Food Frontiers and Security Program

Full design document

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List of acronyms

ACIAR	Australian Centre for International Agricultural Research
ANCORS	Australian National Centre for Ocean Resources and Security
AoW	Area of Work
ARI	Advanced Research Institution
CA	Comparative advantage
CapSha	Capacity sharing
CIP	International Potato Center
DFAT	Department of Foreign Affairs and Trade (Australia)
DRR	Disaster risk reduction
FCA	Fragile, Conflict-Affected (Food Systems)
FCM	Fragility, Conflict, and Migration (CGIAR Initiative)
FAO	Food and Agriculture Organization of the United Nations
GIS	Geographical Information Systems
ICPAC	IGAD Climate Predictions and Applications Centre
ICRC	International Committee of the Red Cross
IGAD	Intergovernmental Authority on Development
IOM	International Organization for Migration
HDP	Humanitarian, Development, and Peace
IAES	CGIAR International Advisory and Evaluation Services
IBSRAM	International Board for Soil Research and Management
IFRC	International Federation of Red Cross and Red Crescent Societies
IRC	International Rescue Committee
ISDC	CGIAR Independent Science for Development Council
IWMI	International Water Management Institute
LMIC	Lower- and middle-income country
M&E	Monitoring and evaluation
MEL	Monitoring, evaluation, and learning
MELIA	Monitoring, evaluation, learning, and impact assessment
MIS	Management information system
NARES	National Agricultural Research and Extension Systems

NGO	Non-government organization
OC	Outcome
OP	Output
PPP	Purchasing Power Parity
PRMF	CGIAR Performance and Results Management Framework
RAFS	Resilient Agrifood Systems
SIDA	Swedish International Development Agency
SME	Small and medium enterprise
SPC	Pacific Community
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environmental Program
UNFCCC	United Nations Framework Convention on Climate Change
UNHCR	United Nations High Commissioner on Refugees
UNICEF	United Nations Children's Fund
USAID-BHA	United States Agency for International Development Bureau for Humanitarian Assistance
USD	United States Dollar
WFP	World Food Programme
WHO	World Health Organization
WorldVeg	World Vegetable Center

1. Executive Summary

CGIAR has played a critical role in shaping major food systems since its inception. The Food Frontiers and Security Program fills a critical gap in CGIAR's ambitious effort to achieve food and nutrition security by focusing on "frontier" food, land, and water systems: fragile and conflict-affected, urban and peri-urban, and island food systems. By 2050, about two-thirds of the world's extremely poor will live in fragile and conflict-affected settings. Cities in low and middle-income countries will be home to well over half of these countries' populations –- many of them poor and in need of quality employment, food, and water. Island states face particularly acute challenges over the next few decades because of climate change. These systems are among the most vulnerable to shocks and crises; are characterized by high numbers of young people; are isolated, with short and resource-scarce food value chains; have relatively high levels of food and water insecurity; are affected by all three forms of malnutrition; and are facing serious environmental threats and degradation. Food system governance is weak in all three systems. New solutions and investments must be catalyzed to support some of the most vulnerable communities globally. Opportunities for improving outcomes through transdisciplinary research have been identified in this Program.

CGIAR is increasingly engaging in these systems; previous Initiatives have built strong partnerships in all three contexts and have demonstrated the potential benefits of focused research and development work combined with targeted capacity development and policy engagement. This work is nascent but rapidly growing amid urgent demand from CGIAR partners.

This Program is built upon three former CGIAR Initiatives: the FCM Initiative, Resilient Cities, and the Aquatic Food Initiative and, will focus on the three frontier systems: Fragile and Conflict-Affected (FCA) Food Systems (AoW2), Urban and Peri-urban Food Systems (AoW3), and Island Food Systems (AoW4). To integrate across these systems, fast-track innovation, and anticipate longer-term trends and required innovations, the Program will establish a Future Food System Lab (AoW1). It will guide and complement the work in the three target food systems and constitute a convening space for other CGIAR Programs, Accelerators, and other partners. It will use new evidence and foresight and digital tools to develop credible future scenarios, establish new partnerships, and collaboratively develop and test innovative food, land, and water system interventions in frontier contexts.

By 2030, the Food Frontiers and Security Program will achieve three key outcomes:

1. Governments and humanitarian and development partners use evidence and innovation to strengthen the sustainability and resilience of frontier food systems
2. Frontier food system actors have enhanced capacities to strengthen sustainability and resilience in fragile and constrained food, land, and water systems
3. Policymakers use new evidence, foresight, and other tools to formulate and implement new policies or investments in frontier food systems.

The Program anticipates these outcomes will directly support improving food and nutrition security in the target systems; providing quality business and employment opportunities for women and youth; improving food system governance; reversing environmental degradation; and positioning policymakers and other stakeholders to support continued innovation and resilience in response to future shocks and crises.

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

2.1. Challenges and megatrends

The Food Frontiers and Security Program focuses on three food systems of growing importance but outside of CGIAR's traditional focus areas: fragile and conflict-affected (FCA) food systems, urban and peri-urban food systems (hereafter, urban food systems), and island food systems. These food systems face significant challenges. Fragile and conflict-affected settings, home to over 1.5 billion individuals, are disproportionately impacted by poverty and food insecurity and face myriad systemic challenges to improving them. Urban areas are experiencing rapid growth but struggle with high unemployment, dietary shifts, climate risks and environmental pollution. Island nations contend with rising sea levels, limited resources, and elevated double burdens of malnutrition and non-communicable diseases. All three frontiers share common challenges, and their compounding factors often exacerbate conflict, forced displacement, and social inequalities.

The Food Frontiers and Security Program addresses megatrends that directly put pressure on the three focus food systems, especially demographic change (urbanization, migration), geopolitical instability, changing consumption patterns, climate change, and emerging technologies (ISDC 2023). Addressing the challenges posed by these megatrends demands novel options for policy, programming, and innovations, drawing on newly emerging technologies and making those accessible to all for a sustainable food system transformation.

2.2. High-level vision

Achieving CGIAR's vision of a world free of poverty, hunger, and environmental degradation will not be possible unless CGIAR's science Portfolio addresses the unique challenges faced by fragile, rapidly transforming, and resource-constrained settings outside the traditional focus of CGIAR — hereafter termed "frontiers": FCA, urban, and island food systems. This will require answering research questions specific to these settings using novel research methods; adapting technologies to the unique needs of the frontier food systems; and working with both new and traditional partners. These frontier systems face complex challenges and have fewer land and water resources to draw upon. Many of the solutions that work elsewhere are insufficient to overcome their challenges. Further, because these settings have been relatively neglected by researchers in the past, there is a strong demand for CGIAR integration.

The Food Frontiers and Security Program will work with partners to generate innovative research-based solutions that directly contribute to improving food, land, and water systems and nutrition in FCA areas, cities, and island nations, enabling them to achieve a sustainable and resilient food future. With our partners, the Food Frontiers and Security Program will co-develop and co-test innovations; generate evidence to inform policies, programming, and interventions; and support their efforts to scale successful solutions. It will advance all five CGIAR Impact Areas in the unique settings of frontier food systems.

The Program recognizes that it is critical to anticipate longer-term trends and developments for these vulnerable food systems. Therefore, it will initiate a forward-looking Future Food Systems Laboratory (hereafter, Lab). The Lab will be a new convening space for CGIAR and partners to rapidly identify and respond to technological and institutional changes in frontier food systems. It will use a variety of new tools to synthesize emerging trends, shape future transitions, and forge new partnerships to anticipate and respond to fast-evolving megatrends.

2.3. What is new in this Program?

The Future Food Systems Lab is a new area of work and will provide a convening space to collaborate on the three frontier food systems to prepare for the future by anticipating new challenges, generating and testing breakthrough innovations. The Lab serves as a collaborative environment for partners to co-develop future food system scenarios and resilience-building innovations. These may involve modular and compact food production technologies, nature-based and circular economy solutions, insect farming using waste for alternative protein production, vertical farming, gender-transformative approaches, and community-driven initiatives. In FCA food systems, the Program will advance innovative risk reduction strategies, bridge the humanitarian-development-peace nexus, promote recovery from crises through social protection programs, and build resilient, equitable agri-food systems. In urban food systems, the Program will generate effective, novel innovations for safe and sustainable food production and distribution - all creating livelihood options for women and youth. In island food systems, with high levels of malnutrition and non-communicable diseases, the Program will support restoring and strengthening indigenous aquatic food- and crop-based systems and equip young women and men with the skills to take charge of them.

3. Evidence-based and demand-led prioritization

The prioritization exercise drew on several factors. First, given that three of our four Areas of Work (AoWs) build on CGIAR Initiatives (Fragile, Conflict-Affected and Migration (FCM) systems; Resilient Cities; and Aquatic Foods), the Program team reviewed the geographies where these Initiatives are active, as well as where current and prospective bilateral projects might offer support. Second, geographic prioritization was guided by the status of key country-level indicators related to the CGIAR Impact Areas and our qualitative gauge of the strength of partnerships and in-country research demand and capacity (critical to research effectiveness). Finally, an assessment of food system fragility and of the potential for geographic concentration and collaboration across AoWs within this Program as well as across Programs was used for further refinement.

The prioritization process started with an expansive list of potential geographies, encompassing most geographies with ongoing work under the existing Initiatives and a list of possible new geographies. As part of the prioritization exercise, we retained 21 countries and two regions where networked regional analyses are planned. These geographies are reflected in the Appendix (Section 3, Tables 1.1 and 1.2). Further, in that same Appendix we present a set of indicators for prioritized geographies in Tables 2.1 and 2.2 (for countries and island food systems only).

The 21 countries finally selected differ in their key indicators related to poverty, gender inequality, economic vulnerability, climate exposure, and conflict, but share exposure to food system risk and fragility. All score low compared to other low- and middle-income countries (LMICs). For example, countries such as Somalia, Mozambique, and Zimbabwe experience alarmingly high levels of moderate or severe food insecurity, with over 70% of their populations affected. Timor-Leste has the highest proportion of its population living in poverty in Southeast Asia and 50% of children under five are stunted due to malnutrition. Gender inequality remains a pressing issue in countries such as Niger and Mali, where the Gender Inequality Index scores reflect particularly high levels of disempowerment. Economic vulnerability is also notable in our selected countries – for example, Zambia and Somalia show especially high percentages of their populations living below the national poverty line and facing extreme poverty. Youth unemployment rates exacerbate these challenges, particularly in prioritized countries such as Ethiopia and Bangladesh, where the rates exceed 30%. Conflict and environmental vulnerability further compound these existing economic and social challenges, particularly in fragile states like

Somalia, Sudan, and Yemen, which are grappling with high levels of internal displacement and severe environmental challenges such as extreme heat. The Fragile States Index and Conflict Index highlight the ongoing instability in these regions, with Somalia and Sudan having millions of internally displaced persons. Their vulnerability to climate change and natural disasters is also significant, with countries like Somalia and Yemen facing ever-increasing risks that are shared with island states such as the Solomon Islands and Timor-Leste. Overall, these indicators highlight the urgency of prioritizing these geographies to address the intertwined challenges of food security, gender inequality, poverty, conflict, and environmental vulnerability in frontier food systems.

While the overall prioritization process outlined above was followed for each type of food system (FCA, urban, island), the differing nature of partnerships and contextual risks in these three systems resulted in slight differences between them in terms of the prioritization process. For countries chosen based on their relevance to the Area of Work on fragile and conflict-affected food systems, the focus was on indicators based on poverty, fragility, conflict, gender, and climate. We prioritized countries with high levels of poverty, hunger, women's disempowerment, instability (e.g., geopolitical, and climate-related), and conflict. Among this group of countries, we further prioritized countries with high-quality existing in-country partnerships (e.g., effective relationships with decision-makers on the ground) and research capacity. Finally, taking account of the security and logistical risks inherent to fragile contexts, we deprioritized areas where research would be difficult to carry out and where in-country partnerships are unlikely to be durable.

The urban food system work focuses on five primary target cities: Nairobi in Kenya, Accra in Ghana, Dhaka in Bangladesh, Manila in the Philippines, and Lima in Peru. These were selected based on: (i) critical urban food system challenges of national and global significance, (ii) expressed demand from in-country stakeholders for CGIAR research to address these challenges, and (iii) existing CGIAR capacity and partnerships in these locations, as evidenced through discussions with Resilient Cities Initiative partners and other CGIAR Programs. These factors will ensure relevance and a high likelihood of success. In these five cities, the Program will implement research across all five sub-AoWs; in addition, more limited research will take place in other cities and countries, such as Antananarivo (Madagascar), Addis Ababa (Ethiopia), Colombo (Sri Lanka), Bangkok (Thailand), Lagos (Nigeria), and Kathmandu (Nepal). These locations are seen as high potential for expanding the Program's activities over time based on partners' demand and resource availability.

Island food system geographic priorities were determined by their exposure and vulnerability to food system risks. Island states consistently have high or very high disaster risk levels. This is often due to their high or very high exposure to extreme natural events and limited capability to cope with them, making their food systems very fragile and therefore a prioritized geography for this Program. For example, the top four countries experiencing water supply risk are islands and the top five countries with the least capacity for social protection are also islands (Day et al. 2019; Alexandrova et al. 2021). The Food Frontiers and Security Program team prioritized the Solomon Islands and Timor-Leste, which feature high on these risk assessments, complemented by a networked partnership model across the Pacific region in its design. CGIAR, through WorldFish, has hosting agreements, staff, and integrated country research programs in these two island countries (Eriksson et al., 2024). Our long-standing engagement in these nations and the region will enable the innovations and transdisciplinary research required to tackle the long-term food system challenges for islands and knowledge exchange with FCA and urban food systems.

Key components used in the prioritization exercise

<table>
<tr><th>Prioritization factor</th><th>Key prioritization components</th></tr>
<tr><td>Scope</td><td>The types of systems initially included in the prioritization exercise included:
Regions, countries, island food systems, urban and peri-urban food systems, traditional/indigenous food systems, and fragile and conflict-affected zones.
The list of countries was:
Afghanistan
Bangladesh
Benin
Burkina Faso
Burundi
Cameroon
Central African Republic
Chad
Colombia
Comoros
Democratic Republic of Congo
Egypt
Eritrea
Ethiopia
Ghana
Guatemala
Guinea-Bissau
Haiti
Honduras
India
Indonesia
Iraq
Jordan
Kenya
Kiribati
Kosovo
Lebanon
Libya
Madagascar
Malawi
Mali
Marshall Islands
Micronesia
Mozambique
Myanmar
Namibia
Nepal
Niger
Nigeria
Pakistan
Palestine
Papua New Guinea
Peru
Philippines
Republic of Congo
Rwanda
Sao Tome and Principe
Senegal
Sierra Leone
Solomon Islands
Somalia
South Sudan
Sri Lanka
Sudan
Syria
Tajikistan
Thailand
Timor-Leste
Tuvalu
Uganda
Ukraine
Venezuela
Vietnam
Yemen
Zambia
Zimbabwe</td></tr>
<tr><td>High-level outputs</td><td>Here is a summary list of the high-level outputs. Please see the Appendix (Section 3, Table 0) for a full description of these high-level outputs.
• Incubation of innovations in frontier foods systems
• Resilience-building innovations in FCAFS
• Innovations to enhance resilience for urban food systems
• Innovations for healthy foods in island food systems
• Scaling pathways in frontier food systems
• Evidence base on innovations in frontier food systems
• Capacity-building tools and materials
• Stakeholder engagement and collaborative learning mechanisms and platforms
• Options for effective programming for frontier food systems
• Tools and frameworks for tailored decision-making in frontier food systems</td></tr>
<tr><td>Stakeholder demand</td><td>Outline the stakeholders that have been and will be consulted during the prioritization exercise: WFP, UNHCR, WMO, UN Opps, ICRC (including but not limited to Climate Centre), Ministries of ag/ interior/ security/ gender and peace, ACCORD (South Africa); IOM, UNDP, SADC, AU, Cordaid, SADC, NUPI, World Vision, Harvest Plus, Action Aid, Solomon Islands National University, Pacific Community (SPC), Kastom Gaden Association, ANCORS at University of Wollongong, Australian Centre for International Agricultural Research.</td></tr>
</table>

4. Comparative Advantage

The Food Frontiers and Security Program leverages CGIAR's core strengths to address challenges in FCA, urban, and island food systems by applying innovative research aligned with global challenges. Its transdisciplinary approach broadens CGIAR's reach into new emerging thematic areas.

For the comparative advantage (CA) analysis, six aggregated high-level outputs (OPs) were used, focusing on Evidence for food system resilience (OP1), Innovations (OP2) Scaling pathways (OP3), Capacity building (OP4), Stakeholder engagement (OP5) and Policy options (OP6). OP1, OP2, and OP3 target institutional and technological innovations, while OP4 and OP5 focus on capacity sharing, and OP6 is linked to policy impact.

