health.
- Integrate digital advisory platforms that provide consistent guidance on disease identification, treatment protocols, preventive care, and livestock management while linking community disease reporting systems to government surveillance systems through formal data-sharing agreements.
- Support enabling policies that strengthen pluralistic livestock extension systems and promote the adoption of harmonized national policy frameworks, operational standards, certification systems, and continuing professional education programs for livestock extension agents to improve service quality, accountability, and farmer trust.
- Strengthen quality assurance systems, product certification, anti-counterfeit measures, and digital registries of certified distributors and wholesalers within the livestock advisory system.

Activity 3: Promote tool adoption, sustained engagement, and long-term use by extension agents

- Promote the use of accessible and appropriate technologies, including icon-based notebooks, SMS-based reporting systems, and mobile applications for extension agents, to improve record-keeping, communication, and adoption among low-literacy users.
- Link livestock traceability systems with vaccination campaigns, insurance programs, and market incentives to strengthen farmer participation and long-term engagement.
- Support community-based programs, cooperative hubs, and digital decision support tools to facilitate adoption at village, community, and household levels.

Targeted Outputs:

- Existing advisory networks mapped and integrated into national program delivery systems in at least three target countries by 2030.
- Country-appropriate national training, certification, and continuing-education programs are supported, with at least 25% of livestock advisory providers certified to deliver bundled livestock services, across at least three target countries by 2030.
- Farmer adoption and sustained use of bundled nutrition, animal health, and herd-management services promoted through certified advisory networks in at least three target countries by 2030.

3. Digital Services and Artificial Intelligence

Goal: Scale livestock advisory outreach through digital technologies and AI by accelerating the delivery, adoption, and sustained use of livestock innovations while ensuring that digital platforms are locally relevant, gender inclusive, and integrated with existing advisory systems.

Activity 1: Integrate digital tools with in-person advisory systems

- Integrate digital veterinary systems with agrovet networks and local advisory services, develop IVR content in local languages, and link digital platforms to vaccination campaigns and national disease surveillance systems.
- Strengthen partnerships among governments, private sector actors, cooperatives, producer organizations, and digital service providers to integrate digital livestock tools into national extension and livestock development strategies.
- Ensure digital recommendations include offline and/or SMS and IVR fallback options.

Activity 2: Develop and deploy digital advisory and AI-enabled livestock management tools for farmers, extension agents, and community-based extension and delivery agents

- Develop and scale digital decision-support and record-keeping tools for farmers and extension agents. Applications may include vaccination reminders, expected calving alerts, strategic deworming schedules, mastitis prevention guidance, pregnancy monitoring, and disease reporting systems.
- Support pilot testing and deployment of remote sensing and AI-enabled grazing management platforms capable of monitoring biomass availability, pasture condition, rotational grazing schedules, and grazing intensity. Integrate satellite-based biomass monitoring into national digital extension systems to generate localized SMS and IVR grazing recommendations and migratory route alerts for pastoralists and communal rangeland management groups.
- Leverage AI to translate technical content into local languages, support voice-based interfaces for livestock keepers, and simplify farmer interaction with complex tools such as ration formulation software and herd management applications.
- Pilot AI-enabled computer vision technologies to support livestock disease identification, forage quality assessment, body condition scoring, and related applications.

Activity 3: Establish regional livestock knowledge banks and digital information systems

- Develop and maintain regional livestock knowledge banks that provide trusted, validated, locally relevant, and practical technical information across all digital and in-person advisory channels.
- Regularly update national feed libraries to reflect seasonal variation in forage resources, feed composition, and locally available feed ingredients.

Targeted Outputs:

- Digital and AI based tools for ration formulation, disease surveillance, and reproductive and herd management deployed and integrated with in-person advisory and national systems in at least five target countries by 2030.
- Regional/country livestock digital knowledge banks established and updated in local languages, serving at least five target countries by 2030
- Digital advisory systems including IVR- and SMS-based services operational in at least five target countries, reaching 20 million smallholder farmers, including women livestock keepers and pastoralists by 2030.

4. Better Inputs

Goal: Ensure that farmers across target countries have reliable, affordable access to feed materials, vaccines, genetic services, and other inputs required to adopt an integrated set of livestock productivity innovations.

