

CGIAR RESEARCH & INNOVATION STRATEGY 2030



Science and innovation that advance transformation of food, land and water systems in a climate crisis

DRAFT
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CGIAR RESEARCH & **2030** INNOVATION STRATEGY



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Glossary

Impact

A fundamental and durable change in the condition of people and their environment brought about by a project or intervention.

Innovation

The process of introducing and taking to scale new ideas, products, services and solutions capable of facilitating impact.

Innovation system

The interlinked set of people, processes, assets and social institutions that enable innovation.

Research

Generation and communication of data, information and knowledge on an empirical basis.

Science

Rigorous hypothesis-based research.

System

A set of interacting entities and processes that form a complex whole.

System transformation

A major shift – bringing about significant positive change for the majority of people in the system – in the governance and functioning of a system.

Acronyms

COVID-19	Corona virus disease of 2019
GHG	Greenhouse Gas
IATI	International Aid Transparency Initiative
ISDC	Independent Science for Development Council
NARES	National Agricultural Research and Extension Services
NGO	Non-Governmental Organization
PRMF	Performance and Results Management Framework
PRMS	Performance and Results Management System
SDG	Sustainable Development Goal
SPIA	Standing Panel on Impact Assessment
UNFCCC	United Nations Framework Convention on Climate Change

2 ZERO HUNGER



Executive summary

Why a new strategy to 2030

The world's food systems require a radical realignment. Food systems have become a part of the problem, they need to be part of the solution. Fifty years ago, when the world was facing rising hunger, CGIAR stepped up to the challenge and helped to save billions of lives. Today, the challenges we face are far more complex, and there is so much more that we are striving to achieve. Today we know that food systems are critical not only for ending hunger, but for providing better nutrition, reducing poverty, promoting inclusion, safeguarding biodiversity, and mitigating climate change. Today's challenges require a renewed strategy from CGIAR, the world's leader on agricultural science and innovation for development.

One CGIAR – the integration of CGIAR's capabilities, knowledge, assets, people and global presence for a new era of interconnected and partnered research towards the SDGs – provides the opportunity for a fresh ten-year strategy that can shape a stronger and more relevant science agenda for today's world of change. One CGIAR enables us to operate as a cohesive organization with a single mission, able to seamlessly leverage all of our capabilities and assets.

This 2030 Research Strategy situates CGIAR in the evolving global context that demands a systems transformation approach for food, land and water systems. It builds on the track record of delivering impacts over 50 years, lifting hundreds of millions of people out of hunger and poverty and supporting low-income producers and consumers.

What CGIAR will offer

To achieve its mission – science and innovation that advance transformation of food, land and water systems in a climate crisis – CGIAR will work with partners to deliver multiple benefits and transformative change across five SDG-focused Impact Areas: (i) Nutrition, health & food security; (ii) Poverty reduction, livelihoods & jobs; (iii) Gender equality, youth & social inclusion; (iv) Climate

adaptation & greenhouse gas reduction; and (v) Environmental health & biodiversity.

CGIAR will strive towards impact at scale globally and regionally by focusing on three Action Areas in which accelerated innovation is required to create sustainable, resilient food, land and water systems and to meet SDG targets. The Action Areas are: (1) Systems Transformation; (2) Sustainable Production; and (3) Genetic Gains.

HOW THE STRATEGY WILL BE IMPLEMENTED

The 2030 Research Strategy stakes success on doing business differently. What's new in how CGIAR will work is grounded in seven key approaches:

- 1 Embrace a **systems-transformation approach**, seeking **multiple benefits** across five SDG-linked Impact Areas
- 2 Leverage **ambitious partnerships for change** in which CGIAR is strategically positioned
- 3 Position **regions, countries and landscapes** as key dimensions of partnership, worldview and impact
- 4 Generate scientific evidence on **multiple transformation pathways**
- 5 Target **risk-management** and **resilience** as critical qualities for food, land and water systems
- 6 Harness **innovative finance** to leverage and deliver research through new investment and funding models
- 7 Make the **digital revolution** central to our way of working

PART 1

Why a new strategy 2030

One CGIAR

Is the integration of CGIAR's capabilities, knowledge, assets, people and global presence, aiming for greater integration in the face of the interdependent challenges facing today's world. It comprises a sharper mission statement and impact focus, unified governance under a common board, institutional integration, common policies and services, strategic partnerships, a global and consistent country and regional presence, and greater pooled funding.

One CGIAR is based on the premise that CGIAR's people can deliver more relevantly, consistently and efficiently when brought together under fewer institutional boundaries, supported by clearer, unified, and empowered management and governance – a truly modern, global organization and leader in agricultural science and innovation, with greater interactions across disciplines and regions. For our partners, CGIAR will be more accessible and easier to work with both locally and globally, providing a one-stop shop to access all of our global capabilities.

Purpose of this document

This document presents CGIAR's high-level strategy for making an ambitious and meaningful contribution to transformation of the world's food, land and water systems – both towards and beyond the 2030 Sustainable Development Goals. It provides an overview of how CGIAR will deploy and develop its capacities, assets, skills and activities to address key global and regional challenges with partners. The strategy covers all research for development programming across all CGIAR.

This CGIAR 2030 Strategy will be delivered through 3-year Investment Plans for 2022-2024, 2025-2027 and 2028-2030. These Investment Plans will provide a much greater level of detail on the objectives, targets, activities, deliverables and budgets of CGIAR Initiatives based on detailed co-analysis and co-design together with partners and investors.

Rationale: A new strategy to address new challenges

Food, land and water systems need profound transformation – one in which CGIAR must play a central role. People across the world are facing changes that are swifter and more interconnected than our institutions' abilities to respond: climatic shocks, environmental decline, technological innovation, and profound global shifts in demographic expansion, economic growth and geopolitical power.

Food – the ways we grow, gather, transport, process, trade, store and consume it – is a central driver of the main challenges facing humanity. Most of the world's population eats too little, too much, or the wrong combinations of food. Many agricultural production systems degrade our land and water resources, destabilize climate, and threaten important ecosystems and biodiversity, all at an unsustainable cost to our health, livelihoods and economy.

What's more, the global food system is creating and multiplying risks, and faces increasing uncertainty itself from these risks – particularly as we head further into a climate crisis that is taking the world into an uncharted future. The global disruptions caused by COVID-19 could prove a precursor for food system shocks under the climate crisis. Yet it is entirely possible to change our trajectory. We find ourselves with an unprecedented opportunity for humanity to 'build back better' from Covid19 by transforming food, land and water systems that are at the root of the pandemic and the climate and other crises.

For 50 years, CGIAR has been delivering critical science and innovation to support food security and the development of successful and inclusive agricultural economies. But CGIAR's original mission – to solve hunger – must now expand to address wider 21st century challenges as well and embrace a systems-transformation approach for food, land and water systems to deliver broad access to affordable, sufficient healthy diets and decent employment within environmental limits. Under resource scarcity and global connectivity, the challenges of food and nutrition security, poverty reduction, gender equality, climate and environment are simply not separable.

CGIAR's TRACK RECORD AND ASSETS

CGIAR has experience and knowledge spanning 50 years that builds on a track-record of innovation and world class research. Evidence shows that past investment in research and development conducted jointly by CGIAR with partners have yielded very high returns. CGIAR research has demonstrably helped to lift hundreds of millions of people out of poverty.

Contributions of CGIAR to breeding, agronomic practices, policy change, improving nutrition, natural resource management and climate change responses have resulted in a 10-fold return on investment (a benefit-cost ratio of 10:1). CGIAR is also the world's largest steward of plant genetic resources; approximately 90% of all germplasm transfer reported under the International Treaty of Plant Genetic Resources for Food and Agriculture is distributed by CGIAR genebanks and breeders.