The following narrative summarizes the preliminary findings of the CA analysis by identifying the sources of comparative advantage and potential partners required for delivering each output. We recognize that this analysis was conducted at a very high level and the CA of specific partners needs to be analyzed in detail during the Inception Phase. A more detailed CA Analysis table by output can be found in the Appendix.

Human and social capital

The CA analysis revealed that several types of human capital are key strengths for CGIAR in delivering these outputs. The CGIAR research team includes biophysical scientists, social scientists, and data analysts and possesses wide expertise in FCA, urban, and island food systems.

CGIAR's strong partnerships with international universities and research institutes bring cutting-edge methodologies and discoveries. In addition, partnerships with national universities, government agencies, humanitarian development partners, non-governmental organizations (NGOs) and local innovators from the private sector or academia contributes local knowledge and enable the program to co-design innovations. Identifying new partners and relying on their CA in human capital will fill the gaps in CGIAR and its national partners' expertise for delivering outputs in new and emerging research areas, e.g. the Future Food System Lab (AoW1).

Moreover, CGIAR relies on its social capital of extensive local and regional partnerships. NARES and local NGOs with their linkage to the communities and beneficiaries will ensure interventions are locally adapted and widely accepted. These long-term relationships underpinned by a physical presence in many countries, as well as the principles of engagement for country integration (See Section 7), facilitate knowledge exchange, collaboration and innovation uptake, thereby amplifying CGIAR's impact.

Governments (national and city) and humanitarian development partners (e.g. UNHCR, WFP) provide other important sources of human and social capital, given their ability to enable implementation and scaling through policy planning and programming. While CGIAR has traditionally focused on strong ties with ministries of agriculture, livestock and fisheries, the Frontier Program will strengthen connections to national planning ministries, city governments and host communities. Further human and social capital will be complemented through strengthened collaboration with city networks (C40 Cities, ICEI) and regional research organizations relevant for frontier food systems to enhance its understanding of the broader context and political landscapes at the regional level and benefit from their partner networks for delivery.

Biophysical capital

The CGIAR Centers participating in the Food Frontiers and Security Program have excellent laboratory facilities, mainly in their head office countries but also a few in the frontiers focus geography (e.g. Islands). These facilities support advanced scientific and technical research in experimental food production, trials, aquaculture, environmental health, and food safety.

Despite this valuable infrastructure, geographical coverage is still limited. To this end, CGIAR has invested in building biophysical capacities, such as labs, testing facilities, piloting sites, and training facilities, in several NARS centers and local universities, aiming to establish local centers of excellence to complement CGIAR's biophysical capital. Partners, such as government agencies and private sector companies might also have physical infrastructure that can complement CGIAR's biophysical capital for testing and scaling innovations in frontier systems.

A presence across regions, combined with access to CGIAR-owned and partner facilities, gives the Food Frontiers and Security Program 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 national partners, cities, host communities, and the private sector will contribute the more important biophysical capital, while CGIAR's strength is leveraging its own research infrastructure to develop research methodologies and innovations. For example, in the urban food system AoW, biophysical capital of subnational governments, and the private sector is essential for testing, validation, and scaling. The private sector has the biophysical capital for scaling food systems innovations.

Incentives

All CGIAR Centers have distinct yet complementary institutional priorities that align with the Food Frontiers and Security Program's objective of addressing the complex challenges associated with food system resilience in FCA settings, cities, and islands. Incentives for CGIAR Centers are very strong to deliver the proposed outputs as these align well with their missions, visions, and strategies and allow for the continuation of ongoing research while also making room for new ideas.

It is expected that delivering outputs will create opportunities for co-creation to generate public goods and impact on the ground. Successful engagement for traditional CGIAR partners can be considered strong evidence through well-established long-term collaborations. For NARES partners, collaborating with CGIAR on output delivery increases their technical 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 (within-country and abroad). For national and international universities, 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.

National government and city departments will benefit from the increased technical capacity and direct access to innovations and technical backstopping which is a strong incentive for creating impact. This new evidence, innovations and expanded international connections are also important for accessing funds for investing in food system resilience. An even stronger incentive would be employment opportunities through new business models and evidence of the impact of joint activities on impact indicators.

Access to well-documented innovations, established business models, and practical technical support presents a strong case for collaboration with NGOs, and humanitarian development

partners. The same applies to private companies, startups and small-scale entrepreneurs who may be interested in selected innovations, provided there are clear, proven business models with well-defined exclusivity rights.

5. Program-level Theory of Change (ToC)

The Food Frontiers and Security Program focuses on three food systems that have emerged as new frontiers for CGIAR: fragile and conflict-affected (FCA) food systems; urban and peri-urban food systems; and island food systems. Each is addressed in a separate Area of Work (AoW). To support integration and cross-learning among these food systems, and begin shaping their sustainable and resilient futures, a Future Food Systems Lab (AoW1) was designed. The Lab will support CGIAR and its partners to apply new tools to anticipate emerging trends, foster innovation, and strengthen capacities to anticipate and respond to emerging challenges in frontier food systems, and to co-create resilient and equitable food futures. AoW1 will also identify promising and scalable innovations to address future food security and nutrition challenges in frontier food systems. Achieving this will require identifying and developing strong relationships with new partners, including private sector partners working on new technologies and foods (e.g., innovative startups focused on vertical farming, alternative proteins, climate resilient production) while continuing to work with existing partners and demonstrating the value of anticipating and preparing for future challenges. By 2030, decision-makers in the three target food systems will integrate foresight analysis and digital tools into planning processes; innovators, SMEs, and scaling partners will use frontier innovations to build food system resilience; and stakeholders will access and use evidence from the other three AoWs to guide programming and promote further innovation.

The objective of AoW2 on FCA Food Systems is to inform integrated interventions along the Humanitarian, Development, and Peace (HDP) nexus using context-specific evidence. The purpose is to prevent and prepare for, effectively respond to, and recover from crises. The FCM Initiative demonstrated to United Nations (UN) agencies, national and local governments, NGOs, and other partners that our mixed methods research can improve their responses to shocks and crises and thus contribute to poverty reduction, gender equality, environmental health, and improved diets in the most vulnerable food systems on the planet. Thus, there is a strong demand for evidence that will enable the Program to achieve its 2030 outcomes. Through research, capacity-strengthening activities, collaboration with UN agencies, and policy engagement, by 2030, HDP actors, governments, and NGOs will design and implement more effective conflict-, climate-, and gender-sensitive policies, programs, and investments to build resilient FCA food systems.

AoW3 on Urban Food Systems aims to improve livelihoods and promote healthier diets through resilient, productive, and sustainable urban food systems. AoW3 has strong partnerships with key partners such as urban governments, private firms, and civil society in its five target cities. The Program will use a demand-driven approach in which CGIAR convenes local stakeholder platforms (or uses existing ones) to share research results and identify priorities. The research will identify ways to improve the production and consumption of safe and nutritious food in urban areas; minimize food loss and waste and maximize resource use efficiency; support the informal food sector to create more decent jobs for young women and men in urban food systems; and contribute to increased availability of safe foods in the market. By 2030, through engagement, capacity strengthening, and policy analysis, efficiency in management and operations of urban food systems will be strengthened; urban populations, especially the urban poor, will have better access to healthy locally produced food; more young women and men will obtain decent work in urban food

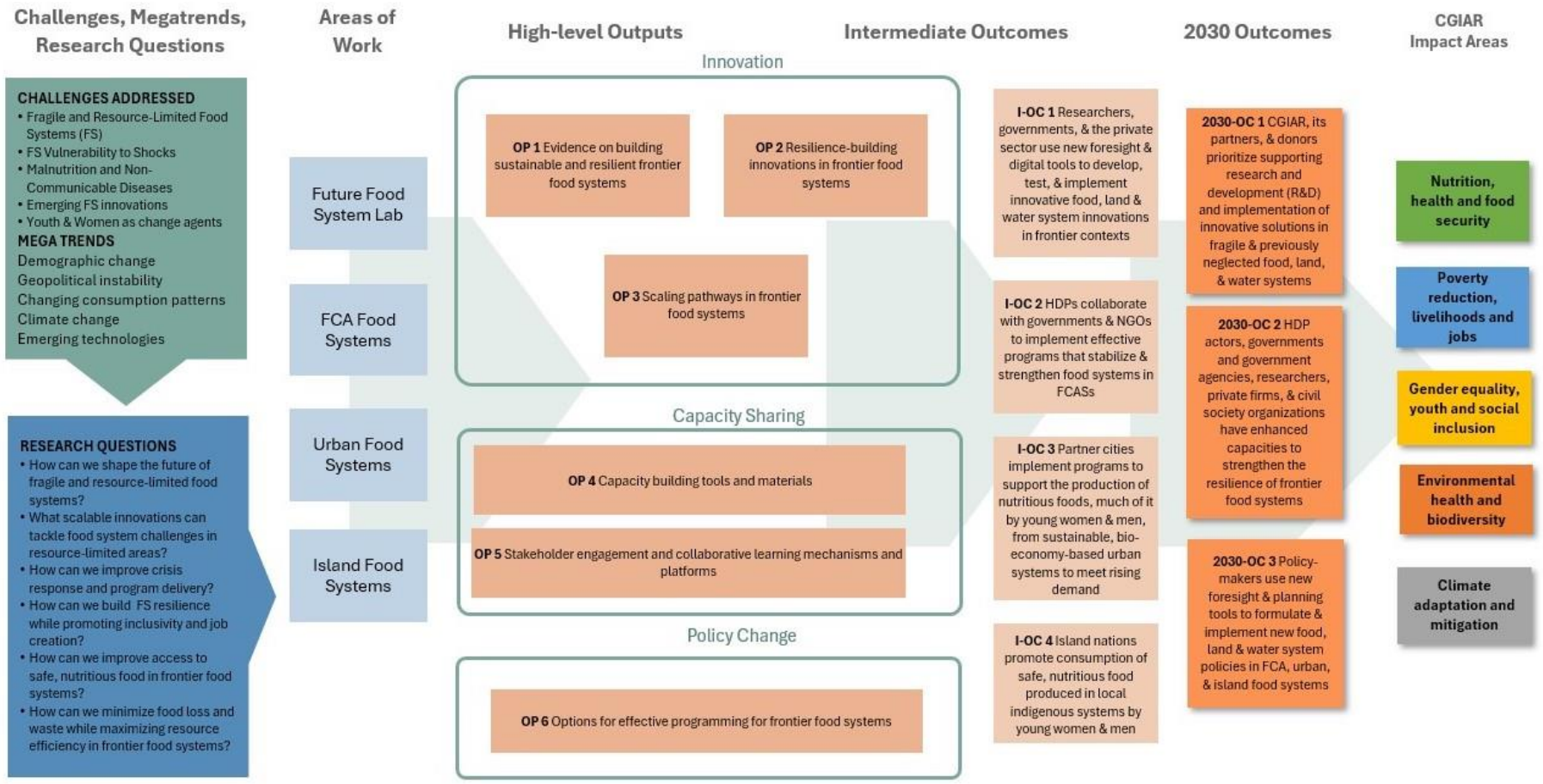
systems; and the environmental health of urban food systems will improve as food waste is reduced and recycled.

Island nations, especially in the Pacific but also in the Caribbean, are characterized by malnutrition and non-communicable diseases resulting from a complex set of historical food system transitions influenced by colonial legacies and global trade integration (Andrew et al. 2022). Island Food Systems (AoW4) focuses on strengthening the resilience and productivity of island food systems and encouraging the consumption of nutritious, locally produced food to achieve healthier diets. CGIAR has 40 years of experience in Pacific Island food systems through WorldFish's Pacific program and has developed strong partnerships and a solid reputation with governments and civil society. By 2030, we anticipate that through this AoW, island food system actors in the Pacific will be using innovations to improve nutrition and equity outcomes; national programs for healthy and sustainable island food systems built on CGIAR evidence will be operational; and CGIAR evidence will support the creation of attractive employment opportunities for young women and men. Small island food system actors will be using innovations to improve nutrition and equity outcomes from food systems, and four national programs for healthy and sustainable island food systems built on evidence will be operational. We also anticipate a gradual rise in collaboration with other island nations, especially in the Caribbean and Western Indian Ocean.

The outcomes of the four AoWs contribute to the intermediate outcomes of the full Program. The Program will achieve the following outcomes by 2030:

1. Governments, humanitarian and development partners have access to evidence and innovation that strengthen the sustainability and resilience of frontier food systems
2. Frontier food system actors have enhanced capacities to strengthen sustainability and resilience in fragile and constrained food, land, and water systems
3. Policymakers use new evidence, foresight, and planning tools to formulate and implement new policies or investments in frontier food systems.

This Theory of Change (ToC) responds to the demand for our planned products. Our experience in the three previous Initiatives that are the Program foundation has demonstrated the need for the proposed research. The Future Food System Lab responds to demand from CGIAR stakeholders, most strongly the ISDC (2023); and to a recognition that while major food system transformations are required in these frontier food systems, a strong evidence base is needed to shape these transformations. The Program will build on its current partnerships to create a strong demand from policymakers, donors, private firms, and civil society organizations for products that will be relevant in the long term.



Program-level Theory of Change (ToC) Visual

Program high-level outputs (OPs) and Partnerships

ToC Element	Statements	Contributing Area(s) of Work	Partners (including internal) and roles	Assumption	Indicator and target for 2030
OP 1 Evidence on building sustainable and resilient frontier food systems	Co-created knowledge products to provide precise, tailored, and contextual advice to stakeholders in frontier food systems	1, 2, 3, 4	National and local governments, humanitarian agencies, non-governmental organizations, civil society organizations, private sector, CGIAR		
OP 2 Resilience-building innovations in frontier food systems	Co-created technological and institutional innovations that are conflict, climate, and gender-sensitive to build resilience in frontier food systems	1, 2, 3, 4	National and local governments, NARES humanitarian agencies, non-governmental organizations, civil society organizations, private sector, CGIAR		
OP 3 Scaling pathways in frontier food systems	Evidence and advice for bringing tested innovations in frontier food systems to scale	1, 2, 3, 4	National and local governments, NARES, humanitarian agencies, non-governmental organizations, civil society organizations, private sector, CGIAR		
OP 4 Capacity-building tools and materials	Tools and materials for designing and implementing innovations to drive the transformation of frontier food systems to build resilience and promote healthy diets	1, 2, 3, 4	National and local governments, humanitarian agencies, non-governmental organisations civil society organizations, CGIAR		
OP 5 Stakeholder engagement and collaborative learning mechanisms and platforms	Engagement and capacity-sharing activities that promote cross-learning opportunities among stakeholders	1, 2, 3, 4	National and local governments, NARES, humanitarian agencies, non-governmental organizations, civil society organizations, private sector, CGIAR		
OP 6 Options for effective programming for frontier food systems	Gender- and age-sensitive programming and policy recommendations that support sustainable and resilient frontier food systems	1, 2, 3, 4	National and local governments, NARES, humanitarian agencies, non-governmental organizations, civil society organizations, CGIAR		
I-OC 1	Frontier food system actors are using evidence and tools to develop, test, & implement innovations	1, 2, 3, 4	National and local governments, NARES, humanitarian agencies, non-governmental organizations, civil society organizations, private sector,	The Program is successful in nurturing equitable and effective partnerships through principles of engagement (See Section 7)	

ToC Element	Statements	Contributing Area(s) of Work	Partners (including internal) and roles	Assumption	Indicator and target for 2030
I-OC 2	Frontier food system actors implement effective programs that stabilize & strengthen food systems in FCA settings	2	National and local governments, NARES, humanitarian agencies, non-governmental organizations, civil society organizations, private sector	Partnerships lead to the generation of evidence that identifies successful and cost-effective programming	
I-OC 3	Partner cities implement programs to support the production of nutritious foods, much of it by young women & men, from sustainable, bio-economy-based urban systems to meet rising demand	3	National and local governments, NARES, humanitarian agencies, non-governmental organizations, civil society organizations, private sector	Evidence and Program are relevant to the needs of partner cities	
I-OC 4	Island nations strengthening their food system resilience by using evidence to promote innovation for safe, nutritious food produced in Indigenous systems with young women & men	4	National and local governments, NARES, Indigenous groups and actors, non-governmental organizations, civil society organizations, private sector	Evidence and innovations are relevant to the needs of frontier food system actors	
2030-OC 1	Governments, humanitarian and development partners have access to evidence and innovations that strengthen the sustainability and resilience of frontier food systems	1, 2, 3, 4	National and local governments, humanitarian agencies, international NGOs, civil society organizations, private sector	Innovations developed across frontier food systems enable actors	50 new and adapted innovations used
2030-OC 2	Frontier food systems actors have enhanced capacities to strengthen sustainability and resilience in fragile and constrained food, land, and water systems.	1, 2, 3, 4	National governments, large- and small-scale agricultural businesses	Capacity-sharing tools respond to partner needs	Frontier food system actors in 25 countries apply new capabilities
2030-OC 3	Policymakers use new evidence, foresight, and planning tools to formulate and implement new policies or investments in frontier food systems.	1, 2, 3, 4	National and local governments, humanitarian agencies, civil society organizations	Policymakers can engage in the research process	20 new policies or investments

6. Areas of Work

6.1 AoW1: Future Food Systems Lab

Narrative: Planned outcomes, research questions, and major outputs

Problem being addressed: Despite each having specific characteristics, conflict-affected areas, urban and peri-urban regions, and islands share common challenges. These areas often suffer from constrained resources, social inequalities, isolation, and vulnerability to climate-related risks. Small island nations and fragile food systems are particularly prone to food insecurity due to their remoteness and reliance on imports (Atzori et al., 2024). Urban and peri-urban areas are vulnerable to climate shocks and food supply disruptions, aggravated by rapid population growth, underdeveloped infrastructure, and limited space for local food production (Caroline and Kristina, 2022; Béné et al. 2024). In FCAs, traditional interventions by humanitarian actors often focus on short-term, crisis-driven solutions that fail to address the root causes of vulnerability and promote the transition to development and resilience-building. Additionally, poor integration into governance and market systems further hinders resilience in these types of regions. As a result, these fragile landscapes remain trapped in cycles of food insecurity and environmental degradation.

