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Consortium

CGIAR Strategy and Results Framework 2016-2025

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1 Summary

The challenges facing -- and opportunities for -- agriculture and food research for development are evolving rapidly and are increasingly being recognized as integral to the overall sustainability of our planet and its people. CGIAR, as one of the world's leading publicly funded research partnerships for a food secure future, sits at the core of this evolution. This draft document represents our latest thinking on the advancement of our Strategy and Results Framework (SRF), which is intended to be released and implemented in early 2015, after broad stakeholder engagement.

The current document begins by focusing on the many interrelated challenges linked to food security, poverty reduction, improvement of health and nutrition, climate change and environmental sustainability, and the advances that we are seeing in science in general, and agriculture specifically. Within that context, we then turn our attention to the value proposition of CGIAR moving forward -- our niche and our competitive advantage. The 15 international agricultural Research Centers that comprise CGIAR link diverse regional, technical and disciplinary skills across the natural and social sciences. CGIAR has a unique mandate to develop and deliver international public goods that no other single organization (public or private) can offer. Its genebanks hold the most intensively used and globally shared genetic resources in trust for the world community. CGIAR's global network of research sites -- encompassing a wide array of 'facilities', such as learning alliances and innovation platforms, adaptive and participatory on-farm research and action sites, experiment stations and laboratories -- that are located in the target domains where we aim to achieve impact, provide a unique platform to conduct agricultural research for development. The convening power of CGIAR is highlighted as a modern 'global docking station' to harness world-class expertise and capability from other organizations to connect the CGIAR to NARES, Advanced Research Institutes the private sector and development organisations.

A key part of our strategy in moving forward will be to focus on what we do best, while working with partners to ensure that our science has impact. Broad strategic principles are identified that include the need to: address the most tractable and urgent global agricultural issues in a cost-effective manner, ensure that funding and research priorities are aligned to bring strategic focus, support scientific risk taking, and place a renewed focus on research excellence/scientific rigor. The opportunities and challenges emerging from 'big data' are recognized, along with the need to establish global alliances to support data management, visualization and analytics.

It is proposed that CGIAR focuses its research on three broad domains: **addressing commodities within agri-food value chains; managing agro-ecosystems and landscapes;** and **enhancing voice and participation of low and middle income countries on global issues.** In each of these domains, the comparative strengths and advantages of CGIAR are critically assessed. Three cross-cutting topics of global importance – **women and youth; nutrition and health;** and **climate change** – are identified, with the aim of systematically strengthening and building coherence in research across all three areas.

Finally, this document looks at how to move from research to impact, and discusses new partnership arrangements that reflect mutual commitment and accountability together with new approaches to capacity development. The final section proposes a pathway towards being able to measure that impact and hold ourselves accountable.

This specific document has been prepared for review and discussion at the November 2014 Fund Council and Funders Forum meetings, with the intention of it being approved for further development. We recognize that there is much work to do on this new Strategy and Results Framework (SRF) over the next few months, including broad stakeholder engagement and consultation.

2 Global challenges drive change

Agricultural and food systems worldwide are adapting to rapid and profound change, and the contribution of CGIAR must be adjusted accordingly. Research attuned to the new circumstances will yield high returns and measurable impact.

The combination of a growing population and rising incomes, coupled with urbanization, changes in dietary preferences introduces complexity into the chain of transactions that link producers and consumers. The focus of attention has shifted from a narrow interpretation of growth in food supply to a broader vision of development of food systems, and the efficiency of resource use within them. Losses of crops and livestock products due to pests, spoilage and spillage are estimated to be substantial, and their reduction offers opportunities for potential gains in efficiency. Concerns about food safety and nutrition are deep, and increased consumption of plant-based proteins, livestock products, fruits and vegetables offers scope to improve nutritional and health outcomes in low-income countries. Demand for meat, fish, eggs and dairy products is outpacing that for staple grains in low and middle-income countries, creating a need to manage associated risks of food safety and disease, including zoonoses. However, large

groups of the most vulnerable people still suffer from undernutrition and caloric deficits, necessitating continued attention to improvements in yields and resilience of cereals.

Where the population is growing rapidly, especially in Africa south of the Sahara and in parts of Central and South Asia, agricultural and food systems must create attractive jobs so as to absorb new entrants. Conversely, in East Asia, farm size and structure need to accommodate exits of labor from agriculture. The jobs agenda brings a new focus to the sector, augmenting agriculture's traditional role as a vehicle for reducing poverty and highlighting its role in growth and employment. Rapid growth in agriculture is accompanied by changes in farm structure, with large and mid-sized commercial farms appearing where small farms formerly dominated.

Current changes in food systems are situated within increasingly evident planetary boundaries to natural resources and increased competitive pressures on their use. Land is sought simultaneously for food and feed crops, livestock production, biofuels, forest products, conservation, urban expansion and other non-agricultural uses, such as mining and reservoirs, and depletion of soil drives farmers onto new lands. Water supplies are both overdrawn and polluted. Unsustainable harvests of fish and other aquatic products undermine marine habitats and the future of oceanic systems. Climate change adds additional pressures on agro-ecologies that are already struggling with the legacy of past environmental mismanagement. Agriculture is a major producer of greenhouse gases and must reduce emissions, while at the same time undertaking major adaptation to changes in temperature, rainfall, and sea level.

