CGIAR

Sustainable Animal and Aquatic Foods Program

Full design document

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Table of contents

List of acronyms

AAF	Animal and Aquatic Foods (Initiative)
ABC	Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT)
ADB	Asian Development Bank
AfDB	African Development Bank
AGRA	Alliance for a Green Revolution in Africa
AI	artificial intelligence
AMR	antimicrobial resistance
AMU	antimicrobial use
AoW	Area of Work
ARI	advanced research institute
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASF	animal-source food
ATRC	Advanced Technology Research Council
AWMYM	all women, men, youth and marginalized individuals
BMGF	Bill & Melinda Gates Foundation
CA	comparative advantage
CBO	community-based and grassroots organizations
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
CDC	Centres for Disease Control and Prevention
COMESA	Common Market for Eastern and Southern Africa
CORAF	Conseil Ouest et Centre Africain pour la Recherche et le Développement Agricoles
CRP	CGIAR Research Program
CSO	civil society organization
DPI	digital public infrastructure
ETH	ETH Zurich University
FAIR	findable, accessible, interoperable, and reusable (data principles)
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
GALS	Gender Action Learning System
GEF	Global Environment Facility
GESI	gender equality and social inclusion

GHG	greenhouse gas emissions
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GROs	global and regional organizations
GTA	gender-transformative approaches
GYSI	Gender, Youth, and Social Inclusion
HEAL	The One Health for Humans, Environment, Animals, and Livelihoods
HLO	high-level output
ICARDA	International Center for Agricultural Research in the Dry Areas
ICT	information and communication technology
IDB	Inter-American Development Bank
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IFPRI	International Food Policy Research Institute
IFRC	International Federation of Red Cross and Red Crescent Societies
IGAD	Intergovernmental Authority on Development
IGES	Institute for Global Environmental Strategies
ILRI	International Livestock Research Institute
INGO	international nongovernmental organization
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IPG	international public good
IPSR	Innovation Packaging and Scaling Readiness
IT	information technology
IWMI	International Water Management Institute
KIPPRA	Kenya Institute for Public Policy Research and Analysis
LD4D	Livestock Data for Decisions
LSHTM	London School of Hygiene and Tropical Medicine
MEL	monitoring, evaluation, and learning
PO	Program Outcome
NARES	national agricultural research and extension system
NGO	nongovernmental organization
R4D	research for development

ROI	return on investment
SAPLING	Sustainable Animal Productivity for Livelihood Nutrition and Gender Inclusion (Initiative)
SAAF	Sustainable Animal and Aquatic Foods (Program)
SLU	Swedish University of Agricultural Sciences
STIB	social, technical, and innovation bundles
SMEs	small and medium-size enterprises
TNC	The Nature Conservancy
TLU	Tropical Livestock Unit
ToC	theory of change
TVET	technical vocational education and training
UAE	United Arab Emirates
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
VSF	Vétérinaires Sans Frontières
WEFI	Women's Empowerment in Fisheries and Aquaculture Index
WELBI	Women's Empowerment in Livestock Business Index
WELI	Women's Empowerment in Livestock Index
WHO	World Health Organization
WOAH	World Organisation for Animal Health
WUR	Wageningen University and Research
WWF	World Wildlife Fund

1. Executive summary

Sustainable Animal and Aquatic Foods (SAAF) offers a unique pathway to sustainably increasing access to more nutritious foods while emitting fewer greenhouse gases (GHGs) and creating resilient and inclusive livelihoods. Livestock and aquatic food systems encompass a range of production systems, species, and ecological zones and require a high degree of contextualization. Bringing animal and aquatic food systems into one program offers new opportunities to demonstrate true system integration to tackle location-specific challenges.

SAAF's vision is as follows:

"People's lives and well-being in low- and middle-income countries are improved by sustainably transforming animal and aquatic food systems, so they foster inclusive, healthy, and nutrient-dense food supply chains that are climate and environmentally friendly."

SAAF addresses all five CGIAR Impact Areas, with significant contributions to (1) nutrition, health, and food security; (2) poverty reduction, livelihoods, and jobs; and (3) climate adaptation and mitigation.

SAAF's comparative advantage lies in its human capital for delivering outcomes, which are being continued from the Initiatives, the excellent laboratory facilities of CGIAR Centers, the living labs in site-specific areas, and its close relationships with local partners, including research institutions, government agencies, and the private sector.

Impact is achieved by delivering eight Program Outcomes (POs). Four focus on innovation adoption by producers, market actors, and communities, facilitated by co-design and capacity sharing. Four focus on behavior change for gender-equitable norms, increased investment, more supportive policies, and integration of animal and aquatic foods into the diets of producing households.

To deliver impact, SAAF has six interlinked Areas of Work (AoWs) designed to work together to achieve SAAF's vision of sustainably transforming animal and aquatic food systems:

1. Productivity+
2. Climate and the Environment
3. One Health
4. Market Systems, Policy Solutions, and Scaling
5. Gender, Youth, and Social Inclusion
6. Digital and Data Solutions

SAAF builds on CGIAR Research Initiatives including Aquatic Foods, Livestock and Climate, One Health, and Sustainable Animal Productivity for Livelihoods, Nutrition, and Gender Inclusion (SAPLING). It also builds on several bilateral projects.

The priority countries identified are Bangladesh, Cambodia, Colombia, Egypt, Ethiopia, Ghana, Guatemala, India, Kenya, Malaysia, Mali, Nepal, Nigeria, Senegal, Tanzania, Timor Leste, Tunisia, Uganda, Vietnam, and Zambia.

Key partners include national agriculture, livestock, and fisheries research institutes; government agencies; UN agencies, including the Food and Agriculture Organization, the World Health Organization, the UN Environment Programme, and the World Organisation on Animal Health; advanced research institutes; universities; nongovernmental organizations (NGOs) and development organizations; market actors; the private sector; and food producer groups.

SAAF has prioritized collaboration with other Programs/ Accelerators. The focus is on producing healthy and sustainable animal and aquatic foods (Better Nutrition and Diets). It complements work from Sustainable Farming, Multifunctional Landscapes, Climate Action, and Policy Innovations by focusing on animal and aquatic food systems versus whole-farm, multifunctional landscape or system-wide contexts. Through its cross-cutting AoWs (Market Systems; Policy Solutions and Scaling; Gender, Youth, and Social Inclusion; and Digital and Data Solutions), SAAF will work with Scaling for Impact, Gender Equity and Inclusion, Capacity Sharing, and Digital Transformation

We have identified USD 84 million in funds from 18 bilateral projects mapped to Sustainable Animal and Aquatic Foods. There are 10 donors for these projects, which suggests broad support for SAAF Program Outcomes.

2. High-level vision in response to challenges and megatrends

2.1. Challenges and megatrends

By 2050, 66% of global livestock emissions will be from low- and middle-income countries (LMICs) as animal agriculture responds to growing populations and incomes.[1] Overfishing and destructive fishing methods have led to a one-third decrease in fish stocks and loss of biodiversity, resulting in declining fish catches.[2] Demand for healthy and affordable animal-source foods will increase by 30%.[3,4] Addressing these challenges requires a transformative approach to how we produce animal and aquatic foods.

These foods are important sources of macro- and micronutrients, particularly for pregnant women and children in their early years.[5,6] They offer an important source of livelihood opportunities for millions in vulnerable communities and provide a buffer for climatic and socioeconomic shocks. early two-thirds of livestock producers and half the workers in fisheries and aquaculture are women.

The main challenges are (1) limited access and affordability in animal and aquatic food value chains (MT 2: changing consumption patterns); (2) a lack of comprehensive data to guide investment and policy decisions in value chains (MT1: demographic patterns), (3) productivity gaps and lack of understanding of what bundles of solutions work in specific contexts; and (4) impacts of climate change on animal and aquatic food systems, and vice versa (MT 4: climate change).[7,8] Other challenges include terrestrial and aquatic ecosystem degradation through poor governance and food loss and waste[9] (MT 5: environmental degradation), resulting in the further spread of animal disease and antimicrobial resistance[10] (MT 6: global health challenge).

2.2. High-level vision

SAAF's vision is as follows:

"People's lives and well-being in low- and middle-income countries are improved by sustainably transforming animal and aquatic food systems, so they foster inclusive, healthy, and nutrient-dense food supply chains that are climate and environmentally friendly."

To achieve this vision, we must transform production systems to produce more nutrient-dense foods, emit less, and be more nature-positive and adaptable and resilient to climate shocks.[11] Livestock and aquatic food systems encompass a range of production systems, species, and ecological zones and require a high level of contextualization.

Bringing animal and aquatic food systems into one program offers new opportunities to demonstrate system integration to tackle location-specific challenges. Integration offers opportunities to share solutions across systems (marine, riverine, lake and wetlands, mixed farming, semi-intensive, pastoral animal systems, and community fisheries). These systems face similar challenges, such as (1) managing disease and food safety, (2) increasing sustainable feed resources, (3) making genetic improvements, (4) addressing environmental and climate concerns, and (5) managing complex market chains. Women play a central role in both animal and aquatic food systems. They produce, sell, and use animal and aquatic foods, which have a direct impact on household livelihoods and nutrition.

SAAF contributes to all five CGIAR Impact Areas and directly to 9 of CGIAR's 11 high-level outcomes.

2.3. What is new in this Program?

1. Genomic innovations in animal and aquatic breeding for more productive and climate-friendly breeds and strains adapted to local conditions (6.1).
2. Food fortification solutions for nutrient-dense animal and aquatic foods (6.1).
3. Integrated surveillance systems, including risk-based approaches to ensure food safety and prevent the emergence and spread of zoonotic and emerging infectious diseases using a One Health approach, including using living labs (6.3).
4. De-risking livestock and fish production through novel business models, innovative financing, and insurance (6.2, 6.4).
5. Market system approaches applied to One Health and Climate and the Environment (6.4).
6. Artificial intelligence (AI)-driven analytics to deliver tailored climate, management, and market information (6.1 and 6.6).
7. Employment and business opportunities in animal and aquatic food (AAF) systems to increase the number of women, youth, and marginalized communities in upstream jobs (6.5).

3. Prioritization

AAF systems in low- and middle-income countries

Livestock production contributes to the livelihoods of over 1.3 billion people globally and accounts for an average of 40% of global agricultural GDP. Aquatic foods are crucial in many regions, with fisheries and aquaculture supporting the livelihoods of around 600 million people and contributing to the nutrition security of over 3 billion.

Challenges facing AAF systems

1. Low productivity and profitability for smallholder farmers.
2. Poor governance and market systems.
3. Climate vulnerabilities and ecosystem degradation.
4. Lack of quality data and digitalization.
5. Chronic underinvestment in sustainable innovative solutions.

SAAF prioritization overview

SAAF's approach to co-developing solutions is to begin by building on the progress achieved by previous CGIAR Research Initiatives and bilaterals.

Proposed solutions include the following:

1. Responsible and inclusive strategic investments in research.
2. Innovations and governance reforms.
3. Adoption of climate-smart practices.
4. Data and digital transformation in food systems.

Increased investments are needed to foster inclusive, healthy, and nutrient-dense food supply chains that are climate and environmentally friendly and ensure efficient and sustainable AAF systems, especially in countries where women, youth, the poor, and marginalized groups are heavily reliant on them (Bangladesh, Ethiopia, India, Kenya, Mali, Nigeria, Tanzania, Uganda, Vietnam).

Country cases

In Bangladesh, 24% of the population lives below the national poverty line,[12] with many dependent on small-scale livestock production and aquaculture. Adopting innovative, low-cost technologies could substantially boost productivity and incomes. **In India**, where around 20% of the population lives below the poverty line, over 50% of the workforce is engaged in agriculture and 70% of rural households depend primarily on agriculture, including animals and aquaculture, for their livelihood. The sector is highly fragmented, with 82% of farmers being small and marginal.[13] Improving access to markets, technology, and finance is critical to enhancing productivity, profitability, and environmental sustainability. Innovations for enhancing productivity to improve profitability, mitigate emissions, and enrich nutrient profiles include (1) advancing breeding programs, (2) refining feed formulations, and (3) deploying health management tools such as targeted vaccines. We aim to promote widespread and equitable adoption by ensuring these innovations are scientifically robust and tailored to specific contexts and social groups.

In Kenya, the agriculture sector contributes 22% to the GDP. There are 8.6 million small-scale farmers and 4.5 million farming households, with livestock accounting for 15% of agricultural output, while fish and aquaculture contribute 2%. Recurrent droughts and floods severely impact food productivity. These households are an untapped resource for building sustainable and resilient nutrient-dense food systems.[14]

In Ethiopia, about 60% of households are engaged in agricultural activities with an average farm size of 1.1 hectares.[15] Food production is vulnerable to climate shocks. Improved and climate-smart livestock production and expanding aquaculture can ensure smallholder livelihoods and food and nutrition security.

In Mali and Tanzania, the situation is similar, with both countries facing unpredictable rainfall and desertification that threaten the productivity of crops and livestock. Introducing resilient animal breeds and aquaculture with improved water management practices are foundational steps toward improving food security.

SAAF is committed to advancing climate resilience and environmental sustainability in food systems by supporting the adoption of practices and technologies that minimize environmental impacts, such as efficient water management and circular bioeconomy strategies. We focus on transforming market systems to improve access and transparency, particularly for small-scale producers, women, youth, and marginalized communities. By addressing these needs, we support smallholder producers in overcoming the challenges posed by climate change and contribute to their long-term food security and environmental stewardship.

In SAAF countries, the animal and aquatic sectors face structural barriers (e.g., inadequate infrastructure, limited market access, and volatile prices). In Sub-Saharan Africa, smallholder farmers, including men, women, and youth, struggle to access local and international markets due to poor infrastructure and insufficient market information.

In the livestock sector, challenges include inadequate veterinary services, poor transportation networks, and limited access to inputs that significantly affect productivity and market access. In aquaculture, barriers include limited access to quality inputs (e.g., fish feed and seeds), insufficient training on best practices, and difficulties in accessing markets (Bangladesh, Cambodia, Egypt, Ghana, Malaysia, Nigeria, Timor Leste, and Zambia). Developing efficient market systems and enhancing market information systems can enhance smallholder farmers' livelihoods.

In Kenya, Ethiopia, and Uganda, zoonotic diseases pose significant risks. One Health focuses on integrated approaches that safeguard human, animal, and environmental health.[16] This is especially important in countries where close daily interactions between humans, livestock, wildlife, and natural resource systems create opportunities for the emergence or re-emergence of zoonotic diseases with pandemic potential.

In Bangladesh and India, SAAF emphasizes the need for productivity enhancements alongside One Health Initiatives, particularly concerning antimicrobial resistance (AMR). The intensification of small-scale production systems in these countries, coupled with high antimicrobial use (AMU), necessitates a balanced approach to increasing productivity while safeguarding public health challenges.

Gender inequality remains an issue in the proposed countries, affecting access to resources, decision-making power, and economic opportunities in animal and aquatic systems. In Uganda, women make up 70–80% of the agricultural labor force, but most of them do not own or control any land.[17] This disparity limits inclusivity, potential productivity and profitability gains, and environmental sustainability. In Bangladesh, Egypt, and India, women play a crucial role in aquaculture and fish value addition but often lack access to credit, training, and technology.[18]

Bangladesh, Colombia, Ethiopia, Guatemala, India, Kenya, Mali, Nepal, Tanzania, Tunisia, Uganda, and Vietnam are key target countries for addressing poverty, climate change, gender inequities, and emissions through the Program (based on Tropical Livestock Units, Multidimensional Poverty Index levels, stunting prevalence, the Gender Inequality Index, the potential for scaling innovations, and stakeholder demand).

Stakeholder engagement

Comprehensive stakeholder engagement is central to our priority-setting process, ensuring that solutions are relevant, feasible, and aligned with the needs and perspectives of stakeholders. This integrative approach enables us to meet urgent needs, foster equitable growth, and contribute to the long-term sustainability of food systems (Table 3.1).

Table 3.1. Prioritization

Prioritization factor	Prioritization component
Scope	• **Focus countries:** Kenya, Ethiopia, Mali, Tanzania, Uganda, Vietnam, Bangladesh, India, Nepal, Colombia, Guatemala, Senegal, Tunisia, Cambodia, Ghana, Nigeria, Timor Leste, Zambia, Malaysia, Egypt (countries at the start of the list have the highest concentration of activities, enabling government policies, pooled and bilateral funding, and Center presence) • Within each country, the focus on specific locations or production systems depends on the focus commodities and Areas of Work (AoWs). A subset of countries (potentially including Kenya, Ethiopia, Mali, Bangladesh, and India) will incorporate all AoWs and multiple commodities.
High-level outputs	• High-level outputs used in the prioritization exercise: • Productivity-enhancing innovations (breeding, feeding, health) that are profitable and equitable and reduce GHG emission intensity [Productivity+]. • Fortification approaches for more nutritious animal and aquatic foods [Productivity+]. • Climate-adapted innovations and monitoring tools for animal and aquatic systems, enhancing resource efficiency and restoration, reducing emissions, and increasing carbon sequestration [Climate and the Environment]. • Mobilized climate finance through innovative business models and financial mechanisms for innovations with proven environmental, climatic, and financial benefits [Climate and the Environment]. • AAF production systems de-risked through integrated prevention and control of zoonotic diseases, AMR, and foodborne diseases, while safeguarding environmental health [One Health]. • Institutional and behavioral models for enhanced uptake (inclusive delivery systems) of animal and aquatic food system innovations [Markets, Policies and Scaling]. • Policy analysis and engagement processes for effective animal and aquatic food systems [Market Systems, Policy Solutions, and Scaling]. • Effective interventions for empowering women, youth, and marginalized groups and for equitable norms in animal and aquatic systems [Gender, Youth and Social Inclusion]. • Development and implementation of knowledge and data management systems that adopt FAIR (findable, accessible, interoperable, and reusable) principles, ensuring accessibility, interoperability, and usability for all market actors, including women, men, youth, and marginalized groups [Digital and Data]. • Strengthened capacity and knowledge among market actors to adopt digital innovations for evidence and data-informed decision-making [Digital and Data]. • Establishing effective platforms, evidence, processes, and a supportive enabling environment (finance, policies, norms) that facilitate the governance of AAF systems using digital innovations [Digital and Data].
Stakeholder demand	• Extensive stakeholder consultations conducted before and during the 2022–24 CGIAR Research Initiatives and CGIAR Listening Sessions conducted in late 2023 and early 2024 in 25 countries have contributed to the prioritization exercise (10 are SAAF-proposed countries). During the Listening Sessions, countries provided their priorities across the five CGIAR Impact Areas, including the challenges and solutions detailed in this proposal. Continued stakeholder engagement will contribute to ongoing priority setting.

4. Comparative advantage

Aggregated high-level outputs (HLOs)
For the comparative advantage (CA) analysis and prioritization, we combined the HLOs of our six Areas of Work (AoWs) into 11 aggregated HLOs with a view to similar requirements for their delivery and to prioritize them for potential impact in selected geographies (see the Appendix: "Comparative advantage [Section 4 of the proposal]").

Four of the 11 aggregated HLOs were combined across AoWs: (1) institutional and behavioral models for enhanced innovation uptake (HLO 6) under Market Systems, Policy Solutions, and Scaling, which combines all elements related to inclusive delivery models from Productivity+, Climate and the Environment, and One Health; and (2) the three aggregated HLOs (HLO 9–11) under Data and Digital Solutions, including data information and decision-support systems and related shared capacity for all AoWs.

Human and social capital
Across the AoWs, the analysis revealed that human capital is a cornerstone of CGIAR's comparative advantage for delivering aggregated HLOs, which are being continued from the Initiatives. For these HLOs, the CGIAR SAAF team has the required expertise in its interdisciplinary teams, which are composed of biophysical and social scientists and data analysts with extensive knowledge and experience in the context of LMICs. CGIAR is also a knowledge hub for innovation in the proposed SAAF Areas of Work.

Knowledge for designing and testing innovations has been enabled by strong ties between CGIAR experts and agricultural research institutes (ARIs) and international universities, whose CA lies in providing the latest research methodologies and discoveries. Identifying innovation partners and relying on their CA in human and biophysical capital will fill the gaps in CGIAR expertise for delivering new HLOs such as food fortification approaches for AAFs (HLO 2), climate finance (HLO 4), and the three HLOs on the design and deployment of knowledge and data management systems, digital capacity building, and innovation development. This is also the case for the increased focus on measuring and monitoring tools for GHG emissions and operationalizing local One Health units.[19] In these fields, the SAAF team will need to build more capacity and expertise.

Overall, disciplinary coverage and expertise are strong within CGIAR, but it does not have sufficient human capacity to co-design, adapt, and implement innovations at a larger scale in the countries where we plan to work. Thus, CGIAR relies on its social capital, consisting of extensive partnerships and networks with national agricultural research and extension systems (NARES), local universities, community-based organizations (CBOs), and NGOs, and will use their extensive human capital. CBOs and NGOs have deep-rooted connections in local communities, can mobilize grassroots support, and are often more adept at ensuring interventions are demand based, culturally appropriate, and widely accepted. CGIAR's long-term relationships with national research-for-development organizations, underpinned by a physical presence in many countries, facilitate knowledge exchange, collaboration, and uptake, thereby amplifying CGIAR's impact.

National governments are another important source of complementary CA in human and social capital, given their ability to enable implementation and scaling. While CGIAR has traditionally focused on strong ties with ministries of agriculture, livestock, and fisheries, One Health will strengthen connections with public health institutes and organizations, and Climate and the Environment with ministries of environment, water, and climate. Further human and social capital could be complemented through strengthened collaboration with international nongovernmental organizations (INGOs) and regional agricultural organizations to enhance CGIAR's understanding of the broader context and political landscapes at the regional level and benefit from their partner networks for delivery.

Biophysical capital
The SAAF CGIAR Centers have excellent laboratory facilities, mainly in their head office countries covering four regions. In addition, the ILRI, ABC, and ICARDA genebanks support advanced scientific and technical research in animal genomics, forage breeding, feed and health, husbandry, aquaculture, fisheries, environmental health, and food safety. Through bilateral funding, ILRI, ABC, and ICARDA are expanding their facilities to measure methane emissions to test productivity-enhancing genetic, feed, and health innovations for their potential to reduce emissions. WorldFish maintains unique research infrastructures used to produce and disseminate genetically improved farmed tilapia and giant tilapia in Egypt and Malaysia and rohu, catla, and silver carp in Bangladesh.

Despite this valuable infrastructure, geographical coverage is still limited. Partners, such as government agencies, private sector companies, and ARIs, often have physical infrastructure, including health facilities, production sites, and logistical networks, that can complement CGIAR's biophysical capital for testing and scaling innovations.

To this end, CGIAR has invested in building biophysical and human capacity in several NARES centers and local universities, aiming to establish centers of excellence to complement its biophysical capital. A presence across regions, combined with access to CGIAR-owned and partner facilities, gives the SAAF team a moderately strong position to deliver impactful research and solutions globally. When it comes to implementing solutions in the field and at a larger scale, the CA in biophysical capital lies more with the proposed partners, while CGIAR's strength is leveraging its own and its partners' ARI research infrastructure to develop research methodologies and innovations.

Incentives
The five CGIAR Centers participating in SAAF have distinct yet complementary institutional priorities that align with the SAAF objective of addressing the complex challenges associated with AAF production systems. Incentives for CGIAR Centers are "very strong" to deliver the proposed HLOs as these align well with their missions, visions, and strategies and allow for the continuation of ongoing research while making room for new ideas.

It is expected that delivering HLOs will create opportunities for living labs to test and prove innovations and generate international public goods (IPGs) and impact on the ground while strengthening shared capacity and ties with partners.

Incentives for traditional CGIAR partners are strong, which is evident from the well-established long-term collaborations between CGIAR and these partners. For national agricultural research system (NARS) partners, collaborating with CGIAR on HLO delivery increases their capacity and connections with the international scientific community, contributes to the publication rate and visibility of involved national scientists (usually important for promotions), and offers opportunities for higher education (in-country and abroad).

For universities and ARIs, joint projects generate and provide access to data and opportunities for field studies and experience for students, also resulting in joint IPGs. Co-design and more adaptive demand-driven research projects also inform their research strategies and priority setting.

Like NARS researchers, government departments benefit from increased technical capacity, direct access to innovations, technical backstopping, and expanded international scientific connections, which are important for loan proposals. An even stronger incentive would be employment opportunities through new business models and evidence of the impact of joint activities on national impact indicators.

Creating incentives for CBOs, NGOs, and INGOs to partner with CGIAR is more challenging as they are interested in access to well-documented innovations, practical technical assistance, and proven new business models, which requires going beyond scientific proof. This also applies to profit-oriented private partners potentially interested in selected innovations related to input supply, increased production, and processing with clearly described and proven profitable business models to guide their investment in small and medium-size enterprises (SMEs). Tech companies may be interested in co-investing in AI/information and communication technology (ICT) solutions once demand has been created. For new service delivery models for AAF producers, co-investing from private enterprises may require incentives from the public sector.

The detailed analysis for each of our aggregated HLOs in the Appendix shows that the proposed Program team builds on its comparative advantage. Nevertheless, incentives for delivering the proposed HLO jointly with the CGIAR team need to be carefully considered to ensure that all partners are equally motivated to contribute resources and expertise toward achieving the HLOs. The CA analysis revealed some differences between continued HLOs and HLOs responding to new challenges. The CA of specific partners needs to be further analyzed for disaggregated HLOs and outputs.

5. Program-level theory of change

SAAF contributes to all CGIAR Impact Areas, with an emphasis on (1) nutrition, health, and food security; (2) poverty reduction, livelihoods, and jobs; and (3) climate adaptation and mitigation.

Impact is achieved by delivering on eight Program Outcomes (POs). Four center on innovation adoption by producers, market actors, and communities, facilitated by co-design and capacity sharing. These four Program Outcomes are as follows:

1. Animal and aquatic food producers, including women, youth, and marginalized groups adopt combinations of innovations for improved productivity and profitability, emissions reduction, nutrient-dense food, healthier animals and aquatic species, and climate and environmental sustainability (PO1).
2. Market actors, including women, youth, and marginalized groups, adopt market system innovations for equitable, efficient, low-emission, and resilient animal and aquatic foods systems (PO5).
3. Communities within animal and aquatic food systems adopt innovations for increased social, economic, and environmental resilience (PO3).
4. Communities within animal and aquatic food systems adopt innovations that improve community health and well-being (PO4).

The remaining Program outcomes center on behavior change for gender-equitable norms, increased investment, more supportive policies, and integration of animal and aquatic foods into the diets of producing households. Specifically,

1. Animal and aquatic food producers, market actors, and communities within animal and aquatic food systems exhibit behavior supporting gender-equitable norms (PO6).
2. Public and private sector actors invest in equitable, efficient, low-emission, and resilient animal and aquatic food systems (PO7).
3. Policymakers and decision-makers implement new or improved policies, regulations, or strategies for equitable, efficient, low-emission, and resilient animal and aquatic food systems (PO8).
4. Animal and aquatic food producers and their households integrate adequate safe, nutrient-dense animal and aquatic foods in diverse diets (PO2).

In response to the challenges and megatrends discussed in Section 2, SAAF designed six interlinked Areas of Work (AoWs) to achieve SAAF's vision of transforming animal and aquatic food systems sustainably.

Productivity+ focuses on increasing the production of nutrient-dense animal and aquatic foods, with the "+" signifying that higher productivity will be paired with increased profitability — a critical incentive for producer adoption — alongside a reduction in emissions, which is essential in addressing the climate crisis.

One Health emphasizes the importance of ensuring that food production remains safe and healthy for people, animals, and ecosystems, while **Climate and the Environment** addresses the broader environmental and climatic factors associated with animal and aquatic food production.

Building strong, inclusive market systems and enabling environments is essential for driving innovation adoption among diverse stakeholders. This is key to the sustainability and scalability of solutions and is facilitated by **Market Systems, Policy Solutions, and Scaling**. This AoW also plays a role in influencing policy and investment decisions in support of sustainable animal and aquatic food systems, while also developing and implementing scaling strategies.

Gender, Youth, and Social Inclusion ensures that solutions for animal and aquatic food production are inclusive, empowering, and equitable and contribute to sustainability.

Digital and Data supports the other AoWs and stakeholders in leveraging advancements in digital and data science to enhance impact.

All AoWs are interconnected to enhance synergy. SAAF will strategically select specific sites where all AoWs will be embedded from the outset. Potential countries for these sites include Vietnam (focusing on mangrove-aquaculture, beef cattle, pigs, and poultry), Bangladesh (tilapia, carps, goat, and poultry), Nigeria (tilapia, cattle, small ruminants, and poultry), and Kenya (tilapia, small ruminants, dairy cattle, and poultry).

The overall SAAF theory of change (ToC) is a series of nested (interconnected) AoW ToCs (see Figure 5.1). Multiple AoWs contribute to each Program Outcome; for example, PO1 is achieved through the joint efforts of all AoWs, while PO2 is achieved through the efforts of four AoWs.

Within each AoW ToC, impact pathways comprise (1) outputs, which include the process of identifying and engaging with stakeholders and partners and co-designing innovations and innovation packages and capacity-sharing approaches; (2) intermediate outcomes as changes in capacities and attitudes within stakeholders and partners; and (3) outcomes as changes in the behavior of stakeholders and partners resulting from enhanced capacity (knowledge, skills, attitudes, and aspirations), improved access to resources, goods, and services, a more supportive and enabling environment, and shifts in social norms among others. All AoWs share an impact pathway influencing policy and investment that, once implemented, will positively influence the enabling environment for SAAF work (for simplicity, this and other feedback loops are not shown in the ToC visuals). The SAAF ToC links with the CGIAR-level ToC through their joint focus on innovation, capacity, and policy.[20]

Key assumptions have been embedded in impact pathways. Examples include (1) capacity-sharing activities result in increased levels of knowledge and skills within groups; (2) political, economic, and governance structures and systems support investment in AAF systems innovations; and (3) decision-makers are willing to use SAAF evidence, data, and tools to inform policy and investment decisions. All assumptions will be monitored and revised to reflect changing conditions or additional activities incorporated to ensure an assumption holds.

All innovation packages are contextualized for a specific animal and aquatic food production system, including mixed systems (various combinations of livestock, aquaculture, and crops), agro-pastoral and pastoral, peri-urban, aquaculture (marine, freshwater, and brackish), and fisheries (coastal and inland).

SAAF will work closely with partners in the design and implementation of its activities through co-design. The goal is to ensure partners have ownership and agency as we jointly conceptualize and implement the program. Co-design is an iterative process that enables innovation users to have direct input into selecting, designing, re-designing, prioritizing, and scaling modalities. Similarly, at a programmatic level, co-design means governmental and institutional partners are central in establishing priorities, designing programs, and establishing development pathways.

Capacity sharing will be achieved through approaches including South–South cooperation to facilitate knowledge and skills exchange among developing countries, technical assistance to provide specialized expertise where needed, and peer-to-peer learning to foster mutual support and experience sharing. Knowledge networks will enable collaboration among multiple stakeholders to disseminate best practices, while public-private partnerships will enhance capacity in key sectors. Capacity-building workshops and training programs will offer structured learning opportunities, complemented by mentorship programs and e-learning platforms to support ongoing development. Community-based approaches will leverage local knowledge and participation to ensure that capacity building is relevant and sustainable.

Gender and equity are central to SAAF. The Gender, Youth, and Social Inclusion (GYSI) AoW will lead this area of research and coordinate the integration of gender and equity analysis across the other AoWs. The GYSI strategic research focuses on supporting the empowerment of women, youth, and marginalized groups in animal and aquatic food systems for improved livelihoods. Integrative gender research ensures that the innovations developed in the other AoWs respond to gender, youth, and marginalized group needs and that benefits from innovation use are equitable. The strategic and integrated work continuously exchanges learning and innovations.

Scaling is built into the AoW ToCs through systems diagnosis and co-design with partners, including the generation of evidence on pathways and policy options that catalyze investment and strengthen the enabling environment. The Market Systems, Policy Solutions, and Scaling AoW supports the identification of viable scaling pathways for specific contexts, considering innovation bundles across the different SAAF AoWs. It also supports the engagement of scaling partners to embed proven pathways into their operations and work with Scaling for Impact to synthesize learning on scaling approaches.

Five Program-level research questions cut across the AoWs:

1. What are the synergies and trade-offs on productivity, profitability, emission reductions, climate and environmental resilience, One Health, and equity associated with innovation packages for producing adequate, safe, nutritious animal and aquatic foods?
2. How can animal and aquatic food systems support empowerment and create business opportunities and jobs for women, youth, and marginalized groups?
3. What are the most effective scaling pathways to achieve SAAF outcomes combining effective partnerships, proven innovations, capacity sharing, and supportive policies?
4. What are the best approaches to co-designing innovations and capacity-sharing approaches in specific contexts?
5. How do we most effectively influence, engage with, and communicate to investors and policymakers the solutions, trade-offs, and synergies of animal and aquatic foods at the global, regional, and national levels?