Planned outcomes - The ambition: This Area of Work will create spaces for innovation, rigorous research and learning, and foresight analysis to tackle the complex, intersecting challenges faced by these fragile food systems. The Lab will collaborate with local partners, government agencies, and the private sector to integrate local knowledge with scientific research. These partnerships will be the foundation of a thriving innovation ecosystem that accelerates the adoption and scaling of solutions tailored to frontier systems. The Lab will generate evidence and guidance to partners and additionally feature a demand-driven co-creation space that will develop and rigorously test a pipeline of innovative and scalable frontier solutions needed to address critical challenges in FCA, urban, and island food systems. By 2030, stakeholders in frontier geographies will incorporate forward-thinking innovative solutions into their decision-making, fostering resilient food systems equipped to respond to near-term crises, long-term threats, and more frequent climate shocks.

The Lab will cultivate a wider community of practice that addresses systemic challenges in frontier food systems. Through the development of foresight and digital tools, it will enable data-driven decision-making, resource management, and risk mitigation. These innovations will improve food security, strengthen livelihoods, and enhance ecosystem health in conflict-prone, urban, and island environments. (See details in the AoW1 ToC Visual below).

Building on success: CGIAR has extensive experience in generating evidence, supporting policy, and fostering innovation in frontier food systems. The Lab will leverage CGIAR's history of promoting resilience through partnerships, learning, and scaling. Examples include the CGIAR Food Systems Accelerator (under CWANA Initiative), the Peace-and-Stability Accelerator (under the CGIAR Initiative on Fragility, Conflict, and Migration), and the Zambia Acceleration Program (under the Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) Program, which have successfully identified and scaled innovations to address challenges in fragile and resource-constrained settings. This experience will drive the identification and scaling of breakthrough innovations for sustainable food systems across frontier geographies.

Research questions and sub-questions: This Area of Work will address three key research questions:

1. Evidence-based strategies for resilience in frontier geographies: What interventions and strategies can promote sustainable and resilient futures?

2. Foresight and tools: How can foresight and digital tools support decision-making, sustainable food security, and adaptation in frontier geographies?

3. Innovative solutions: What breakthrough innovations can be scaled to address food security and nutrition challenges in climate-affected, resource-constrained environments while benefiting small-scale producers and vulnerable populations?

Sub-AoW1.1 (Evidence synthesis and adaptive learning) will create a collaborative learning space for frontier food systems, focusing on systems thinking and knowledge co-creation. It will address food, land, and water system challenges common in frontier geographies, such as rising geopolitical instability, climate change, and increasingly constrained resources. Evidence from the other three AoWs will be consolidated, synthesized, and disseminated to key stakeholders. Gender equality and social inclusion will be central to these efforts, ensuring that innovations overcome structural barriers to equality.

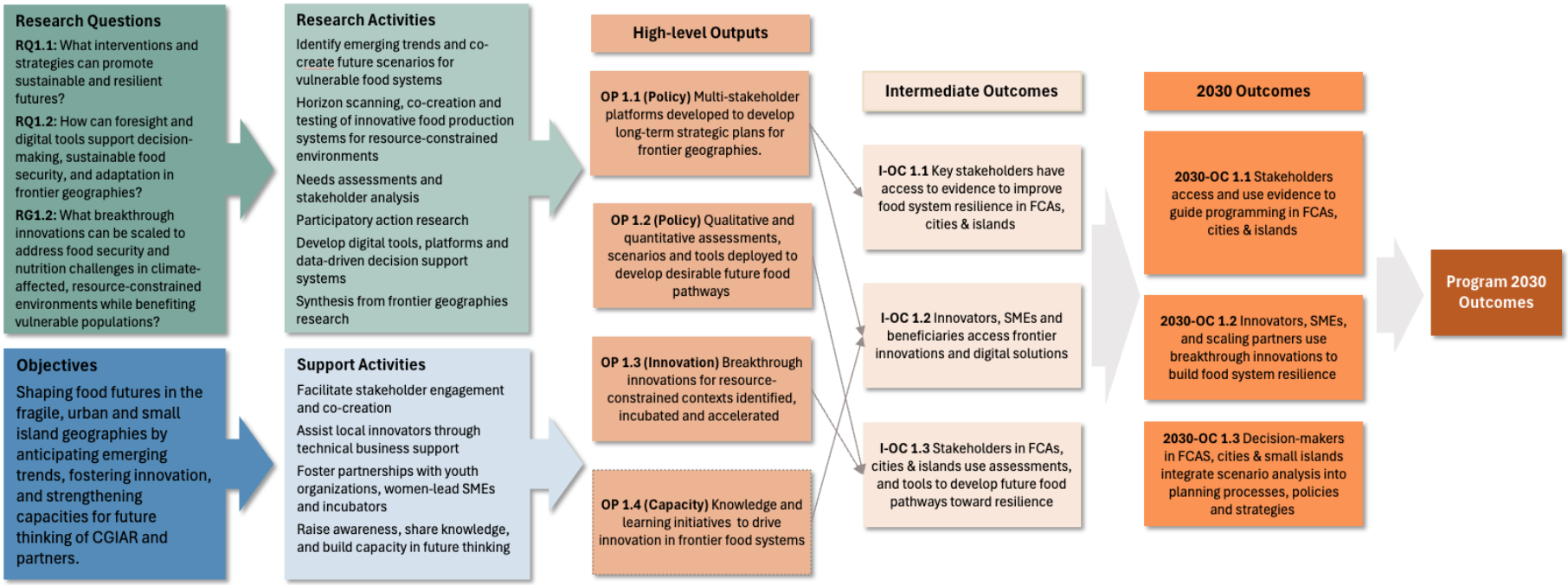
Sub-AoW1.2 (Envisioning Food System Futures) will support resilience in frontier food systems, particularly for vulnerable populations such as women and youth. Emerging megatrends signal a need for a better understanding of strategies for reducing poverty, expanding livelihood opportunities, and promoting healthy diets in frontier geographies— particularly for populations facing disproportionate risks (e.g., women and youth). The Lab will co-create future scenarios and strategies using horizon scanning and scenario planning with local partners. The Lab will also explore the potential of digital twins to simulate complex food systems or resource flows, enabling the identification of circular economy opportunities. This will allow for better anticipation of shocks and long-term challenges, such as climate change, conflict, migration, and resource constraints, which often reinforce food system inequalities.

Sub-AoW1.3 (Incubation of Breakthrough Innovations) will identify, co-create and incubate breakthrough innovations that can transform food systems once they achieve sufficient scale (Mukherji et al. 2023). These innovations may include climate-smart farming, nature-based solutions, circular bio-economy solutions, modular/compact technologies, urban agriculture (e.g., insect and vertical farming), gender-transformative approaches, and community-based initiatives. Efforts will also focus on co-developing digital tools and data platforms to capture, analyze, and share critical food system data, as well as leveraging the Internet of Things to create novel food production systems that enhance efficiency, sustainability, and resilience. Local innovators and SMEs, responding to areas of critical need or demand in frontier systems, will receive support to scale these innovations into viable enterprises through food system lab platforms, innovation hubs, and business development services. These efforts will increase production and resilience in fragile, resource-limited contexts.

Detailed research questions and sub-questions, methods, and planned outputs are presented in the Appendix.

Partnerships

AoW1 will build on partnerships forged by CGIAR in the 2022-24 Portfolio to advance innovation scaling and agribusiness acceleration in various contexts. In East and Southern Africa, the Program will leverage existing partnerships with national and international research organizations, universities, national and local governments, regional bodies, local and international NGOs, and SMEs that were developed under the Diversification in East and Southern Africa Initiative (Ukama Ustawi) and the Zambia Acceleration Program under the Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) Program. The Lab will also build on partnership with the World Food Program (WFP) Innovation Accelerator and local innovators in FCAS to identify, test, and scale innovative and high-impact solutions that improve resilience of refugees and hosting communities. The AoW will work closely with the Scaling for Impact Program, as well as the Multifunctional Landscapes Program on nature-based solutions, to leverage CGIAR's expertise in the application of tools such as Innovation Packaging and Scaling Readiness to develop effective pathways for frontier geographies.



AoW1 Future Food Systems Lab – Theory of Change (ToC) Visual

AoW1 Future Food Systems Lab – ToC Elements, Partnerships, Assumptions, and 2030 Outcomes

ToC Element #	Statements	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
OP 1.1	Multi-stakeholder platforms supported to develop long-term strategic plans for frontier geographies.	National and sub-national governments, universities, regional bodies, local stakeholders, local and international NGOs		
OP 1.2	Qualitative and quantitative assessments, scenarios, and tools deployed to develop desirable future food pathways	National and sub-national governments, universities, regional bodies, local stakeholders, local and international NGOs		
OP 1.3	Breakthrough innovations for resource-constrained contexts identified, incubated, and accelerated	Universities, NARES, local stakeholders, SMEs, incubator programs		
OP 1.4	Knowledge and learning initiatives to drive innovation in frontier food systems	National and sub-national governments, universities, NARES, regional bodies, local stakeholders, SMEs, local and international NGOs		
I-OC 1.1	Key stakeholders have access to evidence to improve food system resilience in FCAs, cities & islands	National and sub-national governments, universities, regional bodies, local stakeholders, local and international NGOs	Relevant stakeholders in target geographies participate in studies and are part of evidence-generation	
I-OC 1.2	Innovators, SMEs, and beneficiaries access frontier innovations and digital solutions	Universities, NARES, local stakeholders, SMEs, incubator programs	The identified solution fits the context and needs of the target population	
I-OC 1.3	Stakeholders in FCAs, cities & islands use assessments, and tools to develop future food pathways toward resilience	National and sub-national governments, universities, regional bodies, local stakeholders, local and international NGOs	Relevant stakeholders in target geographies participate in scenario planning processes	

ToC Element #	Statements	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
2030-OC 1.1	Stakeholders access and use evidence to guide programming in FCAs, cities & islands	National and sub-national governments, universities, regional bodies, local stakeholders, local and international NGOs	Key stakeholders value and use the evidence	At least 20 stakeholders access and use evidence to guide programming in frontier geographies
2030-OC 1.2	Innovators, SMEs, and scaling partners use breakthrough innovations to build food system resilience	Universities, NARES, local stakeholders, SMEs, incubator programs	Reduction in the impact of biophysical or market shocks on food systems	30 SMEs supported to reach their scaling ambition for breakthrough innovations
2030-OC 1.3	Decision-makers in FCAS, cities & small islands integrate scenario analysis into planning processes, policies and strategies	National and sub-national governments, universities, regional bodies, local stakeholders, local and international NGOs	Key decision makers value and utilize evidence from scenario planning processes	Decision makers in at least 5 countries integrate scenario analysis in planning processes, policies, and strategies

6.2 AoW2: Fragile and Conflict-affected Food Systems

Narrative: Planned outcomes, research questions, and major outputs

Problem being addressed: By 2030, an estimated two-thirds of the world's extremely poor will live in FCA countries. Armed conflicts are on the rise globally and these events are becoming protracted, triggering immense challenges—including surges in hunger and severe malnutrition. The livelihoods and well-being of the 1.5 billion people living in FCA settings are threatened in unique ways, including by violence, poor governance, weak social cohesion, climate change, and limited access to infrastructure, productive resources, and basic services. In FCA settings pressure on natural resources can be extremely high, further increasing vulnerabilities in communities and the food systems they depend on. These trends increase the demand for humanitarian and development assistance while also attracting the attention of international and local development and humanitarian actors.

Displacement generates particularly thorny challenges. By 2023, over 117 million people were forcibly displaced worldwide (UNHCR 2023); 80% of them experienced acute food insecurity and high levels of malnutrition. LMICs host 83% of the world's refugees. Migration is an important development tool; it can support livelihoods and build resilience — particularly for youth. However, migration and especially forced displacement can also strain food, land, and water systems and create challenges for those who remain behind.

In FCA settings, CGIAR scientists are working with partners to develop science-based solutions and innovations to effectively prepare for, respond to, and promote sustainable livelihoods and resilience following shocks and crises. These partners require rigorous testing and evaluation of alternative interventions and modalities and integration of humanitarian and development goals. For CGIAR science to contribute to poverty and hunger alleviation, as well as combat climate change, it must be applied in contexts and countries where these problems are most acutely felt. This Program takes a systems approach that combines deep knowledge of food, land, and water systems with expertise on the design of programming and policies to simultaneously address humanitarian and development challenges.

Planned outcomes - The ambition: By 2030, humanitarian and development agencies will collaborate closely with governments and NGOs to implement programs informed by CGIAR research. CGIAR science-based solutions will enable these stakeholders to design conflict-, climate-, and gender-sensitive policies, programming, interventions, and investments to build resilience in FCA food systems. These will offer effective responses to emerging crises while also stabilizing and strengthening food systems, gender equality, and nutrition. This AoW will build a deeper and broader understanding of risks; support preventive and rapid responses to fragility, conflicts, and crises that enhance partners' capacity to meet challenges to human security and resilience within and across borders; and contribute to CGIAR's ambition to enhance research on risk management by providing evidence on ways to safeguard development in FCA areas, where food and nutrition insecurity is high. Demand-driven research will inform partners' efforts to promote food and nutrition security, climate adaptation, resilience to shocks, and inclusive benefits from resilient food, land, and water systems, including for women and youth. (See details in the AoW2 ToC Visual below.)

Building on success: This work builds on strong partnerships forged by the CGIAR Initiative on Fragility, Conflict, and Migration, which are helping to ensure that CGIAR remains agile and relevant amid increasingly frequent shocks and crises. The unique features of FCA food systems inhibit

applied science as usual; this AoW leverages a strong knowledge base on how to develop and implement novel solutions that are contextually appropriate for FCA countries. Its country prioritization is driven by locations of ongoing success as well as high level promise of impact despite geopolitical and biophysical fragility, conflict, and high levels of in- and out-migration. The Program will provide support and rapid responses to fragility, conflicts, and crises — thus strengthening the capacity to meet compound challenges to human security and resilience within and across borders.

Research questions and sub-questions: The FCA Food Systems AoW will address five linked research questions, spanning the phases of fragility and conflict and the impact pathways each presents. First, the AoW will analyze how the impacts of shocks and stressors in FCA food systems can be prevented or mitigated through preparedness measures and effective governance (sub-AoW 2.1). Governments and humanitarian and development partners in FCA food systems are requesting guidance on conflict-sensitive and gender and socially inclusive disaster risk reduction and anticipatory action strategies to help communities prepare for and mitigate the impacts of compound crises and protect social and environmental resources.

Second, the AoW will study how to more effectively respond to crises, including through improved targeting and program delivery (2.2). Partners demand evidence on effective policies, interventions, and tools to address the "new normal" barrage of shocks and crises after they hit, including through responsive and flexible social protection interventions and investments in infrastructure and policies that address root causes of conflict.

Third, the AoW will examine how short-term responses to compound humanitarian crises can be better aligned with long-term development and peace objectives (2.3). Working at the Humanitarian-Development-Peace (HDP) nexus in this way can help ensure that immediate interventions not only address urgent needs, but also contribute to sustainable development and conflict prevention, ultimately reducing the likelihood of future crises.

Fourth, the AoW will examine how programs and policies can be best designed to build resilience for communities and individuals in FCA food systems while promoting the inclusion of women and youth (2.4). Partners rebuilding after shocks and crisis must not only stem immediate hunger and poverty; they need evidence on effective programming to improve livelihoods and resilience and strengthen gender equality and social inclusion (GESI), including for youth.