Many of the environmental challenges derive from lacunae or failures in policy related to land, water, biodiversity and forests. Sound management of complex agri-food systems within their environmental contexts requires a deep commitment to, and engagement in policy reform. Policy dimensions of food systems also take on increased importance with integration of markets across space and linkage between agricultural and energy markets. Efforts to manage volatility by insulating domestic markets impose added burdens on the poor and depress incentives for investment. Better management of public spending for agricultural growth and improved incentives for production and trade through reform or removal of poor policies bring gains in growth and efficiency

Agricultural science is changing faster than public understanding of it in both high and low-income countries. As a consequence, consumers are not always supportive of new developments, and adoption of new products and practices is sometimes slowed. Returns to the underlying research are diminished in such cases. Public education about agricultural science, including outreach from CGIAR, accordingly takes on increased importance and stakeholders need to be involved.

These and many other factors create an urgent and demanding background for development and application of new scientific solutions to assure ample, nutritious and environmentally sustainable food for all in the decades ahead.

3 Harnessing new opportunities

The context for CGIAR's work over the coming decade offers new opportunities: change in global institutions and governance; new understanding of agriculture and its contribution; and very importantly, new tools in natural, social, information and life sciences.

The old bi-modal concept of development according to which rich countries provide flows of assistance and advice to poor beneficiaries has been largely cast aside. It has been superseded by a new understanding of interconnected problems requiring collective action at global level, and new mechanisms for response, such as the shared effort on design of the Sustainable Development Goals, the emphasis on food security within the G20 agenda, The World Economic Forum linking major private firms to the agenda of food security, and enhanced efforts of development partners to coordinate their support for agricultural growth, nutrition and environmental management. This new configuration of participants creates opportunities for alliances and partnerships for impact that were not available on the same scale in the developmental paradigm of the past.

The several spikes in food prices since 2008 and increased volatility of prices of key staples returned agriculture to the center of global attention after a quarter century of neglect and disinvestment. Concurrently, but largely independently, attention to the double burdens of malnutrition and obesity has increased. The linkage of food and energy markets through the rapid growth of biofuels has reinforced the heightened importance of agriculture. The former focus of environmentalists on conservation has evolved to an emphasis on managing landscapes with cognizance of planetary boundaries in use of natural resources. As a consequence, agriculture is increasingly positioned within the environmental agenda, rather than in opposition to it, as was previously often the case.

Advances in the basic sciences (combining biological, environmental, physical, informatics and social science) create new opportunities for the work of CGIAR. Breakthroughs in nutrition, genetics, informatics, satellite imaging, remote sensing, meteorology, precision farming and low impact agriculture are driving global investments in agricultural technology. Agriculture has shaken off its old image as a lagging sector, and is now seen as the center of the new bio-economy, a user of and contributor to big data for innovation, part of the solution to environmental problems, and the source of healthy

food. This latter issue is suddenly of increased interest to consumers at all income levels collecting and/or analyzing data and contributing to science.

4 CGIAR's vision, mission and goals

Our vision:

A world in which people are prosperous and adequately fed, and the natural environment is sustainably managed for present and future generations.

Our mission:

To generate knowledge and apply science and innovation to convert agricultural challenges of the 21st century into opportunities benefitting people in low and middle-income countries.

Our goals:

1. Reduce poverty
2. Improve health, food security and nutrition
3. Enhance environmental sustainability and ecosystem services

5 CGIAR's evolving niche

The changes in sectoral context sketched above have attracted new resources and partners into the business of agricultural research and development. This, in turn, presents an opportunity for CGIAR to redefine its niche within the new configuration of partners.

The 15 international agricultural Research Centers that comprise CGIAR link diverse regional, technical and disciplinary skills across the natural and social sciences. CGIAR brings a strong and coordinated global scientific presence to low and middle-income countries, where the bulk of the world's poor and hungry reside. It has a unique mandate to develop and deliver international scientific public goods that no other single research organization (public or private) can offer. CGIAR's global network of research sites – encompassing a wide array of 'facilities', such as learning alliances and innovation

platforms, adaptive and participatory on-farm research and action sites, experiment stations, and laboratories – that are located in the target domains where we aim to achieve impact, provide a unique platform to conduct agricultural research for development. CGIAR’s genebanks hold the most intensively used and globally shared genetic resources in trust for the world community. Many observers would concur with the preliminary conclusions of the team currently undertaking a review of CGIAR that: “if such a system did not exist now, it would have to be invented,” to meet the needs of the present and coming decade.

In the 1970s and 1980s, CGIAR was an important player in the field of agricultural research for development, and its position could hardly be characterized as a niche one. CGIAR has historically been a creator of global public goods, a pursuer of long-term programs addressing key public priorities, a steward of vital infrastructure for shared use in low and middle-income countries, a supporter of innovation and risk-taking in agricultural science, a generator of data, a convener of partners and a custodian of ex situ biodiversity.