Activity 1: Improve access to livestock health inputs for smallholder farmers

- Support the regulatory approval, affordable production, distribution, and adoption of regionally relevant, quality-certified, thermostable vaccines for priority livestock diseases, including PPR, contagious bovine pleuropneumonia (CBPP), lumpy skin disease (LSD), ECF, and FMD.
- Strengthen government and private-sector cold-chain systems, vaccine strain matching, and quality assurance for vaccines with limited thermostability.
- Develop and distribute bundled herd-health kits through certified delivery channels, including vaccines, dewormers, acaricides, clean birthing supplies, colostrum management aids, teat dips, mastitis test kits, and animal health record cards.
- Improve access to anthelmintics while implementing stewardship measures, targeted treatment protocols, and parasite resistance monitoring to slow the development of antimicrobial and antiparasitic resistance.

Activity 2: Where relevant, support processing capacity and supply chains for feed, byproducts and novel feeds

- Support supply chains to deliver relevant feed, including novel feeds such as BSF to farmers.
- Support governments in the development of national guidelines, quality standards, and regulatory pathways for novel feed ingredients, including BSF larvae meal.
- Establish reliable substrate supply chains and food-safety controls to support BSF production. Build feed-processing capacity, including drying, grinding, and pelleting infrastructure, for agro-industrial byproducts and novel feed such as BSF larvae meal.

Activity 3: Expand access to water systems and shade infrastructure

- Expand access to reliable on-farm water systems. Support access to communal watering infrastructure along livestock corridors and in pastoral areas while establishing clear community governance, cost-sharing, and long-term maintenance arrangements.
- Develop affordable financing mechanisms for livestock water infrastructure, including cooperative-backed loans, revolving funds, and collateralized financial models.
- Strengthen local supply chains for affordable livestock-related, climate-resilient infrastructure by making available shade structure materials, shade tree seedlings, and improved livestock housing components.

Activity 4: Expand access to artificial insemination, breeding services, and genetic improvement

- Strengthen national artificial insemination services, including semen production and importation, liquid-nitrogen supply chains, and artificial insemination technician training and certification delivered through government and private providers.
- Improve access to reproductive support inputs, including oestrus-synchronization hormones, pregnancy-diagnosis tools, and semen storage systems, through animal advisory services.
- Support community-based breeding programs and cooperative bull and ram hubs in areas where artificial insemination remains limited, particularly within pastoral and small ruminant systems.

Activity 5: Delivery of adequate inputs

- Ensure farmers have access to complementary inputs, including animal-health inputs (vaccines, dewormers), feed and mineral supplements, and basic herd-management inputs, so that farmers can adopt innovations together rather than one at a time.

Target Outputs:

- Thermostable and other quality vaccines for priority diseases (FMD, ECF, PPR, CBPP, LSD) procured and delivered through strengthened cold-chain and extension networks across target countries by 2030.
- Feed rationing related input supply systems supported, including country-specific feed databases and feed-testing capacity, with alternative or novel feed options such as BSF larvae meal supported for scale-up in at least one target country by 2030.
- Improved access to complementary inputs around animal-health (vaccines, dewormers, herd-health kits) feed, and artificial insemination distributed through strengthened advisory systems in at least three target countries by 2030.

5. Behavioral Response and Learning

Goal: Embed a structured learning agenda within the scaling process to identify what works, for whom, and under what conditions, with particular attention to productivity gains, adoption of digital tools, gender equity, and methane emission intensity outcomes.

Activity 1: Embed learning and adaptive evaluation across innovation areas

- Assess the usability, behavioral uptake, impact, and cost-effectiveness of advisory services, particularly digital advisory tools.
- Evaluate the complementarity of in-person and digital advisory systems.
- Document methane emission intensity outcomes alongside productivity, income, and livestock performance indicators to support climate-aligned investment and scaling decisions.
- Where feasible, design rollout strategies to support experimental and non-experimental evaluation approaches that allow estimation of causal impacts and continuous refinement of intervention design and cost-effectiveness.
- Leverage the rapid and visible productivity responses often observed in dairy systems, including changes in milk yield and milk quality, to evaluate and refine farmer behavior change strategies.
- Develop structured learning agendas aligned with MDB project rollouts, and sustain delivery over time.

Targeted Outputs:

- Structured learning agendas embedded in at least four countries with active MDB livestock pipelines by 2030.
- At least three impact evaluations on adoption, productivity, and methane-intensity outcomes initiated by 2030.