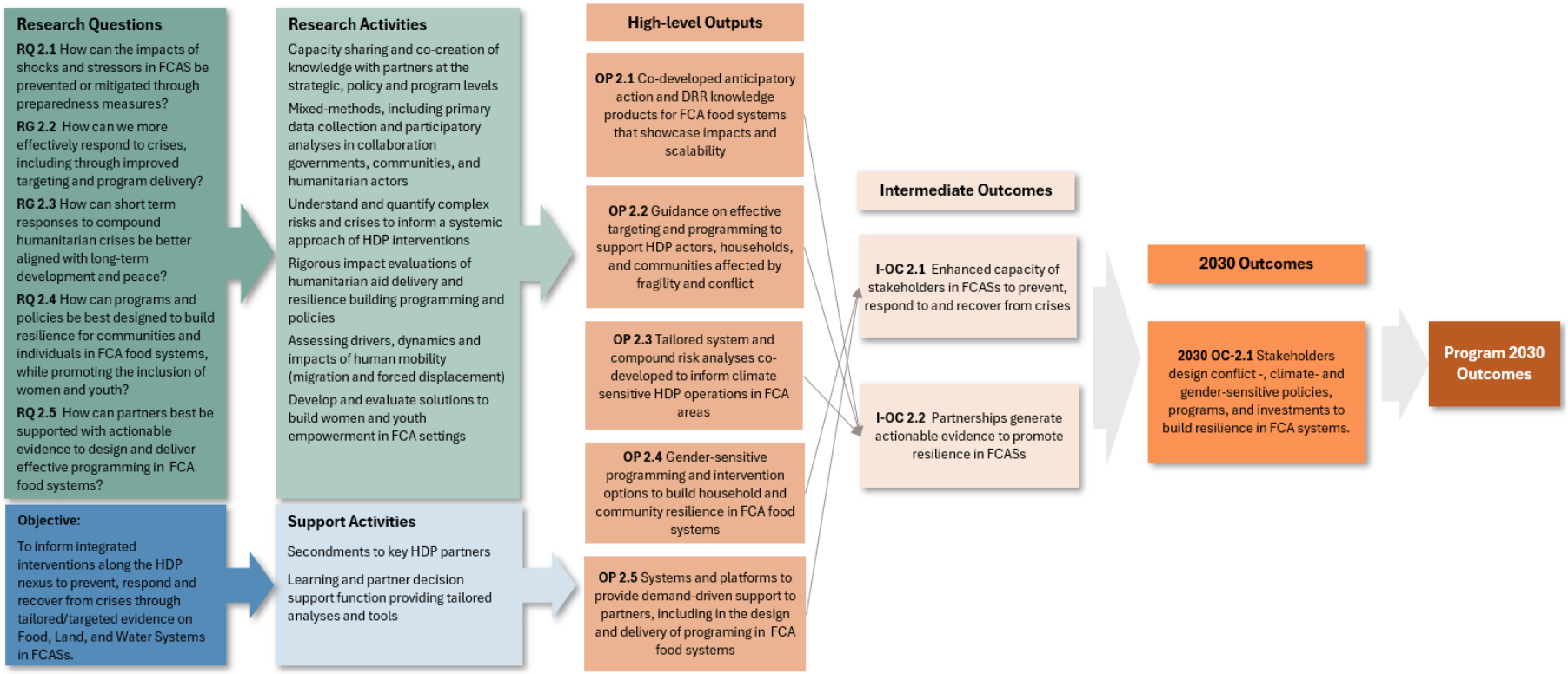
Finally, across all these questions, our work will consider how partners can be best supported with actionable evidence to design, implement, and deliver effective programming in FCA food systems (2.5). We will provide integrated support to their project designs and decision-making processes, much as the CGIAR initiative on Fragility, Conflict, and Migration did for the WFP (via over 30 support projects). Overall, the goal is to support integrated action among demand, innovation, and scaling partners to produce innovations and policies to guide timely and efficient interventions before, during, and after shocks and crises.

Detailed research questions and sub-questions, methods, and planned outputs are presented in the Appendix.

Partnerships

In the past funding phase, this AoW forged impactful partnerships on the ground to achieve co-defined objectives and enhance national government capacity in addressing crises. Most of the activities listed above require close collaboration with implementing partners as well as humanitarian organizations (including WFP, UNHCR, IOM, and IFRC) and other governmental and non-governmental agencies operating in FCA settings (e.g., World Vision, Action Aid, and Harvest

Plus). Collaborations with entities such as the Nigerian Federal Ministry of Humanitarian Affairs, Ethiopian Refugees and Returnees Service, Mozambique's Ministry of Land and Environment, Nepal's Federal Ministry of Home Affairs, and Pakistan's Federal Flood Commission exemplify just a few of our government partnerships. Collectively, our partners are grappling with several challenges, including budget cuts for humanitarian responses coupled with disproportional increases in demand for humanitarian response. These all necessitate prioritizing and improving the efficiencies and impacts of key policies, programming, and interventions. Compounding crises arising from conflict and climate shocks complicate the identification and prioritization of hotspots and vulnerable populations. Rolling out cost-effective and impactful crisis prevention, response, and recovery measures requires testing and evaluating alternative programming and interventions. This entails coordination between implementation and development partners as well as knowledge and technical partners. Building on the successful implementation of bilateral and multilateral partnerships, AoW2 will scale up these partnerships to realize the high-level outputs and ultimate 2030 outcomes described above.



AoW2 FCA Food Systems – Theory of Change (ToC) Visual

AoW2 FCA Food Systems – ToC Elements, Partnerships, Assumptions, and 2030 Outcomes

ToC Element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
OP 2.1	Co-developed anticipatory action and DRR knowledge products for FCA food systems that showcase impacts and scalability	WFP, UNOCHA, UNHCR, UNICEF, USAID-BHA, other humanitarian agencies, national governments, ICPAC, national disaster response coordination centers		
OP 2.2	Guidance on effective targeting and programming to support HDP actors, households, and communities affected by fragility and conflict	UNICEF, WFP, African Risk Capacity, EconAI, national and regional governments		
OP 2.3	Tailored system and compound risk analyses co-developed to inform climate-sensitive HDP operations in FCA areas	WFP, UNHCR, ICRC, IOM, AU, IGAD, governments and local stakeholders		
OP 1.4	Gender-sensitive programming and intervention options to build household and community resilience in FCA food systems	International and national NGOs and humanitarian agencies (WFP, World Vision, Action Aid), national governments, CGIAR Gender and Social Inclusion Accelerator		
OP 2.5	Systems and platforms to provide demand-driven support to partners, including in the design and delivery of programming in FCA food systems	WFP, UNHCR, Anticipation Hub, and national governments		
I-OC 2.1	Enhanced capacity of stakeholders in FCA areas to prevent, respond to, and recover from crises	WFP, UNHCR, ActionAid, World Vision, national governments in relevant countries	Partnerships are created	
I-OC 2.2	Partnerships generate actionable evidence to promote resilience in FCA food systems	WFP, UNHCR, ActionAid, World Vision, national governments in relevant countries	Research successfully carried out and yields actionable lessons	
2030-OC 1	Stakeholders design conflict -, climate- and gender-sensitive policies, programs, and investments to build resilience in FCA systems	WFP, ActionAid, UNHCR, IFRC, IOM	Policymakers and actors appreciate and utilize evidence	Policymakers, humanitarian and/or development stakeholders, or NGOs in 10 FCA countries

6.3 AOW3: Urban Food Systems

Narrative: Planned outcomes, research questions, and major outputs

Problem being addressed: By 2050, over two-thirds of the global population will live in cities, with many youths seeking urban livelihoods. Food insecurity is increasingly an urban issue (HLPE, 2024). Moreover, the rise of cheap, ultra-processed foods and increasing prices for fruits and vegetables are leading to non-communicable diseases like diabetes and heart disease. Urban dwellers, relying entirely on markets, face significant risks during external shocks such as those experienced during the COVID-19 pandemic. Wet markets and informal vendors provide fresh food and create job opportunities but face challenges like lack of access to credit, weak market connections to primary producers, lack of infrastructure, and food contamination. Urban food production can enhance system resilience, but climate change, water scarcity, and unregulated city expansion hinder progress.

Planned outcomes - The ambition: By 2030, CGIAR research outputs will help city governments and development partners to implement programs strengthening urban food systems. Governments will expand systems to turn organic waste into resources like fertilizers and ensure wastewater reuse is safe. Value chain actors will improve food safety practices based on CGIAR research, reducing health risks. Youth will find more jobs in urban food systems, including seedling nurseries, urban farms, food vending, and circular bioeconomy businesses, informed by CGIAR research and supported by government initiatives. Urban populations will have better access to fresh, safe, nutritious, and affordable food, particularly in low-income areas. (See details in the AoW3 ToC Visual below.)

Building on success: CGIAR must work on urban food systems because food insecurity is increasingly an urban problem. The Program adapts CGIAR innovations in crop production, markets, and soil and water management to urban food system challenges. Partnerships with the World Vegetable Center (WorldVeg) and RUAF strengthen competence in fruit and vegetables and governance.

CGIAR's two decades of experience in urban food systems began with the Urban Harvest Program and continue with the Resilient Cities Initiative. Recent research has been published in RUAF's Urban Agriculture Magazine and a forthcoming World Bank white paper. CGIAR and partners have developed methodologies and gender-sensitive indicator frameworks tailored to the multistakeholder urban context adopted by international urban food system networks involving over 200 cities.

This research has been conducted with local stakeholders in five target cities: Nairobi in Kenya, Accra in Ghana, Dhaka in Bangladesh, Manila in the Philippines, and Lima in Peru. CGIAR has built strong partnerships with these city governments, local research organizations, and international partners such as FAO, UNEP, WHO, and the World Bank. While major work will take place in these five cities, limited research is planned in six additional cities depending on partners' demand.

Research questions and sub-questions: Five sub-AoWs will contribute to four prioritized outcome areas: food safety, youth employment, access to quality food, circular bioeconomy, and good governance of urban food systems. All sub-AoWs are needed to create the conditions for transformational change. For instance, improving food safety has production, market, bioeconomy, consumer, and governance aspects requiring coordinated action in each.

Sub-AoW3.1 will analyze how urban populations can produce safe, culturally accepted, diverse and nutritious food. This will include novel research on antibiotic resistance, microplastic contamination, the urban soil microbiome, biofertilizers, and continued research on urban home and community gardens and seedling systems. Previous work on urban gardening has shown clear benefits to women. The AoW will add a focus on climate-proofing urban food production by introducing more heat-tolerant and water-efficient vegetables. Sub-AoW3.2 will analyze how to enhance organic waste recycling and safe wastewater reuse for local food production. This will include novel research on food rescue efforts to reduce food loss and continued research on locally appropriate business models for biowaste conversion that creates jobs for youth. The work will be linked to city governments' climate change action plans.

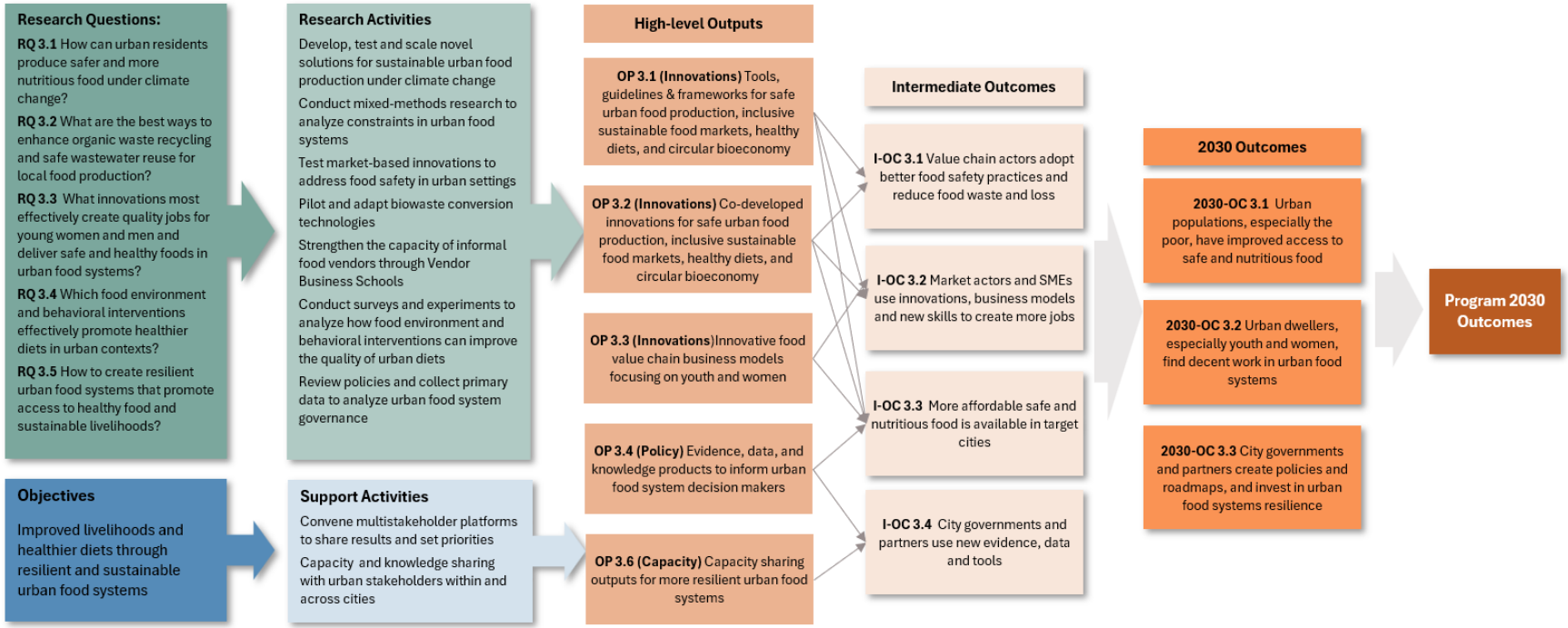
Sub-AoW3.3 will identify and test innovations and business models that create quality jobs for young women and men in urban food systems and deliver safe and healthy food to the market. Market upgrading and professionalization of food vending have much potential to empower women. Sub-AoW3.4 will study how the food environment influences food behavior and how food environment and behavioral interventions can effectively promote healthy diets in urban contexts. Food behavior has a strong gender dimension, which will be analyzed to tailor intervention designs. Close collaboration with the Better Diets and Nutrition Program is envisioned. Finally, sub-AoW3.5 will analyze how to create an enabling stakeholder environment for urban food systems that promotes healthy diets and sustainable livelihoods. A novelty will be establishing (or strengthening existing) multistakeholder platforms in each target city to ensure scalable demand-led innovations.

Detailed research questions and sub-questions, methods, and planned outputs are presented in the Appendix.

Partnerships

AoW3 leverages existing CGIAR and World Vegetable Center partnerships with national research systems, academic institutions, and the private sector. It also leverages CGIAR expertise, mainly based on research in rural areas, for market linkages and application to challenges in urban and peri-urban contexts. For instance, CGIAR has expertise in production systems, agribusiness development, and nutrition, which can be applied to urban food systems.

CGIAR's unique partnerships with city governments in Accra, Dhaka, Lima, Manila, and Nairobi will be fostered while including other stakeholders (e.g., local universities, civil society organizations, and selected private sector organizations) through multistakeholder platforms in each city. International partnerships with the World Bank, FAO, other UN organizations, and global city networks, such as the Milan Urban Food Policy Pact, complement these local partnerships and help achieve global impact with the research.