The reforms of CGIAR that started in 2009 coincided with shrinkage of the system’s relative position in a more crowded field of agricultural research for development. According to the latest data from the Agricultural Science and Technology Indicators, CGIAR at present constitutes about 2% of global public effort in agricultural research, and somewhat less than that if private spending is included. However, it is important to note that research output as measured by citations compares favorably with many of the most advanced agricultural research organizations in the world. Under these circumstances, defining a niche for CGIAR’s contribution to complement that of other players is both necessary and appropriate.

Suggestions for articulation of such a niche are presented below:

- **International public goods:** The CGIAR community alone holds the global mandate for public goods agricultural research to serve the people of the developing world. In the future, the delivery of international public goods in the form of new varieties and breeds, agricultural practices, managerial approaches to natural resources and institutional configurations, will need to deliver multiple benefits that include enhanced environmental and nutritional outcomes. There are also major opportunities for improving and integrating “orphan” breeds and species that may be very important for poor producers, but which have so far received comparatively little attention from formal breeding efforts. Breeding for improved fish species and feed for aquaculture in low and middle-income countries has also received relatively little attention. These research areas have not as yet received investment from the private sector.

- The CGIAR community holds in trust **globally unique genetic resources** for a subset of agriculturally significant species of central importance to sustaining and advancing productivity and yield stability for the world's smallholders in the 21st century.
- **Convening power:** CGIAR can update its historic role as convener of partners to incorporate the concept of a global 'docking station', around which world-class expertise will be mobilized to accelerate innovation and the development of concrete products and services. Such a concept would provide knowledge platforms and infrastructure to link CGIAR, NARES, Advanced Research Institutions and the private sector and thereby deliver greater impact. In addition, CGIAR is well positioned to broker ambitious global alliances to tackle the most pressing challenges facing society.
- **Informing participation of low and middle income countries in key global processes:** CGIAR's research on climate change, trade, food and environmental policy, trends in supply and demand, biosafety, and other issues assists low and middle income countries to develop their positions in global and national dialogue on key issues.
- **Open Data/Shared knowledge systems:** CGIAR's traditional role as a data-intensive system takes on new meaning in the era of big data. Big data opens new opportunities, but requires big capacity to manage, curate and share knowledge systems. CGIAR will need to partner with other organizations to leverage existing infrastructure and capabilities.
- **CGIAR will retain emphasis on Africa south of the Sahara and selected areas of South Asia** as a core component of its niche. Although CGIAR is now small relative to global efforts, it remains large in Africa. Approximately half of the system's work is focused on Africa. This effort represents a large share of total research spending in Africa (about 11%), and it brings global knowledge and capacity to complement regional and national efforts. As African countries and regional organizations rebuild their scientific capacity under the Science Agenda for African Agriculture (endorsed by African Heads of State in July 2014), CGIAR will be called upon to provide even stronger partnership in Africa and will respond positively.

6 Resulting research strategy

6.1 Principles

The following principles inform and guide the development of CGIAR's research strategy:

- Research will address the most urgent and important agricultural global issues, with a strong focus on maximizing returns on investment. A systematic prioritization exercise involving consultation with a broad range of stakeholders will be undertaken prior to the launch of the next round of CGIAR Research Programs (CRPs).
- Mechanisms will be established to enable better alignment of funding to research priorities. The new CRP portfolio will address fewer problems, so that programs of work have clear strategic focus, research concentration and critical mass to ensure greater impact.
- A modest allocation of funding will be sought to support scientific risk taking through the identification of high risk/high reward research areas. Funding will be awarded through open competition for appropriate high priority topics.
- A renewed focus will be brought to research excellence and scientific rigor by ensuring strong scientific oversight by the Independent Science and Partnership Council (ISPC) and a greater use of external independent peer review.
- Big data revolution is generating both opportunities and challenges. A system-wide strategy is needed which recognizes that most of the capacity and expertise for high performance computing, visualization and analytics resides outside CGIAR. However, CGIAR has a central role in data generation, curation and exploitation that requires a global partnership in ag-informatics. There are significant opportunities for leveraging existing infrastructure and capabilities in a cost-effective manner.
- Research will respond to local and national priorities and add value by placing them in the context of global public goods. This will include the rigorous and systematic characterization of key farming systems and landscapes, to facilitate targeted scaling up and the production of baseline data from which to assess progress towards impacts.
- In selected target environments, CGIAR research efforts will be coordinated and co-located to maximize synergy, cost-effectiveness, efficiency and encourage multi-use facilities to promote cross-centre-research.