Figure 5.1. Program-level Theory of Change

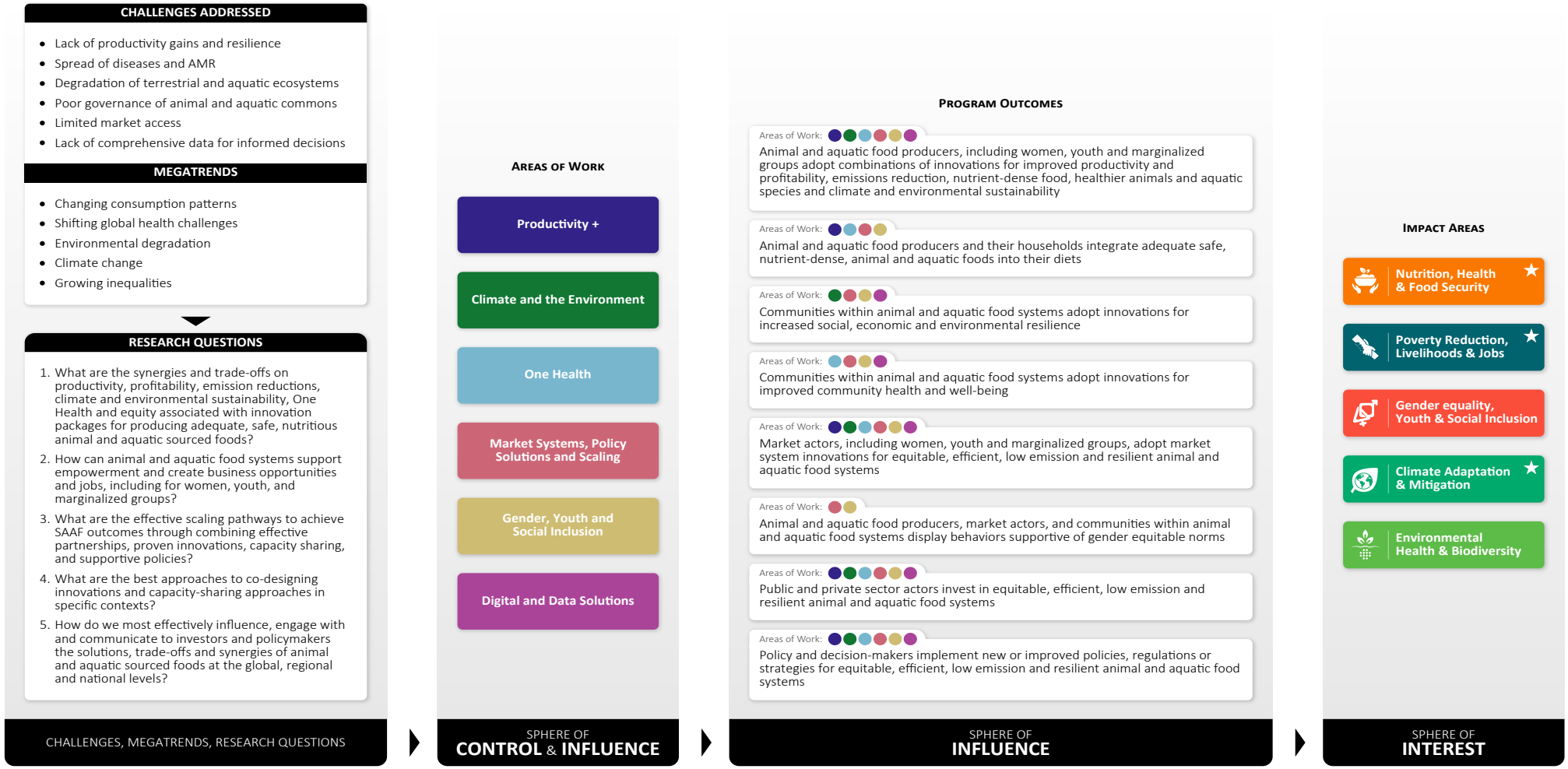


Table 5.1. Partners, assumptions, indicators, and targets

Program Outcome (PO)	Statement	Partners	Assumptions (illustrative, see Section 6 for placement on causal links)	Indicator and target
PO1	Animal and aquatic food producers, including women, youth, and marginalized groups, adopt combinations of innovations for improved productivity and profitability, emissions reduction, nutrient-dense food, healthier animals and aquatic species, and climate and environmental resilience**.**	Consumers and consumer groups Demand, innovation, and scaling partners: producers and producer groups; private sector, including market actors; animal and aquatic food system communities; NARES; universities; local, national, and regional institutions, including government; other decision-makers; development actors; donors Innovation and scaling partners: Breeding for Tomorrow and Genebanks; Better Diets and Nutrition; Climate Action; Multifunctional Landscapes; Policy Innovations; Digital Transformation; Gender Equality and Inclusion; Scaling for Impact; Capacity Sharing	Animal and aquatic food producers have sufficient incentives to adopt innovations. Input and service providers have sufficient incentives to invest in delivering innovations efficiently, equitably, and affordably.	Number of people in animal and aquatic food-producing households that adopt one or more SAAF innovations (disaggregated by gender, youth, and marginalized groups). Target = 1.7 million people
P02	Animal and aquatic food producers and their households integrate adequate safe, nutrient-dense animal and aquatic foods in diverse diets**.**	As above	Animal and aquatic food producers see the benefit and are willing and able to change dietary practices to better integrate animal and aquatic foods**.**	Number of people in animal and aquatic food-producing households integrating adequate safe, nutrient-dense animal and aquatic foods in diverse diets. Target = 300,000 people Number of partners supporting producer households to integrate adequate safe, nutrient-dense animal and aquatic foods in diverse diets. Target = 8 institutions
P03	Communities within animal and aquatic food systems adopt innovations for increased social, economic and environmental resilience**.**	As above	Animal and aquatic producers, market actors, and communities have sufficient incentives to adopt innovations.	Number of people within animal and aquatic food-producing communities that adopt SAAF innovations for improved resilience (disaggregated by gender, youth, and marginalized groups). Target = 420,000 people Number of partners supporting the adoption of SAAF innovations for improved resilience. Target = 10 institutions

Program Outcome (PO)	Statement	Partners	Assumptions (illustrative, see Section 6 for placement on causal links)	Indicator and target
P04	Communities within animal and aquatic food systems adopt innovations for improved community health and well-being.	As above	Animal and aquatic producers, market actors, and communities have sufficient incentives to adopt innovations.	Number of people within animal and aquatic food-producing communities that adopt SAAF innovations for improved overall health and well-being (disaggregated by gender, youth, and marginalized groups). Target = 420,000 people Number of partners supporting the adoption of SAAF innovations for improved health and well-being. Target = 10 institutions
P05	Market actors, including women, youth, and marginalized groups, adopt market systems innovations for equitable, efficient, low-emission, and resilient AAF systems.	As above	Market actors, including women, men, youth, and marginalized groups, have the capacity, knowledge, and willingness to apply inclusive market system innovations.	Number of market actors (excluding producers) adopting one or more SAAF innovations (disaggregated by gender, youth, and marginalized groups). Target = 2,640 people
P06	Animal and aquatic food producers, market actors, and communities within animal and aquatic food systems exhibit behavior supporting gender-equitable norms.	As above	Stakeholders are willing to adopt and embrace gender-equitable behaviors.	Number of people within animal and aquatic food systems (producing households, market actors, and communities) that exhibit behavior more supportive of gender-equitable norms (disaggregated by gender, youth, and marginalized groups). Target = 370,000 people Number of partner norms. Target = 10 institutions
P07	Public and private sector actors invest in equitable, efficient, low-emission, and resilient animal and aquatic food systems.	As above	Political, economic, and governance structures and systems support investment in AAF systems innovations.	USD investment by public and private sector actors in equitable, efficient, low-emission, and resilient animal and aquatic food systems. Target = USD 22 million
P08	Policymakers and decision-makers implement new or improved policies, regulations, or strategies for equitable, efficient, low-emission, and resilient animal and aquatic food systems.	As above	Decision-makers are willing to use SAAF evidence, data, and tools in policy design and investment decisions.	Number of policies, regulations, or strategies influenced by SAAF for equitable, efficient, low-emission, and resilient animal and aquatic food systems. Target = 62 policies

6. Areas of Work

6.1. AoW 1: Productivity+

Productivity+ supports animal and aquatic food producers, including women, youth, and marginalized groups, as they adopt productivity-enhancing innovations that are profitable, reduce emissions, and increase food nutrient value (PO1). It also contributes to adoption of innovations by market actors (PO5), investment (PO7), and policy change (PO8).

Three interlinked pathways contribute to these outcomes: (1) input and service providers, (2) producers, and (3) local, national, and regional institutions (Figure 6.1).

The first pathway recognizes that sustainable productivity improvements depend on input and service providers who can deliver innovations efficiently, equitably, and affordably. Therefore, delivery systems are based on business models and input and service providers' capacities for entrepreneurship, inclusion, and innovation.

The second pathway focuses on producers and supporting them as they adopt contextualized combinations of innovations that suit their needs and preferences. Input and service providers and institutions, such as NARES, play central roles in capacity sharing.

The third pathway focuses on improving capacities within local, national, and regional institutions so their staff can more effectively support producers and input and service providers and influence a favorable and inclusive policy environment.

Productivity+ collaborates with all other AoWs: (1) with Markets Systems, Policy Solutions, and Scaling on business models, innovation adoption incentives, policy influence, and scaling; (2) with One Health on animal and aquatic species health management practices; (3) with Gender, Youth, and Social Inclusion on gender responsiveness and inclusion; (4) with Climate and the Environment on ensuring innovations are climate and environmentally friendly; and (5) with Digital and Data Solutions on digital innovations and data management.

Research questions

1. How can innovations in breeding programs, reproductive technologies, digital platforms, and genomics deliver sustained gains in productivity, lower emissions, and support the conservation of animal and aquatic species?
2. How can innovations in animal and aquatic species nutrition, including traditional and novel feeds, forages, and feed-food crops and their delivery systems, improve feed efficiency, nutrition, and productivity with lower emissions?
3. How can innovations in animal and aquatic species' health and welfare and their delivery systems decrease morbidity and mortality and thus increase productivity with lower emissions?
4. How can feeding innovations improve the nutritional quality and nutraceutical properties of animal and aquatic foods?
5. What tools and approaches support the identification and adoption of combinations of innovations for improved animal and aquatic species productivity and profitability, emissions reduction, and nutrient-dense food?
6. What business opportunities can be created for women, youth, and marginalized groups in innovation delivery, and what business models support the delivery of innovations equitably?
7. How can the Productivity+ approach and innovation packages be scaled within different contexts?

To address our research questions we will take the following steps: (1) diagnose production systems and value chains to understand needs and preferences; (2) facilitate the co-design of innovation bundles for different contexts using a transdisciplinary approach to capitalize on the synergies between genetics, genomics, nutrition, feeding, health, and food fortification (upstream work, such as on genomics or vaccine development may be included here); (3) conduct participatory studies to gather evidence and make recommendations; and (4) develop and test pathways for scaling within specific contexts. As Productivity+ is building on a large volume of past and current work, research within some production systems may begin with step 3 or 4.

Sources of comparative advantage

The sources of CGIAR's comparative advantage lie in its extensive collection of forage species and expertise in forage improvement, livestock and fish genetics, feed and health sciences, animal and aquatic production systems, and capacity sharing and its field presence in the Global South.

High-level outputs (HLOs)

Productivity+ has six HLOs using a co-design process for innovation and capacity sharing.

1. **Sustainable breeding and conservation programs for animal and aquatic species and inclusive delivery models.** Working with producers, breeding organizations, artificial insemination service providers, hatcheries, and NARES, we will co-design or strengthen: (1) contextualized genetic improvement programs, including for dairy cattle[21] and buffalo, beef cattle, pigs,[22] small ruminants,[23] chickens,[24] tilapia,[25] carp, and catfish species and aquatic plants; (2) reproductive technologies that support delivery or conservation;[26,27,28,29] and (3) models for efficient, equitable, and affordable delivery of improved genetics[30, 31] or that conserve biodiversity. The genetic improvement programs will differ depending on the context (within-breeding versus crossbreeding; community-based versus nucleus-based), incorporate breeding objectives appropriate for a climate crisis (emissions reduction, heat tolerance), and capitalize on advances in genomics, phenomics, digital solutions, and artificial intelligence. New work here includes a greater focus on animal and aquatic species biodiversity conservation and an increased focus on breeding for a climatically changed future.
2. **Genomic resources for animals, aquatic species, and forages.** Working with national partners, we will (1) strengthen genomic resources for animals, aquatic species, and forages;[32,33] (2) identify genomic variants for ecologically and economically useful traits, feeding into genetic improvement strategies; and (3) develop new ways of mining genomic data (e.g., with artificial intelligence). Where possible, the genomic data will be shared in publicly accessible genomic databases, such as Ensembl.

3. **Cost-efficient animal and aquatic species feed and forage innovations and inclusive delivery models.** Working with producers, feed and seed suppliers, and NARES and taking into consideration traditional and novel feeds, forages, and feed-food crops, we will co-design or strengthen (1) novel ways of reducing emissions and improving feed efficiencies, such as anti-methanogenic compounds in forages[34] and nutrient requirement assessments of farmed species;[35] (2) high-quality, climate-resilient forages by exploiting our forage and feed-food crop genebank resources and improvement programs;[36] (3) digital tools for cost-efficient feed formulations and enhanced decision-making;[37, 38] (4) labor-saving feed processing technologies;[39] (5) circular bioeconomy approaches to ingredients and feeds;[40] and (6) models for efficient, equitable, and affordable delivery of feeds and seeds.[41, 42] New work here comprises novel ways to jointly reduce emissions and increase feed efficiency.

4. **Cost-efficient animal and aquatic species health and welfare innovations and inclusive delivery models.** Working with producers, animal and aquatic healthcare workers, and NARES, we will co-design or strengthen (1) vaccines and diagnostic tools for animal and aquatic species diseases with high economic burdens, including African swine fever,[43] *peste des petits ruminants*,[44] tilapia lake virus,[45,46]and carp parasites;[47] (2) improved herd/fish health management practices, including biosecurity;[48, 49] (3) models for efficient, equitable, and affordable delivery; and (4) risk mapping for climate-sensitive diseases and a risk-based approach to disease control.[50, 51] Reduced animal and aquatic food infections and better health management will also contribute to achieving the outcomes in One Health. This risk-based disease control work is new.

5. **Fortification approaches for more nutritious animal and aquatic foods.** This entails deploying feed formulations and feeding practices to increase the nutritional value of animal and aquatic foods for nutrient-deficient populations.[52, 53] With producers, feed suppliers, NARES, and others, we will (1) assess nutrient deficiencies within groups and design fortification approaches to mitigate them;[54] (2) identify local ingredients and feeds with nutraceutical potential and develop functional (fortified and acceptable) animal and aquatic foods; and (3) test and validate selected functional foods in context, including analysis of nutritional quality and specialized metabolites. While a relatively new research component, this builds on promising earlier work.[55]

6. **Inclusive approaches, tools, and capacity building to support animal and aquatic food producers' adoption of combinations of innovations for improved productivity and profitability, emissions reduction, and nutrient-dense foods**. This recognizes that increased productivity usually requires combined genetics, feeding, and health interventions and that profitability is a primary incentive for producer adoption. There are trade-offs between productivity, profitability, emissions reduction, and food nutrient value. To address these issues, we will work with partners to co-develop innovations and capacity-building approaches, such as (1) digital apps for monitoring on-farm performance for better decision-making;[56] (2) models for trade-off analysis; (3) social and behavior change communications that combine messaging on genetics, feeding, and health practices;[57] and (4) approaches supporting endogenous, producer-led innovations and scaling through farmer-to-farmer extension.[58] Building on past activities, new work will more systematically compare approaches under different contexts.

Work on gender, youth, and social inclusion will ensure that Productivity+ innovations and delivery systems are gender-responsive and that access to innovations and benefit sharing is equitable. Women, men, youth, and marginalized groups have different needs and preferences regarding innovations, such as intersectional trait preferences,[59, 60] and will need tailored support to access and benefit from innovations.[61] They may face barriers to engaging as service providers in innovation delivery, which will require solutions.[62] Should empowerment and gender norm changes be required to enhance equity, this will be conducted in collaboration with the GYSI AoW.

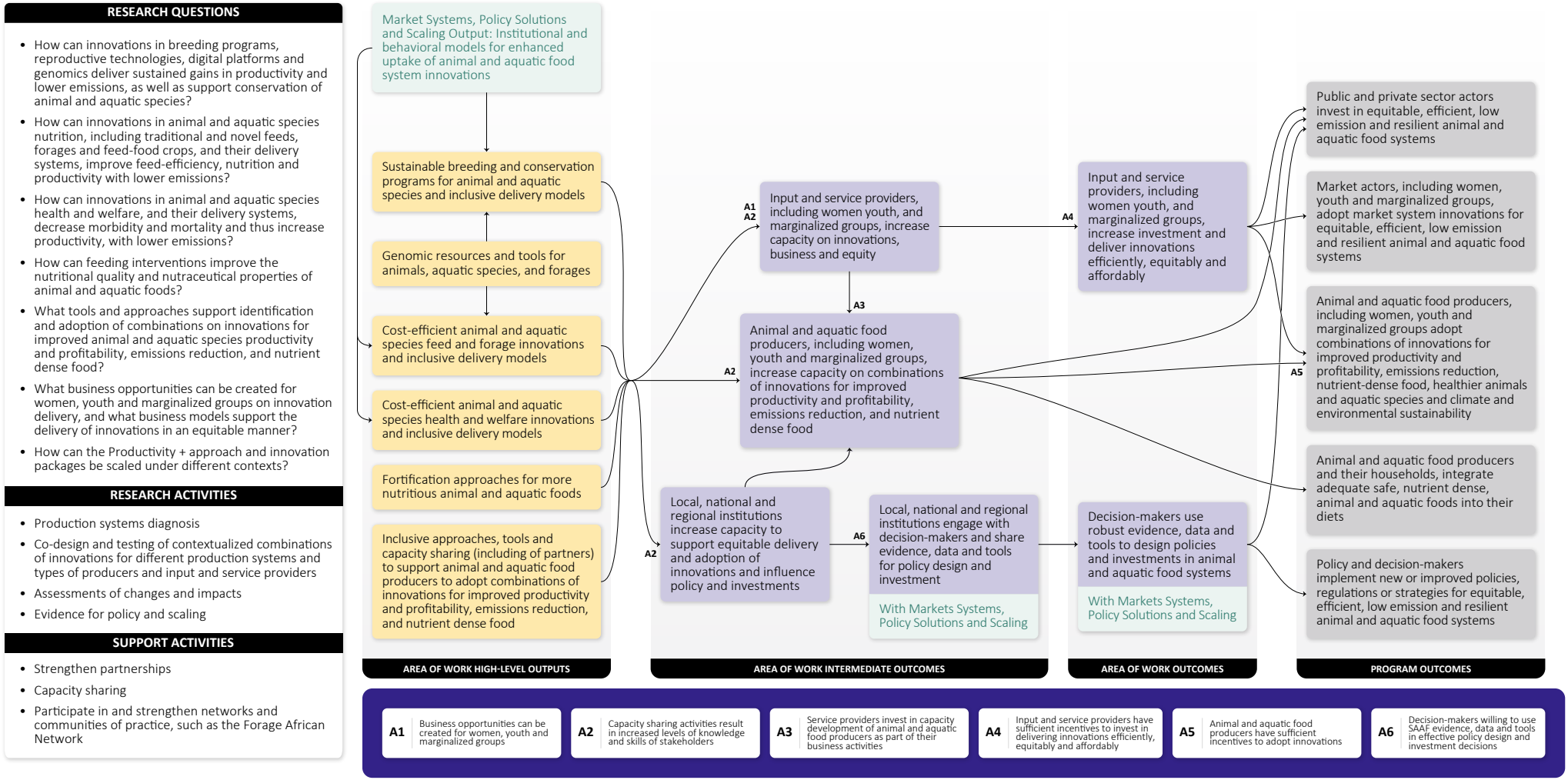
Partnerships

Productivity+ will partner with (1) producers and farmer organizations; (2) the private sector, including veterinarians and other healthcare workers, artificial insemination Centers and technicians, feed and seed suppliers, and hatcheries; (3) the public sector, including NARES; (4) local, national, and regional institutions, including government; and (5) selected advanced research institutes. Productivity+ will also engage in and strengthen networks, such as the Forage African Network, and facilitate South–South knowledge exchange, such as via the Asia-Africa Bluetech Superhighway.[63]

Collaboration with other Programs and Accelerators

Productivity+ will collaborate with the Better Diets and Nutrition Program to identify consumer demand and nutrient deficiencies within specific populations and acceptance of fortified foods; with the Breeding for Tomorrow and Genebanks Program to undertake market assessments, create an enabling environment for genomics work, cost-save on genotyping, and strengthen seed policy; and with the Capacity Sharing Accelerator on best practices in capacity sharing.

Figure 6.1. AoW 1: Productivity+ – Theory of Change



Note: A1-A6 are assumptions.

Table 6.1. Partners, assumptions, indicators, and targets

ToC element # (OC = outcome; I-OC = intermediate OC; OP = output)	Statement	Partners and roles	Assumption (see ToC visual for placement on causal links)	Indicator and target
OC 1.1	Input and service providers, including women, youth, and marginalized groups, increase investment and deliver innovations efficiently, equitably, and affordably.	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions, including government; decision-makers; donors	A1 Business opportunities can be created for women, youth, and marginalized groups. A2 Capacity-sharing activities result in increased levels of knowledge and skills of target groups. A3 Service providers invest in capacity development of animal and aquatic food producers as part of their business. A4 Input and service providers have sufficient incentives to invest in delivering innovations efficiently, equitably, and affordably. A5 Animal and aquatic food producers have sufficient incentives to adopt innovations. A6 Decision-makers are willing to use SAAF evidence, data, and tools in effective policy design and investment decisions.	Number of input and service providers delivering innovations efficiently, equitably, and affordably (disaggregated by gender, youth, and marginalized groups). Target = 530 people USD investment by input and service providers in delivery systems (disaggregated by gender, youth, and marginalized groups). Target = USD 1.1 million
OC 1.2	Decision-makers use robust evidence, data, and tools to design policies and investments in animal and aquatic food systems.	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions, including government; decision-makers; donors		Number of policies, regulations, strategies, or investments designed by decision-makers using SAAF evidence, data, and tools. Target = 11 policies
I-OC 1.1	Input and service providers, including women, youth, and marginalized groups, increase capacity on innovations and technologies, business, and equity.	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions including government; decision-makers; donors		Not required
I-OC 1.2	Animal and aquatic food producers, including women, youth, and marginalized groups, increase capacity on combinations of innovations for improved productivity, profitability, emissions reduction, and nutrient-dense food.	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions including government; decision-makers; donors		Not required
I-OC 1.3	Local, national, and regional institutions increase capacity to support equitable delivery and adoption of innovations and influence policy and investments.	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions including government; decision-makers; donors		Not required
I-OC 1.4	Local, national, and regional institutions engage with decision-makers and share evidence, data, and tools for policy design and investment.	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions including government; decision-makers; donors		Not required

ToC element # (OC = outcome; I-OC = intermediate OC; OP = output)	Statement	Partners and roles	Assumption (see ToC visual for placement on causal links)	Indicator and target
OP 1.1	Sustainable breeding and conservation programs for animal and aquatic species and inclusive delivery models	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions, including government; decision-makers; donors Internal partners: Breeding for Tomorrow and Genebanks		Not required
OP 1.2	Genomic resources and tools for animals, aquatic species, and forages	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions, including government; decision-makers; donors Internal partners: Breeding for Tomorrow and Genebanks		Not required
OP 1.3	Cost-efficient animal and aquatic species feed and forage innovations and inclusive delivery models	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions, including government; decision-makers; donors Internal partners: Breeding for Tomorrow and Genebanks		Not required
OP 1.4	Cost-efficient animal and aquatic species health and welfare innovations and inclusive delivery models	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions, including government; decision-makers; donors		Not required
OP 1.5	Fortification approaches for more nutritious animal and aquatic foods	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions including government; decision-makers; donors Internal partners: Better Diets and Nutrition		Not required
OP 1.6	Inclusive approaches, tools, and capacity building (including of partners) to support animal and aquatic food producers' adoption combinations of innovations for improved productivity, profitability, emissions reduction, and nutrient-dense food	Demand, innovation, and scaling partners: producers and producer groups; community-based and grassroots organizations; private sector, including input and service providers; NARES; universities; local, national, and regional institutions, including government; decision-makers; donors		Not required

6.2. AoW 2: Climate and the Environment

Climate and the Environment supports the efforts of communities within animal and aquatic food systems to adopt innovations for increased social, economic, and environmental resilience (PO3). It contributes to improved productivity and profitability (PO1), equitable market systems (PO5), and increased investments in low-emission and resilient animal and aquatic food systems (PO7).

The main pathways are via market actors (e.g., animal and aquatic food producers, the private sector, and regional institutions), as they increase their capacities for innovation in resilient and low-emission production systems. We work with the Markets Systems AoW to enhance capacity and incentives for the private sector to invest in equitable delivery and increased adoption of climate-adapted innovations while strengthening local, national, and regional institutions to influence policy and investment opportunities.

Research questions

1. How do AAF systems influence climate and environmental sustainability, and what reciprocal impacts do climate and environmental changes have on the productivity, resilience, water, land, and biodiversity impacts of these food systems?
2. What new climate-adapted innovations can be developed and implemented to optimize the use and restoration of water, soil, and land resources; enhance livelihoods; and reduce climate impacts, while simultaneously fostering community resilience and engagement to ensure equitable access to these resources?
3. What innovative business models, financial mechanisms, and evidence of impact are most effective in mobilizing climate finance to support the transition to SAAF systems?
4. How can AAF system resilience and emissions be cost-effectively monitored and optimized for scalability?

Sources of comparative advantage

CGIAR is uniquely positioned to drive low-emission innovation and resilience in AAF systems through our global research Centers; forage, animal, and aquatic species genebanks; bilateral projects (e.g., Low-Methane Forages); and long-term partnerships. CGIAR's expertise extends to gender-transformative approaches, data analytics, and field trials in priority regions across Latin America, Africa, and Asia and the Pacific. CGIAR offers science-based evidence for those working in conservation, industry, finance, and markets to scale resilient low-emission AAF systems by integrating bioscience, social innovation, ecosystem management, business models, policy, and finance. CGIAR's expertise in integrating animal and plant-based production supports circular economy principles, optimizing resource use and minimizing waste.

Methods and approaches

- Life cycle assessments and environmental impact models to evaluate land, water, and climate impacts.
- Field experiments and modeling (process-based, empirical) to estimate the resilience and productivity of pasture, animal, and aquatic species and livelihoods to climate hazards.
- Analysis of economic opportunities and risks, costs of inaction, and returns on investments using standard and stochastic approaches.
- Meta-analyses to assess the effectiveness of interventions.
- Remote sensing, machine learning, and surveys to monitor uptake by end users and assess impacts.
- Participatory methods for co-design, including community conversations and Pioneer-Positive Deviance.

High-level outputs

1. **Evidence of the benefits and impacts of AAF systems on climate and the environment and vice versa.** Animal and aquatic food systems shape climate and environmental outcomes. Sustainable livestock management and technologies (e.g., rotational grazing and deep-root forages) increase soil carbon sequestration. Integrated aquaculture systems (e.g., rice-fish systems and integrated multi-trophic aquaculture systems) boost food production and promote biodiversity and water quality by reducing the need for chemical inputs. Climate change impacts these systems by altering water temperatures and availability, which affects fish and livestock growth rates and health. Quantifying these interactions is the basis for developing strategies that maximize benefits while minimizing environmental harm. A relatively new area of inquiry is to evaluate the economic costs and benefits of climate action and inaction and work on developing sustainable animal and fish feed, resilient animal breeds and fish strains, and better management practices to reduce emissions.
2. **Innovations for efficient use and restoration of water, soil, and land resources; enhanced livelihoods, and reduced climate impacts, while fostering community resilience and engagement for equitable access to resources.** Innovations such as silvo-pastoral systems integrate trees with pasture and livestock, enhance carbon sequestration in biomass,[64] improve soil health[65] and moisture, and reduce methane emissions.[66,67]In aquaculture, innovations such as recirculating water systems and seaweed and bivalve farms minimize water use and pollution, while mangrove restoration supports carbon storage and protects coastal ecosystems. Social-technical innovations that couple technical innovations with social and policy innovations will promote locally led adaptation and strengthen institutional capacities to plan and implement low-emission, climate-resilient development pathways.
3. **Business models, financial mechanisms, and evidence of economic, climatic, and environmental benefits to mobilize climate finance.**[68] Evidence, technical assistance, and co-developed solutions are needed to scale and de-risk investments. Implementing blended finance models has proven effective in de-risking AAF system investments and attracting more capital.[69] Inclusive business development models have promoted access to finance by small aqua-businesses and access to training and extension support by smallholder farmers. Working with microfinance institutions has helped unlock green financing for Guatemalan and Kenyan livestock producers.[70]
4. **Cost-efficient and AAF-specific resilience and emission monitoring tools.** Tracking policies, investments, and project impacts can catalyze new funding and support narratives of progress, but the lack of robust methods for monitoring emission sources or progress on adaptation inhibits investments. Hence, this AoW focuses on developing monitoring and reporting frameworks and indicator datasets for national reporting,[71] improving methods for measuring pasture productivity with remote sensing,[72] and creating new tools smallholders can use to access carbon markets and other funding opportunities.

With women, youth, and marginalized communities, we will co-design ways to increase their participation and leadership positions in managing communal and household resources and environments. We will identify the benefits and obstacles of providing them with resilient and low-emission technologies, such as energy-efficient equipment for fish and animal products handling, preservation, and processing (e.g., exploring Indigenous fish processing and preservation practices).[73]

Partnerships

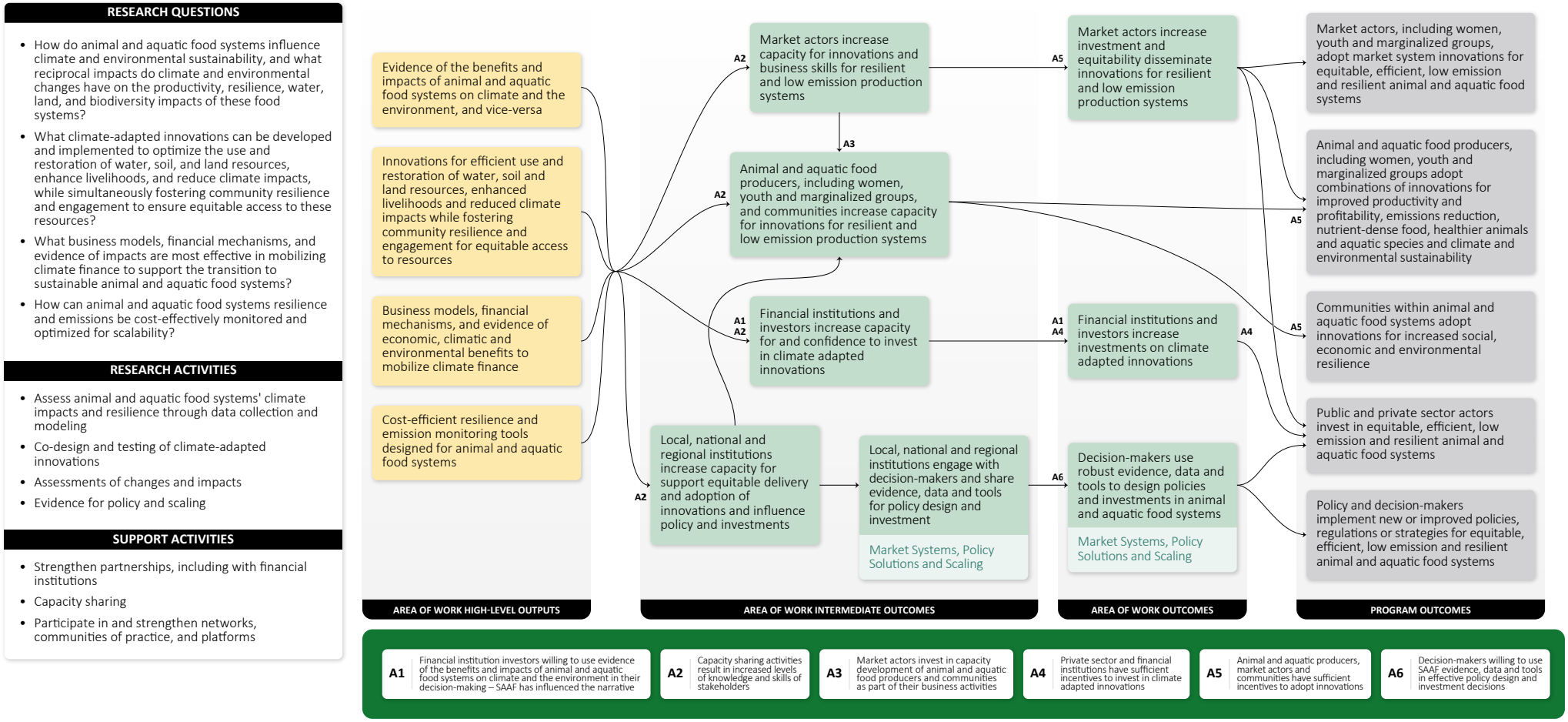
Partnerships include collaborations with governments, agricultural and hydrometeorological research institutions, local producers and value chain cooperatives, and multilateral and multinational organizations (e.g., the World Bank, Marfrig, Minerva, Nestlé, the Inter-American Development Bank, the Asian Development Bank, and the African Development Bank). Engaging with multilateral organizations offers access to funding, global expertise, policy advocacy, and scaling innovations. Partnerships with government agencies ensure investments align with national objectives and generate policy and regulatory support.

Collaborations with NGOs focusing on gender and social inclusion help ensure women, youth, and marginalized groups are represented and have opportunities for empowerment. We will engage with the private sector for technological and financial support and with universities for multidisciplinary research. These partnerships facilitate comprehensive climate impact assessments, co-development of resilient and low-emission practices, and the co-creation of sustainability narratives for scaling SAAF system innovations.

Collaboration with other Programs and Accelerators

- Climate and the Environment collaborates with the Climate Action and Multifunctional Landscapes Programs to scale data, approaches, locations, and partnerships.
- With Climate Action, this AoW leads on-the-ground, producer-centered development of context-specific AAF system innovations. Climate Action offers evaluation frameworks, climate impact data, and advocacy opportunities.
- With Multifunctional Landscapes, we will collaborate with producers on testing and implementing agroecological and ecosystem-based management approaches. The Multifunctional Landscapes Program offers landscape planning, food system policies, strategies, and engagement.
- The Scaling for Impact Program takes tested, bundled climate-adapted AAF system solutions to scale in different geographies and contexts.

Figure 6.2. AoW 2: Climate and the Environment – Theory of Change



Note: A1-A6 are assumptions.