CGIAR has a global presence across four continents with 10,000 staff of 135 nationalities, deployed where the greatest food, land and water system challenges exist. Through innovative partnerships, CGIAR's cross-disciplinary programs have impact at a system level. Carefully curated partnerships link research outputs to development outcomes through CGIAR's trusted networks of national and regional bodies, private sector and civil society organizations. CGIAR is also a convener and advocate for global food and agricultural research.

Today's context requires a refreshed offer from CGIAR that generates solutions of global significance and regional relevance, working through major partnerships for transformation. Research cannot make people food-secure or reduce agriculture's environmental footprint. Only innovation can. Innovation is about combining the different contributions needed to develop and take to scale products, services or solutions capable of facilitating significant positive change.

One CGIAR – the integration of CGIAR's capabilities, knowledge, assets, people and global presence for a new era of interconnected research towards the SDGs – provides the opportunity for a fresh strategy that can shape a stronger and more relevant science agenda for today's world of change.

AT A GLANCE: WHAT'S NEW ABOUT THIS STRATEGY?



INNOVATION FOCUS

Understanding that research done strategically within innovation systems provides the key route for knowledge to drive systems transformation



IMPACT AREAS

Seeking multiple benefits through systems change, not through isolated



ACTION AREAS

Moving beyond commodity-based research to integrated systems science



SEVEN KEY IMPLEMENTATION APPROACHES

Adding up to a forward-thinking approach to how we work



One CGIAR

A foundation of new unified governance and management to enable much more streamlined and effective ways of working at scale

PART 2

What CGIAR will offer

A large, stylized orange graphic of a plant or leaf, composed of several vertical stems and horizontal, curved leaf-like shapes, positioned on the right side of the orange background.

Vision

A world with sustainable and resilient food, land and water systems that deliver more diverse, healthy, sufficient and affordable diets, and ensure improved livelihoods and greater social equality, within planetary and regional environmental boundaries.

Mission

Science and innovation that advance transformation of food, land and water systems in a climate crisis.

Impact: multiple SDG benefits

CGIAR is targeting multiple benefits across five Impact Areas. For each of the Impact Areas, CGIAR will contribute to collective global targets for transformation of food, land and water systems across local, regional and global levels.

Table 1. Five impact areas

<h2>Impact areas</h2>	<h3>Nutrition, Health & Food Security</h3>	<h3>Poverty Reduction, Livelihoods & Jobs</h3>	<h3>Gender Equality, Youth & Social Inclusion</h3>	<h3>Climate Adaptation & Greenhouse Gas Reduction</h3>	<h3>Environmental Health & Biodiversity</h3>
 <h2>Collective global 2030 success metrics</h2>	<p>Nearly 690 million people go hungry, with insufficient energy in their diets. If recent trends continue, the number of people affected by hunger will surpass 840 million by 2030</p> <p>2 billion people do not have regular access to safe, nutritious and sufficient food, and suffer the health consequences of micro-nutrient deficiencies and poor hygiene</p> <p>Diet-related non-communicable diseases (cardiovascular disease, cancer, and diabetes) are increasing in all regions</p> <p>Human health is threatened by poor food safety and diseases transmitted within food systems, including emerging diseases</p>	<p>More than 10% of world population live on less than \$1.90 a day and 25% on less than US\$3.20 a day, making a healthy diet unaffordable to billions. Food systems are the world's largest employer, but most jobs are poorly paid and insecure</p> <p>Though half the work is now urban, poverty remains disproportionately concentrated in rural areas (three times as high as in urban areas), where agriculture is the predominant livelihood activity</p> <p>The Covid19 crisis could push 150 million people back into extreme poverty</p>	<p>Women, on average, comprise 43% of the agricultural labor force in low-income and middle-income countries, and account for two-thirds of the world's 600 million poor livestock keepers, yet their access to productive resources, rights and services is limited, holding back prosperity for all</p> <p>More than 85% of the world's 1.2 billion youth live in low-income and middle-income countries, and many of them face limited opportunities for employment or entrepreneurship</p>	<p>Agriculture and food systems produce almost a third of global greenhouse gas emissions, yet agriculture could be a global carbon sink</p> <p>Climate-related disasters could displace 200 million people by 2050</p> <p>Projections at 2° C warming will result in an additional 540-590 million people undernourished globally by 2050</p> <p>Climate change poses major risk for agriculture and food production through high temperatures, erratic rainfall, drought, flooding and sea level rise</p>	<p>A third of the world's soils are degraded. Agriculture accounts for about 70% of global freshwater withdrawals</p> <p>Nitrogen cycles are transgressing planetary boundaries, driven by agriculture, and phosphorus cycles are under threat</p> <p>Agriculture is the biggest driver of forest and biodiversity loss – including of diversity crucial to healthy diets and nutrition</p>
	<p>Deliver affordable healthy diets to 8.5 billion people, ending all forms of malnutrition for the 690 million who suffer from hunger, 2 billion who suffer from micronutrient deficiency and 2.2 billion who are overweight or obese, and reducing by one third cases of foodborne illness (600 million annually) and zoonotic disease (1 billion annually)</p>	<p>Lift 500 million people above the \$1.90 a day (2011 PPP) extreme poverty line and reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions</p>	<p>Close the gender gap in access to resources, information and power for the 750 million women who work in food, land & water systems, and offer decent opportunities to 267 million young people who are not in employment, education or training</p>	<p>Turn agriculture and forest systems into a net sink for carbon; by 2050; implement all national adaptation plans (NAPs) globally and Nationally and update Determined Contributions (NDCs)</p>	<p>Stay within planetary and regional environmental boundaries: consumptive water use of under 2,500 km³ per year (with a focus on the most stressed basins), zero net deforestation, nitrogen application of 90 Tg year⁻¹ (with a redistribution towards low-input farming systems) and phosphorus application of 10 Tg year⁻¹.</p> <p>Maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels.</p>
<p>These impacts and targets are closely linked to the SDGs, particularly:</p>					

In support of these global targets, specific impact pathways and indicators will be identified for each CGIAR Investment Plan. All CGIAR Initiatives within these Investment Plans will develop an accountability framework of the outputs, outcomes and impacts that CGIAR intends to deliver to address these Impact Areas using a stage-gating approach. This approach involves managing research through distinct stages, separated by assessment and decision points known as stage-gates, to ensure the delivery of impact-oriented results.

Impact pathways through innovation systems

CGIAR understands innovation systems as central to impact at scale. Innovation – the package of complementary contributions needed to develop and take to scale products, services and solutions – happens within innovation systems of partnerships, networks, assets and institutions. Using an overall framing of innovation systems, CGIAR measures its

effective contributions from research to impact along three main pathways, all working within partnerships:

- ✓ Science-based **innovations** – co-development of bundles of knowledge products, technologies, institutional arrangements, services and other solutions along a scaling pathway. Activities include participatory design, testing and piloting, and researching and advancing the enabling environment.
- ✓ Targeted **capacity development** – working with individuals and organizations – designed to improve the utility and use of innovations. Activities range from training-of-trainers at the farmer level, through to ongoing institutional support to national partners, particularly NARES peers, and decision support for policy-makers at global level.
- ✓ Innovation in **policy** – including business strategies and development programs together with more formal public policy sector instruments. Activities include engagement in policy dialogue at all levels, as well as policy analysis, foresight and other tools.