- The particular niche of CGIAR in the global R4D arena will be exploited and further strengthened by smart specialization of its research which will:
 - o attract, diversify and leverage innovative sources of additional funding to support cutting edge science facilities, infrastructure and research investments;
 - o balance the need for the rapid delivery of impact with more long-term and strategic research;
 - o foster and promote gender equity

6.2 Key research domains and cross-cutting science initiatives

CGIAR focuses its research on three broad domains: **addressing commodities within agri-food value chains; managing agro-ecosystems and landscapes;** and **enhancing voice and participation of low and middle income countries on global issues**. In each of these domains, comparative strengths and advantages of CGIAR are critically assessed, and complementary partnerships with non-CGIAR entities are established. CGIAR builds on its historic and continuing core strength for commodity research in the value chain domain, while recognizing the increasing importance of the private sector, by partnering and focusing on those areas/niches where this sector has a smaller presence. In the agro-ecosystem and global analyses domains, CGIAR will exploit its role as convener of science and partners, while maintaining a sufficient critical mass for constructive engagement. Three cross-cutting topics of global importance – **women and youth; nutrition and health;** and **climate change** – will systematically strengthen and build coherence in research across all three domains.

6.2.1 Addressing commodities within agri-food value chains

Research on commodities within value chains is vertically integrated and focuses on the development and delivery of improved crops, animals and forest products, improved production and post-harvest technologies, and strengthened value chains, as part of a sustainable intensification approach. It starts from a multi-disciplinary analytical understanding of farming systems (including multiple crops, trees and animal species) in the target domains and identifies opportunities for improvement from a systems perspective. Whole value chain analyses will identify the most promising entry points for

improvements, constraints to adoption and best value for investments. Life-cycle analyses will map carbon and energy footprints along the value chain and propose entry points for improvements. Using new tools emerging from agricultural and food systems informatics, the integration of value chain actors and connections to markets will further enhance efficiency and effectiveness of systems. Policies will be developed that aim to accelerate the innovation processes and alleviate constraints to adoption. In connection with systemic research activities, the adoption of local solutions will be scaled up at landscape, regional and national levels for increased impact.

Building on its extensive network of multi-location research sites (on-farm, on-station, laboratories) and innovation platforms, novel systems will be analyzed, tested and adapted under the socio-environmental conditions of the target domains. Participatory and adaptive research will translate generic principles into site-specific and local solutions. Increased co-location and shared use of sites and facilities will provide entry points for new partners working on new systems, crops and animal species. The development of improved crop varieties and animal breeds will benefit from increased collaboration at experimental infrastructure, such as field phenotyping platforms, multi-location breeding sites and participatory variety selection sites. Exploiting advances in biotechnology, the huge wealth of genetic diversity available in CGIAR's genebanks will be opened up, complemented with the creation of new sources of diversity (e.g. through genome editing), and utilized to create novel products in a faster way. Breeding will focus on novel traits that are responsible for enhanced nutritional content, yield potential, pest and disease tolerance and adaptation to climate change. Sustainable cropping systems will be designed using concepts of ecological and sustainable intensification, including approaches of conservation agriculture, such as minimum tillage. Cropping system design will incorporate the need to be adaptive to climate change, mitigate greenhouse gas emissions (low carbon footprint, reduced methane emissions) and provide diversity of food that contributes to enhanced nutritional value.

Further down the value chain, product value will be enhanced, through improved post-production technologies and more efficient transactions. In the case of crops, this will entail opportunities for improved harvesting, drying, milling, transport and processing. Measures will be developed to reduce exposure to food-borne diseases along the food chain, especially related to fungal toxins (Mycotoxins), biological hazards (especially zoonotics), and chemical contaminations.

6.2.2 Managing agro-ecosystems and landscapes

Research on agro-ecosystems focuses on landscape approaches in ecologies/regions with well-defined constraints and opportunities. Examples of such environments are drylands with scattered populations, major river deltas with large urban population centers, mountain areas with isolated populations, and forests or forest mosaics with urban centers and low rural densities. Units of analysis start at farming systems and move up through landscape components to basin, watershed and agro-ecological zones, while research tools are firmly grounded in systems-analytical approaches. Farming systems research will focus on sustainable intensification and adaptation to climate change through improving soil health, crop rotation, crop-animal interactions, agroforestry and principles of conservation agriculture. Improved sustainable soil management contributes to the delivery of agricultural production and other ecosystem services. Diversification of crop and animal production systems enhances resilience against, for example, climate risks and global market shocks. Enhanced market access and improved livelihood resilience of the poor in rural landscapes will help communities to adapt to shocks and extreme events.

Many opportunities for reversing degradation of land and water resources and mitigating climate change require solutions that span multiple spatial and temporal domains, transcend national boundaries and involve multiple actors with various – and often conflicting – interests. Sequestration of carbon in landscapes (e.g. through agroforestry, improved pasture management) can contribute to mitigation of global warming, but may have trade-offs with other ecosystem services. Hence, instruments are needed to analyze, quantify, map and make explicit trade-offs and potential win-win situations, so as to inform stakeholders and policy-making processes. Increasing ecosystems' resilience and capacity to adapt to shocks often involves measures that involve communities instead of single farmers. For example, the enhancement of biological resilience to insect pests transcends measures that single farmers can take (such as implementation of integrated pest management) and includes solutions such as ecological engineering of the landscape and enhancing biodiversity across the landscape. The enhancement of ecosystem services increasingly relies on the acknowledgement that beneficiaries are often not located in the physical region where they are generated. For example, the availability of clean water downstream depends on water management practices implemented upstream. Novel tools, new regulatory approaches and forms of local institutions, as well as collective action, are needed to operationalize the concept of payment for environmental services.