Table 6.2. Partners, assumptions, indicators, and targets

ToC element # (OC = outcome; I-OC = intermediate OC; OP = output)	Statement	Partners and roles	Assumption (see ToC visual for placement on causal links)	Indicator and target
OC 2.1	Market actors increase investment and equitability to disseminate innovations for resilient and low-emission production systems.	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: Intergovernmental Panel on Climate Change (IPCC); Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES)	A1 Financial institutions and investors are willing to use evidence of the benefits and impacts of animal and aquatic food systems on climate and the environment in their decision-making – SAAF has influenced the narrative. A2 Capacity-sharing activities result in increased knowledge and skills among target groups. A3 Market actors invest in capacity development of animal and aquatic food producers and communities as part of their business activities. A4 Financial institutions and investors have sufficient incentives to invest in climate-adapted innovations. A5 Animal and aquatic food producers, market actors, and communities have sufficient incentives to adopt innovations . A6 Decision-makers are willing to use SAAF evidence, data, and tools in effective policy design and investment decisions.	Number of market actors equitably delivering innovations (disaggregated by gender, youth, and marginalized groups). Target = 260 people USD investment by market actors in disseminating innovations for animal and aquatic food systems (disaggregated by gender, youth, and marginalized groups). Target = USD 1.1 million
OC 2.2	Financial institutions and investors increase capacity and confidence to invest in climate-adapted innovations.	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		USD investment by financial institutions and investors in climate-adapted innovations (disaggregated for women, youth and marginalized groups). Target = USD 5.5 million
OC 2.3	Decision-makers use robust evidence, data, and tools to design policies and investments in animal and aquatic food systems.	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		Number of policies, regulations, strategies, or investments designed by decision-makers using SAAF evidence, data, or tools. Target = 19 policies
I-OC 2.1	Market actors increase capacity on innovations and business skills for resilient and low-emission production systems.	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		Not required
I-OC 2.2	Animal and aquatic food producers, including women, youth, and marginalized groups, communities, and community groups increase capacity on innovations for resilient and low-emission production systems.	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		Not required
I-OC 2.3	Private sector and financial institutions have increased capacity and confidence to invest in climate-adapted innovations.	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		Not required
I-OC 2.4	Local, national, and regional institutions increase capacity to support equitable delivery and adoption of innovations and influence policy and investments.	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		Not required

ToC element # (OC = outcome; I-OC = intermediate OC; OP = output)	Statement	Partners and roles	Assumption (see ToC visual for placement on causal links)	Indicator and target
I-OC 2.5	Local, national, and regional institutions engage with decision-makers and share evidence, data, and tools for policy design and investment.	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		Not required
OP 2.1	Evidence of the benefits and impacts of animal and aquatic food systems on climate and the environment and vice versa	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		Not required
OP 2.2	Climate-adapted innovations for efficient use and restoration of water, soil, and land resources and reduced climate impacts, including lowered emissions and increased carbon sequestration	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		Not required
OP 2.3	Business models, financial mechanisms, and evidence of economic, climatic, and environmental benefits to mobilize climate finance	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		Not required
OP 2.4	Cost-efficient resilience and emission monitoring tools designed for animal and aquatic food systems	Demand, innovation, and scaling partners: producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors; multilateral banks Demand and innovation partners: IPCC, IPBES		Not required

6.3. AoW 3: One Health

One Health develops and supports innovations in animal and aquatic food systems to improve community health and well-being (PO4). It integrates adequate safe, nutrient-dense foods into producers' diets (PO2) and improves policies and institutions around One Health (PO8).

There are four pathways: (1) increasing the capacities of market actors, including women, youth, and marginalized groups; (2) enabling communities and animal and aquatic food producers to adopt innovations addressing One Health challenges including zoonoses, food and water safety, and AMR; (3) enhancing the capacity of development actors to use One Health research evidence for decision-making and investment; and (4) strengthening local, national, and regional institutions to support equitable delivery and adoption of innovations and influence policy and investment (Figure 6.3).

We explore interactions between climate, gender, environment, and animal and human health, focusing on transmission pathways to develop sustainable strategies for disease control and to improve food safety in livestock and aquatic production systems.

Research questions

5. How do AAF production systems contribute to One Health risks, including emerging infectious and zoonotic diseases (EIZD), food safety, and AMR, and how do socioeconomic, cultural, and environmental factors, such as climate change, land use, water use, and demographics, influence these risks?
6. What are the primary drivers of EIZD in animal food production systems, including wild meat, and how can these transmission patterns be predicted and mitigated?
7. What are the drivers of antimicrobial use (AMU) in livestock and aquaculture, how can they be effectively quantified and reduced across various farm contexts, and what are the associated economic and gender-specific implications of production system intensification?
8. What are the health and economic impacts of foodborne diseases in traditional and informal markets and wild meat value chains, and how can cost-effective food safety interventions be scaled and integrated into national and regional food systems? What are the drivers of success and failure of food safety interventions?
9. What are the risks associated with AMR and pathogen contamination in watersheds and cropping soils to animal and aquatic food production, and what are the most effective environmental interventions to mitigate these risks while addressing broader issues such as water quality, soil health degradation, and climate change?
10. What are the economic and health benefits of One Health Initiatives, how can these be measured, and what best practices can be identified for governments and organizations to operationalize and invest in One Health to effectively deliver improved health outcomes for humans, animals, and the environment?

Sources of comparative advantage

We are building on strong capabilities and successful experiences from decades of interdisciplinary research on One Health challenges such as AMR, food safety, and zoonoses in animal, aquatic, and environmental systems. Through enduring national and global partnerships, including World Health Organization [WHO], Food and Agriculture Organization of the United Nations [FAO], World Organisation for Animal Health [WOAH], and United Nations Environment Programme [UNEP].[74] CGIAR can promote integrated One Health service delivery that cost-effectively enhances health outcomes for humans, animals, and the environment.

Methods and approaches

1. Surveys, epidemiological, genomics, and living labs.
2. Environmental modeling and risk assessment to measure the prevalence and transmission of emerging infectious and zoonotic diseases and foodborne diseases.
3. Measurement of AMU and water pollution and associated pathways.
4. Evaluations of the quality and availability of antimicrobials and vaccines.
5. Examination of the socioeconomic, cultural, and political-economic factors driving One Health challenges.

We co-develop, pilot, and scale interventions to reduce and prevent risks of emerging infectious, zoonotic, and foodborne diseases in traditional markers and to reduce AMU and mitigate AMR, including conducting cost-benefit analyses of interventions and identifying climate adaptation strategies that reduce environmental toxicity.

We use a One Health approach to compare the health outcomes (for humans, animals, and environment), costs, and benefits of joint service delivery models with those of traditional single-sector service delivery methods. We measure the social and environmental outcomes of One Health Initiatives and support local, national, and regional One Health platforms.

High-level outputs

1. **Targeted innovations and incentives to reduce EIZD in animal and aquatic food production systems.** We will identify key factors that drive the emergence and transmission of EIZD and develop strategies to mitigate risks.[75] This includes assessing system capacities to combat disease transmission amid climate, environmental, and socioeconomic changes. We will also analyze how environmental factors influence risk pathways and employ simulation models to estimate impacts on human health and nutrition.

   A relatively new area of inquiry will be to develop and evaluate disease control interventions, including integrated disease surveillance systems and measures to reduce risks associated with wildlife interactions and wild meat consumption, to enhance ecosystem health.[76]

2. **Target innovations and incentives to improve food safety in informal markets and enhance nutrition.** Building on more than a decade of research, we examine the health and economic impacts of foodborne disease, look at the role of water in food safety, and launch interventions to improve food safety focusing on critical control points (e.g., informal and traditional markets).[77] We will continue working with health and food safety regulatory authorities to characterize the cost-effectiveness of (1) food safety capacity building, (2) infrastructure provision, and (3) business oversight.[78, 79]

   New work includes scaling microbial decontamination technologies in informal market settings and supporting the implementation of national and regional food safety strategies. Outputs include evidence-informed interventions, institutional arrangements, and technologies to improve food safety in informal markets and enhance nutrition.

3. **Targeted innovations and incentives to reduce AMU and mitigate AMR risks on farms and in the environment** This relatively new area of activity integrates learning in both animal and aquatic foods systems to develop standardized methods to assess AMU and the quality of antimicrobials and vaccines. We will investigate AMU drivers and implement risk-based assessments, monitoring, and modeling in watersheds, and we will pilot interventions, including gender-sensitive and de-risking strategies. This will include evaluating current biosecurity measures, regulatory frameworks,[80] and feed and vaccination strategies to reduce AMU, disease, and AMR. We will also conduct economic analyses to support policy development, create incentives for behavior change, and explore climate adaptation strategies to reduce environmental impacts.

4. **Optimized One Health service delivery model that integrates studies to compare the health outcomes, costs, and benefits of joint service delivery**. Building on strong regional and national networks, we will continue supporting capacity sharing through organizational development, implementation, and sectoral integration.[81,82] We will engage two groups of implementers: government (all levels) and development partners. The latter will focus on NGOs and humanitarian organizations implementing One Health Initiatives locally.[83] This will generate evidence on best practices, added value of One Health, and support sustainable implementation and integration across sectors.

The AoW will work closely with Gender, Youth, and Social Inclusion (6.5) to integrate their data and insights, specifically gender in One Health and gender and AMR research frameworks.[84]

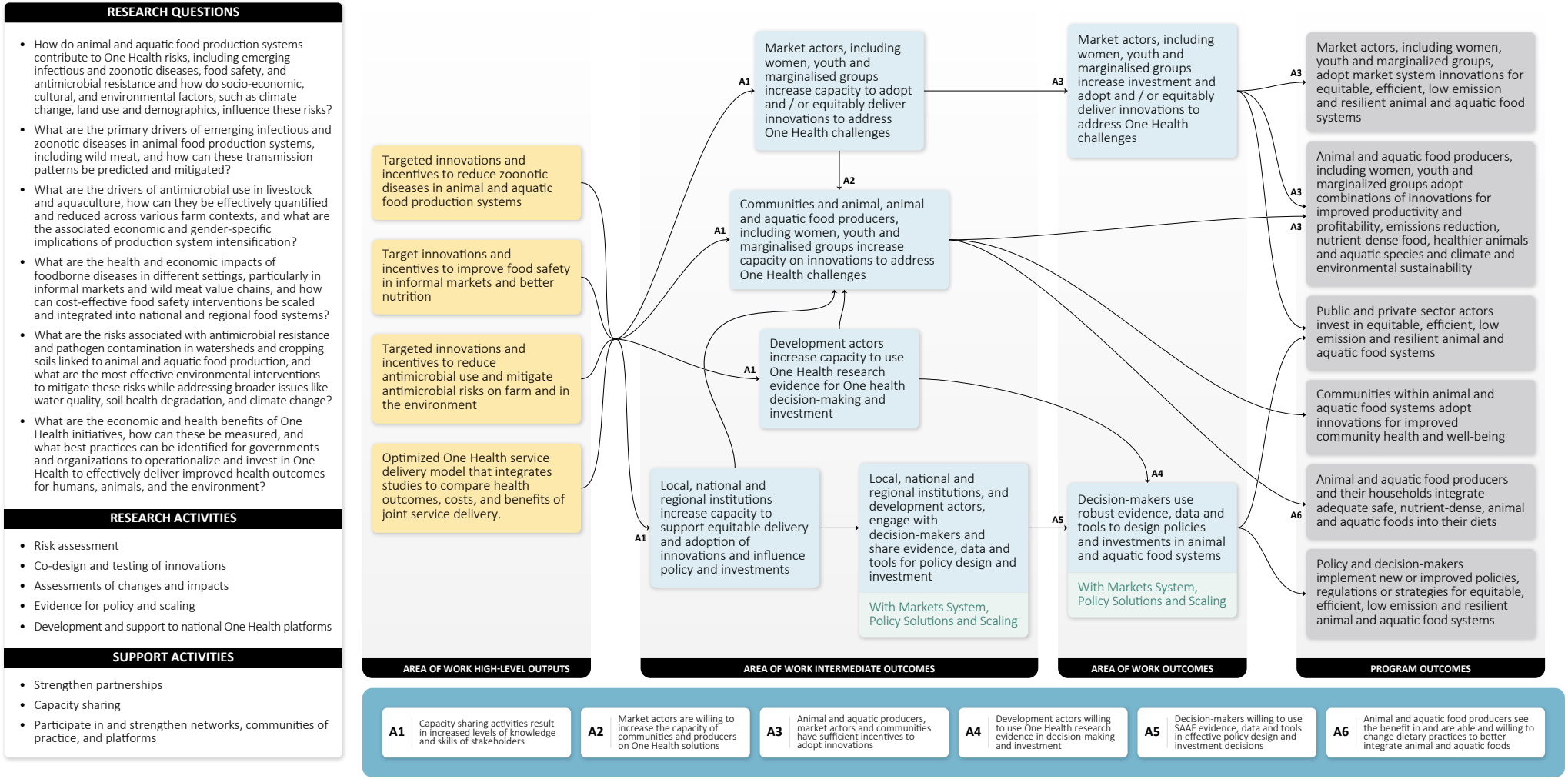
Partnerships

We will strengthen existing partnerships with the African Union, including Africa Centres for Disease Control and Prevention (CDC) and the Interafrican Bureau for Animal Resources (AU-IBAR), the Vietnam One Health Partnership, the Kenya Zoonotic Disease Unit, and WHO, FAO, UNEP, and WOAH. We will engage with communities of practice (Preventing Zoonotic Disease Emergence [PREZODE], the Global Alliance for Livestock Veterinary Medicines [GALVmed], and the African One Health University Network) while exploring new collaborations with private sector partners (Thermo Fisher and Zoetis).

Collaboration with other Programs and Accelerators

We will collaborate with the Better Diets and Nutrition Program on food safety to provide safe, nutritious, and accessible animal-source food for better health and nutrition in Global South countries and with the Scaling for Impact Program on profiling and packaging innovations.

Figure 6.3. AoW 3: One Health – Theory of Change



Note: A1-A6 are assumptions.

Table 6.3. Partners, assumptions, indicators, and targets

ToC element # (OC = outcome I-OC = intermediate outcome; OP = output)	Statement	Partners and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
OC 3.1	Market actors, including women, youth, and marginalized groups, increase investment and adopt and equitably deliver innovations to address One Health challenges.	Demand, innovation, and scaling partners: producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors	A1 Capacity-sharing activities result in increased knowledge and skills among stakeholders. A2 Market actors are willing to increase the capacity of communities and producers on One Health solutions. A3 Animal and aquatic producers, market actors, and communities have sufficient incentives to adopt innovations. A4 Development actors are willing to use One Health research evidence in decision-making and investment. A5 Decision-makers are willing to use SAAF evidence, data, and tools in policy design and investment decisions. A6 Animal and aquatic food producers see the benefit in and are able and willing to change dietary practices to better integrate animal and aquatic foods.	Number of market actors adopting or delivering innovations (disaggregated by gender, youth, and marginalized groups). Target = 260 people USD investment by market actors in adopting or delivering innovations (disaggregated by gender, youth, and marginalized groups). Target = USD 1.1 million
OC 3.2	Decision-makers use robust evidence, data, and tools to design policies and investments in animal and aquatic food systems.	Demand, innovation, and scaling partners: producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors		Number of policies, regulations, strategies, or investments designed by decision-makers using SAAF evidence, data, or tools. Target = 19 policies
I-OC 3.1	Market actors, including women, youth, and marginalized groups, have improved capacity for practices to address One Health challenges linked to animal and aquatic food systems.	Demand, innovation, and scaling partners: producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors		Not required
I-OC 3.2	Communities and animal and aquatic food producers, including women, youth, and marginalized groups, have improved capacity on practices to address One Health challenges linked to animal and aquatic food systems.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors		Not required
I-OC 3.3	Development actors increase capacity to use One Health evidence, data, and tools to support equitable delivery and adoption of innovations and for decision-making and investment.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors		Not required
I-OC 3.4	Local, national, and regional institutions increase capacity on One Health practices to support communities and influence policy and investments.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors		Not required
I-OC 3.5	Local, national, and regional institutions and development actors engage with decision-makers and share evidence, data, and tools for policy design and investment.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors		Not required

ToC element # (OC = outcome I-OC = intermediate outcome; OP = output)	Statement	Partners and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
OP 3.1	Targeted innovations and incentives to reduce zoonotic diseases in animal and aquatic food production systems	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors		Not required
OP 3.2	Targeted innovations and incentives to improve food safety in informal markets and enhance nutrition	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors		Not required
OP 3.3	Targeted innovations and incentives to reduce antimicrobial use and mitigate antimicrobial risks on farm and in the environment	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors		Not required
OP 3.4	Optimized One Health service delivery model that integrates studies to compare the health outcomes, costs, and benefits of joint service delivery.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; decision-makers; development actors; WHO, FAO, WOAH, and UNEP; donors		Not required

6.4. AoW 4: Market Systems, Policy Solutions and Scaling

Aquatic and animal food markets exhibit systemic challenges and policy barriers[85, 86, 87] that hinder the efficiency and inclusiveness of AAF systems. This AoW strengthens the ability of market actors, including women, youth, and marginalized groups, to participate in equitable, efficient, low-emission, and resilient AAF systems (PO5). It also contributes to increased adoption of productivity-enhancing innovations and the supply of nutrient-dense and healthy AAF diets (PO1). It provides evidence for policy design (PO8) and generates evidence for increased investments from the private sector and alternative financing for climate and the environment (PO7).

Outcomes are realized through (1) co-development of robust information systems for effective decision-making; (2) decision-support tools for efficient AAF systems; (3) co-design and testing of institutional and behavioral models that enhance efficiency, inclusiveness, and resilience of AAF systems; (4) evidence-based and participatory policymaking processes; and (5) participatory design of pathways for scaling contextualized innovations and technology packages (Figure 6.4).

We work with Productivity+ on efficient delivery, increased adoption and scaling, and optimized management for profitable producers. With Climate and the Environment, we work to increase the adoption of innovations for resilient and low-emission production systems and incentives for private sector financing of climate-adapted innovations. With Data and Digital Solutions, we work to ensure data availability, interoperability, quality, and accessibility, thereby enhancing decision-making. We work across the whole program to design policies that promote the use of AAF system innovations at scale.

Sources of comparative advantage

Our comparative advantage lies in our advanced and diverse expertise in institutional and behavioral analysis, impact assessment, and policy modeling and our interest in demonstrating impact. Our partnerships with universities and think tanks position us at the forefront of methods in rigorous impact assessment. Our established collaboration with NARES, development NGOs, and the private sector interested in our innovations provides a network of grassroots collaborators, social capital, and business incentives for testing adoption and dissemination of proven innovations for wider impact and policy advocacy.

Research questions

1. What data innovations and tools effectively guide national plans and investments, support market innovations, and facilitate sustainable and equitable systems transformations?
2. Which market system innovations enhance inclusion (social and gender), efficiency, and positive transformation of AAF systems, and how does the transition happen?
3. What are the socioeconomic and environmental benefits and trade-offs of market system innovations and policies in a changing climate?

Methods and approaches

Using a transdisciplinary approach,[88] we apply a mix of ex ante experiments, foresight analysis, and system dynamics models to diagnose systemic challenges within market systems and policy landscapes and generate market intelligence that informs co-design and testing of innovations. We apply randomized trials and field experiments to evaluate adoption and impacts of co-designed innovations and generate evidence that informs policy design, investment, and scaling. The methods present an integrated research-for-development pathway that considers diverse contexts and allows for continuity while providing links to other AoWs, Programs, and Accelerators.

High-level outputs

1. **Robust information systems and data innovations.** Working with local and national government departments, NARES, universities, and ARIs, and with input from food producers and the private sector, we apply systems and policy analysis to identify gender and age-based gaps in the capacity of market actors and address them through data optimization systems.[89] Production and market profiles across regions are used to characterize the productivity, efficiency, sustainability, equity, and resilience of production and market systems.[90,91,92] Web-based platforms tailored to stakeholder needs and with predictive analytics are developed to provide actionable recommendations for nontechnical users. The use, scaling, and effectiveness of these innovations are evaluated to continuously improve their performance and sustainability.
2. **Decision-support tools for sustainable and efficient AAF systems.** Digital decision-support tools are co-designed with local and national government departments, NARES, universities, and ARIs, with input from food producers and the private sector, to deliver benefits particularly to women, youth, and marginalized groups in diverse AAF systems.[93] We bundle and package these gender-responsive tools and facilitate enabling conditions for actors to effectively use them while we generate evidence to inform scaling. These tools offer extension agents, producers, policymakers, and investors actionable insights for productivity and profitability enhancement, waste reduction, and resilience[94] to water and climate risks.
3. **Institutional and behavioral models for innovation uptake.** In this output, we co-design bundled interventions with market actors to modify incentives, behaviors, and capacities of private sector actors toward embedding practices that reduce risks, bridge knowledge and skills gaps, and enhance gender and social equity among AAF producers and consumers. This demonstrates how inclusive models improve business performance while benefiting poor women, youth, and marginalized producers and consumers.[95, 96, 97]

   Building on Productivity+ and Climate and the Environment, we design and test emerging innovations in ecosystem financing,[98] insurance, and delivery models involving entrepreneurship ecosystems that minimize information asymmetry and reduce risks.[99] We focus on rules, regulations, standards, and norms that shape barriers and opportunities for adoption and exchanges between producers and consumers.

   Co-design of innovations is complemented with adoption, impact, scaling, and qualitative studies that generate evidence on the impact of (1) institutional, behavioral, and business models for delivery; (2) AAF system technologies; and (3) a combination of these two interventions on inclusion and efficiency.

   Harmonized evaluation approaches and data integration with the Policy Innovations Program will support insightful analysis involving big data and artificial intelligence.

4. **Policy analysis and engagement processes for effective AAF systems.** We leverage partnerships and apply foresight analysis with gender, nutrition, food safety, and political economy considerations to understand policy barriers to inclusivity and efficiency of AAF sectors. Insights guide policy reviews and co-designed investment plans and strategies for AAF systems, including through gender-inclusive aquatic and livestock masterplans.[100] We promote inclusive AAF policies and investment plans through multistakeholder platforms and awareness campaigns that leverage AAF systems for gender and social equity outcomes.[101]These context-dependent structures formalize interactions and mobilize stakeholders for dialogue, decision-making, and formulating AAF policies. Finally, we assess the sustainability and effectiveness of AAF policies, investment plans, and governance processes to mainstream innovations and grow investments.

5. **Evidence and pathways for scaling.** While co-designing and co-testing innovations, we collaborate with Scaling for Impact and other scaling partners and apply the innovation packaging and scaling readiness (IPSR) approach to package context-specific AAF innovation that enables scaling. Using the IPSR process, we prioritize interventions and innovations that transform AAF systems while generating metrics that influence policies, development programs, and public and private investment to deliver impact at scale. We also identify and address scaling barriers, including capacities, incentives, behaviors, and policies, and co-develop strategies for innovations that are demand driven and proven and enable impact at scale. The IPSR process also helps SAAF monitor and adaptively manage our innovation portfolio alongside our theory of change.

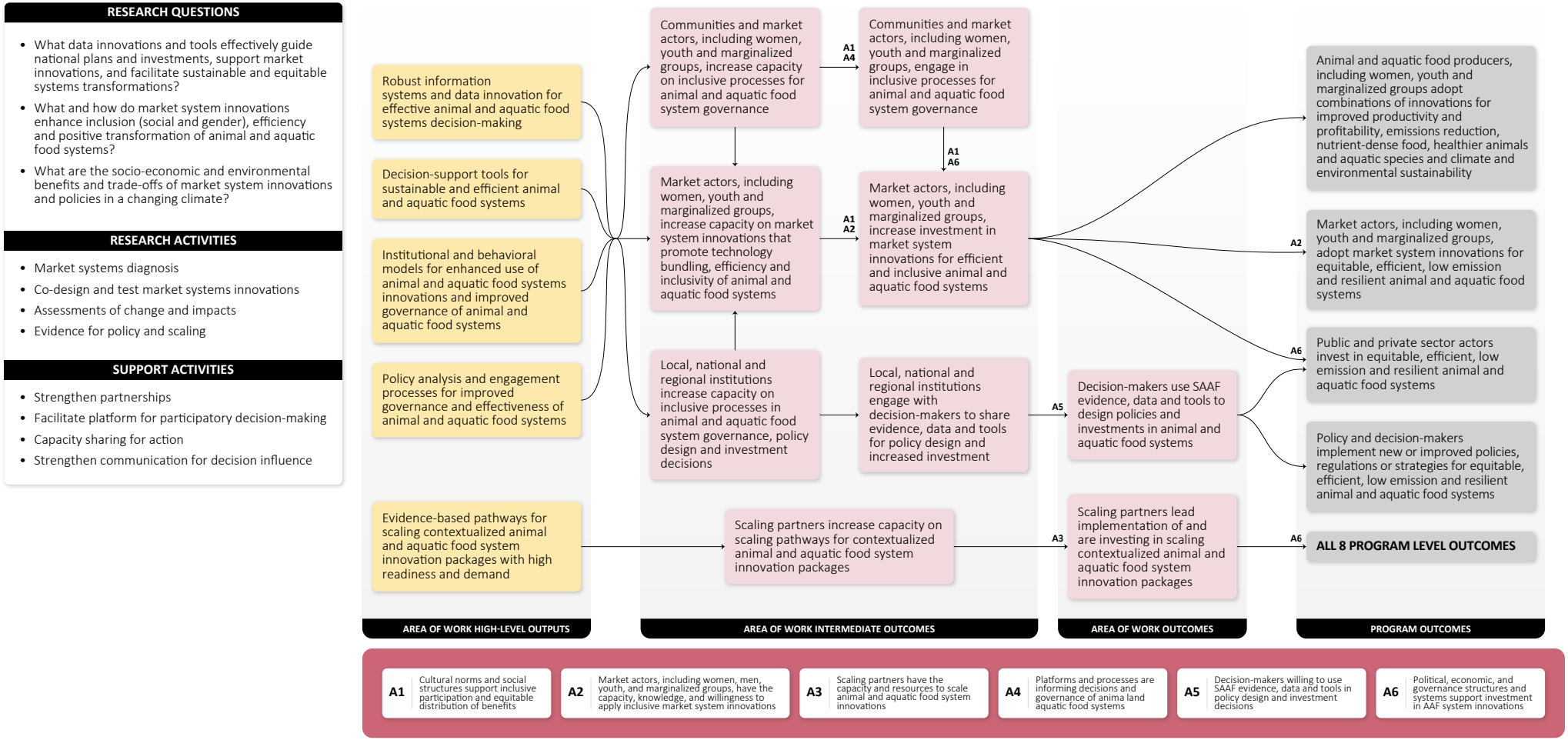
Partnerships

We work with knowledge institutions in the Global South (e.g., NARES), research institutes in the Global North working on tropical livestock and aquaculture issues (e.g., Centre de coopération internationale en recherche agronomique pour le développement [CIRAD]), market actors and their organizations, NGOs, policymakers, and development partners in AAF systems. Partnerships span the five research activities of diagnosis, innovation co-design, change measurement, policy design, and scaling.

Collaboration with other Programs and Accelerators

This AoW evaluates and informs innovation development in Productivity+, Climate and the Environment, Data and Digital Innovations, and One Health, including some initiated under the Initiatives, and contributes to the Scaling for Impact Program by developing behavior change and investment pathways for scaling innovations. We will also work with the Policy Innovations Program to develop and apply methods and approaches to modeling and impact assessment.

Figure 6.4. AoW 4: Market Systems, Policy Solutions and Scaling – Theory of Change



Note: A1-A6 are assumptions.

Table 6.4. Partners, assumptions, indicators, and targets

ToC element # (OC = outcome; I-OC = intermediate OC; OP = output)	Statement	Partners and roles	Assumption (see ToC visual for placement on causal links)	Indicator and target
OC 4.1	Communities and market actors, including women, youth, and marginalized groups, engage in inclusive processes for animal and aquatic food system governance.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors	A1 Cultural norms and social structures support inclusive participation and equitable distribution of benefits. A2 Market actors, including women, men, youth, and marginalized groups, have the capacity, knowledge, and willingness to apply inclusive market system innovations. A3 Scaling partners have the willingness to scale animal and aquatic food systems innovations. A4 Platforms and processes are effective in informing decisions and governance of animal and aquatic food systems. A5 Decision-makers are willing to use SAAF evidence, data, and tools in policy design and investment decisions. A6 Political, economic, and governance structures and systems support investment in animal and aquatic food systems innovations.	Number of people engaged in inclusive processes for animal and aquatic food systems governance (disaggregated by gender, youth, and marginalized groups). Target = 1,200 people Number of platforms supporting inclusive processes for animal and aquatic food system governance. Target = 12 platforms
OC 4.2	Market actors, including women, youth, and marginalized groups, increase investment in market systems innovations for efficient and inclusive animal and aquatic food systems.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Number of market actors investing in market systems innovations (disaggregated by gender, youth, and marginalized groups). Target = 1,590 people USD investment by market actors in market systems innovations (disaggregated by gender, youth, and marginalized groups). Target = USD 2.2 million
OC 4.3	Decision-makers use SAAF evidence, data, and tools to design policies and investments in animal and aquatic food systems.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Number of policies, regulations, strategies, or investments designed by decision-makers using SAAF evidence, data, or tools. Target = 19 policies
OC 4.4	Scaling partners lead implementation of and are investing in scaling contextualized animal and aquatic food systems innovation packages.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		USD investment by scaling partners in scaling animal and aquatic food systems innovation packages. Target = USD 4.4 million
I-OC 4.1	Communities and market actors, including women, youth, and marginalized groups, increase capacity on inclusive processes for animal and aquatic food systems governance.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
I-OC 4.2	Market actors, including women, youth, and marginalized groups, increase capacity on market systems innovations that promote technology bundling, efficiency, and inclusivity of animal and aquatic food systems.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
I-OC 4.3	Local, national, and regional institutions increase capacity on inclusive processes in animal and aquatic food systems governance, policy design, and investment decisions.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
I-OC 4.4	Local, national, and regional institutions engage with decision-makers to share evidence, data, and tools for policy design and increased investment.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
I-OC 4.5	Scaling partners increase capacity on scaling pathways for contextualized animal and aquatic food systems innovation packages .	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required

ToC element # (OC = outcome; I-OC = intermediate OC; OP = output)	Statement	Partners and roles	Assumption (see ToC visual for placement on causal links)	Indicator and target
OP 4.1	Robust information systems and data innovation for effective animal and aquatic food systems decision-making	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 4.2	Decision-support tools for efficient animal and aquatic food systems	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 4.3	Institutional and behavioral models for enhanced uptake of animal and aquatic food systems innovations and improved governance of animal and aquatic food systems	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 4.4	Policy analysis and engagement processes for improved governance and effectiveness of animal and aquatic food systems	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 4.5	Evidence and viable pathways for scaling of animal and aquatic food systems innovations	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; communities and community-based and grassroots organizations; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required

6.5. AoW 5: Gender, Youth, and Social Inclusion

Gender, Youth, and Social Inclusion (GYSI) supports the efforts of animal and aquatic food producers and communities to adopt more equitable norms for the empowerment of women and youth (PO6). It contributes to all Program-level outcomes by ensuring that gender, equity, and social considerations are considered in all activities.

We achieve outcomes by (1) working with research and development actors to gather and analyze disaggregated data on changes in gender and youth empowerment, norms, and resilient livelihoods; and (2) co-designing and implementing interventions that support women and youth empowerment and more equitable norms in AAF systems, using tested packages of socio-institutional and technical interventions.

GYSI will work with Productivity+, Climate and the Environment, and One Health to ensure that innovations consider gender, equity, and youth in their designs and with Market Systems to ensure that models and studies include the impacts of gender, equity, and social inclusion.

Research questions

1. What is the status of women, youth, and marginalized groups in terms of their roles, engagement, opportunities, and constraints in specific (to a given intervention) contexts of animal and aquatic food systems?
2. What contextualized interventions support the empowerment of women, youth, and marginalized groups and create a conducive normative environment?
3. What packages of socio-technical innovations work best for women, youth, and marginalized groups?
4. What are the best ways to engage youth in gaining knowledge, skills, and access to innovations and private sector opportunities that help them participate in, and benefit from, animal and aquatic food systems?

Sources of comparative advantage

SAAF capitalizes on a diverse team of gender scientists and their partners from participating Centers who have deep knowledge of SAAF's strategic and integrated research and a proven track record. Experts across four institutes have collaborated effectively on multi-country, multi-Center, and multi-commodity engagement studies since 2012. We have long-standing partnerships with local and international institutes that can foster rapid growth in needed areas.

Methods and approaches

This research comprises three stages: (1) studying empowerment and norms to develop appropriate interventions; (2) implementing co-designed interventions that support empowerment and address restrictive norms; and (3) examining changes in norms to assess under what conditions these contextualized interventions scale to other settings. We expect that a society with less restrictive gender norms benefits everyone.[102]
We examine gender and youth disempowerment and the structural constraints that shape it and co-develop, implement, and test interventions to identify those that most effectively support empowerment and conducive social institutions. We focus on policy and the best approaches to integrate gender and youth equity into policymaking. With partners, we will scale the most promising innovations and assess how our context-specific innovations scale to other contexts and the changes they can bring to gender norms.

To assess social, technical, and innovation bundles (STIBs), we examine the evidence from strategic work and other AoWs to determine which combinations and implementation modalities move us toward effective and equitable AAF systems. This entails assessing the impact of STIBs on empowerment and norms in combination with other SAAF indicators and conducting a meta-analysis. The approach is two-pronged: integrating gender considerations across all SAAF Areas of Work and conducting strategic GYSI analysis of empowerment, norms, and innovation packages.

GYSI leads strategic research and coordinates the GYSI activities conducted in other AoWs. Methodologically, we conduct qualitative and quantitative research and use an intersectional lens to examine the interplay of individual characteristics in shaping people's lived experiences.[103, 104] Building on work done across Initiatives and bilateral projects, we will explore emerging topics identified in recent scoping reviews, frameworks highlighting new areas of gender integration in AAF systems,[105, 106] and evidence and evaluations that contribute to more impactful interventions.[107]

High-level outputs

1. **Disaggregated data and evidence on gender and youth norms and dynamics.** We will conduct diagnostic research that maps all women, men, youth, and marginalized individuals (AWMYM) in selected AAF value chains relevant to SAAF work, as a basis for developing locally relevant gender and youth-responsive interventions. This research identifies who occupies which value chains and nodes, their type of engagement, and the constraints and opportunities they face in marketing across livestock,[108, 109] small ruminants;[110, 111] fish and aquatic foods value chains.[112] It assesses women's involvement in near-shore and on-shore fishing and gleaning and shell fisheries in coastal communities as well as their consumption of animal and aquatic foods.[113]
2. **Tools and approaches to assess gender and youth changes in empowerment, norms, and resilient livelihoods**. We will improve on existing tools, such as the Women's Empowerment in Livestock Index,[114] the Women's Empowerment in Fisheries and Aquaculture Index,[115] and the gender norms assessment tool developed by SAPLING. New tools tailored to new study areas will be co-developed.[116, 117, 118] We will use Gender Transformative Approach (GTA) training tools (e.g., Savings and Internal Lending Communities,[119] GALS,[120] and others).[121]
3. **Effective interventions that support women and youth empowerment and more equitable norms in animal and aquatic systems.** This includes research on empowerment and norm dynamics and assessments of effective interventions. We continue previous research on:
    1. The meanings of empowerment.
    2. The interaction between empowerment and other livelihood indicators (qualitative and quantitative changes in empowerment in relation to other intersectional factors).
    3. Gender-accommodative versus gender-transformative approaches in AAF systems. FHCDs.
    4. Studies on gender, climate change, and AAF.[122, 123]

We conduct new research on:

i. The interrelational and psychological dimensions of empowerment.

ii. Women's empowerment in fragile contexts, informal markets, and social protection mechanisms.

iii. Employment, work burden, and the unpaid economy.

iv. The effects of the digital revolution on empowerment and norms.

v. The relationship between inequality, norms, and empowerment.[124, 125, 126]

vi. Effective transformative approaches, tipping points, and scaling interventions.