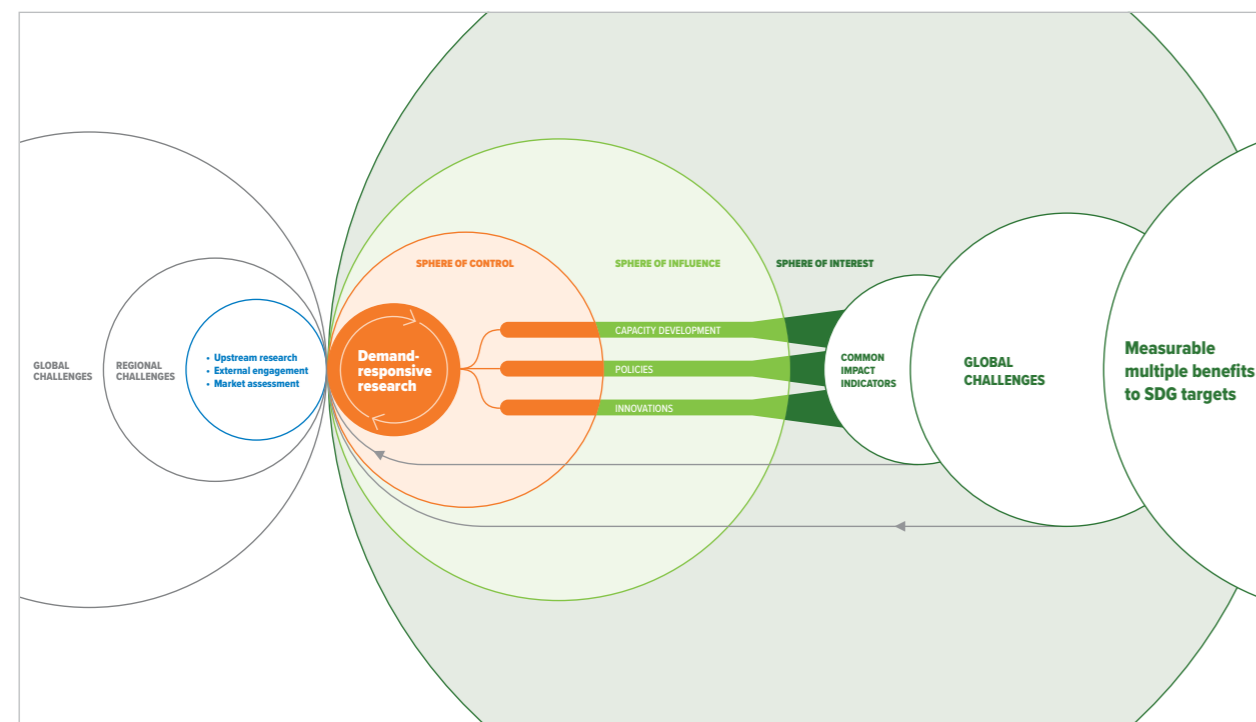


Figure 1. CGIAR's role in taking knowledge through to impact in innovation systems.

Research and innovation portfolio

CGIAR's portfolio of work will be delivered through three Action Areas – coordinated efforts that bring together a set of major ambitions for decadal transformation with a strategic offer from CGIAR. CGIAR will offer Action Areas (1) Systems Transformation; (2) Sustainable Production; and (3) Genetic Gains, which

are described under dedicated headings below. These Action Areas are complementary scopes and will work actively together to avoid siloed approaches. The three Action Areas are selected to build on the firm foundation of CGIAR's traditional strengths in genetics and farming systems with a more ambitious agenda in systems research that brings food systems together with land and water systems (see diagram). Action Areas will be delivered through a small number of significant CGIAR Initiatives (see box).



Figure 2. CGIAR's Action Areas on Systems Transformation, Sustainable Production and Genetic Gains.

CGIAR INITIATIVES

CGIAR Initiatives will be major, prioritized areas of investment that will bring capacity from within and without the System to bear on well defined large challenges. Initiatives will state quantitatively what they intend to achieve, by when, and then work backwards to generate compelling theories of change, activities and resource requirements. Initiatives will come with evaluable results frameworks and clear reporting of results against investment. Initiatives may be targeted at global, regional or country levels.

Action Area on Systems Transformation

Life support systems on land and sea; food systems beyond the farmgate

1 Collective global mission with partners

To forge ambitious new multi-sectoral policies and strategies towards food, land and water system transformation in 50 countries across six regions, crowding in USD 100 billion per annum in investment.

To make a measurable and significant contribution on indicators across all five CGIAR Impact Areas.

2 Global challenge and opportunity

Humanity has made tremendous strides in reducing poverty and food insecurity over the last 50 years. But food systems are failing, creating a daunting array of problems: environmental degradation and land use pressures that are now testing planetary boundaries, a global public health crisis of obesity and diet-related diseases, and poorly paid, insecure jobs for workers in food systems – the world's biggest sector of employment. Food, land and water policy and management practices affect these trends.

Landscapes, water systems and marine systems are being mismanaged to a point of crisis – unable to support food security and livelihoods. The list is long: global warming, extreme droughts, forest burning and death, top soil degradation and erosion, rapidly spreading diseases, including zoonoses and the additional challenges caused by antimicrobial resistance, land and water pollution, river and aquifer depletion, major flood events, massive loss of wild biodiversity, decline of insects and other eco-services to production, rising sea level, faster coastal erosion, growing saltwater incursion, spreading marine anoxic and microplastic zones, and ocean acidification.

As food, land and water systems become more interlinked globally, these challenges must be solved across political boundaries, with transformations from local through to global levels. Solutions need to come from coordinated action across private, public and civil society spheres, in particular to address trade-offs.

This requires reshaping trade, agricultural and social protection policies that are not supporting healthy diets, nor sustainable food, land and water systems. Weak institutional capacities, lack of intergovernmental coordination and absence of transparent processes, resulting in inefficient

use of scarce public resources, exacerbate these problems. More effective and inclusive markets need investment in research and data, appropriate mechanisms for governance of food, and water systems, increasing technology adoption by smallholders, better rural infrastructure and the rebalancing of persistent asymmetries in market power and information.

3 CGIAR's contribution

This area of research will be strongly policy-centric and demand-driven. CGIAR's strategy is to contribute science, expertise and innovations that can inform transformation of food, land and water systems, rather than to seek transformative change through science alone. Policy engagement and capacity development, including greater participation by CGIAR staff in global conversations, will be key catalysts for change.

CGIAR will co-generate an evidence base for national and regional bodies, private sector coalitions and civil society to inform policy options relevant to food, land and water system change. This will include research on the political economy context for system transformation, on strengthening public policy and governance, on financial and advisory services, and on building both value chain and territorial approaches. Foresight and trade-off analysis will help to inform and support policy and institutional options. CGIAR will aim both to contribute to and, where strategic, to lead global evidence-based and action-oriented discourse on food, land and water systems transformation. Addressing major gaps in systems research will be a priority.

Multidisciplinary research on terrestrial, freshwater and marine ecosystems will integrate biophysical, technological, social and institutional dimensions of innovations. This research will be embedded in co-designed participatory processes and partnerships for change, to enable scalable solutions that address social and gender equity for impact at scale. Using advances in remote sensing and big data, CGIAR will increase the quality and use of data to assess landscape trends. CGIAR will similarly work with partners to develop collective capacity in analytic tools and approaches to planning and management of water use and land use at scale. Analysis of trade-offs and synergies between land and water uses – and users – will be used to co-generate solutions that are, wherever possible, equitable, multi-purpose and robust across multiple scenarios.

Market and consumer analysis will feed back into the development of technological options, innovations in services to food system actors (e.g. financial, market intelligence, agro-advisory, pests and diseases surveillance and institutional

options). New research on innovative approaches focusing producer-market-consumer linkages will aim at strengthening market relationships based on sustainability, inclusion and competitiveness. Mapping and analyzing key fragility points in food systems to shocks will provide insights on how to modify economic, labor and value chain structures to increase resilience and future preparedness. Research will address both market approaches, such as inclusive market governance, and public sector approaches, such as large-scale government support programs and social safety nets, to improving environmental, nutritional and socio-economic outcomes.