AoW3 Urban Food Systems – Theory of Change (ToC) Visual

AoW3 Urban Food Systems – ToC Elements, Partnerships, Assumptions, and 2030 Outcomes

ToC Element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
OP 3.1	Tools and guidelines for safe urban food production, inclusive sustainable food markets, healthy diets, and circular bioeconomy	CGIAR, WorldVeg, local university partners, city governments, NGOs, CGIAR Sustainable Farming Program, CGIAR Better Diets and Nutrition Program		
OP 3.2	Co-developed innovations for safe urban food production, inclusive sustainable food markets, healthy diets, and circular bioeconomy	CGIAR, WorldVeg, local university partners, city governments, NGOs, CGIAR Sustainable Farming Program, CGIAR Better Diets and Nutrition Program		
OP 3.3	Innovative food value chain business models focusing on youth and women	CGIAR, local university partners, city governments, private sector, community-based enterprises, informal food vendors, wet market operations		
OP 3.4	Evidence, data, and knowledge products to inform urban food system decision-makers	CGIAR, WorldVeg, city governments, RUAF, World Bank, FAO, Milan Urban Food Policy Pact, C40 Knowledge Hub, ICLEI		
OP 3.5	Capacity sharing outputs for more resilient urban food systems	CGIAR, city governments, local university partners, local NGOs, WorldVeg, RUAF, World Bank, FAO, Milan Urban Food Policy Pact, C40 Network, ICLEI		
I-OC 3.1	Value chain actors adopt better food safety practices and reduce food waste and loss	City governments, national regulatory agencies	Supportive local and national governments	
I-OC 3.2	Market actors and SMEs use innovations, business models, and new skills to create more jobs	SMEs, private sector, wet markets operators	The absence of market shocks affecting input and output prices disincentivizes urban production	

ToC Element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
			Wages in urban food systems are competitive with those in other sectors	
I-OC 3.3	More affordable safe and nutritious food is available in target cities	Food producers, distributions, wet markets, and street vendors	Absence of market shocks or disrupting food production and affecting urban food markets	
I-OC 3.4	City governments and partners use new evidence, data, and tools	City governments, World Bank, RUAF, UN Agencies, Global City Networks such as Milan Urban Food Policy Pact, civil society organizations, CGIAR Policy Innovations Program	Urban governments are receptive to scientific research findings Special interest groups do not derail urban governments from using scientific data and evidence	
2030-OC 1	Urban populations, especially the poor, have improved access to safe and nutritious food	Urban food consumers, schools, and urban poor communities	The increase in healthy food consumption is not outpaced by a simultaneous increase in unhealthy food consumption Innovations scaled through other programs	20 urban food system innovations co-developed, tested, and the best ones implemented at scale
2030-OC 2	Urban dwellers, especially youth and women, find decent work in urban food systems	Urban food producers and distributors, value-chain SMEs, circular economy enterprises, urban dwellers, women and youth	Supportive policy environment for urban food production and retailing. Innovations scaled through other programs. Absence of general economic slowdown or economic shocks that would reduce employment	100 urban food value chain actors use evidence and co-developed innovations to create jobs
2030-OC 3	City governments and partners create policies and roadmaps and invest in urban food systems resilience	City governments, World Bank, UN agencies, Global City Networks such as Milan Urban Food Policy Pact, civil society organizations, CGIAR Policy Innovations Program	The outcome of local elections does not affect the commitment of local governments to urban food system transformation	Each target city implements at least 1 new policy contributing to resilient urban food systems

ToC Element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
				CGIAR evidence influences at least 3 investments in urban food system resilience

6.4 AoW4: Island Food Systems

Narrative: Planned outcomes, research questions, and major outputs

Problem being addressed: Oceanic Island nations have attributes that require deliberate attention when considering drivers of their food system outcomes and strengthening blue economies (Bell et al. 2016). For example, aquatic foods are prevalent in the diets of most Pacific Islanders, and fish is often the most accessible and widely consumed animal-source food (Farmery et al. 2022). Land-based food production is often space- and resource-constrained, with climate change increasing the risks of food insecurity (McGregor et al. 2016). There is a high prevalence of malnutrition among island populations, presenting a double burden of both under and over-nutrition. Decreasing domestic production of nutritious foods and increasing imports of highly processed foods are contributing to worsening diets and some of the world's most concerning health statistics (Brewer et al. 2023a). Of the 20 nations with the highest prevalence of obesity globally, 14 are islands; and nine of the first ten are Pacific Island countries (https://data.worldobesity.org/rankings/). Diet-related non-communicable diseases are now the leading cause of adult death (Andrew et al. 2022). Simultaneously, the prevalence of chronic undernutrition is high, particularly among children under five years of age in Timor-Leste (Bogard et al. 2021), which has one of the highest stunting rates in the world (Global Nutrition Report 2022). Efforts to tackle these food system challenges are not currently guided by high-quality food production datasets (FAO and SPC, 2018). While some data are available, such as on regional trade (Brewer et al. 2023b) and the Pacific Nutrient Database (FAO and SPC 2020), most are not yet in a format that facilitates their use in national government decision-making, planning, or policy development. Island communities have begun combining accumulated traditional knowledge and modern technologies to improve the resilience of their food systems (Iese et al. 2018). Islands also represent an opportunity to better understand food systems as comparatively simple models of larger systems, thus informing scaling efforts.

Planned outcomes - The ambition: By 2030, national governments in island contexts, with partners, will oversee and implement national programs informed by CGIAR research that promote healthy and sustainable transitions in island food systems. National programs will be adaptive, supported by evidence and advice generated through in-country analyses of food trade, production, and consumption databases. Food system actors, including women and youth food producers and distributors, will be using co-designed innovations that increase access to safe and nutritious foods. This will enable communities in island contexts to develop more resilient food production systems, safer aquatic food distribution practices, and increased access to nutritious foods including Indigenous foods. Transitions will be achieved through co-managed coastal fisheries supported by healthier reef, mangrove, and lagoon habitats; widespread adoption of co-developed innovations, including climate-resilient food varieties (such as drought- and salt-tolerant sweet potato and vegetable varieties) and novel production systems such as hydroponics and circular farming; enhanced capacity to safely distribute foods with minimal waste and loss; and establishment of strong networks and platforms, including social movements led by women and youth, for learning and knowledge co-creation. These transformed island food systems will be shaped by Islanders, providing healthier diets, reductions in non-communicable diseases, and a sustainable blue economy, with the potential to share lessons for strengthening climate resilience and gender equity in food systems beyond islands.

This AoW addresses key challenges underrepresented in other Programs: complex malnutrition challenges, climate change, youth unemployment, and environmental degradation in coastal and marine contexts in islands, an otherwise neglected geography in CGIAR. AoW4 comprises the only

deliberate thrust of research in the Pacific in CGIAR's 2030 Portfolio, a region that covers 30% of the planet. (See details in the AoW4 ToC Visual below).

Building on success: AoW4 will be implemented through a coalition of research partners and regional organizations, building on decades of existing experience, expertise, and long-standing relationships in the region WorldFish's nearly 40-year engagement in the Solomon Islands and 15 years in Timor-Leste provides CGIAR researchers with a unique platform to co-develop and co-implement demand-driven research with governments and civil society organizations, simultaneously building capacity and achieving impact. The Pacific Community (SPC), the regional intergovernmental organization in the Pacific, provides a dedicated platform for scaling learning from focal countries to the broader region. The Australian National Centre for Ocean Resources and Security (ANCORS) at the University of Wollongong provides expertise in regional trade analyses and other food systems data, with long-standing collaborations with SPC and national statistics departments across the region. Some of this work is already accessible through the SPC food system data portal: https://sdd.spc.int/food-systems. This solid coalition, which also encompasses national universities and NARES, is uniquely positioned to deliver this AoW and achieve its objective of strengthening the resilience of island food systems and the sustainability of island blue economies.

Research questions and sub-questions: This AoW comprises five sub-areas, each seeking to address a core research question. Specifically, this AoW will investigate how to increase climate-resilient and equitable food production in islands through piloting novel food varieties and production systems, scaling community-based resource management models, and cataloging biodiversity (sub-AoW4.1). Together with partners, the AoW will co-develop and evaluate national programs to increase the safety of food distribution practices, with particular emphasis on innovations in the handling of aquatic foods that are gender-sensitive and youth-focused (4.2). The AoW will examine the effectiveness of behavior change and institutional innovations, such as school meals programs and Indigenous foods movements, to promote more nutritious diets for infants and children, and to increase the agency of women and youth to counter unhealthy food system transitions (4.3).

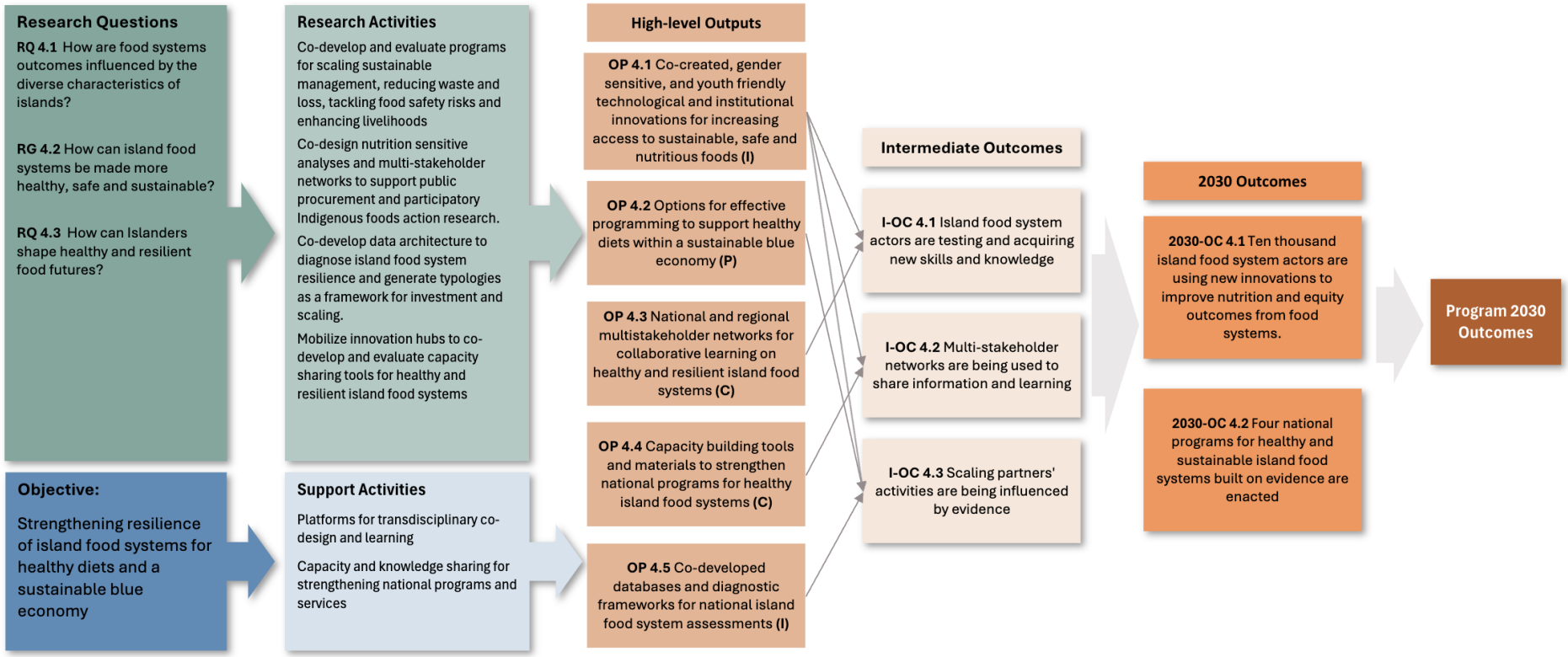
Through locally embedded innovation hubs, the AoW will test tools and approaches for learning and knowledge co-creation among women, men, and youth in island contexts, as well as the role of such platforms in influencing the co-creation and uptake of island food system innovations (4.4). Finally, drawing on existing CGIAR, FAO, and ANCORS research (FAO et al. 2022, FAO and UOW 2023, Wiegel et al. 2023), the AoW will develop a food system diagnosis framework that is attuned to island attributes and grounded in national contexts to provide clear investment options that avoid development and food security blueprint failures (4.5). The first four sub-Areas of Work entail integrated action research focused primarily on the Solomon Islands and Timor-Leste, and a Pacific region component to scaling national programs. The framework co-developed through the fifth sub-area will be supported by new analyses on production and consumption, augmenting the recently developed Pacific food trade database (Brewer et al. 2023b). This work will be particularly relevant to Small Island Developing States globally, and replicable in other island systems such as the Caribbean (discussions with partners are ongoing). Further details on sub-questions, methodologies, and planned high-level outputs are provided in the Appendix.

Partnerships

This AoW merges research in development with capacity building to achieve outcomes and impact at scale. The partnership modalities are designed to facilitate this integration, emphasizing collaborative efforts that respect and uplift Indigenous perspectives, thereby ensuring that our work

in island food systems contributes meaningfully to the well-being of local communities and ecosystems. This means our innovation partners are often also our scaling partners, ensuring our innovations are genuinely co-designed and co-piloted, meet the next users' needs and priorities, and are fit for purpose.

This AoW will be implemented as a coalition of research and regional organizations, including WorldFish, ANCORS, SPC, and Solomon Islands National University, together with national and subnational government ministries, civil society organizations, other national universities, and rural training providers. An existing strong bilateral Australian Centre for International Agricultural Research (ACIAR) investment platform enables continuous partnerships as part of the AoW. New partnerships will be fostered within CGIAR as well as with WorldVeg, to connect their technical expertise on regionally important crops, vegetables, and water management to the Pacific region. AoW4 will work with the Multifunctional Landscapes Program for Systems Ecology Analyses (islands being well-defined spaces and landscapes). Innovations and innovation hub activities in the AoW will be augmented and supported through the Scaling for Impact Program and Digital Transformation Accelerator.



AoW4 Island Food Systems – Theory of Change (ToC) Visual

AoW4 Island Food Systems – ToC Elements, Partnerships, Assumptions, and 2030 Outcomes

ToC Element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
OP 4.1	Co-created, gender-sensitive, and youth-friendly technological and institutional innovations for increasing access to sustainable, safe, and nutritious foods	CGIAR, WorldVeg, national universities, national governments, NARES, food producers & distributors		
OP 4.2	Options for effective programming to support healthy diets within a sustainable blue economy	CGIAR, national universities, national and subnational governments		
OP 4.3	National and regional multistakeholder networks for collaborative learning on healthy and resilient island food systems	CGIAR, civil society organizations, national & subnational governments		
OP 4.4	Capacity building tools and materials to strengthen national programs for healthy island food systems	CGIAR, WorldVeg, national universities, national governments, civil society organizations, rural training providers		
OP 4.5	Co-developed databases and diagnostic frameworks for national island food system assessment	CGIAR, ANCORS, SPC, national governments		
I-OC 4.1	Island food system actors are testing and acquiring new skills and knowledge	Food producers & distributors	Capacity-building tools address food system actors' needs	
I-OC 4.2	Multi-stakeholder networks are being used to share information and learning	National universities, national and subnational governments, civil society organizations, aid and development agencies	Networks align with stakeholder priorities	

ToC Element #	Statement	Partners (including internal) and roles	Assumption (for outcomes only)	Indicator and target (for 2030 outcomes only)
I-OC 4.3	Scaling partners' activities are being influenced by evidence	SPC, national and subnational governments, aid and development agencies	Actors can engage in research processes	
2030-OC 4.1	Ten thousand food system actors are using innovations to improve nutrition and equity outcomes from food systems	Food producers & distributors	Innovations developed enable food system actors to act	10,000 island food system actors are using new food system innovations
2030-OC 4.2	Four national programs for healthy and sustainable island food systems built on evidence are enacted	National and subnational governments, aid and development agencies, national universities, civil society organizations, rural training providers	Research and evidence align with government priorities	Four new island food systems programs are enacted

7. Country integration

This section considers country integration in two parts: 1) integration of the Program in national research and development systems guided by the elements of relevance, legitimacy, and effectiveness in the CGIAR Quality of Research for Development Framework (ISDC 2020); and 2) integration of this Program with other CGIAR Centers and CGIAR-led activities. Across these two dimensions, the Program adheres to the following principles of engagement.

1. Be transparent: The Program will be transparent with our partners about intentions and impacts.
2. Be accountable: The Program will be predictable and accountable in planning with our partners.
3. Be inclusive: The Program will actively seek input and participation from all without bias in hierarchy, gender, religion, or ethnicity.
4. Be committed: The Program will form mutually beneficial partnerships with national agencies built on non-extractive research and a long-term commitment to people and places.

The interweaved co-production of research and practice is increasingly understood to enable change. It relies on partnerships that often span diverse perspectives, values, and identities (Glasbergen 2011, Chambers et al. 2021). The ability to nurture equitable and effective partnerships through these principles of engagement –- how to integrate the research process into national development and scaling systems –- underpins our assumptions in the Program-Level ToC. In the Program design, we considered the role of research in national development and the practices that enable research to be effective. For example, the Program involves a deliberate emphasis on the co-production of knowledge and on-demand research positioned for utility.

1. Integration into national research and development systems: Research-for-development can contribute to improving outcomes for small-scale actors in fragile food systems, but the legitimacy and effectiveness of research have been found difficult to operationalize (ISDC 2021). The evaluation of the Initiatives in the Systems Transformation and Resilient Agrifood Systems (RAFS) action areas highlighted an enduring challenge in CGIAR programming to integrate in ways that position research for application (IAES 2024). The RAFS evaluation included the following recommendation:

“A focus on improving quality and encouraging greater engagement in QoS improvements from NARES partners should form part of this plan to promote improving legitimacy over time.” (IAES 2024 p49)

The Program recognizes this assessment and is organized to integrate national agricultural research, development, and extension systems in a way that builds their capacity, rather than substituting for their activities (Kamanda et al. 2015). In addition, fit-for-purpose models for legitimate research programming are necessarily different in different countries and contexts (see examples in 7.1). The Food System Frontiers Lab (AoW1) places specific emphasis on systematic learning about “how” research can be impactful in these diverse contexts. This extends to the equity and justice implications of the research process and the adequacy of participation, to appreciate how outcomes are achieved and for whom (Shutter et al. 2023). Process-related factors such as the quality, duration, and context of research partnerships are key in ensuring that research is relevant, credible, legitimate, and effective (Douthwaite and Hoffecker 2017; Prain et al. 2020). In the comparative advantage and prioritization sections, we have outlined how the Food Frontiers and Security Program, based on consideration of local

contexts, incentives, and capacity, will engage various actors in the innovation system to cost-effectively achieve the intended outcomes.