4. **Effective packages of socio-institutional and technical interventions that support equity.** For this output, we collaborate with other AoWs by integrating GYSI considerations. We build on previous work by applying and improving existing frameworks and evidence on animal health, genetics, One Health, nutrition, markets, policy, livestock master plans, aquaculture value chain frameworks, and scaling.

   We build on work started under the Digital Initiative on the role of digital tools in empowerment. The findings will be combined with those from high-level output 3 and integrated into STIB packages. We will assess how these packages perform in terms of empowerment and norms through meta-analysis.[127, 128, 129]

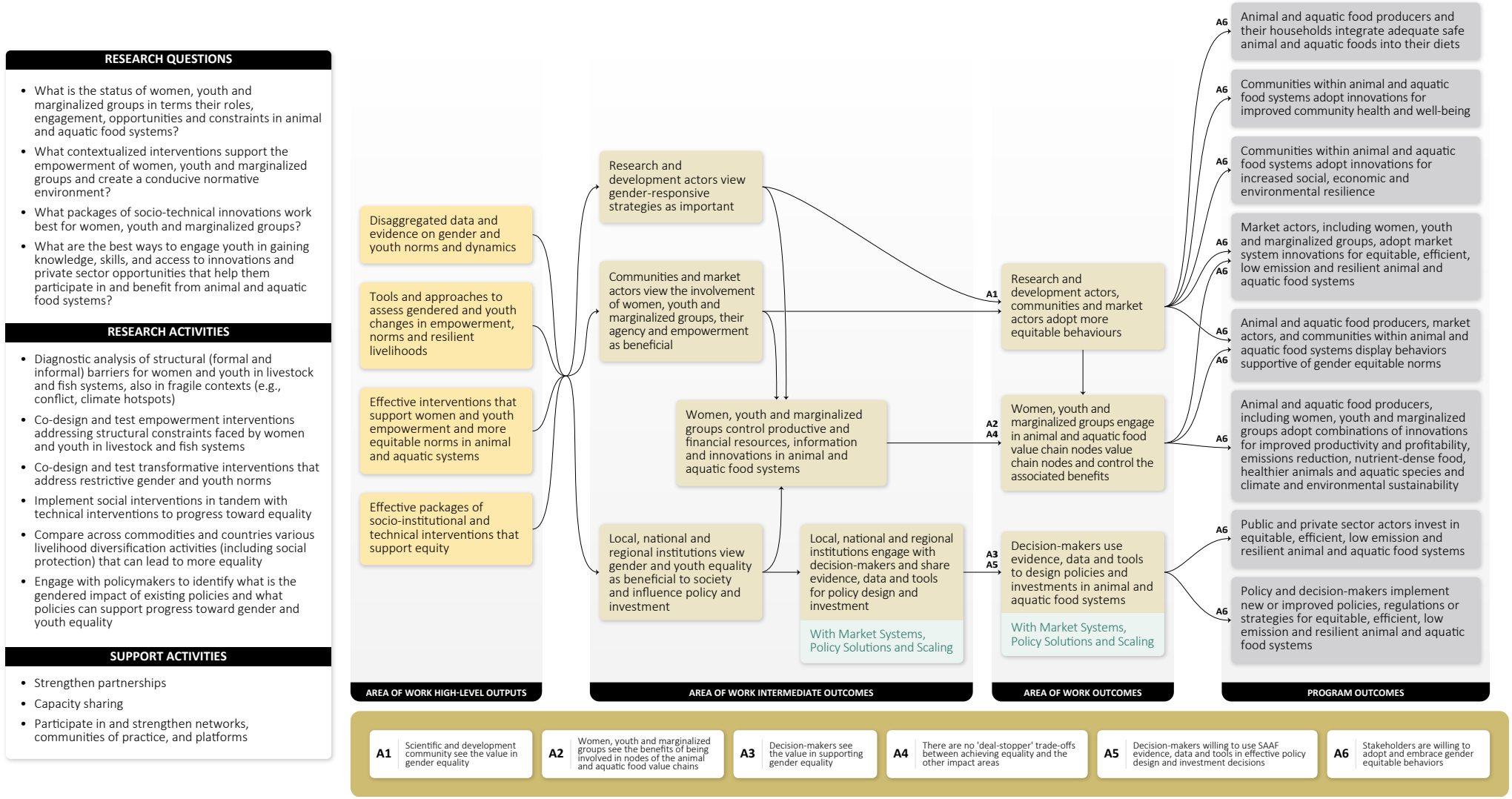
Partnerships

We build on existing collaborations with CGIAR Gender Equality and Inclusion Accelerator, donors, multilateral organizations for the purpose of global and regional lobbying, NARES, civil society, other research institutions, and policymakers to build capacity, scale up STIBs, and create demand.

Collaboration with other Programs and Accelerators

Our research focus is aligned with the Gender Equality and Inclusion Accelerator (empowerment and norms). While the Accelerator works at the agrifood system level, we focus on empowerment and norms within AAF systems. Our findings will provide evidence for analyses undertaken by the Accelerator at the agrifood system level.

Figure 6.5. AoW 5: Gender, Youth and Social Inclusion – Theory of Change



Note: A1-A6 are assumptions.

Table 6.5. Partners, assumptions, indicators, and targets

ToC element # (OC = outcome; I-OC = intermediate OC; OP = output)	Statement	Partners and roles	Assumption (see ToC visual for placement on causal links)	Indicator and target
OC 5.1	Research and development actors, communities, and market actors adopt more equitable behaviors.	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors	A1 Scientific and development community sees the value in gender equality. A2 Women, youth, and marginalized groups see the benefits of being involved in nodes of the animal and aquatic food value chains. A3 Decision-makers see the value in supporting gender equality. A4 There are no "deal-stopper" trade-offs between achieving equality and the other Impact Areas. A5 Decision-makers are willing to use SAAF evidence, data, and tools in effective policy design and investment decisions. A6 Stakeholders are willing to adopt and embrace gender-equitable behaviors.	Number of community members and market actors who adopt more equitable behavior (disaggregated for the intersection of actor type and gender). Target = 370,000 people Number of research and development actors who adopt more equitable behavior. Target = 10 institutions
OC 5.2	Women, youth, and marginalized groups engage in animal and aquatic food value chain nodes and control the associated benefits.	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Number of women, youth, and marginalized groups (disaggregated) who join value chain nodes and who control the associated benefits. Target = 1,000 people
OC 5.3	Decision-makers use robust evidence, data, and tools to design policies and investments in animal and aquatic food systems.	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Number of policies, regulations, strategies, or investments designed by decision-makers using SAAF evidence, data, or tools. Target = 4 policies
I-OC 5.1	Research and development actors view gender-responsive strategies as important**.**	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OC 5.2	Communities and market actors view the involvement, agency, and empowerment of women, youth, and marginalized groups as beneficial.	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
I-OC 5.3	Women, youth, and marginalized groups control productive and financial resources, information, and innovations in AAF**.**	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
I-OC 5.4	Local, national, and regional institutions engage with decision-makers and share evidence, data, and tools for policy design and investment**.**	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 5.1	Disaggregated data and evidence on gender and youth norms and dynamics	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required

ToC element # (OC = outcome; I-OC = intermediate OC; OP = output)	Statement	Partners and roles	Assumption (see ToC visual for placement on causal links)	Indicator and target
OP 5.2	Tools and approaches to assess gendered and youth changes in empowerment, norms and resilient livelihoods	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 5.3	Effective interventions for the empowerment of women and youth and more equitable norms in animal and aquatic systems	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 5.4	Effective packages of socio-institutional and technical interventions that support equity	**Demand, innovation, and scaling partners:** women, youth, and marginalized groups; producers and producer groups; communities and community-based and grassroots organizations; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required

6.6. AoW 6: Data and Digital Solutions

Data and Digital Solutions supports all Program-level outcomes in developing scalable innovations for improved productivity (PO1). Digital innovations facilitating community decisions strengthen resilience (PO 3) and health outcomes (PO4). Digital innovations and AI-based analytics enable data-driven decisions (O6.2), drive investments (PO7), and inform better policies and regulations (PO8). OP6.3 (impacts, trade-offs, and strategies to support ethical and inclusive development and use of digital innovations and analytics) provides analyses to determine how these technologies affect women, youth, and marginalized groups (PO6).

We will achieve these by (1) establishing standardized data protocols and creating federated, harmonized databases for high-quality, FAIR data (I-OC6.1); (2) supporting co-design and deployment of inclusive, scalable innovations and building stakeholders' capacity to develop AAF-specific solutions (I-OC6.2); and (3) providing policymakers with digital tools to make more informed decisions and manage production, market, health, and environmental risks.

This AoW consolidates the data and digital innovation activities across all AoWs and conducts research to harness new digital innovations for transforming SAAF systems. It will collaborate with other AoWs by preparing use cases, sharing data standards, and co-developing digital infrastructure that enhances AAF data availability, interoperability, quality, and accessibility, thereby enhancing decision-making for stakeholders.

Research questions

1. What standards can enable data interoperability and digital innovations across AAF systems?
2. How can digital technologies improve sustainable productivity in AAF systems for women, youth, and marginalized groups while ensuring equity and equitable access?
3. What ethical considerations and best practices can ensure data privacy, inclusion, and security in the application of AI and analytics in these food systems?
4. How effective are digital technologies in providing accurate and actionable data for climate and environmental monitoring and decision-making in AAF systems?

Sources of comparative advantage

This AoW leverages research and activities across CGIAR to harness the promise of digital and AI innovations to develop scalable solutions for producers, market actors, policymakers, and researchers. AAF systems data and digital innovation methods and processes overlap with those in crop systems, but the social, institutional, and biophysical context within AAF systems pose unique data and digital innovation needs (e.g., disease surveillance in livestock, water quality monitoring in aquaculture, or tracking of fish stock levels). CGIAR has a unique CA in addressing these needs based on its convening power, global reach, multi-disciplinary approach, human and institutional capabilities in handling data and knowledge products across different scientific disciplines, strong partnerships, and deep understanding of market actors' needs and interoperability issues. CGIAR's past investments in FAIRification processes, data standardization, and bilateral projects in digital and data innovations, coupled with a strong culture of monitoring, evaluation, and learning, position CGIAR to lead digital innovations for SAAF. CGIAR hosts multiple global databases and platforms for AAF digital innovations (e.g., FishBase), which attract millions of users each year and serve as a critical resource for researchers, policymakers, and practitioners.

Research methods and approaches

We will prioritize participatory approaches to identify end-user needs and co-develop innovations, as well as identifying systematic constraints, including those related to connectivity, hardware, and digital literacy, and strategies for mitigating these. Our innovation methods will ensure that digital innovations are inclusive, incorporate near-real-time data, are based on human-centered design, and comply with best practices for governance and ethical considerations. We will identify sustainability and scalability strategies, including business models and capacity building.

High-level outputs

1. **Standardized FAIR data collection and management protocols, interoperability standards, and data integration mechanisms for AAF systems.** We will design pilot testing and customizing protocols, engagement mechanisms with stakeholders, and improvement cycles for solutions to ensure consistency and effectiveness.
2. **Exploratory digital innovations and AI-based analytics to enable data-driven decisions in AAF systems.** This includes piloting digital tools on the back of data-sharing infrastructure and principles (Output 1) to address high-impact use cases identified in collaboration with other AoWs. We will integrate existing systems, followed by planned cycles of testing, validation, and improvement. Business models and sustainability plans will be co-developed and implemented according to institutional strengths and mandates. Continuous engagement with partners, monitoring, evaluation, and learning will ensure that the tools remain effective, sustainable, and aligned with evolving stakeholder needs.
3. **Strategies to support ethical and inclusive development and use of digital innovations and analytics in AAF systems.** We will engage with stakeholders, gather diverse perspectives, and conduct detailed analyses to determine how digital innovations affect specific groups, identifying positive outcomes and potential risks. Based on these, we will co-develop guidelines and strategies to promote ethical and inclusive practices within SAAF digital innovations and support continuous evaluation to ensure tools remain effective.
4. **Co-development of innovative and scalable platforms, including digital public infrastructure (DPI) for AAF systems.** The focus here is on the participatory scaling of innovative and proven digital innovations and platforms, including DPI for AAF systems. Using multistakeholder consultations, we can identify the needs, requirements, and challenges to scaling. A collaborative design process will ensure effective stakeholder engagement in co-creating inclusive and user-friendly platforms that are readily scalable without significant re-engineering efforts. Feedback is used to refine platforms before deployment. Lessons learned will be documented to guide improvements.
5. **Evidence for decision-makers to make investment and policy decisions on inclusive digital innovations**. Reviews of existing policies and practices will be carried out to identify gaps, opportunities, and best practices. New policies and recommendations are co-developed with stakeholders to promote innovation and address specific needs while working

with local governments and other partners to advocate for policies enhancing inclusive access and use of digital tools. We also focus on building collaborative networks to facilitate knowledge sharing and collective action. Methods will be developed or identified to monitor and track policy and network effectiveness using strategies created to bridge gaps in stakeholder access to information and resources (e.g., sustainability indexes such as AquaIndex).

Gender integration

We prioritize gender integration by identifying gender digital inequity chokepoints, developing gender-inclusive digital innovations, and addressing the gender digital divide. Efforts encompass gendered implementation processes, capacity building for best practices, raising awareness about inclusive design, and ensuring equitable access to digital tools and technologies. The aim is to support women's empowerment and incentivize their active participation in digital initiatives.

Partnerships

We will partner with public and private sector entities, international organizations, academia, NGOs, technology companies, and development agencies. These collaborations are crucial for co-generating accurate data; co-developing digital solutions; sharing best practices; ensuring scalability, sustainability, and timely use of information; and leveraging expertise and resources to maximize impact.

Collaboration with other Programs and Accelerators

The Digital Transformation Accelerator plays a pivotal role in connecting these efforts by ensuring a coordinated and integrated approach to digital innovation across the AAF ecosystem. The Scaling for Impact Program can assist with strategies for scaling and ensuring that impactful digital innovations are promoted and effectively deployed.

Figure 6.6. AoW 6: Data and Digital Solutions – Theory of Change

RESEARCH QUESTIONS

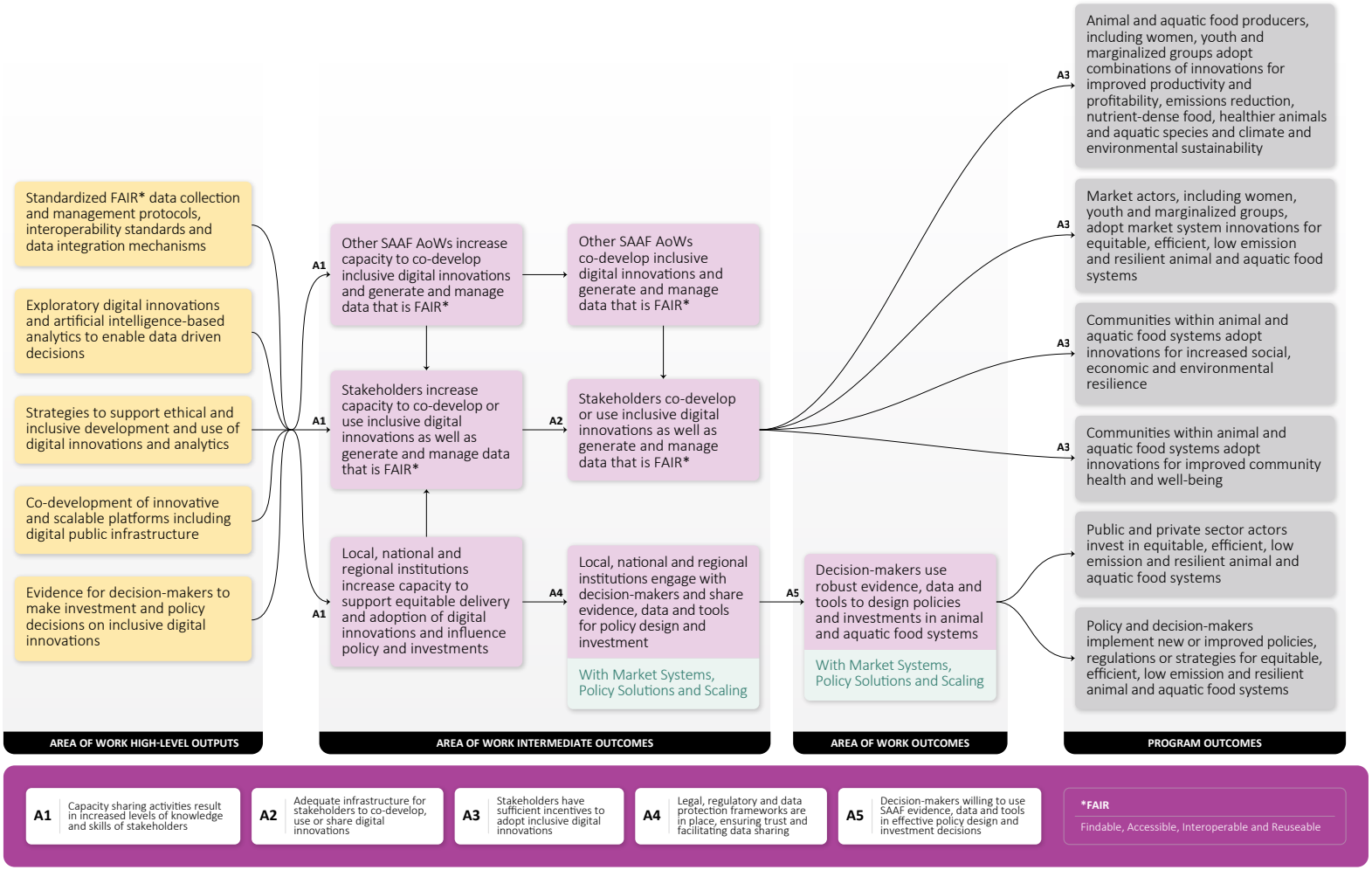
- What standards can enable data interoperability and digital innovations across animal and aquatic food systems?
- How can digital technologies improve sustainable productivity in animal and aquatic food systems for women, youth and marginalized groups while ensuring equity and equitable access?
- What ethical considerations and best practices can ensure data privacy, inclusion, and security in the application of AI and analytics in these food systems?
- How effective are digital technologies in providing accurate and actionable data for climate and environmental monitoring and decision-making in animal and aquatic food systems?

RESEARCH ACTIVITIES

- Diagnosis of data, interoperability, and standards gaps
- Co-design innovation best practices
- Co-develop and test digital infrastructures and technologies
- Develop evidence to support policy makers
- Scale proven data and digital systems

SUPPORT ACTIVITIES

- Strengthen partnerships
- Capacity sharing on data and digital skills
- Participate in and strengthen networks to understand data needs
- Communities of Practice for data standards and interoperability
- Influence standard setting bodies and think tanks



Note: A1-A6 are assumptions.

Table 6.6. Partners, assumptions, indicators, and targets

ToC element # (OC = outcome; I-OC = intermediate OC; OP = output)	Statement	Partners and roles	Assumption (see ToC visual for placement on causal links)	Indicator and target
OC 6.1	Other SAAF AoWs co-develop inclusive digital innovations and generate and manage data that is FAIR.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors	A1 Stakeholders have strong political and institutional willingness to adopt, implement, and collaborate on improved digital strategies and platforms. A2 There are adequate infrastructure, technical capacity, and financial investments to support the development, integration, training, capacity building, and maintenance of digital systems. A3 There is a conducive environment for innovation, with economic and market conditions that support the scaling, sustainability, and adoption of digital tools and data-driven decision-making. A4 Legal, regulatory, and data protection frameworks are in place, ensuring trust and facilitating data sharing, collaboration, and adoption. A5 Decision-makers are willing to use SAAF evidence, data, and tools in effective policy design and investment decisions.	Number of inclusive digital innovations co-developed with other SAAF AoW. Target = 15 innovations % of data sets that SAAF has contributed to that are FAIR. Target = 100%
OC 6.2	Stakeholders co-develop or use inclusive digital innovations as well as generate and manage data that is FAIR.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Number of inclusive digital innovations co-developed by stakeholders. Target = 3 innovations Number of partners promoting SAAF digital innovations. Target = 36 institutions % of data sets that stakeholders have contributed to that are FAIR. Target = 80%
OC 6.3	Decision-makers use robust evidence, data, and tools to design policies and investments in animal and aquatic food systems.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Number of policies, including regulations and strategies, or investments designed Target = 4 policies
I-OC 6.1	Other SAAF Systems AoW increase capacity to co-develop inclusive digital innovations and generate and manage data that is FAIR.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		
I-OC 6.2	Stakeholders increase capacity to co-develop or use inclusive digital innovations as well as generate and manage data that is FAIR.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
I-OC 6.3	Local, national, and regional institutions increase their capacity to support equitable delivery and adoption of digital innovations and influence policy and investment.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
I-OC 6.4	Local, national, and regional institutions engage with decision-makers and share evidence, data, and tools for policy design and investment.	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required

ToC element # (OC = outcome; I-OC = intermediate OC; OP = output)	Statement	Partners and roles	Assumption (see ToC visual for placement on causal links)	Indicator and target
OP 6.1	Standardized FAIR data collection and management protocols, interoperability standards, and data integration mechanisms	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 6.2	Exploratory digital innovations and artificial intelligence-based analytics to enable data-driven decisions	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 6.3	Strategies to support ethical and inclusive development and use of digital innovations and analytics	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 6.4	Co-development of innovative and scalable platforms including digital public infrastructure (DPI)	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required
OP 6.5	Evidence for decision-makers to make investment and policy decisions on inclusive digital innovations	**Demand, innovation, and scaling partners:** producers and producer groups; private sector; NARES; universities; local, national, and regional institutions, including government; NGOs; decision-makers; donors		Not required

7. Country integration

7.1. Example of integration in a country or set of countries

This section presents an example of integration in **Ethiopia**. The program builds on the 2022–24 Initiatives developed with the Ethiopian government, NGOs, and private sector partners. The 2023 CGIAR Listening Sessions provided insights into local needs and aspirations for livestock development and identified collaboration areas where we could make the most impact. The World Bank's support for two new major initiatives[130] led to discussions with their project development team on how to complement these projects to scale our innovations. A Research Portfolio Consultation on SAAF in early August reviewed the Program's priority areas against national strategies and initiatives. The team reviewed Ethiopia's Ten Years Perspective Development Plan (2021–2030) and long-term low-emission and climate-resilient development strategy (2020–2050) to identify priority areas.

The program is embedded in major Ethiopian initiatives: (1) the Ethiopia Food Systems Resilience Project, (2) the Lowland Livelihood Resilience Program, (3) the Livestock and Fisheries Sector Development Program, (4) Yelemat Terufat, and (5) the national One Health Steering Program. The CGIAR team was consulted in developing these initiatives or showcasing proven innovations that have become central to these projects. SAAF aims to actuate these initiatives to achieve broader impacts. Recently, the government launched the National Dairy and Poultry Strategies, supported by the CGIAR team, ensuring alignment with government priorities. CGIAR is a member of the Research and Innovation Platform and has identified integration points where joint efforts are included as deliverables in the government system, a strategy also applied to bilateral projects. The program will contribute to six outcomes by 2030 (e.g., policymakers use program-generated evidence to formulate supportive policies on animal and aquatic food systems; animal and aquatic food producers adopt combinations of innovations for improved productivity, profitability, GHG outcomes, and nutrition). These are fully endorsed by partners.

In Ethiopia, efforts to integrate these elements have been ongoing since the CRPs (2017), with notable successes in small ruminant value chains. More work is needed to achieve effective integration across dairy, poultry, and fish value chains. Initiatives such as One Health and Resilient Cities have collaborated with ministries to create One Health food safety working groups, enhancing cooperation between researchers and policymakers.

Despite these efforts, integration faces challenges: (1) a lack of shared goals and complementary approaches, and (2) perceived transaction costs of integration (e.g., coordination needed to synchronize activities). Some initiatives were implemented but lacked coordination with stakeholders at the national level.

Integration can be strengthened with more frequent face-to-face interactions for learning and engaging local stakeholders. Successful integration was a function of specific skill sets, dedicated personnel with clearly defined roles, and adequate funding. The Pioneer-Positive Deviance team's engagement in the Livestock and Climate Initiative involved co-producing locally led innovations and scaling through extension services. The lessons learned are now being integrated into current efforts.

CGIAR has effective partnership networks in Ethiopia collaborating with the Ethiopian Institute of Agricultural Research, regional research institutes, government universities, the Ministry of Agriculture (including the Department of Fisheries), and private sector entities. These collaborations help CGIAR Centers determine the needs and roles of partners. CGIAR's role involves conceptualizing program ideas, aligning programs with national government priorities, and facilitating implementation. CGIAR is also invested in capacity building and training technical staff and implementers to ensure effective project execution. A critical component of CGIAR's strategy is to engage with local partners to promote locally led innovation and ensure innovators see the results as their own deliverables and incorporate them into their planning.

All SAAF components will be active in Ethiopia and will:

1. Enhance productivity and sustainable practices to improve livestock and fish output while minimizing environmental impact and creating a foundation for economic growth and integrating locally led solutions.
2. Strengthening market systems and effective governance to ensure that increased productivity leads to economic benefits and fair-trade practices.
3. Integrating the One Health Approach to ensure improved health outcomes by addressing environmental and animal health factors.
4. Ensure equitable distribution of benefits, empowering marginalized groups and promoting social cohesion, through Gender, Youth, and Social Inclusion.

The major approaches are (1) building of country teams that jointly plan aligned implementation timelines and apply joint monitoring and evaluation; (2) periodic meetings for reflection on what went well and what needs to be corrected; (3) stakeholders' and partners' co-creation of site-level theories of change to maximize integration; and (4) ICT tools (e.g., digital platforms) to compile information that partners and users can use to create market links where buyers and sellers of livestock and fish products can connect.

SAAF will coordinate with the Climate Action, Multifunctional Landscapes, Policy Innovations, Better Diets and Nutrition, Breeding for Tomorrow and Genebanks, and Sustainable Farming Programs and the three Accelerators. SAAF will work with Scaling for Impact and all Accelerators by (1) creating a platform for program partners to identify synergies and jointly plan implementation; (2) recruiting shared positions to manage and coordinate activities at the field level; (3) modeling results and scenarios generated in one program to inform and support deliverables in other programs; and (4) aligning CGIAR research with broader government initiatives through dedicated staff across Programs (e.g., country convenor, specialized ambassadors), to unify efforts toward common goals and scale CGIAR innovations.

7.2. Overview of selected work in focus countries

Table 7.1. Overview of selected work in focus countries

Region	Country	District/system	Area of Work	Program and Accelerator collaboration	Partners
EA	Kenya	Mixed crop-livestock system; pastoral systems; aquaculture and fisheries	Productivity+; Market Systems, Policy Solutions and Scaling Policy Solutions and Scaling; Climate and the Environment; Gender, Youth and Social Inclusion	SAAF, Multifunctional Landscapes, Policy Innovations, Scaling for Impact, Digital Transformation	Ministry of Agriculture and Livestock Development (MoALD), Kenya Agricultural and Livestock Research Organization (KALRO), **Kenya Plant Health Inspectorate Service** (KEPHIS), Kenya Marine and Fisheries Research Institute (KMFRI), International Centre of Insect Physiology and Ecology (ICIPE), Kenya Fisheries Service, veterinary pharmaceutical companies,, subnational governments, departments of fisheries, business incubators
EA	Ethiopia	Mixed crop-livestock and pastoral systems; aquaculture and fisheries	Productivity+; One Health; Market Systems, Policy Solutions and Scaling; Climate and the Environment; Gender, Youth, and Social Inclusion	SAAF, Climate Action, Multifunctional Landscapes, Scaling for Impact	Ministry of Agriculture (including Department of Fisheries), Ethiopian Institute of Agricultural Research (EIAR), regional research institutes (Amhara Agricultural Research Institute [ARARI], Oromia Agricultural Research Institute [OARI], Tigray Agricultural Research Institute [TARI], Southern Ethiopia Agricultural Research Institute [SEARI], Central Ethiopia Agricultural Research Institute [CEARI], South West Agricultural Research Institute [SWARI]); public universities, private sector
WA	Mali	Pastoral and mixed crop-livestock systems	Productivity+; One Health; Market Systems, Policy Solutions and Scaling; Climate and the Environment; Gender, Youth, and Social Inclusion	SAAF	Institut d'Economie Rurale, Laboratoire Central Veterinaire, Direction Nationale des Services Vétérinaires (DNSV), Ministère de l'Agriculture, Université de Bamako
EA	Tanzania	Mixed crop-livestock systems; pastoral systems; aquaculture and fisheries	Productivity+; Market Systems; Policy Solutions and Scaling; Climate and the Environment; Gender, Youth, and Social Inclusion	SAAF, Multifunctional Landscapes, Policy Innovations, Scaling for Impact, Digital Transformation	Tanzania Livestock Research Institute (TALIRI), Sokoine University of Agriculture (SUA), Ministry of Livestock and Fisheries (MLF), TAMISEMI, Tanzania Fisheries Research Institute, agribusiness incubators, private sector (e.g., Silverlands, AKM Glitters)
EA	Uganda	Mixed crop-livestock systems	Productivity+; Market Systems; Policy Solutions and Scaling; Gender, Youth, and Social Inclusion	SAAF	National Agricultural Research Organisation (NARO), Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF), Ministry of Health (MoH), National Animal Genetic Resources Centre and Data Bank (NAGRC & DB), Makerere University
SEA	Vietnam	Mixed crop-fish-livestock systems	One Health; Productivity+; Climate and the Environment; Gender, Youth, and Social Inclusion	SAAF, Better Diets and Nutrition	National Institute of Veterinary Research (NIVR), National Institute of Animal Science (NIAS), Hanoi University of Public Health Vietnam, Vietnam One Health University Network (VOHUN), private seed sector, agricultural universities (e.g., Vietnam National University of Agriculture [VNUA], Thai Nguyen University of Agriculture and Forestry [TUAF]), Ministry of Agriculture and Rural Development (MARD), Ministry of Health (MOH), Ministry of Natural Resources and Environment (MONRE), Vietnam One Health Partnership
SA	Bangladesh	Mixed crop-fish-livestock systems, aquaculture (marine, freshwater, and brackish) and fisheries (coastal and inland)	One Health; Productivity+; Climate and the Environment; Market Systems; Policy Solutions and Scaling; Gender, Youth, and Social Inclusion	SAAF, Climate Action, Multifunctional Landscapes	Bangladesh Livestock Research Institute, Sher-e-Bangla Agricultural University, Institute of Public Health, Bangladesh Fisheries Research Institute, departments of fisheries, Bangladeshi universities
SA	India	Mixed crop-livestock systems, aquaculture and fisheries	One Health; Productivity+; Climate and the Environment; Market Systems; Policy Solutions and Scaling; Gender, Youth, and Social Inclusion	SAAF, Climate Action, Multifunctional Landscapes	Indian Council of Agricultural Research institutes, particularly Indian Veterinary Research Institute, National Dairy Research Institute (NDRI), National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI), and Indian Council of Medical Research (ICMR); departments of fisheries
SA	Nepal	Mixed crop-livestock systems, aquaculture and fisheries	Productivity+	SAAF	Ministry of Agriculture and Livestock Development, Department of Livestock Services, Nepal Agricultural Research Council, Agriculture and Forestry University
LAC	Colombia	Mixed crop-livestock-tree systems; pasture-based systems	Productivity+; Climate and the Environment; Market Systems; Policy Solutions and Scaling; Gender, Youth, and Social Inclusion	SAAF, Multifunctional Landscapes	Agrosavia, private seed sector
LAC	Guatemala	Mixed crop-livestock-tree systems	Productivity+; Climate and the Environment; Market Systems; Policy Solutions and Scaling; Gender, Youth, and Social Inclusion	SAAF	Ministry of Agriculture and Nutrition, University of San Carlos, Asociación de Ganaderos de Izabal, private seed sector

Region	Country	District/system	Area of Work	Program and Accelerator collaboration	Partners
WA	Senegal	Pastoral and mixed crop-livestock systems	Productivity+; Climate and the Environment; Market Systems; Policy Solutions and Scaling; Gender, Youth, and Social Inclusion	SAAF, Multifunctional Landscapes	Laboratoire d'Elevage et de Recherches Vétérinaires (LNERV), Institut Sénégalais de Recherches Agricoles, Ecole Inter-Etats des Sciences et Médecine Vétérinaires, Direction des Services Vétérinaires, Ministre de l'Agriculture, de la Souveraineté Alimentaire et de l'Élevage
NA	Tunisia	Pastoral and mixed agro-pastoral systems	Productivity+; Climate and the Environment	SAAF, Multifunctional Landscapes	National Institute for Agricultural Research (IRESA), Institut des Régions Arides
SEA	Cambodia	Mixed crop-fish-livestock systems, aquaculture and fisheries	One Health; Productivity+; Climate and the Environment; Market Systems; Policy Solutions and Scaling	SAAF, Multifunctional Landscapes	Institute of Animal Health and Production Research Institute (NAHPRI), Royal University of Agriculture, CelAGrid (NGO), Inland Fisheries Research and Development Institute (IFReDI), private seed sector
WA	Ghana	Mixed crop-tree-livestock systems, aquaculture	Productivity+; Climate and the Environment; Market Systems; Policy Solutions and Scaling; Gender, Youth, and Social Inclusion	SAAF	Council for Scientific and Industrial Research (Animal Research Institute, Forestry Research Institute, Water Research Institute), University for Development Studies, Fisheries Commission (NGOs)
NA	Egypt	Aquaculture	Productivity+; Climate and the Environment; Gender, Youth, and Social Inclusion	SAAF, Climate Action, Multifunctional Landscapes	Central Laboratory for Aquaculture Research; private sector, including feed companies (e.g., Skretting) and farmers
WA	Nigeria	Aquaculture and fisheries	Productivity+; Climate and the Environment; One Health; Gender, Youth, and Social Inclusion	SAAF, Climate Action, Multifunctional Landscapes	Departments of fisheries, International Institute of Tropical Agriculture (IITA), local universities
SEA	Malaysia	Aquaculture and fisheries	Productivity+; Climate and the Environment; One Health; Gender, Youth, and Social Inclusion	SAAF, Climate Action, Multifunctional Landscapes	Departments of fisheries, local universities
SCA	Zambia	Aquaculture and fisheries	Productivity+; Climate and the Environment; One Health; Market Systems, Policy Solutions, and Scaling; Gender, Youth, and Social Inclusion	SAAF, Climate Action, Multifunctional Landscapes	Department of Fisheries, local universities, Natural Resources Development College

8. Boundaries and linkages with other components of the Portfolio

8.1. Boundaries with other components of the Portfolio

SAAF focuses on the supply of healthy nutrient-dense foods from sustainable animal and aquatic production systems. It differs from Sustainable Farming, Multifunctional Landscapes, Climate Action, and Policy Innovations by having a more specific focus on animal and aquatic food systems versus whole-farm, multifunctional landscape, or system-wide contexts. Both SAAF and the Breeding for Tomorrow and Genebanks Program include genetic improvement activities. SAAF will focus on the genetic improvement of animal and aquatic species, forage, and feed-food crops improvement through selection and scaling of improved forages and feed-food crops, while breeding of forages such as *Urochloa* and *Megathyrsus* and feed-food crop barley will be through Breeding for Tomorrow and Genebanks. Better Diets and Nutrition focuses on the consumption of animal and aquatic foods, while SAAF addresses their supply by fostering inclusive, healthy, and nutrient-dense food supply chains that are climate and environmentally friendly.