4 Delivering multiple benefits across Impact Areas

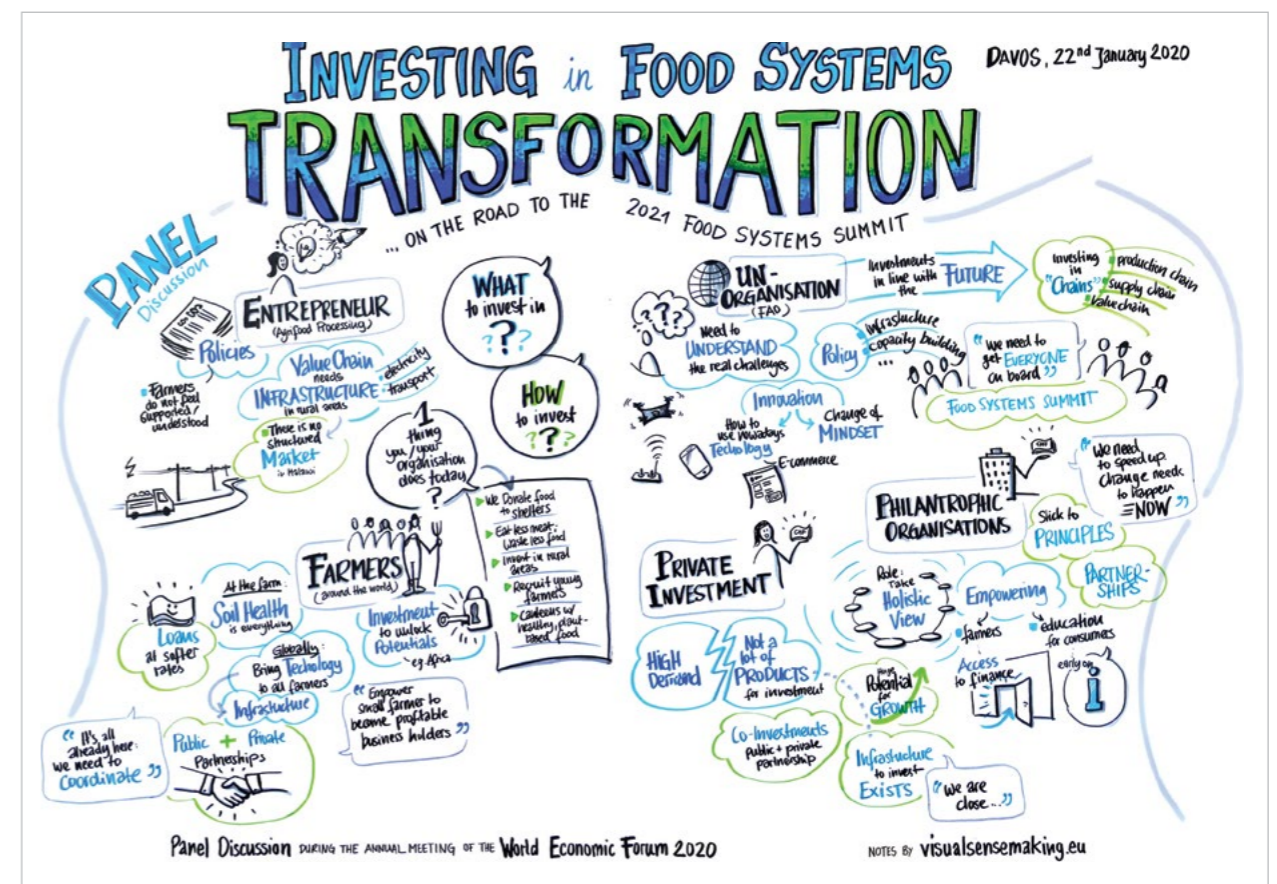
Nutrition, health & food security: via analysis and engagement at all levels to explore the trends and scenarios for globally accessible healthy diets as related to policy choices, emerging risks, demographic change, climate change and other factors.

Poverty reduction, livelihoods & jobs: via policy research that helps lower constraints in accessing productive resources, knowledge, finance and markets, and via supportive research to social safety nets and public programs.

Gender equality, youth & social inclusion: particularly through research that addresses the socio-political barriers to adoption of and benefits from innovations among women and youth.

Climate adaptation & greenhouse gas reduction: by contributing scientific evidence to local, national, regional and global processes on land use, deforestation, dietary change, food waste and production practices.

Environmental health & biodiversity: via positioning of information and knowledge on production systems within the bigger picture of global solutions for staying within planetary boundaries on water use, nutrient use, land use change and biodiversity loss.



Investing in Food Systems Transformation. (Graphic Recording / Panel Discussion section modified from source). Credit: World Economic Forum 2020. Visual Sensemaking. © 2020 Claudia Steinau.

Action Area on Sustainable Production

Farming and harvesting of crops, agroforestry, livestock, aquaculture, fisheries & wild foods

1 Collective global mission with partners

To double the prosperity of resource-poor small-scale food system workers, farmers, fishers and livestock keepers, while keeping production systems within local and global planetary boundaries.

To make a measurable and significant contribution on indicators across all five CGIAR Impact Areas.

2 Global challenge and opportunity

Unprecedented change in demography and markets is reshaping today and tomorrow's food systems – including, critically, the incentives and signals reaching farmers, fishers and livestock keepers. For the past decade, more people have lived in urban than in rural areas. Expanding middle classes are fueling demand for more nutrient-dense foods and for higher standards of food safety and environmental performance. Meanwhile the diets of all consumers, in both urban and rural areas, rely increasingly on processed foods, as longer supply chains edge out more local food systems with fewer participants.

These new realities pose both opportunities and risks, particularly to small-scale food producers, whose numbers projected to remain at around half a billion farms to 2030 and beyond; they remain the dominant suppliers of food globally, providing more than half the world's calories, 60% of fish and livestock products, and 80% of vegetables. Most of these producers today have multiple income streams, including non-agricultural income and strong livelihood links with urban areas.

The 'how' of small-scale food production is also ripe for innovation. Cost savings can be achieved hand-in-hand with reduction of agriculture's environmental footprint, and the building of resilience in the face of risk. For example, agroforestry, digital tools for precision plant nutrition, and multi-trophic aquaculture have all shown widespread positive outcomes in small-scale systems. Combining technological innovation with institutional or market innovations – such as community-based solar-powered irrigation water pumps – can be pivotal to success.

Turning to the risks that global trends pose to small-scale producers, these farming, livestock and fisheries systems face high exposure and sensitivity to risks – for example their largely non-irrigated cropping systems are very sensitive to climate risks – and low capacity to cope or bounce back, due to a generally low asset base for investment. Building resilience through diverse risk management strategies and services will be critical to future inclusive prosperity. Migration – both voluntary and forced – and nonfarm employment will be parts of the mix.

Also, importantly the pace of change is uneven and spatially patchy. Poverty remains disproportionately concentrated in rural areas (three times as high as in urban areas), where agriculture is the predominant livelihood activity. Poorer and landless rural people may be excluded from market-oriented pathways out of poverty. More integrated systems-led rural development approaches, inclusive of public programs and social safety nets, may be critical for people and places left behind.

SUSTAINABLE INTENSIFICATION

Sustainable intensification has two equally important parts to it that must both find their way to farms through innovation systems, with partners: productivity (in all forms, not just yield) and *resource regeneration* (soils and water management, agroforestry, agroecology, biodiversity, microclimate preservation, etc). Farming inevitably entails environmental costs. Resource regeneration compensates, 'seeks to fix that damage' past, present and looking to the future.

3 CGIAR's contribution

The speed of innovation in agricultural production systems needs to accelerate to meet global challenges of progressive climate change, persistent poverty and environmental degradation. CGIAR will put farmers at the center, ensuring that solutions are workable, scalable and multi-benefit – addressing the suite of values, priorities and economic benefits important to fishers, farmers and livestock keepers. Key partners in this work will include CGIAR's peer group of national research and extension service organizations, advanced research institutes and government agencies.