The research issues outlined here typically warrant a strong involvement of the public sector. The experiences of CGIAR in engaging in these areas (through its current systems-based CRPs) have so far produced mixed results. It is acknowledged that considerable

expertise exists outside CGIAR in this area and has remained underutilized and should be explored further by the formation of strategic partnerships. A review of this research domain is required to provide guidance on further CGIAR investments in this area.

6.2.3 Enhancing voice and participation of low and middle income countries on global issues

A research agenda on climate change at global level is needed to increase understanding of impacts of expected climate change on farming systems and of adaptation and mitigation approaches, and to improve understanding of trade-offs and synergies to support a harmonized implementation of improved policies across government sectors and levels. We need to expand our research work supporting effective, efficient and equitable climate mitigation policies that are coordinated across sectoral divides (e.g. the agricultural and forestry agendas) and are aligned with development goals, and support mitigation mechanisms, such as REDD+ and beyond.

Our work will have relevance at international, national and sub-national levels, supporting the international environmental conventions (UNFCCC, UNCBD and UNCCD), as well as countries in the developing world in their efforts to develop climate mitigation and adaptation policies, and suitable technologies. A key global public good is the availability of state-of-the art information on plant genetic resources to plant breeders, scientists, and farmer organizations. CGIAR will contribute to international efforts to develop platforms to connect and share genetic and phenotypic information.

Trade is a key instrument for achieving agricultural growth, reduction of poverty, sustainable use of natural resources and improved nutrition. CGIAR assists low and middle income countries to understand the implications of trade and related agreements in light of changes in agricultural productivity and policy.

As an organization of global agricultural science, CGIAR has a strong interest in all aspects of science policy. Improved understanding of expected returns to alternative paths of investment in research can help internal and external partners make wise decisions about resource allocation. Investments in analytical approaches to foresight, including qualitative and quantitative modeling, have already been established as a collaborative effort of Centers and external partners, and applications will increase over the coming decade. More comparative research is needed on the various regimes for protecting intellectual property, observing these globally, so as to understand which ones perform best under what circumstances. Particular attention should be paid to the access and benefit-sharing mechanisms related to the international movement of plant genetic

resources in the context of the International Treaty on Plant Genetic Resources for Food and Agriculture and the Convention on Biodiversity (Nagoya Protocol). Data on investment in agricultural science must be maintained and improved to support rigorous tracking of impact and returns. Research and capacity development on regulatory issues related to science, such as management of biotechnology, bioethical issues in the livestock sector, and management of risks associated with zoonoses and food safety, can speed the release and safe adoption of new technologies.

Nutrition has a significant policy agenda, particularly in the area of managing malnutrition as well as obesity through regulations that promote a healthy diet. Regulatory efforts to improve food safety have a major bearing on opportunities for low-income producers to participate in trade, as can be seen in the challenges of addressing aflatoxin in Africa, as well as in the periodic closure of the Arab Gulf market for sheep from the Horn of Africa due to Rift Valley fever.

6.2.4 Tapping potential of women and youth

Agriculture underperforms when women, who comprise a significant proportion of the labor force in low-income countries, have limited opportunities to access resources, markets and information. This not only constrains productivity in the agricultural sector, but has direct effects on poverty, food safety, health, nutrition and sustainable resource management. Hence, gender inequality is a cross-cutting issue that directly affects CGIAR delivery of its development goals.

In all three key research domains, CGIAR will generate new knowledge on how barriers based on gender affect food production, availability and nutrition outcomes, and natural resource management. It will deepen understanding of how to design and operate rural extension and business development services, value chains, innovation platforms and similar institutions to include women equally with men. Research will assess the implications of CGIAR and partners' technology, institutional and policy innovations for gender equality, both ex ante to inform the setting of research priorities, targets and objectives, and ex post to better understand the contribution of CGIAR innovations to gender equality outcomes. These findings will be used to set research priorities and targets and to plan strategically when and how innovation design and delivery will address gender differences in agriculture. A gender lens will ensure that developed and promoted products and services are either gender neutral or specifically address the needs of women actors along the value chain to increase their influence over resources and decision-making processes.

Agriculture as a sector of growth must create jobs for large numbers of rural young people, in situations where the population is still rising rapidly and opportunities for migration are limited. How best to do so requires an analysis of systemic constraints to access of the young to land, capital and skills, and sharing of international lessons in how to overcome these barriers. Many of the jobs will be created off-farm, through provision of services, employment in processing and entrepreneurship in trade. Models that show inter-sectoral linkages can help policy-makers understand which investments and policy reforms will have the greatest impact on jobs. An analysis of global experience in late-transforming countries can be very instructive in offering different approaches and benchmarking national experience. Support for entrepreneurship throughout supply chains can provide opportunities for employment of young people. Modern agriculture that leverages mobile phones and mechanization may attract young people in primary production, as well as in the provision of services to increase productivity, profitability and sustainability.