8.2. Linkages across the Portfolio

Breeding for Tomorrow and Genebanks and SAAF will work together to (1) develop joint positions on access and benefit sharing of genetics resources as well as responsible use of genetic innovations; (2) influence policy; (3) develop seed policy, including for forages and feed-food crops; (4) undertake market assessments for breeding programs, including for animals, aquatic species, and forages, through contextualization of existing crop-oriented tools; and (5) jointly negotiate with genotyping service providers for cost savings.

Better Diets and Nutrition and SAAF will collaborate to improve the safety, appeal, and sustainability of animal and aquatic foods in diets. This partnership builds on SAAF's One Health work in food safety and Better Diets and Nutrition's focus on healthier diets through the food environment and demand-driven innovations. Joint efforts will (1) explore sustainable production practices, (2) assess the environmental impact of nutrient-dense diets, (3) examine trade-offs between nutrient adequacy from AAF systems and their cost; (4) facilitate the incorporation of safe animal and aquatic foods into the diets of producing households, many of whom otherwise sell this food; and (5) present a balanced narrative on AAF systems in healthy, sustainable diets.

Climate Action and SAAF will collaborate to create policies, increase investments, and develop innovations that help food system actors adapt to climate change, become more resilient, and reduce emissions. SAAF uses tailored information on climate impacts and hotspots from Climate Action to inform the development of sector-specific solutions. In turn, SAAF provides up-to-date assessments and monitoring tools for the environmental impacts of diverse SAAF systems and innovations for Climate Action to include in databases, syntheses, and advocacy campaigns.

Multifunctional Landscapes and SAAF will collaborate on integrating and evaluating SAAF innovations in multifunctional landscapes, considering socioeconomic, environmental, and biodiversity outcomes. Such innovations include those for One Health, increased animal and aquatic productivity and reduced emissions, soil and water conservation, and business and market models. Recommendations will feed back to SAAF for improvement and contextualization of innovation bundles. The two Programs will also co-develop monitoring tools and improve the enabling environment of animal and aquatic food systems through joint national and global influence.

Sustainable Farming and SAAF will collaborate on evaluating innovation bundles developed for animal and aquatic food producers under SAAF when integrated into different whole-farm contexts, which is the focus of Sustainable Farming. The generated evidence will also inform whole-farm prioritization and decision-support tools being designed under Sustainable Farming, which SAAF can later capitalize on.

Policy Innovations and SAAF will collaborate to ensure an accurate representation of aquatic and animal foods in global food systems modeling and policy analysis. This will involve enhancing the aquatic and animal components within the country and global economic models managed by Policy Innovations. Furthermore, the market-led transformation work under Policy Innovations, which focuses on co-designing and evaluating bundled technology, institutional, and policy innovations, aligns with SAAF's efforts in co-designing institutional and behavioral models for technology delivery. Both Programs will benefit from sharing methodologies and approaches to innovative packaging design and evaluation.

Digital Transformation and SAAF will work to ensure that digital innovations across different AoWs are co-designed using human-centered design principles, are inclusive, and bring global best practices to the software development process. To operationalize this, Digital Transformation and SAAF will identify a set of use cases. While Digital Transformation aggregates and makes available capacities necessary to design and deploy scalable and inclusive digital innovations, SAAF brings the necessary contextual understanding of the use case, including limitations, local partnerships, and necessary domain expertise.

Gender Equality and Inclusion and SAAF have aligned issues on empowerment, norms, and youth through the SAAF AoW on Gender, Youth, and Social Inclusion. SAAF innovations and evidence specific to animal and aquatic food systems will contribute to the agrifood system analysis of Gender Equality and Inclusion. Reciprocally, SAAF will benefit from the work of Gender Equality and Inclusion in terms of tools, approaches, and evidence.

Scaling for Impact and SAAF will collaborate to co-design and implement scaling strategies to integrate animal and aquatic food solutions into broader agrifood systems. Multistakeholder scaling hubs and the Innovation Packaging and Scaling Readiness (IPSR) approach will help prioritize innovation packages and ensure contextualized scaling strategies. This partnership will also generate evidence that informs policy, catalyzes investments, and drives market system transformations while addressing scaling barriers such as capacities, incentives, and the enabling environment. By combining expertise in sustainable food production with scaling methodologies, the collaboration contributes to CGIAR's 2030 outcomes and achieves large-scale impact.

Capacity Sharing and SAAF will foster South–South triangular collaboration in sharing knowledge, best practices, technologies, and innovations in animal and aquatic food systems. It aims to advance institutional and system capacities for development of One Health systems and the use of advanced genetic tools for breed improvement. This partnership will co-design and co-develop leadership and soft techniques and skills training for NARES, CGIAR, and partners to efficiently manage and sustain research innovations and technologies. It will also co-design joint research on policy engagement and advocacy with NARES and agricultural sector partners.

The mechanisms underlying all of these linkages are the sharing of expertise, appointment of joint staff members, co-investment in joint activities, and co-location.

9. Monitoring, evaluation, learning, and impact assessment (MELIA)

The 2025–30 cycle will feature a coordinated approach for MELIA across funding sources in the Portfolio, with greater uniformity in processes, capacities, data management practices, and the use of results to measure progress. A minimum level of reporting into the CGIAR Performance and Results Management Framework will be established for bilaterally funded projects.

Detailed Program MELIA plans will be developed during the Inception Phase, once system-level MELIA principles and indicators are further advanced.

9.1. Monitoring, evaluation, and learning (MEL)

The Program theory of change provides a framework for MEL activities by outlining the steps and assumptions to achieve outcomes and guiding the identification of indicators, monitoring strategies, evaluation criteria, and learning processes. In addition to the Program and AoW theories of change, stakeholders and partners co-create site-level theories of change for key Program locations. These nest upwards to the Area of Work and program-level ToCs (Figure 5.1). The site-level ToCs (1) ensure common vision and alignment of outcomes; (2) facilitate cohesion across the AoWs, including elements funded by bilaterals; (3) facilitate identification of context-specific assumptions; and (4) ensure necessary partners and actors are included. The site-level ToC approach was tested under the SAPLING Initiative and found to be extremely successful.

Yearly joint reflections on the ToCs at Program, AoW, and site level allow us to monitor progress and practice adaptive management. Learning across Program sites will be facilitated by lessons gathered from reflections on site-level ToCs.

The Program will establish a core MEL team as well as MEL focal points for each Area of Work, key program sites, and major bilateral projects. This will ensure that MEL activities are embedded in Program activities rather than treated as additional tasks. MEL activities will be resourced through a core MEL budget and budgets at Area of Work and bilateral levels.

9.2. Impact assessment (IA)

The impact assessment strategy for SAAF is designed to produce robust empirical evidence on the Program's contribution to CGIAR's Impact Areas, with a focus on evaluating long-term and large-scale impacts. This strategy will establish clear objectives, research questions, and testable hypotheses aligned with the Program's ToC. This approach will guide the identification of key outcomes to be assessed in terms of economic, social, and environmental benefits.

The strategy incorporates methodologies for leveraging monitoring data while using both counterfactual and theory-based methodologies to validate the ToC. This includes experimental, quasi-experimental, and observational data to underpin causal inferences. IAs will rigorously evaluate the effectiveness of implementation, such as ensuring that SAAF technologies benefit intended populations, governance reforms increase equity, and improved practices do not exacerbate inequities, including those related to gender and exclusion. Impact assessments will be aligned with significant Program achievements, conducting meta-analyses across specific countries or regions and disaggregating impacts by gender, age, and other key demographics. These assessments will estimate the tangible economic, social, and environmental benefits derived from the Program's outputs and interventions, taking into account contextual factors that influence effectiveness.

The IA strategy will cover geographies, timeframes, scales, and populations of interest, facilitating cross-program learning, data sharing, and meta-analysis. Internal resources are essential for effective data collection and evaluation use, while external collaboration will help to ensure independence and methodological rigor. A structured and dedicated impact assessment team will be established across the Areas of Work, ensuring coordination with the Standing Panel on Impact Assessment to maintain consistency and leverage shared insights.

10. Capacity sharing

Capacity sharing is embedded in the way SAAF works and its theory of change, with many of the AoW outcomes focused on capacity development. Partners are involved at all stages of the implementation and work together with CGIAR researchers in co-design processes. This ensures that roles are complementary and solutions are appropriate, sustainable, and scalable.

There are four pathways for capacity sharing: (1) co-design of interventions and hand-in-hand work with national partners; (2) South–South collaboration and triangular cooperation; (3) capacity development programs for young career researchers; and (4) capacity sharing with policymakers, investors, and other decision-makers. We will work with NARES, government agencies, small and medium enterprises, entrepreneurs, food vendors, community groups, digital groups, and agriculture technology and data agencies.

Capacity sharing builds on past and ongoing efforts and interactions initiated in CGIAR Initiatives and bilateral programs. A major component of AoW 6.1 (Productivity+) is working with national Centers of excellence in genetic breeding and livestock and aquatic production to strengthen the use of advanced genomic tools in breeding-related work. AoW 6.1 also works on disease diagnostics, biosecurity, and awareness raising on access and benefit sharing of genetic resources.[131] South–South exchange and triangular cooperation is a main component of these efforts. This includes work between Asia and Africa in the African Dairy Genetic Gains project[132] and the Asia-Africa blue tech superhighway. SAAF will work with advanced research institutes in the Global North for advanced genetics research that cannot be done elsewhere.

AoW 6.2 (Climate and the Environment) works with community groups and farmers on locally led adaptations with Adaptation Pioneers.[133] It works to strengthen smallholder farmers' capacity to diversify forage-based livestock systems in order to improve climate resilience and reduce emissions, and it sensitizes aquaculture producers to climate change and climate impacts. It also engages in capacity sharing with national policymakers and government agencies on how to adapt national livestock and fisheries policies to support climate change efforts and develop tools for GHG inventories, while estimating uncertainty with partners in the Global North and national partners.

AoW 6.3 (One Health) focuses on (1) building up institutional capacity to strengthen integrated One Health networks within countries for more coordinated responses to outbreaks and disease control, and (2) providing food safety training and awareness raising with small informal market vendors, national laboratory technicians[134,135] and developing materials, manuals, and training events on AMR for farmers, fishers, and communities.[136, 137]
AoW 6.4 (Market Systems, Policy Solutions and Scaling) will focus on two areas of capacity development: (1) building on incubation and entrepreneurship mentoring training workshops that help scale solutions and link small and medium enterprises and financers to SAAF solutions, and (2) work with farmers, fishers, and community groups on business training and decision-support tools.[138]
AoW 6.5 (Gender, Youth, and Social Inclusion) works with international NGOs (e.g., Care, SNV, Oxfam) to scale gender-appropriate solutions.[139,140] GYSI has developed tools (Women's Empowerment in Livestock Index and the FISH gender integration tools) that support capacity building for local partners. GYSI will also work with local women's groups, fishers, and farmers on gender norms training using tools such as community conversations.[141]
AoW 6.6 (Data and Digital Solutions) will co-generate data and knowledge management platforms for national partners,[142,143] particularly national research and meteorological institutes. It will also train development partners, NGOs, and startups on using digital data collection tools. This will include training on data management, FAIR data practices, and data ontologies for animal and aquatic food systems.

SAAF will take advantage of CGIAR Center capacity development, which supports master's and PhD fellows to develop their scientific skills. The CapDev Grand Challenge from the International Livestock Research Institute (ILRI) is a year-long program for academics and fellows that involves developing researchers' skills to carry out systems-based research for development. The fellowship program at ILRI also gives academic and national scientists access to ILRI's research facilities, where they are mentored by senior scientists while contributing to advanced research work, and provides benefits that do not discriminate against women or those with families.

11. Gender and social inclusion

Challenges and prioritization

Inequalities in animal and aquatic food systems are deeply rooted and expected to grow over the next decades as the impacts of climate change negatively impact the most marginal sectors of society. Gender inequalities are the most widespread worldwide and intersect with other forms of discrimination (e.g., age, ethnicity, religion, socioeconomic status) that exacerbate the disadvantages of marginalized groups. Yet these groups depend most heavily on AAF systems for their livelihoods, as input suppliers, producers, traders, processors, value chain actors, and consumers.

Two-thirds of the developing world's rural livestock keepers are women; women comprise half of all people involved in post-harvest processing, transporting, trading, and selling fish, and 45% of all those in subsistence fisheries. This is too many people to be ignored. Youth are significantly underrepresented in the production and business sectors of AAF systems. If women, youth, and marginalized groups are disempowered and lack access to social-technical innovations, finance, and knowledge, they will be unable to effectively participate in or benefit from these systems; these systems, in turn, will cease to thrive.

Achieving gender equality and empowering women and youth are essential for progress toward thriving AAF systems, as well as toward SDG5. While AAF systems have been shown to offer unique potential to support the empowerment of women, youth, and marginalized groups, disadvantages based on gender, age, and other individual characteristics continue to limit the benefits they can gain from these systems.

In SAAF, we aim to develop technological and socio-institutional innovations that enable women, youth, and marginalized groups to progress toward gender equality and AAF systems to thrive. This work is led by the Gender, Youth, and Social Inclusion (GYSI) Area of Work.

Knowledge base: A focus on empowerment to counteract disadvantage

CGIAR has done much to show how AAF can support empowerment. We build on this research and expand to new areas of empowerment that need further research: (1) the psychological and relational dimensions of empowerment (as in a recent study in Ethiopia[144]); (2) the role of AAF systems in building women's empowerment in fragile contexts; (3) the role of collective action for empowerment; (4) employment and empowerment, particularly in informal markets for milk and aquatic foods; (5) work burden and the unpaid economy; (6) the role of the digital revolution in empowerment; (7) how social protection mechanisms and packages enable empowerment and resilience; and (8) the power of access and use of social-technical bundles and related resources.

We focus on the conducive social and gender norms that are the basis of empowerment. Previous research by AAF systems partners has shown the cultural norms that most strongly affect equality in these systems, how such norms are maintained, and their influence on empowerment. We build on this work and continue to explore (1) the best approaches for studying norms and how they evolve; (2) how various determinants of inequality collectively shape norms; (3) the impact of these norms on empowerment; (4) the most effective approaches to addressing restrictive norms to foster a more supportive environment; (5) the mechanisms by which individual changes in attitudes lead to behavioral shifts; and (6) how we scale to larger communities and achieve a tipping point that results in broad changes in social norms. This knowledge helps us leverage AAF system interventions to effect changes in equity and livelihoods and make AAF systems more functional. Such changes will result from innovation bundles: combinations of technical innovations that respond to the needs of all, and socio-institutional innovations that address disempowerment. To this aim, the GYSI Area of Work leads strategic work on empowerment and norms and coordinates integration of equality considerations across the other Areas of Work; it identifies bundles of innovations that are most effective in moving toward equitable AAF systems.

Research questions

Overall, the GYSI work in SAAF aims to understand how AAF systems support gender, youth, and social equality and how gender, youth, and social equality, in turn, support thriving AAF systems. Detailed research questions are included in Section 6.5.

Results and ToC

GYSI will mitigate the disadvantages faced by women, youth, and marginalized groups by removing constraints on access to resources (e.g., employment opportunities and training). GYSI responds to the preferences of these groups (e.g., for animal and aquatic breeds and forage crops) and leverages available opportunities such as new technologies and markets. The expected outputs are gender and youth-responsive innovations that are more likely to be adopted by producers and attract the attention of private and public investors. This will result in communities adopting more resilient practices and policymakers developing more equitable policies.

Access to innovations and opportunities, together with our intentional, strategic empowerment work, is expected to support the empowering efforts of women, youth, and marginalized groups in terms of (1) new jobs in AAF systems; (2) leadership roles; (3) engagement in profitable value chain nodes; and (4) reduced women's work burden. We leverage transformative approaches so that households, communities, and system actors, including decision-makers and funders, adopt behaviors that enable empowerment processes that benefit women, youth, and marginalized groups. Taken together, we expect the livelihoods of the most marginalized in AAF systems to improve. This contributes to SAAF's progress toward social and inclusion Impact Area targets.

12. Climate change

Climate change is threatening animal and aquatic food systems in the low- and middle-income countries of Africa, Asia, and Latin America and the Caribbean. Rising temperatures, ocean acidification, and changing precipitation patterns are altering AAF system habitats and livestock, fisheries, and aquaculture productivity. Climate-induced stressors such as heatwaves reduce livestock productivity by affecting animal health and increasing mortality rates.[145] Extreme weather events (floods and droughts) disrupt feed and forage supply chains and increase the incidence of pests and diseases.[146] In fisheries, rising water temperatures and changes in dissolved oxygen are shifting fish distribution and contributing to collapse, affecting the livelihoods of millions dependent on these resources.[147] There are also economic risks. As AAF systems face increasing impacts, the cost of maintaining production increases, especially for small-scale farmers and fishers, women, youth, and marginalized groups, leading to reduced food security and increased poverty in regions already facing significant challenges.

AAF systems have a significant impact on the climate via greenhouse gas emissions and land use change (e.g., deforestation). Livestock production is a major source of methane, primarily through enteric fermentation in ruminants. Manure management and the use of synthetic fertilizers in feed production contribute to methane and nitrous oxide emissions. Aquaculture, while generally considered to have a lower carbon footprint,[148] contributes to climate change through energy-intensive practices, feed production, and the release of methane and nitrous oxide from ponds. Both land and water use for AAF production can lead to deforestation, habitat destruction, and biodiversity loss. However, some systems (farming bivalves and seaweeds) produce highly nutritious foods with minimal inputs, offering some of the most sustainable opportunities for enhancing food and nutrition security.

Strategies and mitigation efforts

A multipronged approach to AAF systems aims to enhance adaptive capacity and resilience while reducing emissions and expanding the production of low-input systems. This involves the following:

1. **Research and monitoring.** SAAF will intensify research on climate impacts specific to AAF systems in targeted geographies by examining the effects of changing and extreme weather on animal/fish health, feed and forages availability, and aquatic ecosystems using advanced modeling techniques to predict weather and climate scenarios and their potential impacts. The data will inform proactive adaptation strategies. We will also generate data on GHG emissions from AAF systems.
2. **Development of climate-resilient practices.** SAAF will develop and scale up climate-resilient practices and innovations (from gene to landscape level) tailored to the needs of regions, production systems, and livelihoods. For livestock, this includes heat-tolerant breeds, drought/flood-tolerant and low-emission forages, improved animal shelters and housing, and enhanced feed and forage efficiency. In aquatic systems, this includes adaptive fish breeds and farming practices, low-carbon mariculture and aquatic plant species, integrated agriculture-aquaculture systems, and sustainable feeds.
3. **Mitigation with adaptation co-benefits.** SAAF will develop mitigation innovations with adaptation co-benefits[149] by improving feed efficiency in livestock with improved forage and management practices to enhance productivity and carbon capture and reduce emissions. Similarly, sustainable aquaculture practices and fisheries management can sequester carbon and reduce the overall carbon footprint of food production. By co-developing AAF systems innovations and corresponding business models with strong mitigation and adaptation co-benefits, SAAF can inform impactful climate finance decisions.

Capacity building and knowledge sharing

SAAF will leverage partnerships with national innovation systems, private sector actors, and local communities to build capacity for climate-resilient AAF systems. This includes training programs on managing climate risk, adopting climate-smart practices, and integrating local knowledge and resources with scientific research. Capacity-sharing efforts are designed to empower women, youth, and marginalized people to counter inequities in climate vulnerability. Our 2030 goal is to make available to 500 million users the knowledge and tools needed to adapt to climate change.

Policy advocacy and implementation

SAAF will advocate for policy changes at national and international levels. We will work with governments to develop and implement policies that promote sustainable and resilient AAF systems. This includes advocating for incentives that encourage climate-smart practices and the inclusion of animal and aquatic foods in broader climate adaptation and mitigation strategies, including Nationally Determined Contributions and National Action Plans.

13. Risk management

Risks will be finalized and mitigation actions will be developed as part of the risk management plan during the Inception Phase.

The Program has considered risks with the most harmful effects on projected 2030 outcomes (Table 13.1). These are also based on the mapped initiative risks. Mitigation strategies will be elaborated during the program initiation phase with a more detailed risk assessment.

Table 13.1. Preliminary risks identified at proposal stage

Risk title (summarized statement)	Risk statement, including potential event, sources, and consequences for objectives
Risk 1 Species collapse	A collapse of one or more animal or aquatic food species caused by an epidemic would result in reduced productivity and profitability of farmers and fishers, less nutrient-dense food, sicker animals and aquatic species, and damage to climate and environmental resilience.
Risk 2 Global recession	A global recession would limit direct investment in some animal and aquatic food sources owing to their long and expensive production timelines, niche markets, or limited farmer/fisher purchasing power. This would result in limited input and service provider participation, reducing their ability to scale innovations.
Risk 3 Immature innovations	Past CGIAR and donor investment in animal and aquatic foods resulted in limited mature innovations able to increase the productivity and profitability of farmers and fishers, the supply of nutrient-dense foods, the production of healthy animals and aquatic species, and climate and environmental resilience within the Science Program budget. This would result in unscalable/ incompletable supply-driven innovations by 2030.
Risk 4 Insufficient data	The unwillingness of a national government and producers to share accurate or potentially embarrassing data on animal and aquatic food diseases, production, profitability, and genetic diversity would result in neighboring and regional decision-makers lacking the information needed to contain disease outbreaks, avoid species inbreeding, incentivize market actors, and reduce greenhouse gas emissions.
Risk 5 Changes in government	A change in societal values brought about by the election of a very conservative government in a SAAF priority country could result in a society unwilling to modify existing social norms by 2030, thereby reducing the productivity and profitability of farmer and fisher households.

14. Funding sources

Bilateral/W3 funding

The 18 bilateral/W3 projects initially mapped to the Sustainable Animal and Aquatic Foods Program represent USD $82 million (Table 14.1) from 10 donors. Half of this funding comes from the UK Foreign, Commonwealth and Development Office. Four of the five contributing Centers have bilateral projects mapped to the Program. One bilateral project funded by Bezos Earth Fund and BMGF (Anti-methanogenic Feedstock for Livestock in Global South) contributes US$19 million to Alliance Bioversity– CIAT, ILRI, and ICARDA.

Bilateral mapping at the Area of Work level shows significant bilateral funding for Productivity+, Climate and the Environment, One Health, and Markets Systems, Policies and Scaling. On the other hand, Gender, Youth and Social Inclusion, and Data and Digital Solutions will need to raise additional funding to implement planned activities.

Some of the projects in Table 14.1 are also mapped to other CGIAR Programs and Accelerators, including Multifunctional Landscapes (2 projects), Breeding for Tomorrow and Genebanks (4 projects), the three Accelerators (3 projects each), and Better Diets and Nutrition, Climate Action, and Scaling for Impact (1 project each). Sustainable Animal and Aquatic Foods will closely coordinate with all these Programs and Accelerators (see Section 8).

Table 14.1. Bilateral/W3 projects and programs mapped to the Sustainable Animal and Aquatic Foods Program

Project/program title	Lead CGIAR Center	Funder	Duration	Expected 2025–30 funding USD ('000)	Relevant Program Areas of Work, if known
F-AG10607-Asia-Africa Bluetech Superhighway Project (Coast)	WorldFish	United Kingdom Foreign Commonwealth & Development Office (FCDO)	74 months	43,271	Productivity+
L-BMG026-CGIAR Livestock Partnership	ILRI	BMGF-Bill & Melinda Gates Foundation	9 months	12,481	Productivity+, One Health and Markets Systems, Policies and Scaling
F-PP-2022-1020-Climate-Resilient Aquaculture Systems for Africa	WorldFish	BMGF-Bill & Melinda Gates Foundation	48 months	11,179	Productivity+ and Climate and the Environment
L-EUR022-EU Support to sustainable Livestock system in Ethiopia	ILRI	European Commission	43 months	8,398	Productivity+, Climate and the Environment and One Health
L-UOE012 Centre for Tropical Livestock Genetics and Health	ILRI	BMGF and FCDO	32 months	7,974	Productivity+
BIUSA (BEF) – Screening, Developing and Deploying anti-methanogenic feedstock into livestock systems in the Global South	ABC	Bezos Earth Fund		6,335	Climate and the Environment
BMGF – Anti-methanogenic Feedstock for Livestock in Global South	ABC	BMGF-Bill & Melinda Gates Foundation	45 months	6,127	Climate and the Environment
L-BMZ002-One Health Research, Education and Outreach Centre	ILRI	Germany-BMZ-German Federal Ministry for Economic Cooperation and Development	12 months	5,995	One Health
L-KOR025- Improving Human Health Through Sustainable Value Chains in Human-Animal-Environmental Interactions Using ICT in Vietnam infection	ILRI	Korea-MAFRA-Ministry of Agriculture, Food and Rural Affairs	12 months	4,837	One Health and Data and Digital Solutions
F-AG10578-Dev. & Scaling of Sustainable. Feeds for RAqFS in Sub-Saharan Africa	WorldFish	Norway-NORAD-Norwegian Agency for Development Cooperation	30 months	3,565	Productivity+
L-MML008-Fleming Fund Country Grant for Kenya Phase 2	ILRI	The Fleming Fund	14 months	3,418	One Health

Project/program title	Lead CGIAR Center	Funder	Duration	Expected 2025–30 funding USD ('000)	Relevant Program Areas of Work, if known
L-CIA024-Anti-methanogenic Feedstock for Livestock Systems in Global South	ILRI	BMGF-Bill & Melinda Gates Foundation	45 months	3,135	Climate and the Environment
L-EUR021-Capacitating One Health in Eastern and Southern Africa	ILRI	EC-European Commission	12 months	3,030	One Health
L-MML007-Antimicrobial Resistance and One Health, including Animal Health, the Environment and Practitioner Engagement Eastern and Southern Africa	ILRI	Euroconsult Mott MacDonald	12 months	2,250	One Health
D-200375-ICARDA – Screening, developing and deploying anti-methanogenic compounds	ICARDA	CIAT-International Center for Tropical Agriculture	43 months	2,159	Productivity+ and Climate and the Environment
D-200385-BMGF – Anti-methanogenic feedstock for livestock	ICARDA	CIAT-International Center for Tropical Agriculture	45 months	2,095	Climate and the Environment
F-AG10582-Technologies for African Agri Transformation Phase	WorldFish	AfDB-African Development Bank	27 months	1,282	Productivity+ and Markets Systems, Policies and Scaling

High-level breakdown of pooled funding by Area of Work

Table 14.2. High-level breakdown of pooled funding by Area of Work in 2025, baseline scenario (USD '000)

Area of Work	Pooled funding amount
Cross-cutting (MELIA, etc.)	$3,308
AoW 1 Productivity+	$13,116
AoW 2 Climate and the Environment	$2,342
AoW 3 One Health	$4,684
AoW 4 Markets Systems, Policy Solutions, and Scaling	$2,300
AoW 5 Gender, Youth, and Social Inclusion	$1,866
AoW 6 Data and Digital Solutions	$758
Total	**$28,374**

A variety of **assets** support the work across the different AoWs. These include biophysical assets and facilities such as laboratories, genebanks, biorepositories, hatcheries, fish rearing facilities, aquaculture stations, farms, and animal care facilities, primarily used by the Productivity+, Climate and Environment, and One Health AoWs. These assets will require funding for new equipment, maintenance, and other operational needs. Additionally, digital assets such as databases, repositories, data management systems, digital platforms, and cloud/server infrastructure, used by all AoWs, will need investment for updates, ongoing development, maintenance, and licensing fees. Both pooled and bilateral funding will contribute to these efforts.

Annex: Pooled funding

For each AoW, Tables A.1–A.6 provide proposed activities, geographies, linked bilaterals, and Science Programs and Accelerators.

For Productivity+, there are 12 activities of which 4 are new or mostly new activities. The activity with the largest budget within Productivity+ relates to genetic improvement programs for animal and aquatic species (USD 4,390,000), as this budget includes USD 3,183,000 in funds specifically for the sub-activities African Dairy Genetics Gains and Tropical Poultry Genetics Solutions (via targeted funding from the Bill and Melinda Gates Foundation). The newer activities involve technologies and models for conservation of animal and aquatic food biodiversity, risk mapping for climate-sensitive diseases, and a risk-based approach to disease control; functional (fortified and acceptable) animal and aquatic foods; and supporting animal and aquatic food producers to adopt contextualized combinations of innovations. These newer activities are targets for additional funding under the surge budget. Many Productivity+ activities have linked bilaterals, and in these cases the pooled funding will target species or sites outside of the bilateral funding.

For Climate and the Environment, there are 10 activities of which 2 are relatively new. These focus on forage biodiversity and management options for mitigation and resilience in SAAF, including anti-methanogenic feeds, and adoption of climate-adaptive, nature-based aquaculture and silvopastoral systems (seaweed, bivalves, etc.). The latter is a target for surge funding along with additional assessments of carbon, land, and water footprints and further development of monitoring, reporting, and verification systems for GHG emissions and carbon capture. Continuing work is foundational in that it builds on previous activities in specific countries where there are demands. This includes index-based livestock insurance and engagement and business models for climate financing.

For One Health, there are six activities, with a new activity called Operationalizing One Health and a mostly new activity on prevention and control of zoonoses. Operationalizing One Health is a key target for surge funding that will develop business cases to promote One Health investment, implementation, and scaling. New areas of zoonosis prevention and control will see more work on wildlife, which will contribute to an improved understanding of the role of wildlife in food systems and how to better manage the benefits and risks. Another new area is the use of living labs to study health, ecological, and climate risks in the context of climate-resilient food systems. The final two new activities are analyzing the success and failure of food safety interventions in traditional markets and studying disease control and AMR in integrated systems of livestock and fish. Most activities have linked bilateral projects and build on long-standing partnerships in the countries and regions where the activities take place.

For Markets Systems, Policies, and Scaling**,** there are 11 activities, both new and continuing. New activities are (1) SAAF information gap assessment and market system diagnosis; and (2) identification of market and policy needs for decision support tools and studies to understand the uptake of decision support tools and policy integration. This AoW also builds on partnerships with government agencies and the private sector that were established in the research Initiatives. Activities in this area will also directly link to the Policy Innovations Program and the Scaling for Impact Program. Surge funding would allow for expanding the work to additional countries, value chains, and commodities.

For Gender, Youth, and Social Inclusion, 11 activities make up the research, from targeted diagnosis and baselines to testing of interventions for empowerment of women and youth, and conducive norms; to policy engagement; to testing of technological and socio-institutional bundles; and to scaling. Endline and meta-analysis will not be done in 2025. Most activities build on previous work and expand both research on and testing of interventions based on lessons learned. Youth and policy (which are more emphasized than previously), scaling (a new area), and further testing of promising interventions are targets for surge funding. All activities will foster cohesion within SAAF by collaborating with other AoWs and linking to the work of the Gender Equity and Inclusion Accelerator.

Digital and Data Solutions has 13 activities (including 3 new ones). Many are linked to bilaterals, but it is expected that this AoW will be entrepreneurial and leverage pooled funding to develop new proposals and funding opportunities, as digital and AI-related activities have the potential to draw in more funding. Much of this work depends on pooled funding and fosters cohesion within SAAF by collaborating with other AoWs as well as links to the work being done in the Digital Transformation Accelerator. A key aspect of this will be designing an integrated information system for SAAF.

Table A.7 shows the partners we will be working with in specific countries and to which we will potentially allocate funds. This diverse mix of partners includes national research institutes and universities, government agencies, NGOs, cooperatives, and some private sector entities.

Building on CGIAR Research Initiatives

SAAF builds on the work of several CGIAR Research Initiatives and bilateral projects and programs. Below is a summary of the research initiative activities that will be continued under SAAF, what might be discontinued, and new areas of inquiry.

Initiative on Sustainable Animal Productivity for Livelihoods, Nutrition, and Gender Inclusion (SAPLING)

SAPLING aims to help transform livestock sectors in target countries to make them more productive, resilient, equitable, and sustainable. It works on 15 livestock value chains in seven countries in East Africa (Ethiopia, Kenya, Tanzania, Uganda), West Africa (Mali), Southeast Asia (Vietnam), and South Asia (Nepal).