Three areas for special attention are increasing efficiency of resource use (water, land, labour, and organic/inorganic fertilizers) in a holistic manner,

strengthening resilience, and securing social equity. Agricultural research will step up the rate of innovation in soil health, agronomy, agroforestry, farm diversification, land regeneration, and management of biodiversity, water, pests and diseases.

Research will explore multiple context-relevant pathways for farming systems. These include agro-ecological approaches that leverage ecosystem functioning and local knowledge, technology-based approaches that optimize small-scale producers' access to and use of modern inputs, and circular economy approaches that aim to eliminate waste and keep resources in use.

Innovations at the farm level will be complemented by research to improve services to farmers, including informational (extension, forecasts, advisories), financial (credit and insurance), health (veterinary and plant health), infrastructural (transport, post-harvest facilities to avoid spoilage) and market support (input supply, procurement platforms, certification). Emphasis will be put on creating affordable and equal access to these services for women and young people, and on harnessing digital tools. CGIAR will work with implementation partners across these services, particularly those in the private sector.

This work will link closely with that on land systems, as efforts to halt deforestation and manage land use conversion need to be closely linked to better modes of production in farms and fisheries, and that on water systems, to understand on-farm water extraction and use within the wider context of watersheds, river basins and groundwater systems. Food system research will also provide the market framing for all work on production systems, as well as address the challenges facing those producers unable to leverage market opportunities, due to a low asset base, exposure to risks, geographical isolation and social exclusion.

4 Delivering multiple benefits across Impact Areas

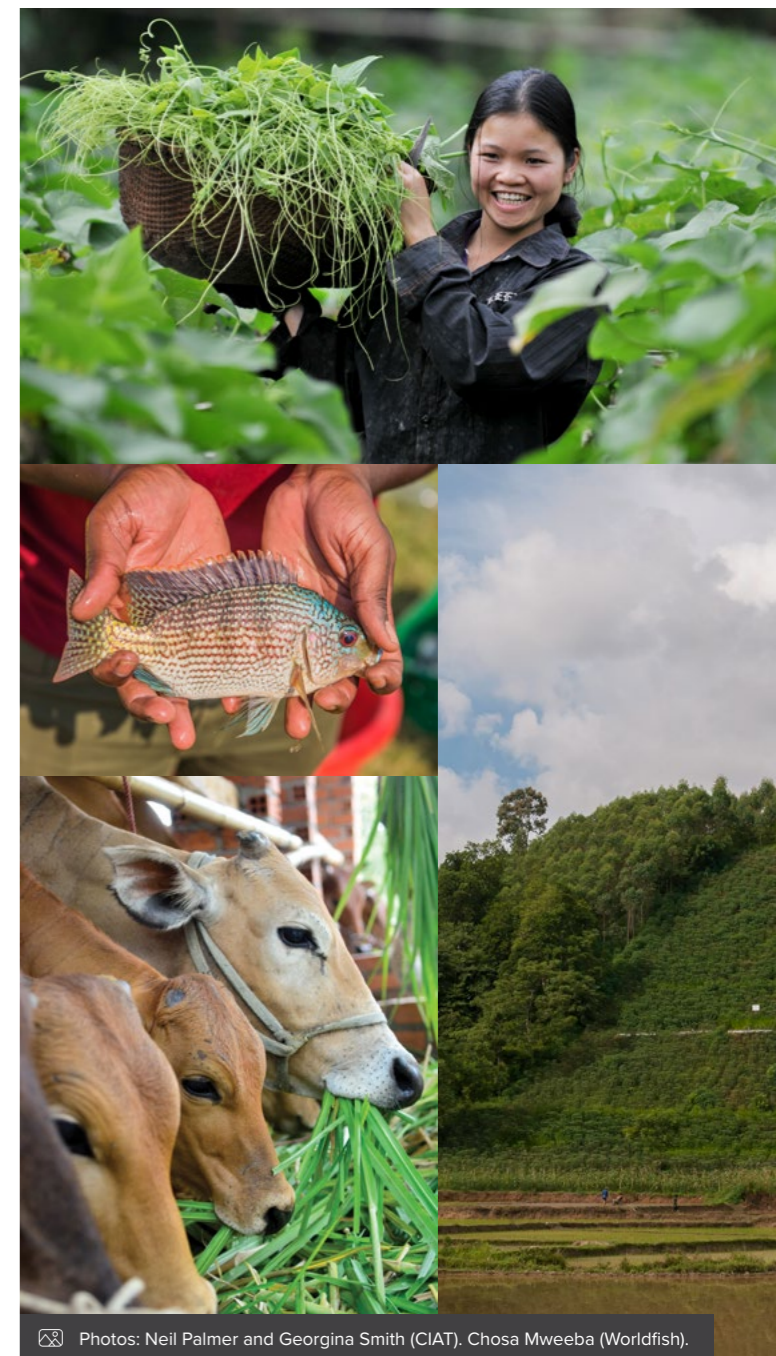
Nutrition, health & food security: through two routes – by increasing and stabilizing the incomes and productive assets of small-scale producers, and by increasing the availability of affordable higher-nutrition foods into local and urban food markets.

Poverty reduction, livelihoods & jobs: by increasing and stabilizing the incomes and productive assets of small-scale producers, through more cost-effective practices, diversified production and income-generating opportunities, and access to better inputs, market opportunities, policies and services.

Gender equality, youth & social inclusion: through co-design and systematic analysis that enable equal access to innovations, capacity development and advance in services and policies.

Climate adaptation & greenhouse gas reduction: by increasing the basket of products, practices and services available to small-scale producers to enhance their adaptive choices, and by offering options that reduce emissions in economically beneficial ways for small-scale producers.

Environmental health & biodiversity: via improved on-farm management of water, nutrients and biodiversity coupled with higher-order landscape and circular economy approaches.



Photos: Neil Palmer and Georgina Smith (CIAT), Chosa Mweeba (Worldfish).

Action Area on Genetic Gains

Genebanks and breeding

1 Collective global mission with partners

To improve the genetics of domesticated plants and animals to ensure annual genetic gains of >1.5% on farms and in aquaculture across nutrition, livelihoods, equality, environment and climate dimensions, and genetic turnover increased by 50%.

To future-proof genetic resources collections to ensure their long-term availability, and to amplify the value of diversity and new traits today while also enhancing readiness to unanticipated future challenges in food systems.

To make a measurable and significant contribution on indicators across all five CGIAR Impact Areas.

2 Global challenge and opportunity

Plant and animal genetic resources are a foundation of the world's food and nutrition security, and the livelihoods of millions of farmers, fishers and livestock keepers. In a time of escalating climate uncertainty and growing demand for healthy and diverse diets, genetic improvement of crops and livestock and better use of genetic resources is vital.

Thus it is no surprise that SDG2 on ending hunger and malnutrition has a specific target, SDG2.5, on maintenance – and equitable sharing – of the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species. The most recent SDG scorecard shows that global holdings of crop genetic resources are stable for now – albeit with insecure future funding – but that holdings are insufficient for crop wild relatives, wild food plants, neglected and underutilized crop species, livestock and fish species. This is an important risk to current and future human well-being. For example, the SDG scorecard finds that 73% of assessed local livestock breeds are at risk of extinction.

Genetic gains and adaptation in crops and animals, through traditional and modern breeding, underpin agriculture's ability to provide ample nutritious food in the face of emerging diseases, environmental stresses and changing climates. Public breeding systems in low- and middle-income countries supply the lifeblood of seeds and breeds to the poorest farmers who are not profitable markets for the private sector. But public sector breeding systems in these countries

have had insufficient capacity and organization to deliver a steady stream of improved, market-preferred crop varieties, livestock breeds and fish breeds that are demonstrably more productive, nutritious and resilient than those that farmers currently raise.