6.2.5 Improving nutrition and health

Improving the nutrition and health of poor people, particularly of young women, mothers and children, is an economic and social imperative. Traditionally, improving nutrition and health has been the focus of specific public health interventions. In recent years, and especially in the midst of the recent food price and economic crises, it has become evident that other sectors, and especially agriculture, have to play a more important role in accelerating progress in both reducing malnutrition and the growing problems of overconsumption. Nutrition-sensitive agriculture initiatives have the potential to address these problems at scale. Food-borne diseases have impacts on the health and livelihoods of people, especially the poor.

CGIAR will improve the nutritional value and quality of agricultural produce, diet quality and diversity, and policies that influence consumer behavior and food choice (paying particular focus to maternal and child health) along the value chain. Biofortification of staple crops will be accelerated through advances in genome sequencing and increased genetic diversity. Diversified cropping and farming system solutions that supply enhanced diet diversity will be tested and disseminated. We will develop informatics and metrics to support a better understanding of behavior and incentives for food safety. Research on other dimensions of human health focus on development and adoption of good agricultural practices that will improve water quality, reduce disease risks and promote improved input use and safety.

6.2.6 Addressing climate change

Over the next 40 years, farmers will face a range of new abiotic and biotic stresses resulting from a progressively changing climate characterized by higher temperatures, altered precipitation patterns and river water availability, rising sea levels and increased extreme events in general (droughts, floods and hurricanes). Agriculture is an important contributor to climate change: agriculture and its impacts on deforestation and land use change account for about one-quarter of global greenhouse gas emissions. CGIAR research will contribute both to adaptation to, and mitigation of climate change.

The adaptation dimension integrates research that includes analysis of current farming systems and how they are likely to change, identification of technologies and practices and understanding processes of institutional learning and adaptation. Across spatial scales, we identify and evaluate promising adaptation options to quantify, through modeling approaches and sound field-based action research, and their efficacy in relation to expected future climatic conditions. We will develop enabling policies and institutions, from the farm to national level, to facilitate change processes. We will investigate the social, institutional and policy environments required for promising adaptation options to function so that together they can be used to establish effective agricultural adaptation plans and strategies, at national, regional and global level.

To mitigate climate change, we must lower emissions from agriculture, while also sustaining or improving food security and livelihoods. We will identify and facilitate the implementation of agricultural technology options that will yield the most cost-effective mitigation. We will use a variety of methodologies and tools, such as on-farm emissions measurements, systems analysis, remote sensing, scenarios, modeling and socio-economic analysis. We will assess the various climate technology and policy options that are accessible, while evaluating the different trade-offs and synergies related to environmental, livelihood and food security aspects.

One important major effort in the coming years will be to provide research support to international efforts to develop efficient, effective and equitable climate mitigation and adaptation policies that are synergistic with each other and with development and sustainability goals, such as REDD+, National Adaptation Plans and the UNFCCC's Agricultural Roadmap. REDD+, in particular, harnesses the major contribution that healthy forested landscapes can make to climate mitigation and is one of the most advanced components of future Low Emissions Development Strategies, which are part of any form of Green Economy or bio-economy effort. Since a REDD+ framework has been enacted through the Warsaw Framework in 2013, and is strongly expected to be implemented following decisions in Paris 2015, the focus of our efforts will be directed towards research that supports countries in their efforts towards implementation.

6.3 From research to impact

6.3.1 Achieving change at scale

CGIAR achieves change by generating knowledge, connecting with a wide range of partners, learning from successes and failures, and strengthening the capacity of all participants in the process. Multiple pathways exist to achieving the system-level goals of reduced poverty, improved food and nutritional security and safety, and improved natural resource management and ecosystem services. Impact pathways and theories of change have been developed, together with partners, as part of a strategy for building the networks and engagement required for sustained impact, and these are continuously adapted and revised as part of learning processes. Central to achieving impact is the adoption of improved products, services and policies. Many possible roadmaps toward adoption exist at different spatial scales, from local to national, regional and global. At local sites, CGIAR concentrates its R&D efforts “on the ground” with its partners. This varies from upstream research taking place at advanced laboratories, breeding locations and experimental platforms, to participatory action sites and innovation platforms, where CGIAR collaborates with its many partners to develop, test and implement novel solutions. Products adopted at local level can reach more users at larger spatial scales through diffusion from one geographic area to another, often involving policy dialogue to help achieve the institutional conditions needed for successful scaling up.

Mindful of these various modes of scaling out and scaling up, CGIAR develops and strengthens the enabling environment for facilitating outcomes at – and across – spatial scales: it takes action to mobilize, strengthen (capacity for research, innovation and extension), inform, support and link partners, and to promote equity – especially gender equity. It also investigates incentives to adoption, supports policy with information on constraints and enablers to adoption, facilitates cross-scale (country) learning and exchange, enhances systems’ resilience and capacity to change, and suggests institutional change when needed.