SAAF will build on the SAPLING Initiative by (1) continuing and strengthening the approaches to stakeholder engagement and co-design from the onset; (2) the use of site-level theories of change to contextualize solutions and monitor change; (3) integrating existing and co-designing new feed, health, and genetics solutions with input and service delivery to enhance productivity; (4) ensuring market competitiveness of livestock keepers and other market actors; (5) facilitating inclusiveness and the empowerment of women, youth, and marginalized groups, including through job creation; (6) undertaking policy and engagement work for increased investment by the public and private sectors and a more enabling environment; (7) contextualizing innovation packages and scaling approaches for different production systems; and (8) building the capacity of a range of partners. With Better Diets and Nutrition, SAAF will build on SAPLING approaches for using safe animal-source foods within producing households.

Areas not well addressed under SAPLING that will be strengthened through SAAF include (1) ensuring animal and aquatic food production enterprises are productive and profitable; (2)

reducing emissions; (3) increasing the nutrient density of animal and aquatic foods as part of production practices (feeding); (4) conserving animal and aquatic species biodiversity, including through in vitro approaches; (5) conducting risk mapping for climate-sensitive diseases and a risk-based approach to disease controls; (6) considering animal and aquatic food production, One Health, and Climate and the Environment more holistically; and (7) thinking beyond the animal food value chains (the focus of SAPLING) to whole-farm, landscape, and system levels (including in collaboration with other Programs).

Within SAAF, work on SAPLING's existing livestock value chains will continue and expand, incorporating the new elements described above. For some value chains, new sites within countries may be selected, and new partnerships may be required for additional expertise. SAAF will have fewer assessments and more action research in comparison with SAPLING (as there is already a strong understanding of the focal value chains and systems).

Initiative on One Health

The One Health Initiative aims to show how a One Health approach – which recognizes the interconnections between people, animals, plants, and their shared environment – can help manage zoonotic diseases, improve food and water safety, and reduce antimicrobial resistance, leading to better human, animal, and environmental health. One Health works in seven countries across Asia and Africa.

Under the One Health AoW, we will continue to develop integrated zoonotic disease surveillance tools and food safety interventions for traditional markets; quantify foodborne disease risk and the use of antimicrobials in animal and aquatic food production; and investigate the role of water in disease transmission. Through this portfolio of work, we will continue to generate evidence of One Health risks in food systems and develop solutions to prioritize, mitigate, and manage these risks.

New AoWs will include a greater focus on understanding and managing the risks of wildlife as reservoirs of emerging infectious zoonotic diseases. Food safety work will focus on identifying and scaling microbial decontamination technologies in informal market settings and supporting national and regional food safety strategy implementation. AMR research will evaluate biosecurity and vaccination strategies to reduce disease prevalence and AMU and conduct cost-benefit analyses of AMR mitigation efforts. The water research will deepen the work on watershed modeling for health risk assessment and planning for risk mitigation as well as focus on policy change and solution adoption. A completely new area will involve operationalizing One Health by generating evidence on best practices and added value to One Health and supporting investments, sustainable implementation, and integration across sectors.

Initiative on Livestock and Climate

The Initiative on Livestock and Climate addresses the challenges that climate change poses to livestock production and seeks to support livestock-dependent communities without accelerating GHG emissions or degrading land, water, and biodiversity.

We will continue using results from carbon, land, and water footprint assessments of diverse AAF systems under various climate scenarios and move beyond tool development. We will enhance monitoring, reporting, and verification systems for GHG emissions by integrating digital innovations. A key focus will remain on testing forage biodiversity and management options to support both mitigation and resilience in AAF systems. Additionally, we will scale climate-linked credit scoring and index-based insurance to unlock microfinancing and provide mitigation services for AAF producers. We will reinforce our work with new business models and financial mechanisms to mobilize climate finance, strengthen human-centric approaches for delivering weather and climate information, and evaluate the full economic costs and benefits of climate action. Sustainable animal and fish feed, resilient fish strains, and improved management practices will be developed to reduce emissions in aquaculture. Community-driven resource management for resilience and mitigation will expand across AAF systems, alongside promotion of climate-adaptive, nature-based aquaculture and silvo-pastoral systems.

Some changes include discontinuing work in conflict zones, shifting climate security toward inclusivity and vulnerability, and continuing regenerative livestock activities, particularly in rangelands, under the Multifunctional Landscapes Program.

Initiative on Aquatic Foods

The Initiative on Aquatic Foods aims to build the resilience of aquatic food systems and unlock their full potential by scaling research and innovations. It forms part of CGIAR's new Research Portfolio, delivering science and innovation to transform food, land, and water systems in a climate crisis.

SAAF will build on the progress of the Aquatic Foods Initiative, which advanced research through its Work Packages and strengthened partnerships across countries such as Bangladesh, Cambodia, Ghana, India, Kenya, Timor-Leste, and Zambia. The Aquatic Foods Initiative made notable contributions by disseminating innovations such as improved fish strains (e.g., GIFT tilapia, G3 rohu), influencing national and global policies, supporting multistakeholder platforms for inclusive governance, and expanding decision-support and digital tools for aquatic food systems. SAAF will continue these efforts, with a focus on scaling innovations that enhance productivity, environmental sustainability, and nutrition. The Program will also strengthen integration across input supply, production, and market systems while emphasizing stakeholder engagement and co-design to ensure solutions are relevant, inclusive, and impactful.

In contrast to the Aquatic Foods Initiative, SAAF will place greater emphasis on reducing emissions from aquatic foods, increasing nutrient density in production, and considering ecosystem-level resilience and biodiversity. Action-oriented research will take precedence, focusing on scaling innovations and integrating aquatic foods into national agricultural innovation systems. Some diagnostic workstreams from the earlier phase will be phased out as SAAF leverages the evidence gathered to implement practical, scalable solutions, ensuring aquatic food systems contribute to climate resilience, inclusion, and sustainability.

Table A.1. Productivity+ Area of Work proposed activities linked to ToC outputs and geographies, and linked bilaterals and Programs/Accelerators

Activity	Title / description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
1	Co-design and testing of genetic improvement programs for animal and aquatic species, linked to efficient, equitable, and affordable delivery systems, and capacity sharing	1.1	**East Africa** – Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Continuing	BMGF – CGIAR Livestock Partnership – African Dairy Genetics Gains BMGF – CGIAR Livestock Partnership – Tropical Poultry Genetic Solutions Technologies for African Agricultural Transformation	
2	Co-design and testing of conservation technologies and models for at-risk animal and aquatic species, and capacity sharing	1.1	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Mostly new	Center for Tropical Livestock Genetics and Health	
3	Co-strengthening of genomic resources for animal and aquatic species and forages, and use of these resources to identify genomic variants for ecologically, economically, and environmentally important traits, including for emissions reduction, and capacity sharing	1.2	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Continuing	Center for Tropical Livestock Genetics and Health Asia-Africa BlueTech Superhighway	Breeding for Tomorrow and Genebanks
4	Co-design and testing of innovations for feeding approaches that reduce emissions and improve feed efficiency; efficient, equitable, and affordable delivery of cost-efficient feed formulations; labor-saving feed processing; and circular economy approaches to ingredients and feeds, and capacity sharing	1.3	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Continuing	EU Support to sustainable Livestock systems in Ethiopia Technologies for African Agricultural Transformation Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Sahara Africa	

Activity	Title / description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
5	Co-design and testing of improved forage and feed-food crops through selection, as well as equitable and affordable delivery systems for forages and feed-food crops (both bred and selected), and capacity sharing	1.3	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Continuing	EU Support to sustainable Livestock systems in Ethiopia Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Saharan Africa Climate-Resilient Aquaculture Systems for Africa Anti-methanogenic feedstock for livestock systems in Global South	
6	Co-design and testing of vaccines and diagnostic tools for economically important animal and aquatic species disease, linked to efficient, equitable, and affordable delivery systems, and capacity sharing	1.4	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Continuing	BMGF – CGIAR Livestock Partnership – Transforming Animal-Health Solutions and Services for LMIC	
7	Co-design and testing of herd/ fish health management practices, including biosecurity, and capacity sharing	1.4	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Continuing	EU Support to sustainable Livestock systems in Ethiopia Climate-Resilient Aquaculture Systems for Africa Asia-Africa BlueTech Superhighway	
8	Co-design and testing of risk mapping for climate-sensitive diseases and a risk-based approach to disease control	1.4	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	New		

Activity	Title / description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
9	Co-design and testing of functional (fortified and acceptable) animal and aquatic foods, based on knowledge of nutrient deficiencies within groups of people, and capacity sharing	1.5	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Mostly new		Better Diets and Nutrition
10	Co-design and testing of approaches to support animal and aquatic food producers to adopt combinations of innovations for improved productivity and profitability, emissions reduction, and nutrient-dense foods, under different contexts, and capacity sharing	1.6	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Mostly new	Climate-Resilient Aquaculture Systems for Africa Asia-Africa BlueTech Superhighway	Sustainable Farming; Multifunctional Landscapes; Digital Transformation; Capacity Sharing; Scaling for Impact
11	With stakeholders, ensuring Productivity+ innovations and delivery systems are gender-responsive and that access to innovations and benefit sharing is equitable	1.1 1. 1.3 1.4 1.5 1.6	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt; **Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Continuing		Gender Equality and Inclusion
12	Influence of policy design and investment for a more enabling environment for adoption and scaling of Productivity+ innovations	1.1 1.2 1.3 1.4 1.5 1.6	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Mali, Nigeria; **Southern Africa –** Zambia; **North Africa** – Egypt**; Southeast Asia** – Cambodia, Malaysia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal	Continuing	Asia-Africa BlueTech Superhighway	

Table A.2. Climate and the Environment Area of Work proposed activities linked to ToC outputs and geographies, and linked bilaterals and Programs/Accelerators

Activity	Title/description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
1	Assessing carbon, land, and water footprint of diverse AAF production systems, under different climate scenarios and with/without implementation of innovation packages/system transformations	2.1 2.3 2.4	Global	Continuing	Screening, developing, and deploying preparation of anti-methanogenic feedstock into livestock systems in the Global South; Using genetic diversity to capture carbon through deep root systems in tropical soils	Climate Action
2	Development of monitoring, reporting, and verification systems for GHG emissions and carbon capture	2.1 2.2 2.4	Global	Continuing	Screening, developing, and deploying preparation of anti-methanogenic feedstock into livestock systems in the Global South; Using genetic diversity to capture carbon through deep root systems in tropical soils	Climate Action
3	Testing of forage biodiversity and management options for mitigation and resilience in SAAF	2.1 2.2 2.4	**South Asia** – India; **Latin America and the Caribbean** – Colombia, Guatemala	New	Screening, developing, and deploying preparation of anti-methanogenic feedstock into livestock systems in the Global South; Using genetic diversity to capture carbon through deep root systems in tropical soils	Climate Action
4	Scaling climate-linked credit scoring and index-based insurance to unlock green financing and provide resilience and mitigation service bundles for all AAF producers	2.2 2.3	**East and Southern Africa** – Ethiopia, Kenya, Tanzania; **Latin America and the Caribbean** – Colombia, Guatemala, West Africa	Continuing		Climate Action; Scaling for Impact
5	Human-centric design and delivery of weather and climate information services for resilient and low-emission AAF systems	2.2	**East Africa** – Ethiopia, Kenya, Tanzania; **Latin America and the Caribbean** – Colombia, Guatemala; **West Africa** – Ghana, Mali, Nigeria Senegal	Continuing		Climate Action; Scaling for Impact
6	Identification and exploration with partners of new business models and financial mechanisms to mobilize climate finance in AAF Systems	2.3	**East Africa** – Ethiopia, Kenya, Tanzania; **West Africa** – Ghana, Mali, Nigeria, Senegal; **Latin America and the Caribbean** – Colombia, Guatemala	Continuing		Climate Action

Activity	Title/description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
7	Assessment of economic costs and benefits of action and inaction for climate and the environment in AAF Systems	2.1 2.3	Global	Continuing		
8	Developing and testing of sustainable fish feed, better management practices, and resilient fish strains to reduce emissions and enhance climate-adaptive aquaculture	2.1 2.2 2.3	**East Africa** – Kenya, Tanzania; **West Africa** – Ghana, Mali, Senegal; **South Asia** – India; **Southeast Asia** – Myanmar, Vietnam	Continuing		
9	Assessment and development of community-engaged methods of resource management for resilience and mitigation, in all AAF systems	2.2 2.3 2.4	**South Asia** – India; **Southeast Asia** – Myanmar, Vietnam, Timor Leste; **East Africa** – Ethiopia, Kenya, Tanzania	Continuing		Food Frontiers and Security; Multifunctional Landscapes
10	Testing and promotion of the adoption of climate-adaptive, nature-based aquaculture and silvo-pastoral systems (seaweed, bivalves, etc.)	2.1 2.2 2.3	**South Asia** – India; **Southeast Asia** – Myanmar, Vietnam; **Pacific** – Timor-Leste; **East Africa** – Ethiopia, Kenya, Tanzania; **West Africa** – Ghana, Mali, Senegal; **Latin America and the Caribbean**: Colombia, Guatemala	Mostly new	Screening, developing, and deploying preparation of anti-methanogenic feedstock into livestock systems in the Global South;	Climate Action

Table A.3. One Health Area of Work proposed activities linked to ToC outputs and geographies, and linked bilaterals and Programs/Accelerators

Activity	Title/description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
1	Reducing farm-level antimicrobial resistance risks in livestock and aquatic farming systems Accurately quantify AMU and assess the quality of antimicrobials and vaccines, focusing on substandard products. Investigate socioeconomic, cultural, and systemic drivers of AMU, and implement risk-based, cost-effective interventions. Evaluate biosecurity and vaccination strategies to reduce disease prevalence and AMU, and conduct cost-benefit analyses of AMR mitigation efforts.	3.1	**East Africa –** Ethiopia, Kenya, Uganda; **Southeast Asia** – Vietnam; **South Asia –** Bangladesh	Continuing	Fleming Fund Country Grant for Kenya, Phase 2 Antimicrobial Resistance and One Health, including Animal Health, the Environment and Practitioner Engagement (AMROH) Eastern and Southern Africa (ESA) Climate-Resilient Aquaculture Systems for Africa	Better Diets and Nutrition; Scaling for Impact
2	Evidence-based approaches for zoonosis prevention and control Conduct epidemiological studies and use simulation models to design, deploy, and evaluate disease control measures in various animal and aquatic food production systems, including wild meats.	3.2	**East Africa –** Ethiopia, Kenya, Uganda; **West Africa** – Côte d'Ivoire; **Southeast Asia** – Vietnam	Continuing and new	One Health Research, Education and Outreach Centre for Africa Capacitating One Health in Eastern and Southern Africa Improving human health through sustainable value chains in human-animal-environmental interactions using ICT in Vietnam Climate-Resilient Aquaculture Systems for Africa Asia-Africa BlueTech Superhighway	Better Diets and Nutrition; Scaling for Impact; Multifunctional Landscapes
3	Safer food and nutrition Assess the impacts of foodborne diseases, including bushmeat, on risk, gender, animal welfare, and environment. Scale and institutionalize interventions in informal markets with government partners, strengthen national food safety groups, evaluate economic impacts of safety measures, test food safety technologies, and collaborate with international agencies to support pro-poor policies.	3.3	**East Africa –** Ethiopia, Kenya; **West Africa** – Côte d'Ivoire; **Southeast Asia** – Vietnam; **South Asia** – India	Continuing	Capacitating One Health in Eastern and Southern Africa One Health Research, Education and Outreach Centre for Africa	Better Diets and Nutrition; Scaling for Impact; Food Frontiers and Security

Activity	Title/description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
4	Operationalizing One Health and scaling Compare health outcomes and the cost-effectiveness of joint versus traditional service delivery models. Develop indicators to measure the social and environmental impacts of One Health Initiatives. Conduct studies to identify factors that contribute to successful One Health implementation.	3.4	**East Africa –** Ethiopia, Kenya; **Southeast Asia** – Vietnam; **South Asia** – India	New	Improving human health through sustainable value chains in human-animal-environmental interactions using ICT in Vietnam Asia-Africa BlueTech Superhighway	Multifunctional Landscapes
5	Integrating environment into One Health Monitor and model antimicrobial resistance (AMR) and pathogen pollution in watersheds, assess risks and survey specific settings. Perform cost-effectiveness analysis before implementing mitigation strategies for AMR, manure, and aquaculture waste in water and soil.	3.5	**East Africa –** Ethiopia, Kenya; **West Africa** – Ghana; **Southeast Asia** – Vietnam; **South Asia** – India	Continuing	Climate-Resilient Aquaculture Systems for Africa Asia-Africa BlueTech Superhighway	Multifunctional Landscapes; Food Frontiers and Security
6	Ensuring gender equity in One Health To integrate the data and insights of the AoW Gender, Youth, and Social Inclusion, particularly their gender in One Health research framework	3.6	**East Africa –** Ethiopia, Kenya; Uganda; **Southeast Asia** – Vietnam; **South Asia** – India	Continuing		

Table A.4. Markets Systems, Policies, and Scaling Area of Work proposed activities linked to ToC outputs and geographies, and linked bilaterals and Programs/Accelerators

Activity	Title/description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
1	SAAF information gap assessment and market system diagnosis	4.1	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Ghana, Mali, Nigeria; **Southern Africa –** Zambia; **Southeast Asia** – Cambodia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal; **Latin America and the Caribbean –** Colombia	New		Digital Transformation; Scaling for Impact
2	Design and development of SAAF market data tools	4.1	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Ghana, Mali, Nigeria; **Southern Africa –** Zambia; **Southeast Asia** – Cambodia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal; **Latin America and the Caribbean –** Colombia	New and continuing		Digital Transformation
3	Studies to understand uptake of data innovations and policy integration	4.1 4.5	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Ghana, Mali, Nigeria; **Southern Africa –** Zambia; **Southeast Asia** – Cambodia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal; **Latin America and the Caribbean –** Colombia	New and continuing		Scaling for Impact; Policy Innovations
4	Identification of market and policy needs for decision-support tools	4.2	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Ghana, Mali, Nigeria; **Southern Africa –** Zambia; **Southeast Asia** – Cambodia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal; **Latin America and the Caribbean –** Colombia	New		
5	Co-design and testing of innovations in decision-support tools	4.2	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Ghana, Mali, Nigeria; **Southern Africa –** Zambia; **Southeast Asia** – Cambodia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal; **Latin America and the Caribbean –** Colombia	New and continuing		
6	Studies to understand the uptake of decision-support tools and policy integration	4.2 4.5	**Starting with countries with operational decision-support tools in 2025: East Africa –** Ethiopia, Kenya; **West Africa –** Ghana; **Southeast Asia** – Cambodia, Myanmar	New		Scaling for Impact; Policy Innovations
7	Behavioral studies for uptake of SAAF innovations	4.3	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Ghana, Mali, Nigeria; **Southern Africa –** Zambia; **Southeast Asia** – Cambodia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal; **Latin America and the Caribbean –** Colombia	New and continuing		
8	Impact assessments for uptake of SAAF innovations	4.3 4.5	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Ghana, Mali, Nigeria; **Southern Africa –** Zambia; **Southeast Asia** – Cambodia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal; **Latin America and the Caribbean –** Colombia	New and continuing	Asia-Africa BlueTech Superhighway	Scaling for Impact; Policy Innovations

Activity	Title/description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
9	Studies to understand policy barriers to inclusive and efficient growth of AAF sectors	4.4	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Ghana, Mali, Nigeria; **Southern Africa –** Zambia; **Southeast Asia** – Cambodia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal; **Latin America and the Caribbean –** Colombia	New and continuing		Policy Innovations
10	Co-design and testing of engagement processes for effective AAF systems	4.4	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Ghana, Mali, Nigeria; **Southern Africa –** Zambia; **Southeast Asia** – Cambodia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal; **Latin America and the Caribbean –** Colombia	New and continuing	CGIAR Livestock Partnership – Policy Options for Livestock Asia-Africa BlueTech Superhighway CGIAR Livestock Partnership – Global Livestock Advocacy for Development	Policy Innovations
11	Assessment of the sustainability and effectiveness of AAF policies, investment plans, and governance processes, policy integration and scaling	4.4 4.5	**East Africa –** Ethiopia, Kenya, Tanzania, Uganda; **West Africa –** Ghana, Mali, Nigeria; **Southern Africa –** Zambia; **Southeast Asia** – Cambodia, Myanmar, Vietnam; **South Asia –** Bangladesh, India, Nepal; **Latin America and the Caribbean –** Colombia			Scaling for Impact; Policy Innovations

Table A.5. Gender, Youth and Social Inclusion Area of Work proposed activities linked to ToC outputs and geographies, and linked bilaterals and Programs/Accelerators

Activity	Title/description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
1	Designing new and refining existing tools to conduct research and assess the impact of interventions	5.2	Global	New and continuing	Asia-Africa BlueTech Superhighway Climate-Resilient Aquaculture Systems for Africa Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Sahara Africa Technologies for African Agricultural Transformation Phase II CGIAR Livestock Partnership – Gender	Gender Equality and Inclusion
2	Diagnostic analysis on structural (formal and informal) barriers and aspirations for women and youth in livestock and fish systems, also in fragile contexts (e.g. conflict, climate hot spots), including baselines on empowerment and norms	5.1	**East Africa** – Ethiopia, Kenya, Tanzania; **West Africa** – Ghana, Nigeria; **Southern Africa** – Zambia; **South Asia** – Bangladesh; **Southeast Asia** – Vietnam	New	Asia-Africa BlueTech Superhighway Climate-Resilient Aquaculture Systems for Africa Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Sahara Africa Technologies for African Agricultural Transformation Phase II CGIAR Livestock Partnership – Gender	Gender Equality and Inclusion
3	Co-design and testing of empowerment interventions – based on various livelihood diversification activities for women and youth (including social protection) – addressing structural constraints faced by women and youth in livestock and fish systems	5.4	**East Africa –** Ethiopia, Kenya, Tanzania; **West Africa** – Ghana, Nigeria; **North Africa** – Tunisia; **South Asia** – Bangladesh; **Southeast Asia** – Vietnam	New and continuing	Asia-Africa BlueTech Superhighway Climate-Resilient Aquaculture Systems for Africa Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Sahara Africa Technologies for African Agricultural Transformation Phase II CGIAR Livestock Partnership – Gender	Gender Equality and Inclusion
4	Co-design and testing of transformative interventions that address restrictive gender and youth norms	5.3	**East Africa –** Ethiopia, Kenya, Tanzania; **West Africa** – Ghana, Nigeria; **North Africa** – Tunisia; **South Asia** – Bangladesh; **Southeast Asia** – Vietnam	New and continuing	Asia-Africa BlueTech Superhighway Climate-Resilient Aquaculture Systems for Africa Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Sahara Africa Technologies for African Agricultural Transformation Phase II CGIAR Livestock Partnership – Gender	Gender Equality and Inclusion
5	Co-design and testing of youth employment opportunities through AAF systems	5.3	**East Africa –** Ethiopia, Kenya, Tanzania; **West Africa** – Ghana, Nigeria; **Southern Africa** – Zambia; **Southeast Asia** –Vietnam	New	Asia-Africa BlueTech Superhighway Climate-Resilient Aquaculture Systems for Africa Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Sahara Africa Technologies for African Agricultural Transformation Phase II CGIAR Livestock Partnership – Gender	Gender Equality and Inclusion

Activity	Title/description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
6	Integration of gender considerations in the Livestock Master Plan	5.3	**West Africa** – Nigeria	Continuing	CGIAR Livestock Partnership – Gender	
7	Engagement with policymakers to progress toward gender and youth equality	5.3	**East Africa –** Ethiopia, Kenya, Tanzania; **West Africa** – Ghana, Nigeria; **North Africa** – Tunisia; **South Asia** – Bangladesh; **Southeast Asia** – Vietnam	New and continuing	Asia-Africa BlueTech Superhighway Climate-Resilient Aquaculture Systems for Africa Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Sahara Africa Technologies for African Agricultural Transformation Phase II CGIAR Livestock Partnership – Gender	
8	Collaboration with the other AoWs to develop STIBs that are gender and youth responsive	5.4	**East Africa –** Ethiopia, Kenya, Tanzania; **West Africa** – Ghana, Nigeria; **Southern Africa** – Zambia; **Southeast Asia** – Vietnam	New and continuing	Asia-Africa BlueTech Superhighway Climate-Resilient Aquaculture Systems for Africa Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Sahara Africa Technologies for African Agricultural Transformation Phase II CGIAR Livestock Partnership – Gender	Gender Equality and Inclusion
9	Endlines to assess the impact of social interventions in tandem with technical interventions (STIBs) on empowerment and equality	5.4	**East Africa –** Ethiopia, Kenya, Tanzania; **West Africa** – Ghana, Nigeria; **Southern Africa** – Zambia; **Southeast Asia** – Vietnam	New	Asia-Africa BlueTech Superhighway Climate-Resilient Aquaculture Systems for Africa Development and Scaling of Sustainable Feeds for Resilient Aquatic Food Systems in Sub-Sahara Africa Technologies for African Agricultural Transformation Phase II CGIAR Livestock Partnership – Gender	
10	Meta-analysis of the performance of STIBs across commodities and countries to identify which can best lead to more equality	5.4	**East Africa –** Ethiopia, Kenya, Tanzania; **West Africa** – Ghana, Nigeria; **Southern Africa** – Zambia; **Southeast Asia** – Vietnam	New		
11	Study the scaling of equity-enhancing interventions	5.4	**East Africa –** Kenya, Tanzania; **West Africa** – Ghana; **Southern Africa** – Zambia	New and continuing		Scaling partners

Table A.6. Data and Digital Area of Work proposed activities linked to ToC outputs and geographies, and linked bilaterals and Programs/Accelerators

Activity	Title/description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
1	Country-level landscape studies Country-level studies of AAF systems to understand digital and data usage, needs, and baselines	6.1 6.3	**East Africa** – Ethiopia, Kenya; **South Asia** – India; **Southeast Asia** – Vietnam; **West Africa** – Senegal; **South America** – Colombia	Continuing	Asia-Africa BlueTech Superhighway	
2	Integrating and expanding existing data sources Standardize, expand, and integrate existing data platforms (e.g., FishBase)	6.3 6.4	**East Africa** – Ethiopia, Kenya, Tanzania; **Southern Africa** – Mozambique; **South Asia** – India; **Southeast Asia** – Timor-Leste; **West Africa –** Senegal; **South America** – Colombia	Continuing	Asia-Africa BlueTech Superhighway	
3	AAF systems index development Setup an expert community group to design, develop, and collect data for AAF systems indices	6.3 6.5	**East Africa** – Ethiopia, Kenya, Tanzania; **Southern Africa** – Mozambique, **South Asia –** India; **Southeast Asia** – Vietnam; **West Africa –** Senegal	New		
4	Co-creation of dissemination tools Design, development, and testing of ICT tools through participatory approaches (workshops, focus group discussions), and prototyping of digital platforms	6.2	**East Africa** – Ethiopia, Kenya, **South Asia –** India, **West Africa –** Senegal, **Southeast Asia** –Vietnam	Continuing	Asia-Africa BlueTech Superhighway	Digital Transformation
5	Digital tools and data assessment needs Studies to understand country-level data management protocols, storage, and privacy protection	6.1 6.5	**East Africa** – Kenya, Tanzania; **Southern Africa –** Mozambique; **Southeast Asia** – Vietnam; **South Asia –** India	New		Digital Transformation
6	SAAF cross-cutting digital platform integration Protocols and tools to integrate digital and data solutions across Areas of Work	6.1 6.2	Global	New		
7	Evidence for resilient agriculture A detailed ontology and meta-dataset describing the context, management, and outcomes of livestock experiments	6.3 6.5	Global	Continuing		Climate Action; Sustainable Farming
8	Digital tools for scoring credit risk and financial inclusivity Continued development and evaluation of climate-linked credit scoring across a broader range of systems, farmer typologies, and finance and microfinance partners	6.2 6.3	**South America –** Colombia; **East Africa –** Kenya; **Southern Africa –** Zambia	Continuing		Climate Action; Scaling for Impact

Activity	Title/description	ToC output	Geography	New or continuing	Linked bilateral projects	Linked Programs/ Accelerators
9	Digital citizen science for improving the availability and accessibility of AAF systems data Existing citizen science tools using citizen science approaches will be improved or new ones deployed to enhance the availability of data for AAF systems and to make it FAIR as well as AI-ready	6.2	**East Africa –** Ethiopia, Kenya	Continuing		Climate Action; Digital Transformation
10	Digital livestock climate advisory services Develop or strengthen tools (including AI-enabled) and models that translate, tailor to user needs, and disseminate climate and weather data into actionable climate services for fishers, livestock keepers, and herders	6.2	**South Asia – India**; **East Africa –** Kenya; **West Africa –** Senegal; **South America –** Colombia	Continuing	CGIAR Livestock Partnership – African Dairy Genetics Gains	Climate Action; Digital Transformation; Scaling for Impact
11	Data analytics, AI for trade-offs and AAF systems decision-support tools Develop, test, and deploy user-centric and gender-inclusive decision-support tools based on data analytics, AI, and other latest techniques to improve productivity, health, and income of smallholders in AAF systems	6.5	**East Africa –** Kenya; **Southeast Asia –** Vietnam**; South Asia –** India	Continuing	CGIAR Livestock Partnership – African Dairy Genetics Gains Improving human health through sustainable value chains in human-animal-environmental interactions using ICT in Vietnam	Climate Action; Digital Transformation
12	Digital AAF systems community of practice (COP) and collaboration mechanisms Establish and facilitate a COP for researchers and practitioners of digital innovations in AAF systems and co-create DPI concept for AAF systems	6.3	**East Africa –** Kenya; **Southeast Asia –** Vietnam**; South Asia –** India	new		Digital Transformation
13	Digital innovations in livestock insurance for improving design and reducing transaction costs Continued development of data infrastructure, AI/ machine-learning modeling approaches, and software systems for improving livestock insurance schemes with public and private stakeholders/	6.2	**East Africa –** Kenya	Continuing		Climate Action

Table A.7. Indicative list of partners who may receive pooled funding budget

Country	Illustrative key partners who may receive pooled funding budget
Bangladesh	**NGOs, cooperatives:** NGO Forum for Public Health; Bangladesh Fisheries Research Institute (BFRI)
Cambodia	**Agricultural research institutes and academia:** Inland Fisheries Research and Development Institute (IFReDI); Institute of Technology of Cambodia (ITC)
Colombia	**NGOs, cooperatives:** Ganaderia Sonstenible, Fundación Ecotonos
Côte d'Ivoire	**NGOs, cooperatives**: Centre Suisse de Recherche Scientifique en Côte d'Ivoire, One Health Platform of Côte d'Ivoire (Plateforme Une Seule Santé [PLUSS])
Egypt	Central Laboratory for Aquaculture Research, feed companies (Skretting), and fish farmer association
Ethiopia	**Government and para-governmental entities:** Addis Ababa Water and Sewerage Authority, Institute of Animal Health **Agricultural research institutes and academia:** Regional Agricultural Research Institutes (ARARI, OARI, SARI, SWEARI, TARI), universities **Private partners**: AbacusBio, livestock services delivery agents **Civil society organization**: Women Empowerment-Action
Ghana	**Agricultural research institutes and academia:** Council for Scientific and Industrial Research – Water Research Institute (CSIR-WRI); University of Ghana **Government and para-governmental entities:** Fisheries Commission **Private entity:** CowTribe **NGOs, cooperatives:** CARE
Guatemala	**NGOs, cooperatives:** Comite de ganaderos de Izabal, YAPU solutions
India	**Agricultural research institutes and academia:** Indian Council of Agricultural Research; Indian Institute of Technology Roorkee **Private entities:** Crea2Sol **NGOs, cooperatives:** farmer groups; The Agri Collaboratory
Kenya	**Agricultural research institutes and academia**: Kenya Agriculture and Livestock Research Organization; Kenyan Marine Fisheries Institute **Government and para-governmental entities:** Kenya Meteorological Department **Private entities:** Kuza Biashara **NGOs, cooperatives:** farmer groups; Mercy Corps; Ripple Effect
Malaysia	University Science Malaysia, Department of Fisheries, Universiti Malaysia Terengganu, Malaysia Fisheries Society
Mali	**Government and para-governmental entities:** Mali-Meteo; Institute of Rural Economy (IER), Central Veterinary Laboratory (LCV)

Country	Illustrative key partners who may receive pooled funding budget
Myanmar	**NGOs, cooperatives:** Myanmar Fishery Federation; Mercy Corps; Hope Putao **Private entities:** KT Feed Mill Co., Fresh Studio
Nepal	**Government**: National Animal Breeding and Genetics Research Centre, Department of Livestock Services, Ministry of Agriculture and Livestock Development
Nigeria	**Agricultural research institutes and academia:** Lagos State University, University of Ibadan, Nigeria Institute of Oceanography and Marine Research **Private entities:** local feed mills and hatcheries, Aquaculture Association of Nigeria
Senegal	**Government and para-governmental entities:** Agence Nationale de l'Aviation Civile et de la Météorologie; L'Agence Nationale de Conseil Agricole et Rural **Private entities:** Jokolante
Solomon Islands	Aquaculture and Fisheries Divisions of the Ministry of Fisheries and Marine Resources, Aquaculture and Fisheries Association of Solomon Islands
Tanzania	**Agricultural research institutes and academia:** Tanzania Agriculture and Livestock Research Institute (TALIRI) **NGOs, cooperatives:** Shujaaz
Timor-Leste	Department of Fisheries of the Ministry of Agriculture and Fisheries
Tunisia	**Government**: National Institute of Agronomic Research of Tunisia (INRAT)
Uganda	**NGOs, cooperatives:** Ripple Effect
Vietnam	**Agricultural research institutes and academia**: National Institute of Animal Science of Vietnam; Vietnam National University of Agriculture **Government and para-governmental entities:** provincial and district-level governments **NGOs, cooperatives:** farmer groups; Vietnam Women's Academy
Zambia	**Government and para-governmental entities:** Zambia Meteorological Department; Water Resources Management Authority (WARMA); SmartZambia, Department of Fisheries **NGOs, cooperatives:** Youth for Ecosystem Restoration, Natural Resources Development College, Musika Zambia, Aquaculture Association of Zambia, Aller Aqua Zambia

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CGIAR

Sustainable Animal and Aquatic Foods Program

Appendix

November 15, 2024

Appendix. Comparative advantage (Section 4 of the proposal)