The global challenge is to step up humanity's systems for the maintenance and deployment of genetic stocks, flows and gains. CGIAR, as the legal custodian of 760,467 accessions of priceless agro-biodiversity and the go-to partner in plant and animal breeding in low- and middle-income countries across the world, must play a pivotal part in rising to this challenge.

Genebanks and breeding are not the silver bullet to solve the world's poverty, nutritional and environmental problems. But without them food systems will be stuck in a stalemate, unable to respond to emerging threats. They are a primary line of defense and creativity for food systems in the face of a volatile present and an uncertain future.

3 CGIAR's contribution

Genebanks: The 11 CGIAR genebanks, strategically located in centers of genetic diversity, safeguard a unique global resource of animal, crop, tree and forage diversity. Their legal obligation to conserve and make available accessions on behalf of the global community is enshrined in the International Treaty on Plant Genetic Resources for Food and Agriculture. They fulfill thousands of requests for germplasm from users in more than 100 countries worldwide every year.

The CGIAR genebanks and germplasm health units monitor, test, germinate, multiply, characterize, clean, culture, store, and distribute germplasm under high scientific standards of operation. In recent years the genebanks have coordinated and aligned on standards, practices and appropriate benefit sharing and engagement with users – and will keep on improving in these areas. Future-focused technologies for disease indexing, high-throughput sequencing and phenotyping and screening data have the potential to create a dramatic increase in value and demand for diversity.

Breeding: As with genebanks, the demand for new crop and animal varieties and breeds is continuous and expanding, due to the relentless suite of pests, diseases and environmental risks in a climate-challenged world. Thus the scientific challenge is to improve breeding product lines and cycles so that they respond rapidly to emerging needs – which are often specific to geographies and markets.

Working more strategically with national agricultural research and extension services will be a central aspect of accelerating real-time adaptation to climate change in the context of intensifying, commercializing food systems. CGIAR will also look outwards to the upstream molecular and cellular biology science communities who shape the frontiers of what is possible in breeding.

CGIAR's modern approaches to managing breeding lines will aim for genetic gains in small-scale, often low-input, farms across a variety of demand-driven value-added traits: resilience to climate change, tolerance or resistance to diseases and pests, better and more diverse nutrition (e.g. through biofortified varieties), and more attractive market traits, including those valued by women.

Varietal replacement rate on farm will be a priority. The breeding process will be accelerated by 25-50% through next-generation techniques in informatics, gene technology and artificial intelligence. CGIAR will also accelerate the scaling out of new varieties and breeds into widespread use through innovative public-private partnerships to help develop strong seed, livestock and fishery systems that maximize farmer access.

Animal breeding will identify specific, targeted bottlenecks in genetics and breeding that limit the benefits of livestock and fish for small-scale farmers. Solving these bottlenecks will entail both application of established approaches, such as artificial insemination, to these less well-served markets alongside innovative solutions, for example genome editing, that can leapfrog more traditional methods.

4 Delivering multiple benefits across Impact Areas

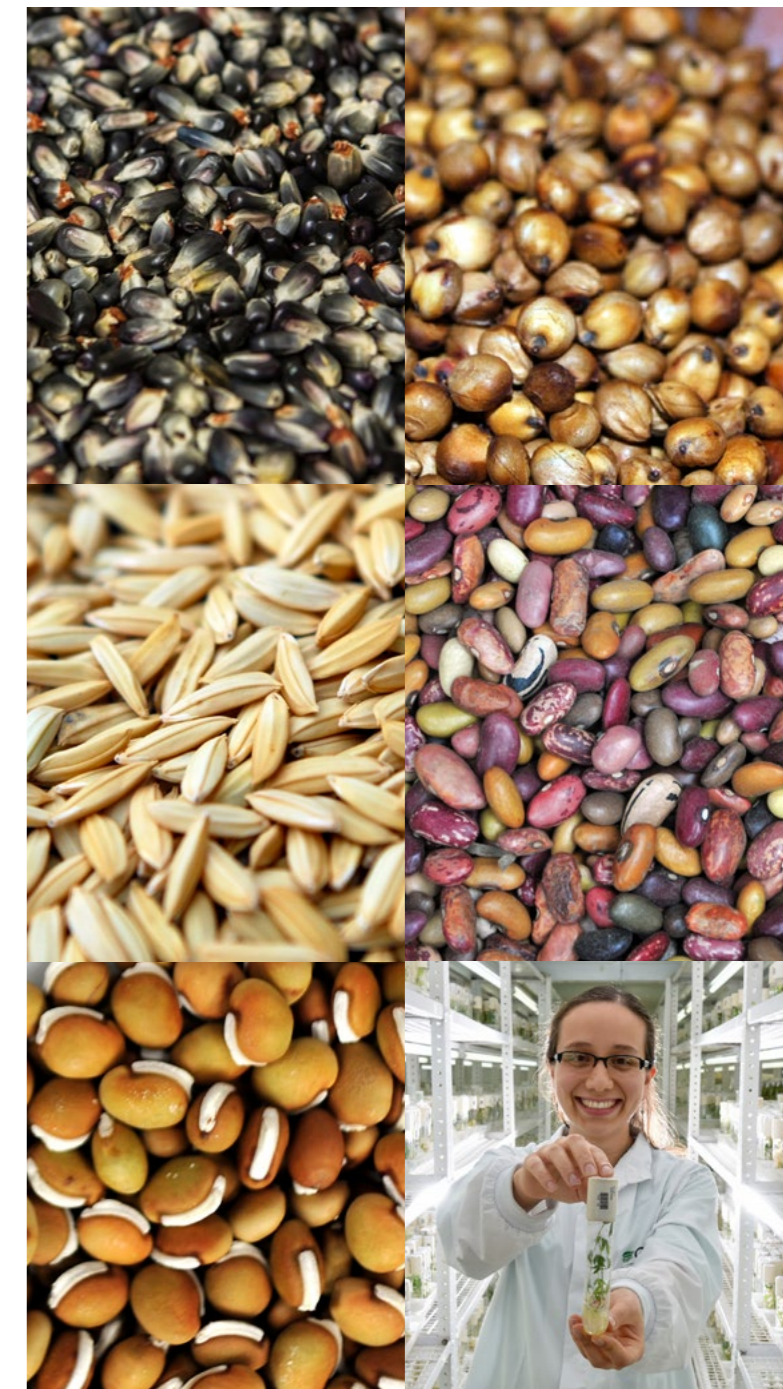
Nutrition, health & food security: through custodianship and distribution of a wide variety of crops and their wild relatives; breeding of nutrition-rich fish, livestock, legumes, roots, tubers, bananas and cereals, and biofortification.

Poverty reduction, livelihoods & jobs: through adoption of new varieties and breeds, which has demonstrably lifted hundreds of millions of rural people from poverty through improved farmgate prices, higher and more stable farmer incomes, and access to new markets.

Gender equality, youth & social inclusion: by supplying improved varieties and breeds that are affordable and accessible to women and disadvantaged social groups, and meet their specific market preferences (e.g. storage or cooking time, taste, labor intensity).

Climate adaptation & greenhouse gas reduction: via effective and constant adaptation to a changing climate, intensifying farming systems and lower-emissions breeds and varieties, for example livestock breeds with better feed conversion ratios, drought-tolerant maize and heat-tolerant beans.

Environmental health & biodiversity: breeding to reduce environmental footprint, e.g. less water or pesticides, to help stay within planetary boundaries, and locally to reduce local water stress, pollution, biodiversity loss and undesirable land use change.



Photos: Juan Arredondo, María Vinje D. (Crop Trust) and Neil Palmer (CIAT).