2. CGIAR research integration: In addition to these principles of integration, the Food Frontiers and Security Program also pays attention to CGIAR's Integration Framework Agreement (2022). The implementation of the Program will be based on the principles of streamlining and harmonizing procedures across Centers working in shared geographies or adjacent research themes to avoid unnecessary duplications, administrative burdens, and excessive bureaucracy.

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

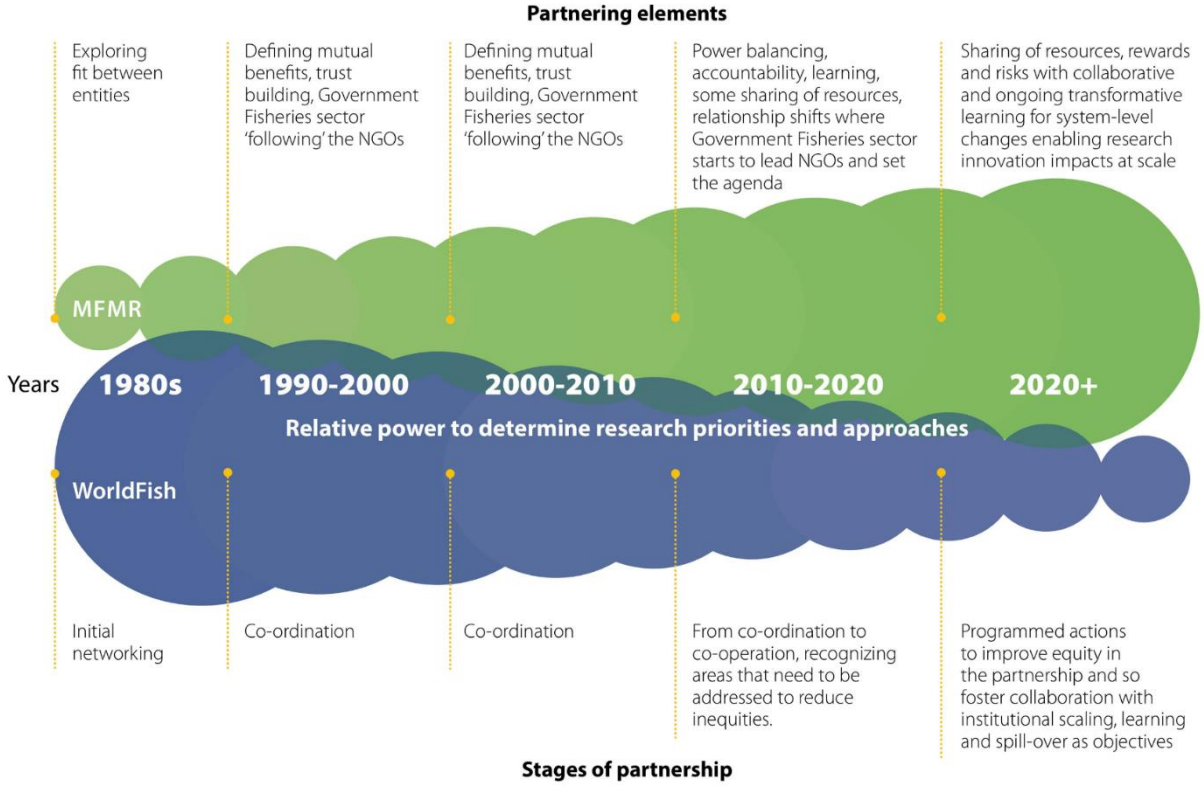
The Food Frontiers and Security Program spans 21 countries. The approaches to integration differ among them due to their different circumstances. Three examples of country integration are briefly presented.

Nigeria

AoW2 will leverage existing partnerships and infrastructure with local institutions in those countries characterized by some form of fragility. Nigeria is an example where the FCM Initiative has established important activities, which are co-created with local governments and humanitarian partners. Nigeria's agrifood systems continue to grapple with compounding shocks arising from violent conflict and climate shocks that disrupt food systems while also creating major stresses to water and land resources. As part of its 2022-2024 CGIAR portfolio, FCM has launched several activities aiming to identify system-level vulnerabilities as well as triggers of various types of conflict, including farmer-herder conflicts in Nigeria. AoW2 will build on these efforts and further strengthen the partnerships with local institutions and humanitarian actors operating in these settings.

Solomon Islands

WorldFish has been operating under a hosting agreement as a legal entity in Solomon Islands since 1985. Over nearly four decades, the WorldFish program has evolved from a purely technical mariculture pursuit into a deeply integrated research program supporting national development. For example, annual operational plans align its program with the goal of the government host agency –- integrating the program into the development ambition of the national government (e.g., Eriksson et al. 2024). The country partnerships and permanent presence of WorldFish have endured through civil war and evolved through stages reflecting growing national capacity (see Figure below). The country program spans several sectors and, during the 2022-24 period, has made significant progress in creating partnerships spanning areas of nutrition, traditional agriculture, and Indigenous foods, as well as establishing an Innovation hub for island food systems. The continued presence and focus on strengthening national and regional programs in support of nourishing island food systems has afforded a high level of legitimacy that positions the Food Frontiers and Security Program to achieve significant impacts nationally and across the Pacific region (Schwarz et al. 2022).



Source: Schwarz et al. (2020)

The differences in relative participation, collaboration, and power between the Ministry of Fisheries and Marine Resources and WorldFish to determine and direct research for development needs over time, mapped to the stages of a research-development partnership, adapted from Prain et al. (2020), and including themes of equity described by Price et al. (2020).

Bangladesh

Building on the Resilient Cities Initiative, national policies and city government plans are driving the demand for CGIAR interventions in urban food system resilience. In Bangladesh, the Program's activities align with the government's 2020-2025 urban agriculture plan, which promotes rain-fed rooftop and vertical farming in megacities like Dhaka to address the nutritional needs of the growing population (Alam et al. 2023). Strong partnerships with city governments and key urban food system stakeholders are critical to our success. The Program is establishing formal agreements with target cities and focusing on building subnational capacity to enable city governments to plan and invest in resilient urban food systems. Additionally, the Program is collaborating with development partners, including FAO, UNDP, and multilateral development banks, to support city and country investments in food system resilience.

7.2. Overview of selected work in top 15 countries

Regions	Country/ies	District/System	Area of Work	Program and Accelerator collaboration	Key partners
East and South Africa	Ethiopia	Mixed crop-livestock farming system, Migrant settlements, pastoral systems	2. Fragile and conflict-affected food systems	Policy Innovations, Scaling for Impact	WFP, World Vision, National Disaster Risk Management Commission, National Rehabilitation Commission
	Kenya	Circular and resilient cropping systems, informal markets, aquatic food systems, food production in constrained spaces, food system assessment	2. Fragile and conflict-affected food systems 3. Urban and peri-urban food systems	Better Diets and Nutrition, Policy Innovations, Scaling for Impact, Capacity Sharing, Gender Equality and Inclusion, Digital Transformation	Nairobi City Council, Mazingira Institute, Africa Union Commission Kenya Dairy Board RUAF Global Partnership on Sustainable Agriculture Milan Food Policy Pact World Bank, WFP, The Kenyan Ministry of Labor and Social Protection
	Mozambique	Mixed crop-livestock farming system,	2. Fragile and conflict-affected food systems	Climate Action	WFP, UNHCR
	Somalia	Mixed crop-livestock farming system	2. Fragile and conflict-affected food systems	Policy Innovations	Ministry of Agriculture, Ministry of Livestock, Forestry and Range, World Vision, Save the Children, Dahabshil, WFP
	Sudan	Mixed crop-livestock farming system, conflict-affected setting	2. Fragile and conflict-affected food systems	Policy Innovations	WFP, UNDP
West and Central Africa	Burkina Faso	Mixed crop-livestock farming, fragile setting	2. Fragile and conflict-affected food system	Climate Action	WFP, UNHCR
	Ghana	Circular and resilient cropping systems, informal markets, aquatic food systems, food production in constrained spaces, food system assessment	2. Fragile and conflict-affected food systems 3. Urban and peri-urban food systems	Better Diets and Nutrition, Scaling for Impact, Digital Transformation	University of Ghana, Ministry of Sanitation and Water Resources Ministry of Food and Agriculture Accra City, Private Sector in waste and recycling sector
	Mali	Fragile setting	2. Fragile and conflict-affected food systems	Policy Innovations	WFP, UNHCR
	Nigeria	Mixed crop-livestock farming system, fragile and conflict-affected setting	2. Fragile and conflict-affected food systems	Policy Innovations, Better Diets and Nutrition	WFP, Ministry of Agriculture, Ministry of Education, Nigerian Federal Ministry of Humanitarian Affairs

Regions	Country/ies	District/System	Area of Work	Program and Accelerator collaboration	Key partners
Latin America	Honduras	Migration hotspots	2. Fragile and conflict-affected food systems	Policy Innovations, Better Diets and Nutrition	IOM, USAID
	Peru	Circular and resilient cropping systems, informal markets, aquatic food systems, food production in constrained spaces, food system assessment	2. Fragile and conflict-affected food systems 3. Urban and peri-urban food systems	Policy Innovations, Better Diets and Nutrition, Scaling for Impact	City of Lima Incubagraria/University of La Molina, Ecosad, Welt-HungerHilfe
South Asia	Bangladesh	Circular and resilient cropping systems, informal markets, aquatic food systems, food production in constrained spaces, food system assessment	2. Fragile and conflict-affected food systems 3. Urban and peri-urban food systems	Policy Innovations, Better Diets and Nutrition	WFP, Arizona State University, Pennsylvania State University
South-east Asia and Pacific	Philippines	Circular and resilient cropping systems, informal markets, aquatic food systems, food production in constrained spaces, food system assessment	3. Urban and peri-urban food systems	Better Diets and Nutrition, Scaling for Impact, Digital Transformation	FAO, Quezon City (part of Manila metropolitan area), Private sector active in waste management and recycling
	Solomon Islands	Indigenous foods and traditional agriculture, circular and resilient cropping systems, aquatic food systems, international food trade, food system assessment	4. Island food systems	Multifunctional Landscapes, Scaling for Impact, Capacity Sharing, Sustainable Animal and Aquatic Foods, Better Diets and Nutrition	National and sub-national governments, SINU, SPC, KGA, ANCORS at UOW
	Timor-Leste	Indigenous foods and traditional agriculture, circular and resilient cropping systems, School meal programs, aquatic food systems, international food trade, food system assessment	4. Island Food Systems	Multifunctional Landscapes, Scaling for Impact, Capacity Sharing, Sustainable Animal and Aquatic Foods, Better Diets and Nutrition	National and sub-national governments, SINU, SPC, ANCORS at UOW

8. Boundaries and linkages with other components of the Portfolio

8.1. Boundaries with other components of the Portfolio

The boundaries of the Food Frontiers and Security Program with others are its unique food systems –- fragile and conflict-affected, island, and urban food systems. CGIAR expertise and coordinating functions for research and partnerships relating to these food systems are housed here.

8.2. Linkages across the Portfolio

The writing team has engaged with several other Programs and Accelerators. Further linkages and integration will be developed with the rest of the Portfolio as the portfolio develops.

The Food Frontiers and Security Program will increase our knowledge and understanding of drivers of food system fragility through research in FCA, urban, and island food systems. In this transdisciplinary pursuit, several research themes connect with other Programs, as does our ambition to fast-track impacts from them through linkages with the Accelerators.

Climate change is recognized as a significant driver of food system fragility and a threat to frontier food systems. The Program evaluates adaptive capacity by addressing underlying vulnerabilities to climate change. The work on community-led adaptation frameworks is one example. The Program plans to work with the **Climate Action Program** to co-develop tools and approaches to support the development of climate- and conflict-sensitive programming and investments that improve climate adaptation and deliver co-benefits for peace. An example is community-based approaches to adaptation and mitigation in fragile food systems.

Communities in frontier food systems often experience isolation to varying degrees; this strongly influences food system outcomes. Several research areas linked to geographies and environments connect closely with the **Multifunctional Landscapes Program** approaches developed around environmental systems and land/seascapes to address food security and biodiversity conservation tradeoffs. Islands, conflict-affected regions, and urban spaces represent specific landscapes and natural resources where competition and scarcity are drivers of insecurity and conflicts. The two Programs will jointly analyze and develop investment strategies that can be meaningfully applied in fragile areas, cities, and islands.

Together with the **Policy Innovations Program**, the Food Frontiers and Security Program will develop empirically grounded theories, methods, and approaches to study and respond to the complexities of frontier social-ecological and food systems, and how they will develop in time and space. The Programs plan to work jointly on foresight and rapid response analysis of the impacts of shocks such as conflict and extreme weather on food systems, along with preparedness and policy response options. The Programs also plan political economic analysis and causal impact evaluations of policies and programming to prevent, address, and rebuild after crises in fragile and conflict-affected food systems It will collaborate with global networks on urban food systems in the dissemination of evidence and data to inform policy formulation and governance for urban settings.

Close collaboration with the **Better Diets and Nutrition Program** is envisaged to conduct research to promote access to healthy and safe diets in frontier food systems. These present unique challenges related to understanding consumer demand and the role of diverse rural and urban market systems in providing access to healthy and safe foods. Island food systems struggle with the consumption of unhealthy foods and the relative affordability of healthy

options. Joint work on promoting the availability and affordability of healthy foods through unique market innovations in the three frontier food systems will identify how to make progress on these difficult questions.

Integration with Scaling for Impact and Accelerators

The Food Frontiers and Security Program will coordinate with the **Scaling for Impact** regional teams to scale our thematic work. Specifically, the two Programs will collaborate to understand the direct and indirect drivers of migration and displacement, which add pressure to food systems across regions. They will develop tools and approaches to ensure CGIAR's Programs are conflict-sensitive, avoid doing harm, and produce co-benefits of social cohesion and peace. Leveraging the Initiatives' experiences, the Program will refine and adapt accelerator/incubator approaches for implementation in fragile contexts, cities, and small islands.

Collaboration with the **Gender Equality and Inclusion Accelerator** will strengthen our gender, youth, and intersectional research. It will support our objectives of ensuring that women, youth, and other vulnerable groups in frontier geographies, who face unique vulnerabilities, can become powerful agents of change within these food systems. The two Programs will analyze barriers to gender equality, social inclusion, and youth engagement; co-develop training manuals and tools to support women's empowerment; and evaluate programming and policies supporting women's livelihood opportunities and voice in their communities.

The Food Frontiers and Security Program will work with the **Digital Transformation Accelerator** to evaluate the potential gaps in digital technologies to address challenges and build resilience in FCA, urban, and small island food systems. The two Programs will co-develop digital tools and data platforms to capture, analyze, and share critical food system data; and build capacity for data-driven decision-making by co-designing decision-support tools tailored to diverse stakeholders' needs in resource-constrained and isolated geographies.

Finally, the Program's strategy for **capacity sharing** is to create opportunities for exchange for students, early career, and senior researchers; support mentorship with and between southern institutions in partnership with existing networks and alliances; provide direct support to individuals and research centers through small grants for write-shops, conferences, and publications; and second CGIAR staff to UN organizations in regional hubs to leverage local expertise and build capacities.

9. Monitoring, Evaluation, Learning, and Impact Assessment (MELIA)

9.1. Monitoring, Evaluation, and Learning (MEL)

The Food Frontiers and Security Program is fully aligned with the *CGIAR Performance and Results Management Framework* (PRMF) and will use CGIAR's management information system (MIS) for reporting and evaluation. The Program will use AoW ToCs to guide baseline assessments, define partnerships, track achievements, and adjust implementation strategies. Data and information for monitoring, evaluation, and learning (MEL) will be collected continuously and reported at different levels. Data for output and outcome indicators will be collected and entered into the Management Information System (MIS) annually. Details associated with each output and outcome will be collected in the MIS and processed for quality assurance, synthesis, aggregation, and presentation. Whenever possible, and to assess and reflect on how this Program is narrowing gender gaps, data in all MEL activities will be disaggregated by sex. The Program will devote reasonable resources and MELIA expertise to support these MEL activities.

Ultimately, the MEL activities and M&E results will inform annual funding priorities and strategies as well as associated adjustments to plans and budgets throughout the Program.

As part of the M&E and reporting process, an annual learning event will facilitate reflection, work planning, and ToC validation and adjustment for the following year. Learning questions to guide the review will include: (i) Is the Program helping stakeholders to understand and respond to food land and water system-related risks in FCA, urban, and small island food systems? (ii) How are the Program and its Areas of Work collaborating with others to achieve 2030 outcomes and scale innovations? and (iii) Is the Program responding to our partners' needs and context?