6.3.2 Partnerships for impact

Change in the global context, the entry of new players into agricultural research, and redefining CGIAR’s niche – all these combine to create opportunities for envisaging partnerships in new ways. The scale of the challenges and the urgency needed to address them requires leveraging strategic partnerships with a range of organizations, particularly through large coalitions and initiatives capable of tackling the world’s food and nutrition

security mega-challenges. This will require deeper engagement with advanced research institutions from across the globe, with development actors and political processes, such as CAADP, the SUN movement, etc. The choice will be driven by the underlying theory of change. CGIAR will therefore be selective in its choice of partners, with specific purpose and desired impact as deciding factors. Complementarity and value addition must drive the configuration of such partnerships. Partners in general fall within the categories of research partners, implementation partners, and partners in communication and outreach. A smaller number of partnerships than in the past will be proactively managed for results. Partnerships will be mutual and equal, with differentiated but firmly confirmed commitments from both sides. The contributions of all partners will be explicitly costed, and the general expectation will be of burden sharing and parallel finance, rather than internal transfer from one partner to the others. Products adopted at local level can reach more users at larger spatial scales through processes of outscaling and upscaling. In its simplest form, scaling up may expand services to more clients in a given geographical space. This can also involve “horizontal” diffusion replication, from one geographic area to another. In “functional” expansion, additional areas of engagement are added to the existing ones. In “vertical” upscaling, activities move from a local or provincial engagement to a nationwide engagement, often involving policy dialogue to help achieve the policy and institutional conditions needed for successful national-level scaling up.

The increased emphasis on partnerships as a vehicle for delivery of impact implies a different approach than in the past. CGIAR can draw on relevant set of lessons drawn from the past on factors that contribute to the success of partnerships:

- **A common agenda.** All partners share a vision for change, including a common understanding of the problems and a joint approach to solving them through agreed actions.
- **Shared measurement.** Collecting data and measuring results consistently across all partners in a large and complex landscape or oceanscape ensures that efforts remain aligned and partners hold each other accountable.
- **Mutually reinforcing activities.** Partners must be differentiated, but they have to coordinate through a mutually reinforcing plan of action.
- **Continuous communication.** Consistent and open communication lines are critical across a large and diverse partnership, in order to build trust, assure realization of mutual objectives and create common motivation.

- **Backbone support.** Creating and managing collective impact requires a designated entity with staff and specific skill sets, to serve as the backbone for the entire partnership, and to coordinate partner organizations.

The future CGIAR strategy for partnerships will be guided by the above principles. They imply relationships between CGIAR and research partners in low-income countries that are quite different from those in the past. The classic relationship was one in which a senior CGIAR partner provided expertise and funding to the junior partner. Many research partners in low-income countries no longer need or desire such a hierarchical relationship. They own their own agendas and seek funding independently. They do not wish to revert to a dependent relationship in which significant shares of their budgets flow through CGIAR and assume the associated transactions, costs and risks. The new basis for partnership recognizes mutuality of commitment and coordinated effort to raise funds, most of which will be handled through parallel financing. In selected cases, in which pass-through funding is the best modality to accomplish an agreed work program, this system will be used, but it will not be the dominant form of partnership.

Such an approach to partnership with NARES and other partners in low-income countries is suitable for those that have, in fact, increased their capacity. A number of countries remain in fragile status and cannot yet participate in partnerships on these grounds. In such cases, CGIAR will, upon invitation, work with implementation partners (often international NGOs or development partners) and national clients to define the knowledge agenda and capacity development needed to accompany a developmental intervention. CGIAR's contribution to implementation will be costed and funded, usually through bilateral contracts.

CGIAR's engagement with the private sector has grown in recent years, reflecting the increased attractiveness of markets in low and middle-income countries, and clearer frameworks for cooperation between public and private institutions. CGIAR programs' theories of change now explicitly acknowledge the role of the private sector in contributing to the achievement of CGIAR's mission. Further work on intellectual property and related frameworks will be needed to fully harness the potential of this growing partnership. Promising instruments for involving partners from the private sector, as well as others, are multi-stakeholder platforms and alliances convened around major global issues.

CGIAR will develop a comprehensive partnership strategy on the basis of the principles noted above and derive operational guidelines to assist its programs in effectively managing partnerships. The strategy will recognize the diversity of partners, and their critical importance to achieving CGIAR's mission.

6.3.3 Capacity development for shared results

Capacity development is a strategic enabler of both CGIAR and its partners to engage in world-class agricultural research for development. Capacity development goes far beyond the transfer of knowledge and skills through training, and cuts across multiple levels – individual, organizational and institutional.

The development of academic institutions in developing countries, and the increased global mobility of students, allows CGIAR to rely on these institutions to deliver the broader education in CGIAR areas of work. Therefore, so far as traditional training of individuals is concerned, CGIAR can concentrate on capacity development that is more narrowly related to the conduct of research in these fields, and particularly on providing experiential learning by working within research teams. One of CGIAR's comparative advantages in capacity development lies in its ability to provide practical, hands-on mentorship in professionally run research laboratories and experimental stations. An example of such a CGIAR-run facility is the Nairobi-based Biosciences eastern and central Africa (BeCA) hub, established by NEPAD and run by ILRI to provide cutting edge facilities for African researchers.