Cross-cutting impact support

Recognizing that current capacity gaps are holding back global progress towards the SDGs, CGIAR will invest in building particular capacity across three of its five Impact Areas: nutrition and health, gender equality, and climate. For these, cross-cutting functions will support research, knowledge management, capacity development and policy engagement at national, regional and global levels.

Improving nutrition and integrating health: At the interface of diets, environment, climate change, gender and equity, CGIAR will generate evidence on incentives, regulation, food environments and appropriate responses to supply and demand needs. Research will focus on affordable, diverse and healthy diets that fit local consumer preferences including nutrient-rich crops, biofortification, diet diversification, cellular agriculture, animal protein and novel plant protein sources to combat malnutrition, improved understanding of food preferences, food processing and other nutrition-sensitive actions for under- and over-nutrition. CGIAR will strengthen research on gender empowerment, social inclusion programs and policy support that are critical for improving household nutrition and health. CGIAR will adopt an integrated 'one health' approach to improve understanding of links among crop, livestock, wildlife and ecosystem health. Research will tackle anti-microbial resistance and address foodborne illnesses, identifying and addressing risk factors for disease spread through different channels, including informal markets, and developing and piloting better surveillance and response systems to benefit public health.

Advancing equality for women: CGIAR will deliver new evidence, close data gaps and identify integrated solutions to reduce social inequalities within changing food, land and water systems – addressing gender particularly, and increasing the focus on youth and other dimensions of social marginalization over time. Research will advance methods for understanding and overcoming the root causes of gender inequality, and foster critical thinking and cultural change on gender by identifying concrete solutions at technological, organizational, and institutional and policy levels. Work will be facilitated through strong integration and progress in socioeconomic and behavioural sciences, including modelling using big data. Special emphasis to demonstrate that working in agriculture and food is exciting for young people because of the new tools (digital, mechanization, small businesses along the value chain, and services), will also be an area of focus.

Leveraging response to the climate crisis: CGIAR will integrate climate action across the portfolio to address adaptation and mitigation challenges. CGIAR will aim to support governments and partners to

deliver commitments under the Paris Agreement while providing improved food and nutrition security. Through global policy engagements, CGIAR will provide thought leadership to inform in agriculture and food security. Novel approaches will apply a climate-risk lens and, through innovative partnerships with the finance and agribusiness sectors, facilitate greater and better investments in agriculture to address the climate crisis. Integrated foresight and modelling, use of big data, algorithms and artificial intelligence, agroecology and social sciences will inform better decision-support tools to assess and manage risks. Options for technologies and practices will build on local knowledge and will include diversification of farming systems, crop varieties, animals and technologies to balance risks and improve nutritional outcomes. CGIAR research will leverage sustainable finance to develop new instruments to incentivize and support adaptation and mitigation efforts.

INDEPENDENT ASSURANCE OF QUALITY OF RESEARCH

CGIAR draws on fully external, impartial and expert advice related to strategic planning and positioning, program evaluation and impact assessment. CGIAR's independent advisory services comprise the Independent Science for Development Council (ISDC), the Standing Panel on Impact Assessment (SPIA) and an independent evaluation workstream implemented at the request of CGIAR System Council. ISDC provides independent scientific guidance, foresight and review to inform CGIAR's governance bodies in their decisions on research strategy and the research portfolio. SPIA offers CGIAR rigorous, strategic advice on efficient and effective impact assessment methods and delivers independent evidence of impact of CGIAR research investments. The independent evaluation workstream commissions independent evaluations of CGIAR research and delivery, designed to meet both accountability and internal learning functions.



Photos: Stefanie Neno, Neil Palmer and Georgina Smith (CIAT).

PART 3

How CGIAR will implement this strategy



The 2030 Research Strategy stakes succession doing business differently. What's new in how CGIAR will work is grounded in seven key approaches:

- 1** Embrace a **systems-transformation approach**, seeking **multiple benefits** across five SDG-linked Impact Areas
- 2** Leverage **ambitious partnerships for change** in which CGIAR is strategically positioned
- 3** Position **regions, countries** and **landscapes** as key dimensions of partnership, worldview and impact
- 4** Generate scientific evidence on **multiple transformation pathways**
- 5** Target **risk-management** and **resilience** as critical qualities for food, land and water systems
- 6** Harness **innovative finance** to leverage and deliver research through new investment and funding models
- 7** Make the **digital revolution** central to our way of working

A changed context for CGIAR requires a different approach to how we work. Below are seven ways in which CGIAR will work differently. Together, these will add up to a major progression in the way that CGIAR will do research and maximize pathways for research to impact at scale.

1 Embrace a **systems-transformation approach** for food, land and water systems **seeking multiple benefits** across five SDG-focused Impact Areas. CGIAR has a strong track record of impact through plant and animal sciences, particularly breeding and disease control. Now it is time for CGIAR to strive for a similar level of impact through integrated systems research. The pursuit of impacts across environment, livelihoods, equality, nutrition and climate collectively rather than on separate tracks will often come through more interdisciplinary and transdisciplinary approaches, and will inevitably take us beyond the farmgate into broader landscapes and food systems. This ambition is encapsulated in CGIAR's new Action Area on food, land and water systems – but will be embedded throughout all CGIAR work.

Key implementation elements:

- ✓ Multi-disciplinary research design that brings together social, economic, environmental and health considerations.
- ✓ Use of foresight and trade-off assessment during project development and implementation.
- ✓ Inclusion of all five Impact Areas in assessment criteria for all CGIAR Initiative designs and reporting requirements.
- ✓ Specific gap filling in systems research, recognizing that science alone does not create systems change and stimulating the need for research on technological, environmental and institutional processes.
- ✓ Focus on specific scientific contributions to wider agendas for transformation, feeding into impact pathways that, even while incremental on their own, can play a part in unlocking wider change and broader benefit to society.
- ✓ Building CGIAR's capacity in systems research.

2 Embed research within **ambitious partnerships for change** in which CGIAR is strategically positioned within broader innovation systems and transformation agendas towards the SDGs. These involve key partners from national to global levels. CGIAR will work with partners before, during and after research, to ensure that all activities in science, capacity development and policy work are designed to respond to

partners' needs, and are delivered in ways that accelerate specific opportunities for change. Matching partnerships to the challenge, with greater diversity in the range of research and scaling partners – many beyond the agriculture sector – will be key to addressing wider systems transformation ambitions.

Key implementation elements:

- ✓ Use of innovation systems as the working model for CGIAR's strategy to influence change.
- ✓ Identifying useful points of entry for science in existing active partnerships among global and regional bodies, including private sector, public sector and civil society.
- ✓ Co-communication and co-delivery within these partnerships.
- ✓ Adoption at CGIAR Initiative level of targets and metrics developed, used and measured by partners.
- ✓ Commissioned evaluations to capture partners' assessments of CGIAR contributions to partners' agendas for transformation.

PARTNERSHIPS OF CRITICAL IMPORTANCE TO CGIAR'S ROLES IN INNOVATION SYSTEMS

Three types of partnerships were identified in a recent independent evaluation as especially critical to CGIAR:

Partnerships along the impact pathway, particularly with peers in national systems (for upstream research, and for applied research and scaling) – key partners to co-deliver on innovations in technology, institutions and policy include advanced research institutes, NARES, national governmental agencies, regional bodies, and scaling partners in the public and private sectors, including civil society partners, farmers, and consumers. NARES – national agricultural research and extension systems – will be CGIAR's primary peers in all regions and countries. CGIAR will work closely together in this peer group to respond to national needs, share knowledge and tools, raise capacity where it is lacking, and work in cross-country platforms on shared agendas. CGIAR will be catalytic and complementary to NARES, building capacity and adjusting our behavior over

time as their capacities change. CGIAR will develop a one-stop shop for NARES, to enable sharing of solutions, co-research, intellectual property rights and shared advocacy platforms.