9.2. Impact assessment

In addition to the MEL activities, the Program will conduct causal impact assessments of selected interventions that are novel and for which evidence is lacking. Robust tools and methods will be deployed to evaluate the short- and medium-term impacts of the interventions and innovations contributing to the five CGIAR Impact Areas. The evaluations will also help test some critical ToC assumptions linking the key activities and outcomes the Program aims to achieve. The assessment results will be reviewed with partners and stakeholders to inform future programming and identify new knowledge gaps. Besides the quantitative impact assessments, the Program will also use process evaluation methods and process tracing methodologies to analyze how the Program's activities are influencing policies and investments as laid out in our ToC. The results will help reassess ToC assumptions and risks and, if necessary, adjust our approaches and methodologies as well as partner selection and collaboration models. Importantly, these studies will be designed and reviewed considering their scaling potential.

10. Capacity sharing

Global science on FCA, island, and urban food systems in LMICs remains geographically imbalanced. Knowledge generated by lower-income country institutions has limited visibility and policy impact. Further, despite decades of capacity development investments with CGIAR partners, many local research organizations remain under-resourced. The "localization agenda" is an opportunity to shift this imbalance by moving beyond unilateral training and technical assistance to sharing capacity and co-creating scientific knowledge. The Food Frontiers and Security Program will leverage its partnerships to develop locally relevant, demand-driven research and interventions. It will also accelerate the acquisition and retention of knowledge, skills, innovations, and technologies in an effective, equitable, innovative, and culturally appropriate manner. The Program will do this in collaboration with the Capacity Sharing Accelerator (particularly the CapSha Innovation Lab and South-South and Triangular Cooperation Areas of Work), by:

- Creating opportunities for the exchange of students, early career, and senior researchers
- Mentorship with and between southern institutions in partnership with new and existing networks and alliances
- Supporting individuals and research centers through small grants for write-shops, conferences, and publications
- Seconding CGIAR staff to UN organizations in regional hubs to leverage local expertise and build capacities.

Capacity sharing efforts will focus on partners at individual, institutional, and network levels. With support from the Capacity Sharing Accelerator, the Program will develop new modalities for leveraging CGIAR research evidence, tools, and models and link evidence to policies and investment plans focusing on poverty, food security, fragility, and social equity.

Individuals (students, early career, and senior researchers)

The Program will continue with FCM's successful thematically dedicated, time-bound academies, combined with longer-term mentorship for early career researchers, and small grants to support individual scientists and selected research centers to achieve long-term improvements in publication levels and research quality from the south.

The Program will also continue implementing technical, scientific, and professional training programs, including PhD- and MSc-level training and short courses for scientists and professionals from NARES and other partners. This will be provided by our university and training partners and include research training and capacity-strengthening workshops with local partners. The focus will be on transdisciplinary and interdisciplinary approaches to understand and address the complex and intersecting challenges faced by FCA, urban, and island food systems.

Institutions (e.g., NARES partners in government, policy think tanks, NGOs, UN agencies)

Partnerships with organizations such as the World Bank and FAO are crucial to contribute to the global urban food policy agenda. At the institutional level, and building on successful experiences with WFP and UNHCR, AoW2 will second CGIAR staff to UN and other organizations working in crisis contexts to provide surge capacity and respond to emergencies by leveraging CGIAR's land, water, and food systems science. Seconded staff members can more easily understand the needs of partners and provide tailored evidence and solutions to respond more effectively to crises. These new models of partnership and co-creation of solutions and knowledge will be supported by, and inform, the further development of the CapSha Marketplace and Community of Practice.

AoW3 on Urban Food Systems will target capacity sharing to city governments and key local partners engaged in urban food production, distribution, and food waste recycling. The Future Food Systems Lab will work across the AoWs with local partner organizations to develop future capabilities to anticipate and respond to emerging trends, uncertainties, and challenges faced by FCA, urban, and small island food systems.

Networks (southern research networks, national and provincial partners)

A strong focus of our capacity development and sharing efforts will be strengthening existing partnerships with NARES networks and building new partnerships with research and advocacy networks. Building on the experience of collaborating with organizations such as the Climate Migration in Africa Research Network and Resilient Cities Network and its partner universities, the Food Frontiers and Security Program will invest in partnerships with regional and global science networks led by individuals and institutions in LMICs. It will also promote a multipurpose innovation hub at the Nusatupe Research Station in Solomon Islands to respond to the demand for a facility to convene research, training, and services for at-risk small island states with national and provincial partners.

Finally, we recognize and will give visibility to the important roles that local researchers and communities play in the production and validation of knowledge. Ensuring that both the learning process and the ownership of outputs are shared equitably between CGIAR, host-country partners, and communities will contribute to equalizing power relations. Therefore, we will couple the co-design of innovations and scaling strategies with the empowerment and targeted capacity building of junior-level team members, partners, and stakeholders.

11. Gender and social inclusion

This Program addresses food systems where women face unique and critical challenges. Women are disproportionately negatively affected by shocks and crises and have less access to channels of power and influence that could help them benefit from programming that addresses these challenges (Kosec and Swinnen 2023). In fragile and conflict-affected food systems, women's empowerment is lower than men's; women's assets are often the first to be sold; men are often prioritized for access to scarce training, resources, and infrastructure; and gender-based violence is pervasive (Malapit and Brown 2023; UNOCHA 2023). In urban food systems, women often struggle with precarious employment, have more limited opportunities to engage in paid work, are paid less than men for the same job, and carry a disproportionate burden for unpaid care work, all of which hinder their ability to engage fully and equitably in food-related economic activities (Urban Links 2020). Women living in small island food systems are uniquely vulnerable to climate change-induced hazards that threaten their livelihoods, resilience, and health (Poorun-Sooprayen 2023). Like women, youth across these frontier geographies also face many unique vulnerabilities and opportunities. They are the future of the frontier food systems the Program analyzes and comprise a growing demographic. However, they are most likely to migrate (including forcibly) and are critically important in combating extremism and violence and avoiding geopolitical instability.

This Program promotes gender mainstreaming in frontier geographies (MOPAN 2019). In deploying programming before, during, and after, shocks and crises; supporting livelihoods and health in urban food systems; and addressing the unique market and health challenges facing small island states, the Food Frontiers and Security Program will support women's empowerment and livelihood opportunities for women and youth.

The Program will also contribute to building CGIAR and partners' expertise in measuring women's empowerment, considering the unique vulnerabilities and opportunities women face in settings characterized by frequent shocks, violence, and displacement. It will also support partners to implement new programming or strengthen gender equality and social inclusion dimensions of existing policies and programming to help improve livelihoods and food security, including for youth, and promote gender equality in frontier food systems.

Context-specific research is key to fully understanding the specific vulnerabilities, needs, and structural barriers to empowering women in each frontier system. The work will also address how to co-design programs and policies to best support women's income-generating opportunities, including access to decent jobs. This work will focus on innovations that involve women in the co-design process as well as those designed for women's use. Finally, the work will consider how programs, policies, and innovations can empower women within these contexts and serve to position them as agents of change within these frontier food systems.

The role of youth, both young men and young women, is also of key importance in frontier geographies. The research structure detailed above will apply in the Program's work similarly to the role of youth, to understand the specific challenges youth face. The Program will co-design and evaluate innovations that serve to empower them and will also consider the specific challenges faced by other vulnerable groups such as displaced populations and indigenous populations in island states.

The work on these questions will contribute to the core outcomes and outputs of the Program. The Program-level outputs include sets of innovations tracing back to each Area of Work (Program Outputs 1 and 2 [see Section 5 Table]). These sets of innovations will all include innovations designed to be used by and benefit women and options designed to effect policy change (Program Output 6). Capacity-sharing efforts will also be designed to include women as

stakeholders and beneficiaries (Program Outputs 4 and 5). In addition to mainstreaming gender in the Program-level ToC, some AoW outputs and outcomes directly address gender. These are:

- AoW2-OP4: Gender-sensitive programming and intervention options to build household and community resilience in FCA food systems
- AoW2-2030-OC1: Stakeholders design conflict-, climate- and gender-sensitive policies, programs, and investments to build resilience in FCA systems
- AoW3-2030-OC2: Urban populations, especially young women and men, obtain decent work in urban food systems.

12. Climate change

Climate change poses significant challenges to food systems in FCAs, cities, and islands — landscapes intricately linked by their vulnerability to climate shocks. These regions face interconnected risks, including water scarcity and pollution, resource competition, migration, and conflict, which undermine food security and livelihoods. Addressing these challenges requires a unified approach integrating adaptation, mitigation, and policy action across diverse but interconnected food systems. The Food Frontiers and Security Program strengthens resilience in these fragile landscapes, creating sustainable, scalable solutions that address the evolving needs of climate-vulnerable communities.

In FCA food systems, climate stressors such as droughts, floods, and weather extremes intensify competition for scarce resources like water and arable land. These tensions, compounded by conflict and forced displacement, increase pressure on already fragile food, land, and water systems. At the same time, rising global temperatures and more frequent extreme weather events drive rural depopulation, particularly among youth who migrate to urban areas in search of more stable livelihoods. Urban areas face their own climate vulnerabilities, including rising temperatures, inadequate infrastructure, and growing food insecurity, exacerbated by rapid population growth and increased demand for animal-sourced food, which contributes to greenhouse gas emissions. Islands, similarly, face acute climate risks from sea-level rise, ocean acidification, and severe storms. These changes threaten food systems and communities that rely on ocean resources for livelihoods and have limited access to adaptation strategies due to geographical isolation. In all these fragile contexts, climate change multiplies risks, destabilizing food systems and driving cycles of poverty, displacement, and resource depletion. Furthermore, these geographies are not always distinct –- they are overlapping; therefore, the science of developing solutions must be integrated.

The Program addresses these challenges by enhancing climate resilience through solutions that integrate local knowledge with CGIAR research. Resilience-building requires anticipating risks and promoting climate-smart innovations that are both adaptable and scalable. In FCA regions (AoW2), the Program strengthens food systems by integrating anticipatory actions that address the root causes of fragility by linking short-term emergency objectives to long-term resilience building. For instance, improving water management and resource distribution helps reduce competition, while locally adapted agricultural techniques empower communities to produce food under increasingly unpredictable conditions.

In urban and peri-urban areas (AoW3), the Program focuses on circular economy models and improved waste and wastewater management practices to reduce greenhouse gas emissions and enhance climate change adaptation. By converting organic waste into valuable agricultural inputs, the Program helps close nutrient cycles and reduce urban waste. Technologies that support urban agriculture, such as water-efficient irrigation systems, safe wastewater reuse and drought-tolerant crops, are also explored to help cities reduce dependence on external food sources. Collaboration with local governments and the private sector will be crucial for scaling

these solutions and ensuring alignment with broader climate action plans, helping cities mitigate emissions while adapting to climate change.

In island systems (AoW4), the Program strengthens climate adaptation strategies that address immediate and long-term risks posed by sea-level rise and extreme weather events. This includes promoting sustainable fisheries management, salt-tolerant crops, and water-saving technologies that help food system actors manage scarce resources. These strategies are co-developed with local stakeholders to ensure they are contextually relevant and sustainable over the long term.

The Future Food Lab (AoW1) will drive innovation, scaling, learning, and foresight analysis to advance climate adaptation and mitigation strategies. By co-creating solutions with researchers, stakeholders, and policymakers, the Lab will test climate-resilient innovations, build partnerships, and scale successful models, ensuring interventions are forward-looking and responsive to evolving climate challenges.

The Program supports CGIAR's goal of equipping 500 million users, including the most vulnerable and marginalized, with climate-resilient solutions by 2030. It will conduct climate risk assessments and engage communities to create locally appropriate adaptation strategies, addressing immediate needs while building long-term resilience to climate shocks across all geographies.

The Program also supports CGIAR's goal of reducing agricultural emissions by one gigaton annually by 2030 through low-emission models with adaptation co-benefits. By reducing food waste, promoting sustainable practices, and improving water and nutrient efficiency, the Program helps LMICs transition to climate-smart, sustainable agricultural systems that contribute to both mitigation and adaptation goals.

Central to this approach is translating scientific research into actionable climate policies. The Program will work closely with policymakers, local institutions, multilateral finance institutes, and international organizations to integrate solutions into national climate policies. Through capacity-building initiatives, the Program will help policymakers and community leaders anticipate climate risks, develop effective responses, and scale successful interventions. The Program will also advocate for integrating climate and conflict-sensitive agricultural innovations into policy frameworks to ensure they receive the necessary support for large-scale deployment.

13. Risk management

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

Risk title	Risk statement including potential event, sources, and consequences on objectives
1. Inadequate capacity to implement innovations	Government and non-government partners have limited financial and technical capacity. Investment in capacity sharing may not be adequate to enable partners to implement innovations needed to improve food security/resilience. *Moderately high likelihood and impact*.
2. Weak governance among implementation partners	A major dimension of food system fragility is weak governance, which may increase the exclusion of those with limited resources, especially women and youth, undermining our ability to target these populations. *Moderately high likelihood and impact*.
3. Unpredictable/ inadequate funding	Funding uncertainty reduces our ability to develop long-term partnerships, while sudden reductions affect our credibility with partners. *Moderately high likelihood, potentially high impact*.

Risk title	Risk statement including potential event, sources, and consequences on objectives
4. Catastrophe diverts resources	Increased frequency and severity of climate-related events (e.g., flood, drought), overwhelming food systems where the Program works, or diverting financial and human resources for response. *Low likelihood, potentially high impact*.

14. Funding sources

The Program has a total of 40 bilateral projects at a combined funding of USD 29.9M mapped across the AoWs (see Table below). There is a concentration of bilateral projects on AoW2, totaling USD 22.2M. AoW3 and AoW4 have USD 3.8M and USD 5.0M allocated, respectively. No bilateral projects are mapped to AoW1 yet, though the bilateral projects were assigned to Programs before proposal design, and the methods for this mapping exercise are currently under review. The hope is that additional bilateral funds might be subsequently allocated to AoW1. All bilateral income streams allocated to Program AoWs are managed by participating CGIAR Centers and fall clearly within the scope of AoWs designed in the Food Frontiers and Security Program. The projects include research and development of technical materials that augment the Program's high-level outputs.

In AoW2, there is a significant bilateral project contribution to all sub-AoWs, and five out of 24 projects continue to 2027 or longer. The pooled to bilateral funding ratio is [tbd]. The funder base is diverse, including contracts with countries (e.g., USA, UK, Italy, Netherlands, Germany, Sweden, Colombia), the European Commission (EC), UN agencies (FAO, WFP), INGOs (e.g., World Vision International), and universities (e.g., University of Bern, Cornell). The bilateral portfolio includes global-, regional- (Africa, MENA, Sahel), and country- (e.g., Guatemala, Yemen, Mozambique, Jordan) level projects. The Portfolio addresses the main challenges of migration, displacement, conflict, fragility, food security, gender, and social inclusion and how CGIAR evidence and tools can inform more effective and inclusive policies, programs, and investments.

In AoW3, there are six projects, of which one extends into 2027. The pooled to bilateral funding ratio is [tbd]. The projects are funded by various donors including the Swiss Federal Department of Foreign Affairs, Australia-DFAT, Sweden-SIDA, and World Bank. The projects are implemented through CGIAR Centers. For example, CIP is actively engaged in bilateral projects focused on post-harvest technologies and the development of short-value chains, which are vital to improving food security in urban areas. IWMI is implementing projects focusing on circular bioeconomy in cities such as Accra, IITA has bilateral projects focusing on urban food production, while ILRI has ongoing bilateral projects focusing on food safety in informal markets in cities such as Nairobi. In addition, these bilateral projects align with broader work across other work areas of this Program, such as those focusing on the development of informal market systems, promoting value chains, food production, enhancing food safety, and exploring circular bioeconomy models fragile settings, as well as island food systems.

In AoW4, there are six projects. The pooled to bilateral funding ratio is [tbd]. Contracts include IDRC, FAO-Global Environment Facility, but most projects are ACIAR-funded. Projects map across all sub-AoWs. For example, WorldFish manages work focusing on community-based resource management as a strategy for resilient aquatic food production at islands in the Pacific (AoW4.1), as well as fish handling and food safety (AoW4.2) and nutrition-sensitive food systems analyses (AoW4.3-5). Some of these projects are managed through a regional university partner (ANCORS at UOW), with several national and regional peak bodies also having leading roles. ACIAR bilateral income streams for research at the islands are in design for the next phases of investment until 2030. In addition, projects with Global Environment Facility (GEF) and IDRC have

strong transdisciplinary focuses on climate change, Indigenous practices, and food production resilience.

The pooled funding allocation followed the guidelines set by the CGIAR Portfolio Design team to allocate according to two scenarios: Scenario 1 “baseline” and Scenario 2 “surge”. Using Scenario 1, the total Program budget is [tbd] and bilateral projects make up [tbd%]. Using Scenario 2, the total Program budget is [tbd] and bilateral sources make up [tbd%]. In considering the mix of bilateral and pooled funding, the strategy is to manage diverse income streams as a Program to deliver toward targets and expand the overall portfolio for frontier food systems research.