Table A1.1. Comparative advantage analysis for the Sustainable Animal and Aquatic Foods Program's high-level outputs

High-level output	Needed sources of CA required to deliver high-level output	CGIAR's sources of CA in delivering high-level output	Potential partner types (e.g., NARES, SMEs, private sector)	Partners' sources of CA in delivering high-level output	Analysis and indication of where CA lies
Productivity+: Productivity-enhancing innovations (breeding, feeding, health) that are profitable and equitable and reduce GHG emission intensity	**Human capital** 1. Biophysical scientists to cover genomics, breeding, feeding, health, food safety, GHG emission 2. Social scientists to cover profitability and inclusiveness: economists, gender specialists 3. Data analysts: biometricians, modelers 4. Skills and knowledge **Biophysical capital** 1. Access to laboratories (nutrition, genomics, health) 2. Animal-handling facilities 3. Forage breeding programs 4. Infrastructure to measure emissions 5. Secure data storage and computing facilities 6. Access to global data and modeling outputs 7. Presence on the ground 8. **Social capital** 1. Relevant partnerships and networks to co-design and implement 2. Long-term relationships and commitment with national research for development (R4D) organizations to achieve impact 3. Long-term scientific links to newest discoveries (blue sky) and adaptive research **Incentives** • For NARES: increased capacity and international scientific links • For CGIAR: publication of IPGs, impact on the ground • For national universities and ARIs: ccess to data, relevant fieldwork, and experience for students • For CBOs and INGOs: access to innovations and technical assistance, new business models	**CONSIDERING THE 5 CGIAR CENTERS COLLABORATING IN SAAF** **Human capital (strong)** • 1–3: cover all required disciplines • 4: Knowledge hub for Innovations **Biophysical capital (moderately strong)** • 1: access to own state-of-the-art laboratories, built capacity in some NARES centers • 2: ILRI (Nairobi and Addis), WorldFish (Egypt and Malaysia), Alliance (Cali), ICARDA (Lebanon); all: access to NARES research and national university facilities • 3: Alliance, ICARDA • 4: ILRI, Alliance, ICARDA, World Fish? • 5+6: all Centers • 7: across all 5 high-coverage regions and country presence **Social capital (moderately strong)** • 1: partnerships and networks with NARES and grassroots organizations (CBOs) • 2: long-term relationships and commitment with national R4D organizations through physical presence • 3: long-term scientific links with partner universities through capacity development and joint publications **Incentives (strong)** • Publication of IPGs • Proof for developed and used innovations • Opportunity to address diverse challenges (living labs) • Impact on the ground • Development of partner capacity and strong human ties	**CURRENT PARTNERS** • **Demand partners**: NARES, government, CBOs, funders, GROs, private sector • **Innovation partners**: internal CGIAR, NARES, universities, ARIs, CBOs • **Scaling partners**: internal CGIAR, government, NGOs, INGOs, development actors and projects, private sector **NEW/TO BE EXPANDED PARTNERS** • Demand partners • ARIs: Global Methane Hub • Funders: AfDB, ADB, IFAD • Regional agricultural research organizations (FARA, ASARECA, CCARDESA) • Intergovernmental organizations (IGAD, COMESA) **Innovation partners** • ARIs: Global Methane Hub • International research institutes and universities (Cornell, Maryland, Boku, Florida, WUR, SLU) **Scaling partners** • INGOs: Oxfam, CARE, Heifer International, Land O'Lakes Venture37	**CURRENT PARTNERS** ***NARES/national universities*** **Human capital (moderate)** • 1–3: partly covering, usually weaker in social science and data analytics • 4: not always to the required level **Biophysical capital (moderate)** • 1–3: access available in most cases but not always fully functional • 4: rare • 5+6: varied across target countries • 7: high **Social capital (moderate)** • 1+2: good • 3: mostly weak or moderate **Incentives (strong)** • Increased technical capacity • International scientific links • Improved publication records for promotion • Opportunities for higher education (within-country and abroad) ***Government*** **Human capital (weak to moderate)** • 1–3: partly cover the knowledge required for articulating demand and scaling • 4: not always aware **Biophysical capital (moderate)** • 1–3: access available in most cases but not always fully functional • 4: rare • 5+6: varied across target countries • 7: high **Social capital** • 1+2: very good • 3: weak or moderate **Incentives (moderate)** • Impact on the ground • Increased technical capacity • Access to innovations and technical assistance • International scientific links • New business models ***CBOs/innovation platforms*** **Human capital (moderate)** • Usually no technical capacity and limited skills for innovation implementation at the beginning • Traditional organizational setup for implementation and often relevant traditional knowledge and skills **Biophysical capital (weak)** • Mostly not applicable but access to animals and aquatic systems **Social capital (strong)** • Excellent because of strong social networks (bonds and trust) and building on traditional institutions **Incentives (strong)** • Access to innovations and new practices, inputs, technical backstopping, expectation to increase incomes and improve livelihoods	CA for this HLO lies with CGIAR with regard to scientific human capital, knowledge, and skills because of its coverage and global reach. CGIAR also has a CA to some extent on specific biophysical capital but with limited geographical coverage; through continuous long-term presence in some of the target countries across the six CGIAR regions. CGIAR has built social capital and networks and can bring partners together to co-design and implement innovations that can generate impact on the ground. Incentives for delivering this HLO are high for CGIAR and nearly all partners. To overcome some limitations in CGIAR's CA, we will continue to build on • the CA of NARES with regard to their human and social capital • the CA of selected ARIs in providing in-depth and blue-sky expertise and the latest state-of-the-art infrastructure • the CA of government's presence on the ground and ability to enable implementation and scaling Given the CA of INGOs and regional agricultural organizations in terms of human capital related to understanding the broader context and political landscapes and in terms of their social capital, we will explore more strategic partnerships with these organizations for across-country delivery of innovations in SAAF.

High-level output	Needed sources of CA required to deliver high-level output	CGIAR's sources of CA in delivering high-level output	Potential partner types (e.g., NARES, SMEs, private sector)	Partners' sources of CA in delivering high-level output	Analysis and indication of where CA lies
				Private sector (input and output supplies) **Human capital (degree of CA depends on innovation)** • Specialized expertise and capacity • Business orientation, which helps to ensure sustainability **Biophysical capital (potentially strong)** • Infrastructure on the ground **Social capital (potentially strong)** • Business networks, linkages to government and donor communities **Incentives (moderate to strong)** • Access to innovation that can lead to new business opportunities • Technical backstopping • Financial support ***ARIs*** **Human capital (strong)** • 1–3: across different institutes covering all required disciplines • 4: Knowledge hub for Innovations **Biophysical capital (moderate)** • 1+2: access to state-of-the-art laboratories and animal handling facilities • 3: some have forage breeding programs • 4: few have the infrastructure for methane emissions • 5+6: usually have data storage and analytics • 7: only limited presence on the ground **Social capital (weak to moderate)** • Long-term scientific links with partner universities through capacity development and joint publications **Incentives (strong)** • Publication of IPGs • Proof for developed and used innovations • Opportunity to address diverse challenges (living labs) • Impact on the ground • Development of partner capacity and strong human ties **NEW PARTNERS** ***INGOs and regional agricultural organizations*** **Human capital (moderate)** • 1–3: cover knowledge required for articulating demand; understanding regional broader issues and context and political landscapes • 4: some skills and knowledge **Biophysical capital (weak to moderate)** • 1–4: depends on country infrastructure • 5+6: varied across organizations • 7: varied across organizations, most depend on national partners **Social capital (moderate to strong)** • Good linkages and networks with NARES, local NGOs, and governments, with grassroots organizations and civil society **Incentives** • Impact on the ground • Increased technical capacity • Access to innovations and new business models	

High-level output	Needed sources of CA required to deliver high-level output	CGIAR's sources of CA in delivering high-level output	Potential partner types (e.g., NARES, SMEs, private sector)	Partners' sources of CA in delivering high-level output	Analysis and indication of where CA lies
Productivity+: Fortification approaches for more nutritious animal and aquatic foods	**Human capital** 1. Animal science/nutrition scientists 2. Animal/fish health scientists 3. Animal and aquaculture breeders 4. Food safety and quality assurance scientists 5. Social scientists: economists and gender specialists 6. Human nutritionists and dietitians 7. Food technologists 8. Value chain scientists 9. Biometricians **Biophysical capital** 1. Innovation labs: dedicated to researching new fortification methods and conducting trials to evaluate the effectiveness of fortified animal and fish feeds 2. Demonstration farms and aquaculture sites for experimenting with and demonstrating the benefits of different fortification methods and fortified feeds in real-world settings 3. ICT tools: software for data collection, analysis, and dissemination of information regarding fortification practices, and web-based platforms such as online forums, databases, and websites that facilitate information exchange and resource sharing **Social capital** 1. Partnerships and collaboration between government, NGOs, private sector, and local communities for effective fortification initiatives 2. Engagement with local communities to ensure fortification strategies are culturally appropriate and accepted 3. Trust and relationships among stakeholders encourage the sharing of resources and knowledge **Incentives** • For NGOs/CBOs: access to technical support for the production and distribution of fortified animal and aquatic foods • For private sector (food/feed companies): research support on fortification programs and creation of consumer demand and acceptance • For academia and research institutions: joint research projects/ publications on fortification • For CGIAR: publications and dissemination to promote best practices in fortification effort • For community health workers: trained individuals can act as advocates for fortified foods • For government, CBOs, and NGOs: access to training in nutrition, food production, and fortification techniques • For farmers and fishers: training programs to enhance knowledge and skills on fortification	**Human capital (strong)** • 1–5: these core expertise areas are covered by all CGIAR Centers involved. As a new area of research, specific competencies may be needed in fortification. • 5–6: these expertise areas can be covered in partnership with human health initiatives • 8–9: these expertise areas are covered by all CGIAR Centers involved; capacity building in fortification may be required **Biophysical capital (moderately strong, particularly because this is a new area of research)** 1. State of the Art labs at ILRI (Nairobi and Addis), WorldFish (Egypt and Malaysia), Alliance (Cali), ICARDA (Lebanon). As this is a new area of research, specific equipment may be required to facilitate fortification strategies. All CGIAR Centers have access to NARES research and national university facilities. 2. all CGIAR Centers have strong collaboration with farmers in their respective mandate areas 3. ILRI is strong in ICT tools. All CGIAR Centers have capacity to use software for data collection, analysis, and dissemination of information and to facilitate information exchange. **Social capital (strong)** 1. Existing partnerships with NGOs, CBOs, NARES, universities 2. Engagement with local communities through various platforms in current projects 3. CGIAR Centers have cultivated trust and strong relationships with different categories of stakeholders **Incentives (strong)** 1. Strong capacities to conduct and disseminate research findings 2. Opportunities for matching funds for research and scaling of technologies 3. Transfer of technology and expertise of developed innovations 4. Publication of IPGs 5. Opportunity to help spread awareness and information 6. Opportunity to address diverse challenges in different contexts 7. Demonstration of impact on the ground	**CURRENT PARTNERS** • Demand partners: government ministries and regulatory bodies, food safety authorities, international organizations, funders (World Bank, USAID, BMGF, AfDB, IFAD, etc.), CBOs, health and nutrition advocacy groups, dairy and aquaculture cooperatives • Innovation partners: NARES, universities, CGIAR Centers, local feed companies, consumer advocacy groups • Scaling partners: food and feed industries, NGOs (e.g., Heifer International, Send a Cow, Oxfam, SNV) **NEW/POTENTIAL PARTNERS** **Demand partners:** international organizations (FAO, WHO, UNICEF), funders, CBOs, local health initiatives, health and nutrition advocacy groups, International Feed Industry Federation, international feed companies • Innovation partners: Feed the Future Innovation Lab for Fish (Mississippi State University), Texas A&M University (USA), Wageningen University & Research (Netherlands), Institute of Aquaculture, University of Stirling (UK), Cornell University (USA), SLU (Sweden); private sector nutrition startups • Scaling partners: NGOs: (Micronutrient Initiative Forum, Helen Keller International, Global Fortification Alliance, Fortification Initiative, Global Alliance for Improved Nutrition, African Agricultural Technology Foundation); consulting firms specializing in agriculture and nutrition	***Government ministries, regulatory bodies, and food safety authorities*** **Human capital (moderate)** • 1–3: in-depth knowledge and impact of nutrition on overall health, but usually a narrow focus centered on health rather than nutrition or food quality • 4, 6, and 7: good regulatory knowledge and food quality enhancements, but bureaucratic limitations and heavy focus on compliance rather than promotion of new strategies • 5, 8, and 9: usually weaker in social science and data analytics **Biophysical capital (moderate)** • Have access to labs but they are poorly equipped and most often not functional • Have full access to farms and fish sites but with weak links; goodwill exists for collaboration • Have rare access due to limited capacities **Social capital (strong)** • 1–3: all are strong and trusted partnerships **Incentives (moderate)** • 1: very good • 2: rare and weak linkages with the private sector • 3: rare and weak linkages with academia • 4: weak linkages with CGIAR, could be better • 5 and 6: moderate collaboration • 7: very good linkages and collaboration ***NARES and academia*** **Human capital (moderate)** • 1–7: partly covering, usually weaker in social science and data analytics • 8–9: not always up to standard in value chain approaches and biometrics **Biophysical capital (moderate)** • 1: have access to labs, but they are poorly equipped and most often not functional • 2: good links to farms • 3: rare access to ICT tools **Social capital (moderate to strong)** • Good linkages and networks with NARES, local NGOs, governments, grassroots organizations, civil society **Incentives** • Impact on the ground • Increased technical capabilities • Access to innovations and new knowledge ***NGOs (local and international)*** **Human capital (moderate)** • 1–4: cover partial knowledge required for advancing fortification strategies • 5–9: some skills and knowledge but weak in social science, value chain research, and biometrics **Biophysical capital (weak to moderate)** • 1: no access to labs • 2: strong collaborations with farmers and linkages to CBOs • 7: varied across NGOs **Social capital (moderate to strong)** • Good linkages and networks with NARES, local NGOs, governments, grassroots organizations, civil society **Incentives** • Impact on the ground • Increased technical capacity • Access to innovations and new knowledge	For this HLO, the CA lies with CGIAR regarding • Scientific human capital, knowledge, and skills • Research infrastructure and equipment but located in geographical locations where CGIAR has had a long-term presence • Strong convening power, partnerships, and networks to support strong research collaborations to foster impact on the ground Incentives stemming from nearly all partners to deliver this HLO are equally high for CGIAR. This being a new area of research, there are gaps in all areas of CA. For example, specific competencies and lab equipment may be needed for fortification. To overcome some limitations in CGIAR's CA, we will continue to • leverage existing partnerships with NARES, NGOs, and academia. As this is a new area of research, collaboration with international universities that are already working in this area is strongly encouraged. • collaborate with the private sector on fortification strategies on sustainability and scaling • leverage the CA of governments in terms of knowledge, the impact of nutrition on overall health, regulatory knowledge, and food quality enhancements, and linkages with farmers to pilot, validate, and scale technologies • leverage the strategic and strong partnerships with NGOs across countries to implement our innovations

High-level output	Needed sources of CA required to deliver high-level output	CGIAR's sources of CA in delivering high-level output	Potential partner types (e.g., NARES, SMEs, private sector)	Partners' sources of CA in delivering high-level output	Analysis and indication of where CA lies
				Private sector (input and output supplies) **Human capital (degree of CA depends on the innovation)** • Specialized expertise and capacity across disciplines • Business orientation, which helps to scale technologies **Biophysical capital (potentially strong)** • Access to good laboratory infrastructure and equipment with business orientation **Social capital (potentially strong)** • Business networks, linkages to government and donor communities **Incentives (moderate to strong)** • Access to innovation that can lead to new business opportunities • Technical backstopping • Financial support	

High-level output	Needed sources of CA required to deliver high-level output	CGIAR's sources of CA in delivering high-level output	Potential partner types (e.g., NARES, SMEs, private sector)	Partners' sources of CA in delivering high-level output	Analysis and indication of where CA lies
Climate and Environment: Climate-adapted innovations and monitoring tools for animal and aquatic systems, enhancing resource efficiency and restoration, reducing emissions, and increasing carbon sequestration	**Human capital** 1. Biophysical scientists to cover soil science, animal/fish science, water science, climate science, GHG emissions and bioeconomy 2. Social scientists to cover adaptative capacity and inclusiveness: socio-economists, gender specialists 3. Data analysts: biometricians, modelers 4. Skills and knowledge **Biophysical capital** 1. Access to analytical laboratories (soil, forage, water, GHG) 2. Animal-handling facilities 3. Forage breeding and selection programs 4. Infrastructure to measure GHG emissions 5. Secure data storage and computing facilities 6. Access to global data and modeling outputs 7. Presence on the ground **Social capital** 1. Relevant partnerships and networks to co-design and implement innovations 2. Long-term relationships and commitment with national and international R4D organizations to achieve impact 3. Long-term scientific links to newest discoveries (blue sky) and adaptive research **Incentives** • For NARES: increased capacity and international scientific links • For CGIAR: publication of IPGs, impact on the ground • For governments: climate benefits to reduce global warming and access carbon markets • For national universities and ARIs: access to data, relevant fieldwork, and experience for students • For CBOs and INGOs: access to innovations and technical assistance, new business models	**CONSIDERING THE 5 CGIAR CENTERS COLLABORATING IN SAAF** **Human capital (strong)** • 1–3: covering all required disciplines • 4: Knowledge hub for Innovations **Biophysical capital (moderately strong)** • 1: access to own state-of-the-art laboratories, built capacity in some NARES centers • 2: ILRI (Nairobi and Addis), WorldFish (Egypt and Malaysia), Alliance (Cali), ICARDA (Lebanon); all: access to NARES research and national university facilities • 3: Alliance, ICARDA • 4: ILRI, Alliance, ICARDA, World Fish • 5 and 6: all Centers • 7: across all 5 high coverage regions and country presence **Social capital (moderately strong)** • 1: partnerships and networks with NARES and grassroots organizations (CBOs) • 2: long-term relationships and commitment with national R4D organizations through physical presence • 3: long-term scientific links with partner universities through capacity development and joint publications **Incentives (strong)** • Publication of IPGs • Proof for developed and used innovations • Opportunity to address diverse challenges (living labs) • Impact on the ground, • Developing partner capacity and strong human ties	**CURRENT PARTNERS** • Demand partners: NARES, governments, CBOs, funders, GROs, private sector, general public and consumers, producers • Innovation partners: internal CGIAR, NARES, universities, ARIs, CBOs, producers • Scaling partners: internal CGIAR, government, NGOs and INGOs, development actors and projects, private sector, development banks **NEW/TO BE EXPANDED PARTNERS** • Demand partners • ARIs: Global Methane Hub, FAO • Funders: AfDB, ADB, IFAD, Bezos, Gates • National and international agricultural and environmental organizations (TNC, WWF) • Intergovernmental organizations (IGAD, IPCC, IPBES) **Innovation partners** • ARIs: Global Methane Hub, FAO • International research institutes and universities (ETH, AgResearch, GRA, WUR, SLU) **Scaling partners** • INGOs: Minerva, Papalotla	***NARES/national universities*** **Human capital (moderate)** • 1–3: partly covering, usually weaker in social science and data analytics • 4: not always to the required level **Biophysical capital (weak)** • 1–3: access in some cases but not always fully functional • 4: rare • 5+6: rare • 7: high **Social capital** • 1+2: good • 3: mostly weak **Incentives (moderate)** • Increased technical capacity • International scientific links • Improved publication records for promotion • Opportunities for higher education (within-country and abroad) ***Government*** **Human capital (weak)** • 1–3: partly cover the knowledge required for articulating understanding, goal setting, demand and scaling • 4: not always aware **Biophysical capital (weak)** • 1–3: access in rare cases but not always fully functional • 4: rare • 5+6: varied across target countries • 7: high **Social capital** • 1+2: very good • 3: weak or moderate **Incentives (moderate)** • Impact on the ground • Increased technical capacity • Access to innovations and technical assistance • International scientific links • New business models • International commitments ***CBOs/innovation platforms*** **Human capital (moderate)** • Usually no technical capacity and limited skills for innovation implementation at the beginning; have the traditional organizational setup for implementation and often relevant traditional knowledge and skills **Biophysical capital (weak)** • Mostly not applicable but access to animals and aquatic systems **Social capital (moderate)** • Medium because of weak social networks (bonds and trust) and building on traditional institutions **Incentives (strong)** • Access to innovations and new practices, inputs, technical backstopping, and expectations is limited; pressure to reduce emissions and increase resilience	CA for this HLO lies with CGIAR with regard to scientific human capital, knowledge and skills because of its coverage and global reach. CGIAR also has a CA on specific biophysical capital but with very limited geographical coverage. Through the continuous long-term presence in some of the target countries across the six CGIAR regions, CGIAR has built social capital and networks and can bring partners together for co-design and implementation of innovations that can generate impact on the ground. CGIAR has a deep understanding of the different production systems that are radically different from the ones in the Global North. Incentives for delivering this HLO are high for CGIAR and nearly all partners. To overcome some limitations in CGIAR's CA, we shall continue to build on • the CA of NARES with regard to their human and social capital • the CA of selected ARIs in providing in-depth and blue-sky expertise and the latest State of the Art infrastructure • the CA of governments, using their presence on the ground and climate and environment commitments and their ability to enable implementation and scaling Given the CA of INGOs and regional agricultural organizations in terms of their specific human capital related to understanding broader context and political landscapes and their social capital, we will explore more strategic partnerships with these organizations for across-country delivery of our innovations related to climate and environment in SAAF.

High-level output	Needed sources of CA required to deliver high-level output	CGIAR's sources of CA in delivering high-level output	Potential partner types (e.g., NARES, SMEs, private sector)	Partners' sources of CA in delivering high-level output	Analysis and indication of where CA lies
				Private sector (input and output suppliers) **Human capital (moderate)** • Medium expertise and capacity • Business orientation, which helps to ensure sustainability **Biophysical capital (weak)** • Infrastructure on the ground is lacking **Social capital (potentially strong)** • Business networks, linkages to government and donor communities **Incentives (moderate to strong)** • Access to innovation that can lead to new business opportunities such as carbon markets • Financial support ***ARIs*** **Human capital (strong)** • 1–3: across different institutes covering all required disciplines • 4: Knowledge hub for Innovations **Biophysical capital (moderately strong)** • 1+2: Access to state-of-the-art laboratories and animal handling facilities • 3: Some have forage breeding programs • 4: Some have infrastructure for methane emissions • 5+6: Usually have data storage and analytics • 7: only limited presence on the ground **Social capital (moderate)** • Long-term scientific links with partner universities through capacity development, technologies, and joint publications **Incentives (strong)** • Publication of IPGs • Proof of developed and used innovations • Opportunity to address diverse climate and environmental degradation • Impact on the ground • Developing partner capacity and strong human ties ***INGOs and regional agricultural organizations*** **Human capital (moderate)** • 1–3: cover knowledge required for articulating demand; understanding regional broader issues and context and political landscapes • 4: some skills and knowledge **Biophysical capital (weak to moderate)** • 1–4: Depend on country infrastructure • 5+6: very varied across organizations • 7: varied across organizations most depend on national partners **Social capital (moderate to strong)** • Good linkages and networks with NARES, local NGOs, governments, grassroots organizations, civil society, and in some cases advance institutions **Incentives** • Impact on the ground • Increased technical capacity • Access to innovations and new business models	

High-level output	Needed sources of CA required to deliver high-level output	CGIAR's sources of CA in delivering high-level output	Potential partner types (e.g., NARES, SMEs, private sector)	Partners' sources of CA in delivering high-level output	Analysis and indication of where CA lies

Climate and Environment: Mobilized climate finance through innovative business models and financial mechanisms for innovations with proven environmental, climatic, and financial benefits	**Human capital**
	1. Biophysical scientists to cover soil science, biologists for biodiversity, animal/fish science, water science, climate science, GHG emissions, bioeconomy
	2. Social scientists to cover adaptative capacity and inclusiveness: socioeconomists, gender specialists, public and media relations specialists, lawyers
	3. Data analysts: biometricians, modelers
	4. Skills and knowledge
	
	Biophysical capital
	1. Secure data storage and computing facilities
	2. Access to global data and modeling outputs
	3. Presence on the ground
	
	Social capital
	1. Relevant partnerships and networks to co-design and implement innovations
	2. Long-term relationships and commitment between government, banks, and investors
	
	Incentives
	• For local banks: increased capacity and international scientific links
	• For CGIAR: publication of IPGs, generation of income
	• Climate benefits to reduce global warming and access carbon markets
	• For CBOs and INGOs: access to innovations and technical assistance, new business models
		CONSIDERING THE 5 CGIAR CENTERS COLLABORATING IN SAAF
		
		Human capital (strong)
		• 1–3: covering all required disciplines
		• 4: Knowledge hub for Innovations
		
		Biophysical capital (moderately strong)
		• 1: good data storage facilities
		• 2: good access to global data and modeling
		• 3: across all 5 high-coverage regions and country presence
		
		Social capital (moderately strong)
		• 1: partnerships and networks with NARES and grassroots organizations (CBOs)
		• 2: long-term relationships and commitment with national R4D organizations, banks, and some investors through physical presence
		
		Incentives (strong)
		• Publication of IPGs
		• Proof of developed and used innovations
		• Opportunity to address diverse challenges (living labs)
		• Impact on the ground, income ,and climate/ biodiversity generation
		• Developing partner capacity and strong human ties
			CURRENT PARTNERS
			
			• **Demand partners**: investors, banks, governments**,** funders, private sector, animal and aquatic food consumers
			• **Innovation partners**: internal CGIAR, FAO, multilateral banks
			• **Scaling partners**: internal CGIAR, government, NGOs and INGOs, private sector, development banks
			
			NEW/TO BE EXPANDED PARTNERS
			
			• Demand partners
			  ◦ World Bank, investors, FAO, some funders (GEF, GIZ), banks, IFC
			  ◦ Environmental organizations (TNC, WWF)
			  ◦ Intergovernmental organizations (IGAD, IPCC, IPBES, GRA)
			• **Innovation partners:** FAO
			• **Scaling partners:** INGOs, private sector (Minerva, Papalotla)
				Investors and banks
				Human capital (weak)
				• 1–4: low capacity except for economist
				
				Biophysical capital (weak)
				• 1–3: rare
				
				Social capital
				• 1–2: mostly weak
				
				Incentives (weak)
				• Increased technical capacity
				
				Government
				Human capital (moderate)
				• 1–4: absent except for economist, political relation, lawyer
				
				Biophysical capital (moderate)
				• Access to data and processing
				
				Social capital (strong)
				• 1–2: very good
				
				Incentives (strong)
				• Income and revenue generation
				• Access to innovations and technical assistance
				• International business links
				• New business models
				• International commitments
				
				Private sector
				Human capital (strong)
				• High expertise and capacity in business, which helps ensure sustainability
				
				Biophysical capital (weak)
				• Infrastructure on the ground is lacking
				
				Social capital (strong)
				• Business networks, linkages to government, banks, investors
				
				Incentives (strong)
				• Access to innovation that can lead to new business opportunities such as carbon markets
				• Financial support
				• Impact on the ground
				• Increased technical capacity
				• Access to innovations and new business models
					CA for this HLO lies with CGIAR with regard to scientific human capital, knowledge, and skills because of its coverage and global reach. CGIAR also has a CA on specific biophysical and analytical capital but with limited geographical coverage. Through continuous long-term presence in some of the target countries across the six CGIAR regions, CGIAR has built social capital and networks and can bring partners together for co-design and implementation of innovations that can generate investments. CGIAR has a deep understanding of the different production systems that are radically different from the ones in the Global North.
					
					Incentives for delivering this HLO are high for CGIAR as it can be seen as an independent trusted party.
					
					To overcome some limitations in CGIAR's CA, we wil continue to build on
					• the CA of banks to their human and social capital
					• the CA of selected ARIs in providing in-depth expertise in productivity, climate, and environmental impacts of AAF systems
					• the CA of governments using their presence on the ground and climate and environment commitments and their ability to enable investments
					
					Given the CA of INGOs and regional development banks in terms of their specific human capital related to understanding broader context and political landscapes and their social capital, we will explore more strategic partnerships with these organizations for across-country investments based on our innovations related to climate and environment in SAAF.

High-level output	Needed sources of CA required to deliver high-level output	CGIAR's sources of CA in delivering high-level output	Potential partner types (e.g., NARES, SMEs, private sector)	Partners' sources of CA in delivering high-level output	Analysis and indication of where CA lies
One Health: AAF production systems de-risked through integrated prevention and control of zoonotic diseases, AMR, and food-borne diseases, while safeguarding environmental health	**Human capital** Interdisciplinary teams including: 1. Biophysical scientists covering genomics, human, animal, aquatic food, and environmental health, food safety, and GHG emissions 2. Social scientists focusing on profitability and inclusiveness, behavior change, and gender 3. Data analysts providing biometric and modeling expertise **Biophysical capital** 1. **Laboratories**: covering nutrition, genomics, AAF and environmental health, and food safety 2. **Animal-handling facilities**: For practical research and interventions 3. **Infrastructure for measuring emissions**: to assess and mitigate environmental impact 4. **Secure data storage and computing facilities**: for handling large datasets and complex models 5. **Access to global data and modeling outputs**: for facilitating comprehensive analyses 6. **Presence on the ground**: ensuring practical, field-based research and implementation **Social capital** 1. Extensive networks and relationships with other research institutions, government bodies, NGOs, and private sector partners 2. Long-term relationships with national R4D organizations 3. Connection to cutting-edge research: long-term scientific links ensure access to the latest discoveries and adaptive research **Incentives** • For NARES: increased capacity and stronger international scientific connections • For CGIAR: publication of IPGs, tangible impact on the ground For national universities and ARIs: access to data, relevant fieldwork, and practical experience for students For CBOs and INGO: access to innovations, technical assistance, and new business models	**Human capital (strong)** Each Center contributes specialized human capital jointly covering all required disciplines through interdisciplinary teams: • ILRI: animal health and livestock systems • WorldFish: aquaculture health and fisheries • IWMI: water management • IFPRI: food policy and systems • Alliance Bioversity CIAT: agrobiodiversity and climate resilience CGIAR serves as a knowledge hub for innovations with a strong track record. **Biophysical capital (moderately strong)** • Access to state-of-the-art laboratories and advanced research in animal health, aquaculture, environmental sustainability, and food safety across multiple locations • CGIAR has built capacity in several NARES centers, enhancing local research capabilities • Widespread geographical presence across regions, combined with access to both CGIAR-owned and NARES facilities **Social capital (fairly strong)** • 1–3: all apply to CGIAR, with 2 underpinned by physical presence **Incentives (strong)** CGIAR mission is to deliver impactful research and innovations while sharing and building partners' capacity, which requires: • track record of IPGs through state-of-the-art publications • track record of impact on the ground • real-world environments like living labs for testing and scaling innovations • commitment to developing partner capacity and fostering strong human ties	**CURRENT PARTNERS** • **Demand partners**: NARES, government, development actors, CBOs, funders, GROs, private sector • **Innovation partners**: internal CGIAR, NARES, universities, ARIs, CBOs • **Scaling partners**: internal CGIAR, government, WHO, FAO, UNEP, and WOAH, NGOs, development actors and projects, private sector **NEW/TO BE EXPANDED PARTNERS** **Demand partners** • ARIs: Ecohealth Alliance, Pirbright Institute, Swiss Tropical and Public Health Institute, Institute of Tropical Medicine • Funders: AfDB, ADB, IFAD, Gates, USAID, Wellcome Trust, World Bank, EU Horizon, IDRC, GIZ • Regional agricultural research organizations (FARA, ASARECA, CCARDESA) • Intergovernmental organizations (IGAD, COMESA **Innovation partners** • ARIs: Global Methane Hub, Pirbright Institute • International research institutes and universities (Cornell, Maryland, Boku, Florida, WUR, SLU, Liverpool, LSHTM) **Scaling partners** • INGOs: Oxfam, CARE, Heifer International, Land O'Lakes Venture37, The Brooke • Intergovernmental agencies: WHO, FAO, WOAH, UNEP • Private sector: pharmaceutical (e.g., Merck), agribusiness (e.g., Cargill), CBOs	**CURRENT DEMAND PARTNERS** **Human capital** • NARES and government agencies: extensive knowledge of local agricultural practices, public health systems, and policy frameworks; they provide crucial insights into the needs and capacities of local communities. • Development actors and funders: convening power through their relationships with governments, major NGOs, development funders, etc. • Private sector: technical expertise and business networks **Biophysical capital** • NARES: often have access to research facilities and experimental farms that are vital for testing and refining innovations • Government and development actors: control infrastructure such as health facilities, laboratories, and data systems necessary for large-scale implementation. • Private sector: contributes advanced technology, production facilities, and logistics networks crucial for scaling innovations **Social capital** • CBOs: Have deep connections within local communities, enabling them to effectively mobilize grassroots support and ensure that interventions are culturally appropriate and accepted • Government and GROs: Possess strong networks that link various stakeholders, from local communities to international bodies, facilitating policy integration and wide-scale adoption • Private sector: leverages extensive business networks and partnerships to scale solutions across different regions and sectors **NEW/EXPANDED DEMAND PARTNERS** **Human capital** • ARIs: bring specialized expertise in emerging fields • Intergovernmental organizations and regional research bodies: provide knowledge and leadership in regional coordination, essential for implementing cross-border initiatives. **Biophysical capital** • ARIs: offer state-of-the-art laboratories and field research facilities that are critical for high-level research and development • Funders: Enable access to financial resources for infrastructure development and capacity building • Regional research organizations: provide access to regional research facilities and databases that are key for collaborative research and scaling interventions **Social capital** • Intergovernmental organizations (e.g., IGAD, COMESA): facilitate cross-border collaboration and policy alignment, crucial for regional One Health Initiatives • Regional research organizations (FARA, ASARECA, CCARDESA): act as hubs for coordinating research and development across countries, fostering collaboration among national research systems	**HUMAN CAPITAL** ***CGIAR (multiple Centers)*** **Strengths:** For One Heath, CGIAR boasts a highly skilled and interdisciplinary workforce with deep expertise in agriculture, animal and aquatic health, environmental science, and food systems. CGIAR Centers have a strong track record of conducting cutting-edge One Health research into aspects such as AMR, food safety, and zoonotic diseases and developing innovative solutions that address complex global health challenges. **Weaknesses:** While CGIAR excels in research, its capacity for large-scale implementation and localized adaptation of interventions can sometimes be limited, particularly in regions where it lacks a strong on-the-ground presence. For One Health CGIAR has limited expertise in human health and disease, apart from some expertise in human health nutrition. ***Potential partners*** **Strengths:** Partners such as ARIs, international universities, and NGOs bring specialized expertise and are often well placed to translate research into practice, particularly at the local level. **Trade-offs:** The CA in human capital is relatively balanced, with CGIAR holding an advantage in interdisciplinary research and innovation, while partners excel in specialized expertise and local implementation. Collaboration is essential to leverage these complementary strengths. For One Health research, it is important that we partner with public health institutes and organizations. **BIOPHYSICAL CAPITAL** ***CGIAR*** **Strengths:** CGIAR has access to state-of-the-art laboratories, research facilities, and experimental farms across various regions. ***Potential partners*** **Strengths:** Partners such as government agencies, private sector companies, and ARIs often have extensive physical infrastructure, including health facilities, production sites, and logistical networks, that are crucial for scaling innovations. **Trade-offs:** The CA in biophysical capital lies with potential partners when it comes to scaling and implementing solutions on a large scale. CGIAR's strength lies in leveraging its research infrastructure to develop innovations, while partners are better suited to deploying these innovations in the field.