Partnerships with the private sector – building interdependent relationships with small, medium and large enterprises, as well as with private sector coalitions to accelerate sector-wide progress. These partnerships, following rigorous ethical standards, will be not only a one-way channel for scaling technologies, but pivotal to market assessment, product design and research implementation. We understand farmers, livestock keepers and fishers as private sector constituents, and our research will support their focus on improving both short-term and long-term prosperity. A business focus to our work is essential to bridge the gap from innovation to uptake, with systematic use of tools such as market research, capacity development, product profiles and stage-gated research management. CGIAR will develop a one-stop shop for private sector enterprises, to enable sharing of solutions, sustainable and ethical sourcing, intellectual property rights and transparent contracting.

Multi-stakeholder platforms – structured alliances of stakeholders from public, private and civil society convened in the international development community to address complex global problems enshrined in the SDGs, with CGIAR participating in those whose architecture and activities are best designed to link global policy and local action, and whose actions are informed by research, with particular focus on territorial approaches.

3 Position **regions, countries and landscapes** as key dimensions of partnership, worldview and impact – as the source of demand, and as the location of co-design and co-delivery of innovation, capacity development and policy change with partners. CGIAR will build on deeply established presence in selected geographies and landscapes, embedded in strategic partnerships, to develop coherent and compatible solutions and impact at scale. Coordination across CGIAR will provide an integrated offer and a single point of entry for partners at country and regional levels, nurturing strong partnerships and presence, and building shared accountability towards national and regional development goals.

Key implementation elements:

- ✓ Active ongoing engagement with regional stakeholders on identifying shared priorities, co-designing activities and cultivating critical research and development partnerships.
- ✓ Requirement that all research design defines outcomes and impacts in specific regions, countries and landscapes (e.g. a cross-boundary river basin).
- ✓ Country strategies to contribute to regional and country policies and investment programs.
- ✓ Research objectives aligned with national and regional targets and plans.
- ✓ Commissioned evaluations to capture regional and country-level assessments of CGIAR success in meeting demand.



Photos: Neil Palmer (CIAT), P. Lowe (CIMMYT).

A climate crisis across six major global regions

South East Asia & the Pacific (SEA)

Key climate risks in Southeast Asia are flooding, sea level rise and salinization. Coastal areas and major deltas – such as the Mekong and the Irrawaddy – are particularly at risk, as they are home to dense populations of people alongside vast areas of rich floodplain crop production, plus the mangroves that protect coastlines and provide breeding grounds for fisheries.

Central & West Asia & North Africa (CWANA)

As the most water stressed region in the world, with annual average rainfall between 100 and 400 mm, climatic risks to water are the main constraint to agriculture-led development, in both the highlands and in major deltas like the Nile.

South Asia (SA)

Rising temperatures, erratic monsoon rainfall, flooding and sea-level rise are the top climate risks across this densely populated region. The major breadbasket of the Indo-Gangetic Plains faces huge challenges of water management and land degradation.

West & Central Africa (WCA)

Rainfall variability is the single biggest climate change threat in West and Central Africa. More frequent and severe droughts across the Sahel, including deadly dry spells within growing seasons, are driving changes in livelihoods, for example into livestock or out-migration to urban areas.

East & Southern Africa (ESA)

Agriculture has great potential as a driver of economic growth but is held back by sensitivity to uncertain climates. The region faces a geographic patchwork of climate challenges, most commonly shorter and more unreliable growing seasons, particularly in the more arid south.

Latin America & the Caribbean (LAC)

Climate variability, with long drought spells and more frequent pest and disease outbreaks, is a key risk in the region. Two-thirds of pasture lands are degraded and agricultural expansion and burning pose a serious threat to forest conservation. The dry corridor across Guatemala, Honduras, Nicaragua, and El Salvador is particularly at risk, threatening the livelihoods of millions.

4 Generate scientific evidence on **multiple transformation pathways** that are appropriate to different contexts. Both sustainable intensification and agro-ecological approaches will help identify such pathways adapted to the huge diversity of agriculture, land, water and food systems. As no one size fits all, the challenge is to help stakeholders make decisions and manage trade-offs in different contexts. CGIAR will contribute to current and future debates with scientific knowledge on different options for change – and will aim to be a balanced and trusted research for development organization that provides evidence for the optimization of choices regarding food, land and water systems.

Key implementation elements:

- ✓ Provision of knowledge on different pathways and innovations, or a mix of pathways.
- ✓ Working with research users to improve and understanding of the distribution of benefits, costs and risks associated with competing options.
- ✓ Economic and social sciences research to improve knowledge on incentives and drivers for different pathways.
- ✓ Focus on tactical entry points to use science to support system change, rather than attempting to tackle the entire system.

5 Target **risk-management and resilience** as critical qualities for food, land and water systems in a world where the climate crisis and emergence of new infectious diseases like Covid19 demonstrate that rapid change, shocks and tipping points are the new normal. From the outset, CGIAR work will consider vulnerability to multiple risks to food systems (e.g. zoonoses, degraded ecosystems, climatic shocks, market swings, political upheaval, migration) – and how this vulnerability can be turned into resilience by reducing exposure where possible, building human and societal capacity, and managing the sensitivity of forest, water, farming and food systems to the onslaught of systems shocks. Research, capacity development, policy engagement and partnerships will explore multiple possible future scenarios, map major pathways for change, and aim to create solutions that are robust across multiple scenarios and contexts.

Key implementation elements:

- ✓ Active use of foresight and trade-off tools
- ✓ Generation of solutions that are demonstrably robust across multiple future scenarios and contexts

- ✓ Greater collaboration with service-oriented partners, including lending and insurance sectors, on specific risk management tools
- ✓ Building internal and external capacity in course corrections based on monitoring, evaluation and learning

6 Harness **innovative finance** to leverage, and deliver research through new investment models. In addition to established investment in CGIAR programs, new and innovative finance mechanisms will be developed to expand and deepen programming. This will explore partnerships and financial streams beyond agriculture, in sectors such as health, water supply and sanitation, disaster prevention and preparedness, and security. Additionally, alignment and framework agreements with international finance institutions, including regional development banks, will help to embed innovations in loan programs, and support the implementation of new programs. Increased attention will be made to private and innovative funding, including: corporate social responsibility, philanthropy (including trusts, foundations and high net worth individuals), shared value partnerships, blended finance, and impact investing. Sourcing innovative finance externally will be complemented by innovative financing models to support higher-risk areas of science and innovation through an innovation fund.

Key implementation elements:

- ✓ Industry liaison and intellectual property function to support targeted private sector investment to scale innovations
- ✓ Capacity established to implement, and project manage, climate finance and other global funds
- ✓ A hub to advance global legal frameworks to incentivize financial contributions
- ✓ An innovation fund to support smaller, higher-risk areas of science and innovation

7 Make the digital revolution central to our way of working, leveraging the rapid global spread of digital technologies to change how agri-food innovation is done – using the best tools available (e.g. big data analytics, artificial intelligence) to enhance research, but also engaging digitally empowered end-users to support them in improving their own access to and use of innovations and knowledge. CGIAR will facilitate the co-design of inclusive, transformative digital services across the food system, and to help build the supporting innovation systems to accelerate their growth.

Key implementation elements:

- ✓ A new digital strategy for CGIAR to be launched in 2021
- ✓ Engagement with private sector and development partners on developing both cutting-edge and context-appropriate digital solutions, including artificial intelligence, machine learning and big data.
- ✓ Improving access to and use of digital innovations by partners, with focus on small-scale farmers.
- ✓ Actively using and regularly updating digital tools in all lines of research.



Photos: Toby Smith (Crop Trust).