The Program has been designed as an ambitious transdisciplinary enterprise focusing on otherwise neglected food systems and the Scenarios based on historical allocations do not match that ambition. Therefore, the Program has set a target pooled funding allocation (a pooled funding “Ambition”) for AoWs in 2025. The pooled funding ambition reflects the estimated allocation required to ensure continuity and growth also of the bilateral income stream: a strategic investment to position CGIAR for what is a clear growth area and an emerging opportunity. It is unrealistic to consider further reallocations between AoWs, as they are all now allocated to ensure Program continuity and accountabilities developed in 2022-24.

In the final version, a table will be inserted here, showing the breakdown of pooled funding by Area of Work for different budget scenarios.

Table: Bilateral project allocations by Area of Work

Project/ program title	Lead CGIAR Center	Funder	Duration	Expected 2025-30 funding (kUSD)	Relevant Program AoW
Jahez: Improving Anticipatory Action and Climate Change Adaptation in Refugee-Host Systems in Jordan AL MURANA	IWMI	UK-FCDO	2024 - 2029	$5,000,000	AoW2
SPIR II	IFPRI	World Vision International	2021 - 2028	$4,715,194	AoW2
Water Security Initiative - MENA Region	IWMI	Sweden-SIDA	2024 - 2026	$1,572,005	AoW2
IPV RESEARCH COLLAB PH 2	IFPRI	Anon	2021 - 2027	$1,457,136	AoW2
FSP PHASE 4	IFPRI	European Commission	2022 - 2026	$1,150,421	AoW2
WFP LTA - Supporting WFP Climate Action in Mozambique	CIAT	World Food Programme	2024 - 2025	$1,100,000	AoW2
Tools4SeedSystems: working towards resilience through root, tuber and banana crops in humanitarian settings	CIP	USA - USAID	2022 - 2026	$1,042,984	AoW2
CASH 4 WORK-CfW SFD-LIWP	IFPRI	SFD	2023 - 2027	$779,084	AoW2
ACUTE FOOD INSECURITY	IFPRI	USA - USAID	2022 - 2026	$664,768	AoW2
YEMEN FOOD SECURITY-YFSRR	IFPRI	FAO	2023 - 2027	$553,500	AoW2
MIGRATION ANALYSIS GUATEM	IFPRI	USA	2019 - 2026	$546,654	AoW2
FAO-La diversité des cultures: une opportunité pour les populations vulnérables à la crise sécuritaire et aux changements climatiques au Sahel	Bioversity	FAO	2024 - 2028	$468,240	AoW2
Making Index Insurance Fully Available for Women (MIIFAW) – Phase 2	ILRI	Proposal	Proposed	$436,000	AoW2
FOOD INSECURITY WARNING	IFPRI	USA - USAID	2022 - 2026	$419,793	AoW2
WCDI(SDC)-Advancing the Humanitarian, Development and Peacebuilding Nexus in Africa's Seed Sector. (Integrated Seed Sector Development (ISSD) in Africa Programme – Phase 2	Bioversity	Netherlands-Ministry of Agriculture, Nature and Food Quality	2023 - 2025	$322,980	AoW2
PATHWAY OUTPOVERTY-BAIDOA	IFPRI	World Vision International	2021 - 2026	$284,078	AoW2

Project/ program title	Lead CGIAR Center	Funder	Duration	Expected 2025-30 funding (kUSD)	Relevant Program AoW
Evaluation of the Effectiveness of BHA-Supported Agricultural Practices on Crop Productivity in Emergency Food Security and Resilience Activities	ICRISAT	USA -USAID	2023 - 2025	$238,450	AoW2
USA-USAID-Food Security, conflict and fragility in a compound risk framework	CIAT	USA - USAID	2023 - 2025	$203,277	AoW2
Cost-effectiveness Analysis pilot in 10 WFP-IRP sites (5 countries)	CIAT	WFP	2024 - 2025	$196,400	AoW2
CDE (SWITZERLAND-LBS)-Engagement Platform to unite and scale Sustainable Land Management action in Sub-Sahara Africa (AfrioCAT)	CIAT	University of Bern, Centre for Development and Environment	2022 - 2025	$104,509	AoW2
Gender-responsive innovations for soil rehabilitation, alternative fuel and agriculture for resilient refugee and host community settlements in East Africa	IWMI	Germany-BMZ	2019 - 2025	$70,948	AoW2
From Climate change to conflict: Mitigation through Insurance	ILRI	Netherlands-NOW	2023 - 2027	$55,822	AoW2
COLOMBIA-MINCIENCIAS- Convocatoria de Estancias Posdoctorales Orientadas por Misiones - 2023	CIAT	Colombia - MINCIENCIAS	2023 - 2026	$43,934	AoW2
BUILD RESILIENCE SOC PROTEC	IFPRI	Cornell	2022 - 2025	$25,794	AoW2
ITALY Junior Professional Officer Program 2024 - Research Officer -Sagliocco Livia	Bioversity	Italy	2024 - 2026	$112,200.	AoW2
CIHEAM (EC) SUSTaining and improving local crop patrimony in Burkina Faso and Niger for better LIVes and EcoSystems (SUSTLIVES)	Bioversity	CIHEAM-International Centre for Advanced Mediterranean Agronomic Studies	2021 - 2025	$58,018	AoW2
Onion Value Chain Improvements in Odisha State(1) Phase II	ICRISAT	India-Government of Odisha	2023 - 2025	$33,120.	AoW2
Supporting Pastoralism and Agriculture in Recurrent and Protracted Crisis (SPARC)	ILRI	CowaterSogema International Inc	2020 - 2025	$500,000	AoW2
ETH/IITA - CITY REGIONS FOOD SYSTEMS, RUNRES (THE RURAL-URBAN NEXUS: ESTABLISHING A NUTRIENT LOOP TO IMPROVE CITY REGION FOOD	IITA	Swiss Federal Department of Foreign Affairs	2024 - 2027	$2,184,632	AoW3

Project/ program title	Lead CGIAR Center	Funder	Duration	Expected 2025-30 funding (kUSD)	Relevant Program AoW
SYSTEM RESILIENCE) PHASE II RWANDA - (RAFS) - PJ-3812					
South Asia Water Security Initiative (SAWASI) Demonstration Projects - Pakistan	IWMI	Australia-DFAT	2021 - 2025	$120,225	AoW3
Transboundary Rivers of South Asia (TROSA) Phase-2: Rivers, Rights and Resilience	IWMI	Sweden-SIDA	2023 - 2026	$49,065	AoW3
Sustainable organic waste value chains - Knowledge and Linkages for An Inclusive Economy Phase 2	IWMI	Australia-DFAT	2022 - 2026	$20,617	AoW3
Technical Assistance for the Promotion of the Production and Processing of Orange-Fresh Sweet Potatoes of the MIONJO Project	CIP	Unité Nationale de Gestion de Projets – Banque Mondiale	2023 - 2025	$757,897	AoW3
Promoting Rural Agribusiness and the use of Yacon diversity conserved in Pataz and CIP, through the Bioeconomy and Functional Foods	CIP	Minera Ponderosa (Private sector)	2024 - 2027	$700,000	AoW3
IKAN ADAPT	WorldFish	FAO	2022 - 2026	$2,190,967	AoW4
Climate-Adaptive, Inclusive, Nature-base Aquaculture (CAINA)	WorldFish	IDRC	2023 - 2027	$1,628,467	AoW4
Nutrition Sensitive Fisheries Management in Timor-Leste and Indonesia	WorldFish	Australia-ACIAR	2021 - 2025	$267,806	AoW4
Extend integrated analysis for food system in TL & Pacific	WorldFish	Australia-ACIAR and University of Wollongong	2023 - 2026	$146,282	AoW4
Coalitions for change in sustainable national CBFM	WorldFish	Australia-ACIAR and University of Wollongong	2021 - 2025	$120,669	AoW4
Innovating fish-based livelihoods in Solomon Islands and Timor-Leste	WorldFish	Australia-ACIAR and University of Wollongong	2021 - 2025	$620,765	AoW4

Annex - Pooled funding

AoW1: Future Food Systems Lab

The unique and intersecting challenges facing FCA, urban, and island food systems have resulted in these geographies remaining trapped in cycles of vulnerability, unable to develop the resilient, self-sustaining food systems necessary for long-term stability and security. This new area of work departs from the myopic focus on reactive crisis-driven programming by humanitarian and development partners to identify innovations and pathways that will build food system resilience and reduce reliance on transient measures and humanitarian aid.

The AoW1 is predominantly resourced by the pooled funding originating from WP4-ACCELERATE under the CGIAR FCM Initiative. No deliberate Work Package (WP) existed in the Resilient Cities and Aquatic Foods Initiatives that could be intuitively mapped. Therefore, a propositional amount of funding resources from AoW4 (formerly part of Aquatic Foods) and from AoW3 (former Resilient Cities) has been allocated to AoW1. However, the pooled funding from the former Initiatives, as represented in Scenario 1 and Scenario 2, will not be sufficient to meet the objectives of AoW1. In addition, no bilateral funding has been mapped to the AoW1 meaning that additional pooled funding would be required to achieve the ambitious goals of the Lab and provide a platform from which the Program can leverage bilateral income.

The ISDC recognized the crucial role of the AoW1 work in its review of the CGIAR 2025-2030 Portfolio Narrative. Based on the 2-pager submitted for the Frontiers Program, the ISDC described AoW1 as an “exciting development” whose focus should be clearly defined and adequate resources provided for its success. The Program design team has held wide consultations with key stakeholders to further sharpen the focus of this AoW. This presents a starting point for building a strategy to resource the Food Frontiers and Security Program's ambition.

AoW2: Fragile and Conflict-affected Food Systems

Building on the successful implementation and experiences from the CGIAR Research Initiative on Fragility, Conflict, and Migration (FCM), AoW2 will continue to provide science-based solutions and innovations to support partners operating in FCA food systems along the Humanitarian, Development, Peace (HDP) nexus. The demand-driven research and evidence co-created through the FCM Initiative, to be continued through AoW2, have proven to be effective and useful to many partners, including national and local governments hoping to prepare for, address, and recover from shocks and crises. For example, the FCM Initiative supported nine policy changes in its first year.

The rigorous, mixed methods research conducted by FCM has generated a strong, continued demand for evidence and collaboration that will enable the Program to achieve its 2030 outcomes. Building on these achievements from the 2022-2024 portfolio, AoW2 will use pooled funding for 2025-2030 to continue and strengthen those workstreams and activities that have yielded most potential to address the CGIAR Impact Areas and which are most demanded by our partners. As part of the pool-funded activities, AoW2 will continue to study how the impacts of shocks and crises in FCA food systems can be prevented or mitigated through preparedness measures and effective governance. Co-designed research and capacity building activities will examine policy and investment options, nature-based solutions and scaling pathways to strengthen inclusive disaster risk reduction and anticipatory action strategies in FCM contexts. The "Localization, Livelihoods and Learning Humanitarian Platform” will provide a base for practical knowledge sharing and solutions development.

In response to demand from humanitarian and development partners, AoW2 will additionally expand previous work focusing on informing responses to shocks and stressors. As part of this expansion, this AoW will study the impact of violent conflicts and related shocks (including on vulnerable populations, such as women, youth, refugees, and displaced people) and test alternative responses to cushion the adverse impacts of these crises. Some of the activities will compare the performance of alternative targeting mechanisms while others will assess the cost-efficacy of different modalities (e.g., cash-based versus other types of transfers including digital transfers, or humanitarian assistance versus anticipatory action). The Frontiers Program will also work with aid agencies, supporting them to more effectively allocate resources and develop a localized Women, Peace, and Security Index.

AoW2 will also continue and expand research aiming to understand and quantify complex risks and crises and how interventions can be designed to achieve multiple benefits. For this, the Program will use alternative sources of data, such as social media and media data. These activities will also study policies and investments that can integrate short-term responses to compound humanitarian crises with long-term development and peace objectives.

Beyond preventing and responding to shocks, this AoW will also continue previous activities focusing on studying policies, programs, and investments to build stable individual livelihoods in FCA food systems. While several ongoing projects will receive initial support, the AoW will also build on the learnings from the Initiative to move towards studying programming that supports not only individual livelihoods but also resilience at the community level. These activities will evaluate and identify effective programming that can also ensure and promote the inclusion of women and youth.

Finally, leveraging the successful implementation of the partnerships between CGIAR and WFP under the FCM Initiative, this AoW will continue to provide demand-driven and tailored technical and analytical support to humanitarian partners, including through secondments, with the ultimate objective of informing the design and delivery of programs to address crises and build resilience. Through this vehicle, the Food Frontiers and Security Program will offer strategic support to address specific knowledge and capacity gaps of humanitarian organizations operating in FCASs. Finally, the Program will foster the development of locally relevant and demand-driven research and interventions through dedicated mentorship programs and scientific exchanges, which will increase the volume and quality of research outputs and strengthen the position of southern-led science to inform policy and practice.

AoW3: Urban Food Systems

Building on the ongoing CGIAR Initiative on Resilient Cities, AoW3 ensures CGIAR's contribution to building resilient and sustainable urban food systems aligned with national, regional, and global priorities. Through strategic partnerships with Worldveg, city governments, global networks, and development partners, AoW3 will develop innovations, tools, evidence, and data to enable urban food systems to supply safe, nutritious, and affordable food while creating employment along the value chain and as part of a circular bioeconomy. AoW3 will work with value chain actors and policymakers to improve food safety practices based on evidence generated from CGIAR research, reducing health risks to vulnerable urban populations. AoW3 will support cities in reducing food waste and converting organic waste into valuable resources like biofertilizers. AoW3 will emphasize the youth agenda as a critical pathway to enable city youth to find more jobs and economic opportunities in urban food systems, including seedling nurseries, urban farms, food vending, and circular bioeconomy businesses. AoW3 will generate research evidence to inform improved informal market systems and food environments, giving urban communities better access to safe, nutritious, and affordable food, particularly those in low-income areas.

Urban food systems have become a priority research area for many research centers involved in this AoW, which is evidence of their growing importance in global food systems. The implementation of this work will be supported by leveraging existing bilateral projects and ongoing Initiatives across CGIAR. By tapping into these projects, the Program can optimize resource use efficiency, avoid duplication, and enhance the collective impact on urban food systems. The ongoing partnership with the World Bank and global city networks will continue to be critical leverage for the AoW3 implementation, especially as platforms for global policy engagement.

AoW4: Island Food Systems

AoW4 on Island Food Systems is a new program developed out of the WorldFish Pacific Program as a framework to address a food system neglected by CGIAR and elsewhere - that of small island states and other island systems. The Program on Island Food Systems emerged with a transdisciplinary focus in 2022 (Eriksson et al., 2022). Since then, it has rapidly evolved as part of the CGIAR Initiative on Aquatic Foods. The Aquatic Foods Initiative WP2 augmented bilateral funding streams and created a programmatic framework around island food systems for systematic learning and scaling. During 2022-24, this Work Package made significant progress in developing partnerships spanning areas of nutrition (Eriksson et al., 2023), traditional agriculture and Indigenous foods (Tutuo et al., 2023), and Pacific regional food trade analyses (Brewer et al., 2023a). It also established an Innovation hub for island food systems in Solomon Islands (Bennett et al., 2023). The pooled funding will expand this work in Solomon Islands and Timor-Leste, as well as regionally and globally through networks of partners with research on island-specific scaling.

AoW4 is an emerging science area for CGIAR that builds on long-term embeddedness and transdisciplinary research in the Pacific by WorldFish and its regional partners, but with global ambitions. Recognizing the programmatic innovation and WorldFish's comparative advantage to convene a Pacific program, it has been prioritized by CGIAR Executive Management. Its relevance and legitimacy have been well recognized in these discussions as the platform that can enable the types of innovations and transdisciplinary research required to tackle the long-term food system challenges at islands in the Pacific and elsewhere. The Initiative-legacy pooled funding (roughly USD 1M) is insufficient to deliver the full ambition of the AoW on Island Food Systems. The bilateral pooled funding ratio is [tbd]. The indicated pooled funding ambition (USD 5.1M) in Section 14 is the estimated requirement for fulfilling the ambition for 2025 based on partner consultations during the design of the Program. At least 40% of pooled funds are anticipated to be dispersed to national and regional partners in the Pacific. In addition, the pooled funds will enable continuity of novel integrated research spaces around food safety, Indigenous foods in island food systems and their relationship with efforts on better diets and nutrition.

The geographic localization of research programming to the unique features of islands and their food systems has garnered interest in other regions where islands are prevalent. For example, IWMI and WorldFish are in ongoing conversations with the Caribbean Development Bank. In addition, the islands of the Western Indian Ocean are also part of a longer-term plan for deliberate engagement of food system research. The pooled funding will primarily be used for making continued progress on the research program in partnership with national and regional peak bodies (Solomon Islands National University, Pacific Community), national governments (e.g., Solomon Islands and Timor-Leste), national NGOs (e.g., Kastom Gaden Association) as well as integration of CGIAR expertise where there is Pacific demand for it (e.g., CIP on resilient sweet potato varieties, IWMI on circular production systems, WorldVeg on vegetable production and genetic asset mapping).

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