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				CURRENT INNOVATION PARTNERS **Human capital** • CGIAR and universities: interdisciplinary expertise • NARES: contribute localized expertise and ensure that innovations are contextually relevant. **Biophysical capital** • CGIAR and universities: access to cutting-edge research facilities, including laboratories, field stations, and computational resources • ARIs: provide specialized equipment and facilities for advanced research in areas like genomics, epidemiology, and climate science **Social capital** • CBOs: enable the co-design of solutions with local communities and stakeholders, ensuring that innovations meet local needs and have strong buy-in • Universities and ARIs: maintain global networks of researchers and institutions, facilitating knowledge exchange and collaborative research efforts **NEW/EXPANDED INNOVATION PARTNERS** **Human capital** • Universities and ARIs: provide global expertise and cutting-edge research in areas critical to One Health, such as zoonotic disease management, environmental sustainability, and advanced agricultural practices **Biophysical capital** • Global ARIs and universities: offer state-of-the-art facilities and advanced research capabilities that are essential for pushing the boundaries of One Health research **Social capital** • International research networks: expand the reach of innovations through collaboration with global research networks, ensuring broader dissemination and impact **CURRENT SCALING PARTNERS** **Human capital** • WHO, FAO, UNEP, and WOAH: brings expertise in global health, food security, and environmental governance, crucial for scaling One Health Initiatives worldwide • NGOs and INGOs: possess extensive experience in implementing health and development projects, especially in low-resource settings • Private sector: includes skilled professionals in technology, logistics, and business development, vital for commercializing and scaling innovations **Biophysical capital** • CGIAR and private sector: provide infrastructure and technology that are essential for scaling up successful interventions • UN agencies: offer access to global logistical networks and health infrastructure that are crucial for large-scale implementation **Social capital** • WHO, FAO, UNEP, WOAH and NGOs: have vast networks that connect with governments, communities, and international bodies, ensuring that scaled interventions are widely adopted • Private sector: leverages market access and distribution networks to scale innovations across different regions and industries	**SOCIAL CAPITAL** ***CGIAR*** **Strengths:** CGIAR has built extensive global networks with research institutions, governments, and international organizations. These connections facilitate collaboration and knowledge sharing on a global scale. **Weaknesses:** While CGIAR has strong international networks, its reach at the grassroots level can be limited, particularly in regions where community engagement is critical for the success of interventions. ***Potential partners*** **Strengths:** NGOs, CBOs, and certain intergovernmental organizations excel in social capital, with deep-rooted connections in local communities and the ability to mobilize grassroots support. These partners are often more adept at ensuring that interventions are culturally appropriate and widely accepted. **Weaknesses:** Partners with strong local networks may lack the global influence and strategic partnerships that CGIAR possesses, limiting their ability to scale innovations beyond their immediate context. **Trade-offs:** The CA in social capital generally lies with partners who have strong community ties and local networks. CGIAR's strength in this area is more pronounced at the global and institutional levels, making collaboration with local partners essential for effective implementation. **INCENTIVES** ILRI, WorldFish, IWMI, IFPRI, and Alliance Bioversity CIAT bring distinct yet complementary institutional priorities that align with the objectives of reducing risks in ASF production systems. The consortium ensures that all partners are equally motivated to contribute resources and expertise toward achieving shared goals, including zoonotic disease prevention, control of antimicrobial resistance, increasing food safety, and improving environmental health.

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				NEW/EXPANDED SCALING PARTNERS **Human capital** • INGOs: bring deep experience in grassroots implementation, community engagement, and capacity building, critical for scaling One Health Initiatives • Private sector (Merck, Cargill): provides expertise in product development, commercialization, and global supply chain management **Biophysical capital** • INGOs and private sector: access to extensive networks of facilities and logistical systems, essential for the large-scale delivery of health and agricultural products • Intergovernmental agencies: provide global infrastructure and systems for health, agriculture, and environmental protection, facilitating widespread adoption of One Health interventions **Social capital** • INGOs and CBOs: strong connections with local communities and international networks, ensuring that scaled interventions are culturally appropriate and widely accepted • Private sector: extensive partnerships with governments, NGOs, and other businesses, enabling the broad distribution of innovations and ensuring sustainability	

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Markets, Policies, and Scaling: Institutional and behavioral models for enhanced uptake (inclusive delivery systems) of animal and aquatic food systems innovations	**Human capital** 1. Impact assessment economists to provide rigorous assessment of adoption and impacts of innovations 2. Gender scientists to ensure that adoption models are inclusive 3. Market systems specialists to diagnose systems challenges and ensure sustainable market-based (entrepreneurial, business-oriented) solutions to technology uptake 4. Technology experts that have a better understanding of the technologies to be adopted 5. Agricultural economists to diagnose adoption barriers and design innovations (risk mitigation, financing, etc.) to overcome such barriers 6. Extension professionals to design appropriate extension approaches and relevant content 7. Social scientists to provide a holistic understanding of adoption behaviors **Physical ccapital** 1. Presence on the ground **Social capitalc** 1. Long-term relationships with NARES and national R4D organizations based on joint activities 2. Partnerships and networks with grassroots organizations (NGOs, CBOs, FPOs) 3. Long-term scientific links with partner universities through capacity development and joint publications 4. Connection/relationship with private sector actors **Incentives** • For NARES: increased capacity and international scientific linkages • For CGIAR: publication of IPGs, impact on the ground • For national universities and ARIs: access to data, relevant fieldwork, experience for students, and research and publication opportunities • For INGOs: demand for innovations, technical assistance, and innovative delivery models to be used in their work • For the private sector: increased profits and enhanced business opportunities • For government: tangible impact on the ground, evidence for decision-making and investments, and employment creation • For donors: Impact and value for money • For think tanks: capacity development, generation of knowledge	**Human capital (strong)** Across the five CGIAR Centers: • 1–5 and 7: available • 6: partially available through the capability to develop extension content and generation of evidence of extension delivery methods **Physical capital (moderately strong)** • 1: all Centers have a presence in several countries, but not all proposed target countries are covered **Social capital (moderately strong)** • 1 and 3: inherently available across the 5 CGIAR Centers owing to long similarity and complementarity in mandates and through host country agreements • 2 and 4: partially available, mostly through governments and other local institutions **Incentives (strong)** • Driven by the need to demonstrate impact and value for investment, develop appropriate technologies; pressure to apply rigorous methods that accurately predict results and inform action (rigorous impact assessment); mandate to deliver IPGs	**Demand partners** • Private sector: vet pharmacies, genetic supply companies, feed and forage suppliers, forage seed suppliers, financial institutions, commodity aggregators, aquatic hatcheries and nurseries, large-scale livestock and aquatic enterprises • Funders: World Bank, AfDB, ADB, IDB, philanthropic foundations, aid agencies • NGOs and INGOs: CARE, GIZ, local NGOs • Governments: national and local **Innovation partners** • ARIs, NARES, international research institutes, and universities: Hohenheim, Wageningen, Tufts) • Global think tanks: IGES • Private sector: forage seed companies, financial institutions, commodity aggregators, aquatic hatcheries and nurseries, large-scale livestock and aquatic enterprises, FPOs **Scaling partners** • INGOs: Oxfam, CARE, Heifer International, Land O'Lakes Venture37, GIZ • Private sector: forage seed companies, financial institutions, commodity aggregators, aquatic hatcheries and nurseries, large-scale livestock and aquatic enterprises, FPOs • National and local governments: ministries and extension departments • Funders: World Bank, AfDB, ADB, IDB, philanthropic foundations, aid agencies	***Private sector*** **Human capital (moderately strong)** • 3, 4 and 6 are available across these partner types to help push the portfolio of products/ technologies and services they trade in. **Physical capital (strong)** • 1 is available **Social capital (moderately strong)** • 2 and 4 are inherent in this partner type due to the implication of these for business outcomes, while 1 & 3 are partially available **Incentives (strong)** • Increase profits and enhance business opportunities ***Governments*** **Human capital (weak)** • 4 and 6 are available but sometimes with low capacity while the rest are lacking or of highly limited capacity whenever they exist **Physical capital (strong)** • 1 is available **Social capital (moderately strong)** • 1 and 2 are available due to the accountability of these two partners to governments while 3 and 4 are partially available, but much lower for 4 **Incentives (strong)** • Incentives to demonstrate tangible impact on the ground and evidence for decision-making are needed to attract investments, create employment and win political influence ***Global think tanks*** **Human capital (strong)** • 4 is available; 3 is partially available **Physical capital (moderately strong)** • 1 is available **Social capital (strong)** • 3 is mostly available owing to their connections with governments, academic learning institutions, and NARES; 4 is partially available **Incentives (strong)** • Capacity development, generation of knowledge ***Funders*** **Human capital (moderate)** • 1–5 and 7 partially available but of varied depth skills and capability **Physical capital (moderate)** • 1 partially available **Social capital (moderate)** • 1–4 partially available **Incentives (strong)** Impact and value for money ***NGOs and INGOs*** **Human capital (moderately strong)** • 2, 3 and 6 partially available (available but often of lower capabilities); 1 and 4 are weak **Physical capital (strong)** • 1 is available **Social capital (strong)** • 1, 4 available **Incentives (strong)** • Access to innovations and technical assistance, new business models	CGIAR Centers draw their CA from the high-quality and diverse research expertise needed to design adoption models and to measure the impact of such models. The CA of CGIAR also lies in the incentives to apply cutting-edge methods and to demonstrate impact on the ground while delivering IPGs. This advantage can be enhanced through partnership and exchange with NARES, universities, and think tanks that are looking for opportunities to expand their scope in advanced methodologies in adoption and impact studies. Partnerships with governments, NGOs, and the private sector will also bring on board the CA in physical and social capital through the on-ground presence of these organizations and their networks of grassroots structures, which are needed to physically proof solutions and take proven innovations to scale. Moreover, partnership with the private sector provides the CA of business incentives that are useful in catalyzing the uptake of innovations and therefore provide platforms for piloting options for the uptake of SAAF innovations. Finally, partnership with NGOs provides the CA of a strong demand for innovations, which will be needed to enhance uptake of proven innovations.

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				NARES and universities **Human capital (moderately strong)** • 1–7 is partially available but with cases of limited capacity • Physical capital (moderate because of variation in presence between Global South and Global North) • 1 is partially available **Social capital (strong)** • 1–4 partially available depending on the case **Incentives (strong)** • Incentives for NARES: increased capacity and international scientific links • Incentives for national universities and ARIs: access to data, relevant fieldwork and experience for students, research and publication opportunities	

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Markets, Policies, and Scaling: Policy analysis and engagement processes for effective animal and aquatic food systems	**Human capital** 1. Development economists specialized in modeling 2. Gender scientists to ensure gender integration in policy design 3. Social scientists specialized in policy analysis and governance 4. Subject matter experts (livestock, fish, finance, etc.) to provide technical guidance 5. Engagement facilitators to facilitate policy dialogue and engagement **Physical capital** 1. Presence on the ground **Social capital** 1. Relationship with regional, national, local government 2. Connection/relationship with private sector actors 3. Relationship with nonstate actors (NGOs, CBOs, CSOs, etc.) 4. Long-term relationships with local universities, NARES, and think tanks 5. Established relationships with influential academics and experts 6. Established relationships with reputable personalities with substantial institutional connections **Incentives** • For CGIAR: public good through greater influence on policy for impact • For funders: value for money, increased impact • For government: political influence and visibility • For local universities, NARES, and think tanks: visibility and influence • For private sector: favorable business environment • For nonstate actors: visibility and influence	**Human capital (strong)** • Across the five CGIAR Centers, 1, 2, 3 and 4 are available; 5 is partially available. **Physical capital (moderately strong)** • 1 is available in some countries, but not all. **Social capital (strong)** • 1, 4, 5 available and 6 mostly available through host country arrangements; 2, 3 partially available **Incentives (strong)** • For CGIAR: greater influence on policy for impact	**Demand partners** • Governments: regional, national, local, service delivery parastatals • Funders: World Bank, AfDB, ADB, IDB, philanthropic foundations, aid agencies • Private sector: associations, FPOs, input manufacturers • Nonstate actors: CSOs, CBOs, NGOs **Innovation partners** • Internal CGIAR • Governments: regional, national, local, service delivery parastatals • Universities, NARES, think tanks: KIPPRA, Tegemeo, etc. • Nonstate actors: CSOs (Action Aid, etc.) • Private sector **Scaling partners** • Governments: regional, national, local, service delivery parastatals • Funders: World Bank, AfDB, ADB, IDB, philanthropic foundations, aid agencies • Nonstate actors: CSOs (Action Aid, etc.) • Private sector	***Private sector*** **Human capital (weak)** • Only 4 available but less technical **Physical capital (strong)** • 1 is available since they are key implementers of developed policies **Social capital (moderately strong)** • 2 is available; 1, 3 partially available **Incentives (strong)** • Incentives for private sector: greater stake in policy as key actor affected by policy environment ***Governments*** **Human capital (moderately strong)** • 1, 2, 3, 4 are available but with lower capacity; 5 is not available **Physical capital (strong)** • 1 is available **Social capital (moderately strong)** • 1–6 are available but goodwill is sometimes compromised by mis-aligned political interests and mistrust **Incentives (strong)** • Incentive for government: political influence and visibility ***Universities, NARES, and think tanks*** **Human capital (strong)** • 1–5 available, 6 partially available **Physical capital (strong)** • 1 is available **Social capital (moderately strong)** • 1, 4, 5 available; 2, 3, 6 partially available **Incentives (strong)** • Incentives for local universities, NARES, and think tanks: visibility and influence ***Funders*** **Human capital (moderately strong)** • 1–4 available but sometimes not specialized; 5 partially available **Physical capital (moderately strong)** • 1 is available but remotely engaged **Social capital (strong)** • 1, 3, 4, 5, 6 available; 2 partially available **Incentives (strong)** • Incentives for donors: value for money, increased impact ***Nonstate actors*** **Human capital (weak)** • 1–5 could be available but usually at low level of expertise **Physical capital (strong)** • 1 is available **Social capital (moderately strong)** • 1, 2, 3 and 6 available; 4 and 6 partially available; 5 hardly available **Incentives (strong)** • Incentives for nonstate actors: visibility and influence	CGIAR CA is in the high level of expertise in modeling that is informed by various subject matter specialists with respective Centers. The policy design and engagement process would benefit from partnerships with NARES, local universities, and think tanks and would enable cross-fertilization of approaches that bring the CA of physical presence of the ground and therefore better understanding of context. Partnership with private sector actors will also bring the CA of advocacy and greater participation owing to the greater stake they have in a positive policy environment. Partnerships with government, as the lead policy implementer, are paramount, as favorable policies are aligned with government incentives for political influence and visibility. Finally, nonstate actors bring the CA of grassroots connections and working relationships with government, which positions them for the advocacy and community engagement facilitation role needed in the policy process.

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Gender, Youth, and Social Inclusion: Effective interventions for the empowerment of women, youth and marginalized groups and for equitable norms in animal and aquatic systems	**Human capital** 1. Gender and youth scientists with long-standing experience in empowerment 2. Standardized tools to assess changes in empowerment (WELI, WEFI, WELBI) and norms 3. Experience in designing empowerment in animal and aquatic systems interventions 4. Experience with developing, implementing, and studying gender-transformative approaches in AASs 5. Experience with analyzing the intersection of social markers of disadvantage **Biophysical capital** 1. Secure data storage and computing facilities 2. Presence on the ground **Social capital** 1. Relevant partnerships and networks with development organizations to co-design and implement interventions 2. Long-term relationships and engagement with national R4D organizations to achieve impact 3. Engagement with policymakers to create a conducive environment for equity 4. Experience in multidisciplinary work and knowledge of animal and aquatic technical issues **Incentives** • For NARES: increased capacity, international scientific links, progress toward government goals • For CGIAR: publication of IPGs, impact on the ground, successful interventions and innovations for scaling • For national universities and ARIs: access to data, access to tools and methodologies, support to students for fieldwork and experience, publications in international journals • For CBOs and INGOs: access to innovations and technical assistance, access to new and tested empowerment and transformative models, support to scientifically assess the impact of interventions	**CONSIDERING THE 5 CGIAR CENTERS COLLABORATING IN SAAF** **Human capital (strong)** • Scientific expertise in enhancing empowerment and norms in AASs with an intersectional lens; and capacity to assess impact **Biophysical capital (strong)** • Data storage is digital and available; presence on the ground is strong in countries where we work **Social capital (moderately strong)** • 1: Partnerships and networks with NARES and grassroots organizations (CBOs) • 2: Long-term relationships and commitment with national R4D organizations • 3: Long-term scientific links with partner universities • 4: connection with policymakers depends on the country **Incentives (strong)** • publication of IPGs • evidence of impact on the ground • successful interventions and innovations for scaling	**CURRENT PARTNERS** • **Demand partners**: NARES, governments, CBOs, funders, private sector, national research institutes, UN agencies, international universities • **Innovation partners**: NARES, universities, CBOs, national and international NGOs • **Scaling partners**: governments, NGOs and INGOs, funders, development actors and projects, private sector, UN agencies **NEW/TO BE EXPANDED PARTNERS** Local NGOs, more private partners, more policymakers, more UN agencies, more international universities	***NARES*** **Human capital (moderate)** • Knowledge of local context • Often weak in social science and data analytics **Biophysical capital (strong)** • Presence on the ground **Social capital (moderately strong)** • Established relations with communities; links to policymakers **Incentives (moderate to strong)** • Impact on the ground • Increased technical capacity • Access to innovations and technical assistance • International scientific links and outputs • Progress toward national goals ***Governments*** **Human capital (weak to moderate)** Little expertise in social and gender sciences and measurement of impact **Biophysical capital (strong)** • On the ground presence **Social capital (strong)** **Incentives (moderate)** • Impact on the ground • Increased technical capacity • Access to innovations and technical assistance • International scientific links • Progress toward national goals ***National and international CBOs/NGOs*** **Human capital (moderate)** • Knowledge of local context; experience with implementing interventions on the ground • Often weak in systematic assessment of impact **Biophysical capital (strong)** • Presence on the ground **Social capital (moderately strong)** • Established relations with communities; links to policymakers **Incentives (strong)** • Impact on the ground • Access to technical capacity • Access to innovations and technical assistance • Access to scientific assessments of impact ***Private sector*** **Human capital (moderate)** • Knowledge of technical issues (e.g., poultry business) • No expertise in social impact assessment and gender equality **Biophysical capital (strong)** • Presence on the ground; sustainable models that sustain themselves **Social capital (strong)** • Established relations with communities; links to policymakers; links to value chain actors • Sometimes in conflict with other private companies **Incentives (moderate)** • Impact on the ground • Access to innovations and technical assistance on empowerment and equity • Scientific assessment of impact • Better business	The work planned for GYSI mostly needs social and human capital, both of which are strong in the SAAF GYSI team. The team has a strong CA in conducting gender, youth, and equity research for development, compared with any other partner. Together, we provide a unique combination of expertise: GESI analytical skills integrated with technical animal and aquatic knowledge; long-term experience in developing and testing GESI solutions on the ground and assessing their impact; scientific tools and approaches that we have developed over the years for both targeted, ad hoc studies and standardized assessments; long-term relationships with various types of local partners; and capacity to work with multidisciplinary scientific teams and in partnership with diverse organizations. The SAAF GYSI team has strong incentives to undertake this work given that gender and social analysis for equitable development is of growing interest to the scientific and development communities, CGIAR, and donors, as a key pillar of a sustainable and fair future. The work of CGIAR and the GYSI team sits at the junction between research and development and needs strong partnerships to be effective. The GYSI team has limited experience in implementing co-developed interventions on the ground (such as, for example, business incubation and cooperative governance for empowerment; social media campaigns for transformative change). For this, we partner with NGOs and local governmental bodies. We have no mandate and capacity to scale our interventions to large regions; for this, we partner with governments, the private sector, and international NGOs. Finally, we partner with international and national universities to combine our expertise on research for development with theirs on mostly blue-sky research.

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Digital and Data: Development and implementation of knowledge and data management systems that adopt FAIR principles, ensuring accessibility, interoperability, and usability for all market actors, including women, men, youth, and marginalized groups	**Human capital** 1. Data analysts, IT solution architects, business analysts, database and software engineers to design and develop required IT systems and platforms 2. Private sector agri-businesses, agritechs, NGOs, and development organizations to guide the design of systems 3. Knowledge management professionals, biometricians, statisticians, and others who can provide subject matter expertise 4. Biophysical scientists who can provide backstopping about data and digital specifics from different scientific disciplines 5. Social scientists: economics as well as gender specialists to help navigate interdisciplinary aspects of output and link it to policy-related outputs **Physical capital** 1. Secure data storage and computing facilities 2. Physical spaces to convene workshops 3. Presence on the ground **Social capital** 1. Partnerships with global and local networks on livestock data ontologies and interoperability issues 2. Connections with scientists/managers responsible for data and knowledge management for different scientific disciplines across CGIAR and other R4D institutions **Incentives** • For NARES: better management of research data and knowledge, more efficient use of research funding • For CGIAR: increased re-use of existing data assets and thereby faster innovations to markets • For national universities and ARIs: access to interoperable data and digital public goods • For donors: more efficient use of research funding	**Human capital (strong)** • Across the five CGIAR Centers, parts of AAFS, 3–5 are available within CGIAR while 1 and 2 are partially available in a select few project teams **Physical capital (strong)** • 1: all Centers have secure data and computing infrastructure • 2: ILRI (Nairobi and Addis), WorldFish (Egypt and Malaysia), Alliance (Cali), ICARDA (Lebanon); new hub in collaboration with UAE government can also support both 1 and 2 • 3: all Centers **Social capital (moderately strong)** • 1: partnerships and networks with NARES and grassroots organizations (CBOs), FAO, LD4D, and other similar organizations • 2: past efforts through Big Data platform and the Centers' own efforts around FAIR data workflows created some momentum in developing networks on topics of data interoperability, ontologies, etc. **Incentives (strong)** • More efficient use of research funding • More efficient research workflows and reduced duplication of data collection efforts • Better ROI and impacts realized	• **Demand partners**: NARES, governments, donors, private sector and agritechs, development and regional organizations • **Innovation partners**: private sector, technology companies, development and regional organizations (FAO, AGRA, CORAF) and ATRC (UAE hub), global think tanks (LD4D, Linux foundation, AgGateway, etc.) • **Scaling partners**: internal CGIAR, CBOs, and NGOs	***Private sector, technology companies, and agritechs*** **Human capital (strong)** • 1, 2 available across these partner types **Physical capital (strong)** • 1 can also be strong with private sector and technology companies **Social capital (weak)** • 1, 2: mostly weak **Incentives (strong)** • Strong incentives to work for the private sector in this area ***Governments*** **Human capital (weak)** • 1 is partly available but generally weak **Physical capital (weak to moderate)** • 1 is generally weak but 3 is strong for this category **Social capital (weak)** • In most cases, access to 1 and 2 are weak for governments **Incentives (strong)** • Strong incentives for governments ***Global think tanks*** **Human capital (strong)** • 1, 2, 3 are very strong for these partners; weak or no presence in 4 and 5 **Physical capital (moderate)** • Strong in 1 but no presence in 2 and 3 **Social capital (strong)** • 1, 2: Strong **Incentives (strong)** • Strong incentives to work in this area ***Development and regional organizations*** **Human capital (moderate)** • 3, 5 are partially available across these partner types **Physical capital (strong)** • Strong in all areas **Social capital (strong)** • 1, 2: Strong **Incentives (strong)** • Strong incentives to work in this area ***CBOs and NGOs*** **Human capital (moderate)** • Weak in all areas except in 3 and 5 moderately **Physical capital (moderate)** • Weak in 1 but presence in 2 and 3 **Social capital (moderate)** • 1, 2: Moderate **Incentives (strong)** • Strong incentives to work in this area	CGIAR's CA draws from its convening power, global reach, and partnerships, embedded human and institutional capabilities in handling data and knowledge products across different scientific disciplines, and deep understanding of the market actors' needs and interoperability issues from a data and digital standpoint. The CA of partners draws from connections with a network of public and private actors engaged in designing and building technologies to solve data interoperability issues, designing IT software architecture, and developing and maintaining digital public goods and digital public infrastructure. The CA lies balanced between CGIAR and the partners for this high-level output. The scale-up of this output requires equal inputs from CGIAR in terms of knowledge and domain expertise and also its ability to convene partners. The partners will need to bring in their connections with key stakeholders and draw from their experience of scaling up digital innovations.

High-level output	Needed sources of CA required to deliver high-level output	CGIAR's sources of CA in delivering high-level output	Potential partner types (e.g., NARES, SMEs, private sector)	Partners' sources of CA in delivering high-level output	Analysis and indication of where CA lies
Digital and Data: Strengthened capacity and knowledge among market actors to adopt novel digital innovations for evidence and data-informed decision-making	**Human capital** 1. Social scientists, especially economists and capacity-building experts 2. Biophysical scientists who can provide backstopping about data and digital specifics from different scientific disciplines 3. Agribusiness and value chain experts to bring SME to digital development 4. Human-centered design specialists to enable gender-inclusive digital development 5. Enumerators and field staff **Physical capital** 1. Secure data storage and computing facilities 2. Physical spaces to convene trainings 3. Course content and curricula 4. On the ground presence **Social capital** 1. Partnerships with NARES, CBOs, agri-businesses, agritechs, and other grassroots organizations 2. Partnerships with think tanks and regional organizations **Incentives** • For CGIAR: greater uptake of technologies and impact realization • For donors/government: catalytic effect on outcomes as well as greater uptake of digital innovations • For NARES/ARIs/agritechs: human capacities available for taking up more data and digital innovations in the future	**Human capital (strong)** • Across the five CGIAR Centers part of AAFS, 1, 2 are available within CGIAR while 3, 5 are partially available in select few project teams **Physical capital (strong)** • 1: all Centers have secure data and computing infrastructure • 2: ILRI (Nairobi and Addis), WorldFish (Egypt and Malaysia), Alliance (Cali), ICARDA (Lebanon), and countless project offices; new hub in collaboration with UAE government can also support both 1 and 2 • 3: CGSpace and other knowledge repositories • 4: moderate in this area **Social capital (strong)** • 1: Partnerships and networks with NARES, grassroots organizations (CBOs), FAO, LD4D, and other similar organizations • 2: Links with global organizations like FAO, AGRA, CORAF, LD4D **Incentives (strong)** • More efficient use of research funding and research workflows and reduced duplication of data collection efforts • Better ROI and impacts realized	• Demand partners: NARES, governments, donors, agritechs • Innovation partners: internal CGIAR, development organizations, universities • Scaling partners: agri-businesses and value chain actors, CBOs, NGOs	***Agritechs*** **Human capital (moderate)** • 3, 5 available across these partner types but weak on the rest **Physical capital (moderate)** • 1 and 4 are strong but 2, 3 are variable for this partner type **Social capital (weak)** • 1, 2: mostly weak **Incentives (moderate)** • Strong incentives to work for private sector in this area ***Governments*** **Human capital (moderate)** • 1 is partly available, 5 is strong, but rest are generally weak **Physical capital (moderate)** • 1 is generally weak, but for 2, 4 they can provide some support **Social capital (strong)** • In most cases access to 1 and 2 are strong for governments **Incentives (strong)** • Strong incentives for governments ***NARES*** **Human capital (moderate)** • 1, 2, 5 are strong, and 3, 4 are weakly available **Physical capital (strong)** • 1 is generally weak but strong in 2, 3, 4 **Social capital (strong)** • In most cases access to 1 and 2 are strong for NARES **Incentives (strong)** • Strong incentives for NARES ***CBOs and NGOs*** **Human capital (moderate)** • 5 are strong, and the rest are weak **Physical capital (moderate)** • Weak in 1 to 3 but strong in 4 **Social capital (moderate)** • Moderate in 1 and 2 **Incentives (strong)** • Strong incentives to connect with science organizations and build their capacity in this area ***Agribusiness and value chain actors*** **Human capital (moderate)** • Strong in 3 and 5 while weak in most others **Physical capital (strong)** • Strong in 4, moderate in 1 with good strength in 2, 3 **Social capital (moderate)** • Moderate in 1 and 2 **Incentives (strong)** • Strong incentives since these can help their own businesses	CGIAR's CA draws from human and institutional capacities and the global presence of a network of partners who can assist in capacity building. Partners' CA draws from needed links and connections at the grassroots to mobilize farmers as well as other stakeholders to deliver on capacity-building commitments. The source of CA for this high-level output lies more with partners. CGIAR can offer technical backstopping as well create knowledge assets. But the actual activity of creating capacities as well transferring knowledge is more centered with partners.

High-level output	Needed sources of CA required to deliver high-level output	CGIAR's sources of CA in delivering high-level output	Potential partner types (e.g., NARES, SMEs, private sector)	Partners' sources of CA in delivering high-level output	Analysis and indication of where CA lies
Digital and Data: Establishment of effective platforms, evidence, processes, and a supportive enabling environment (finance, policies, norms) that facilitate the governance of AAFS using digital innovations	**Human capital** 1. Social scientists, especially economists and policy experts 2. Biophysical expertise from different scientific disciplines 3. Agribusiness and value chain experts to bring SME to digital development 4. Human-centered design specialists to enable gender-inclusive digital development 5. Enumerators and field staff 6. Data analysts, IT solution architects, business analysts, database and software engineers to design and develop required IT systems and platforms **Physical capital** 1. Secure data storage and computing facilities 2. Evidence clearing house 3. In-country presence **Social capital** 1. Partnerships with NARES, CBOs, agri-businesses, agritechs, and other grassroots organizations 2. Partnerships with think tanks and regional organizations 3. Relationships with policymakers and government departments **Incentives** • For CGIAR: impact realization • For donors/government: catalytic effect on outcomes as well as greater uptake of digital innovations • For NARES/ARI/agritechs: human capacities available for up more data and digital innovations in the future	**Human capital (moderate)** • Across the five CGIAR Centers part of SAAF, 1, 2 are available within CGIAR while 3, 4, 5, 6 are partially available in a select few project teams **Physical capital (strong)** • 1: all Centers have secure data and computing infrastructure • 2: CGIAR has some evidence of clearing house platforms • 3: ILRI (Nairobi and Addis), WorldFish (Egypt and Malaysia), Alliance (Cali), ICARDA (Lebanon), and countless project offices; new hub in collaboration with UAE government can also support both 1 and 2 **Social capital (strong)** • 1: partnerships and networks with NARES and grassroots organizations (CBOs) as well as with likes of FAO, LD4D, and others • 2: links with global organizations like FAO, AGRA, CORAF, LD4D • 3: strong links with policymakers and government departments **Incentives (strong)** • Improved ROI and greater visibility • Better ROI and impacts realized • More opportunities for digital innovation	• **Demand partners**: governments, donors, private sector and agritechs, development and regional organizations • **Innovation partners**: internal CGIAR, NGOs, technology companies, NARES • **Scaling partners:** development and regional organizations (FAO, AGRA, CORAF) and ATRC (UAE hub), global think tanks (LD4D, TAC, Linux Foundation, AgGateway, etc.)	***Private sector and agritechs*** **Human capital (moderate)** • 3, 5, and 6 are available across these partner types but weak for others **Physical capital (moderate)** • 1 can also be strong but weak in 2, 3 **Social capital (weak)** • 1, 2, 3 are mostly weak **Incentives (strong)** • Strong incentives to work for the private sector in this area ***Governments*** **Human capital (weak)** • 5 is strong, 1 is partly available, but generally weak for the rest **Physical capital (weak to moderate)** • 1, 2 are generally weak, but 3 is strong for this category **Social capital (moderate)** • In most cases access to 1 and 2 is weak for governments, but 3 is strong **Incentives (strong)** • Strong incentives for governments ***Global think tanks*** **Human capital (strong)** • 1, 2, 3 are very strong for these partners; weak or no presence in 4 and 5 **Physical capital (moderate)** • Strong in 1 but no presence in 2 and 3 **Social capital (strong)** • 1, 2, and 3 are strong **Incentives (strong)** • Strong incentives to work in this area as their mandate is strong ***Development and regional organizations*** **Human capital (moderate)** • 3, 5 are partially available across these partner types **Physical capital (strong)** • Strong in all areas **Social capital (strong)** • Strong in all areas **Incentives (strong)** • Strong incentives to work in this area as their mandate is strong ***Donors*** **Human capital (moderate)** • Moderate in all areas **Physical capital (moderate)** • Strong in 1 with presence in 2 and 3 **Social capital (strong)** • 1, 2, 3 are strong **Incentives (strong)** • Strong incentives to work in this area as it is their main objective	CGIAR's CA draws from its global as well as local presence; strong history of working with policymakers, communities, and farmers; and human-centered design and evidence-based approaches to designing and testing digital tools and innovations. The partners' CA draws from their access to industry best practices and technologies for digital innovation development. Regional organizations can play a pivotal role in building advocacy and supporting institutionalization of digital tools. Partners can also bring change management approaches as well as project management skills needed for such complex outputs. This CA lies more with CGIAR given its rich legacy and history of developing demand-driven and human-centered digital innovations and creating an evidence base. Our partners have great capacities in scaling as well as advocacy but need the scientific and technical backstopping.