In addition, CGIAR programs must now make the leap from individual learning to demonstrating livelihood outcomes and impacts, by making science relevant and accessible to a wide range of stakeholders. This requires effective assessment and strategy formulation to implement capacity development activities, tailored to the cultural, organizational and institutional contexts in which new knowledge needs to be applied. Capacity development will only be effective as a vehicle for sustainable development if it is embedded within the broader systems and processes, i.e. CRPs' theories of change, impact pathways and National Agricultural Research and Development Systems, which provide the unambiguous context and strategic framework for its implementation.

Activities will be embedded in ongoing research programs and will target key skill sets required by partners, as well as by CGIAR itself. As the research agenda evolves, skills have to keep pace, ideally anticipating emerging needs. This requires constant monitoring of needs for capacity development and learning on what works in this field. This need for M&E and learning applies both to partners in the South, as well as to CGIAR itself. Staff exchanges, sabbaticals and post-doctoral programs will play an increasing role in ensuring that CGIAR and its Southern partners are capable of making substantial contributions to the global agricultural research for development endeavor.

7 Holding ourselves accountable

The results framework¹ displayed in Figure 1 presents a vision, mission and three strategic goals for the work of CGIAR over the ten year period up to 2025. Activities undertaken by researchers within CGIAR and their partners will contribute to reduction of poverty (and creation of wealth), food security and improved nutrition and health (with particular emphasis on the poor in low and middle-income countries), and maintenance of ecosystem services through better management of natural resources. The pathways through which research achieves impact in these three broad areas are complex, overlapping and non-linear. Figure 1 displays several of the prominent relationships, or impact pathways, that condition achievement of the goals, and to which CGIAR efforts contribute. Implicit in the diagram is a set of well-defined theories of change that clarify the interactions among outcomes and make explicit the required enabling environment. These theories of change are themselves topics of research and refinement, and need enrichment through stakeholder consultation and engagement. A considerable body of work has already been undertaken within CGIAR and by partners to specify key pathways and define entry points – work in this area need not start *de novo*. The results framework as a representation of process should be considered a living document, since improved ways to display the relationships will emerge over time.

Elements portrayed in Figure 1, for example, show that growth in agricultural productivity and profitability contributes to poverty reduction and wealth creation by increasing earnings of farmers, traders and others and by dampening food price increases (thereby freeing income for other purchases and creating new jobs, due to competitive real wages). Households with higher incomes are more resilient and likely to weather shocks without falling into poverty. Genetic improvement through breeding of crops and livestock, managerial innovation incorporating climate smart methods and sustaining ecosystem services, and policy reforms to improve efficiency of food systems all contribute to poverty reduction, both directly through income growth, and indirectly by dampening price levels and volatility. Although highly simplified, this impact pathway captures key elements of the process of poverty reduction. It does not, however, display the feedback loops between the intergenerational development of human capital through better nutrition and health, and their contributions to poverty reduction. Nor does it adequately capture the direct contribution of environmental services (e.g. forest

¹ The Results Framework was developed by the Fund Council during a meeting in Washington, D.C. in August 2014 and reverted back to be incorporated to the SRF document.

products, reclaimed degraded land) to income growth and poverty reduction, or the essential role of empowerment of women and young people.

Similarly, with regard to nutrition, the figure captures several key ways in which agricultural science contributes to improved health, food security and nutrition. However, due to limitations of the medium, it misses others, particularly important feedback loops and non-linearities. Genetic improvement through biofortification can increase the nutritional content of foods. Exposure to food-borne disease, zoonoses and chemical contaminants can be reduced through changes in management practices and protection of soil and water. Diversification of diets and the addition of new sources of protein can improve nutrition. Improvements in value chains can reduce spoilage and loss and diminish risks of illness.

Management of natural resources contributes to maintenance of the natural capital required for sustained agricultural production, as shown in the third block of Figure 1. Ecosystem services also contribute to poverty reduction through enhanced productivity and resilience, and to nutrition and health by increasing dietary diversity and preserving traditional medicinal plants.

The relationships shown in Figure 1 define broad outlines of an accountability framework. The challenges of representing complexity in a two-dimensional diagram have implications for the conceptualization of impact pathways. Earlier in this document, we noted the relevance of feedback loops between and among research domains (commodities in value chains, ecosystems and landscapes, and global issues) and cross-cutting issues (gender and youth, nutrition and health, and climate change) and the joint contribution to system-level goals (poverty reduction, health and nutrition, and a sustained foundation of natural capital). The feedback loops also have implications for accountability.

A workable framework strikes a balance between the complexity of actual relationships and simplicity in representation, since an overly complex accountability framework loses its relevance for management. The correlations between research effort and the three systemic goals (poverty reduction, improved nutrition and health, and improved management of natural resources) are highest at the upper level of the diagram, and for these a set of indicators measuring progress toward goals can be devised. Preliminary sets of such indicators have been developed by CRP directors, by the Fund Council in the meeting of August 2014, and by groups working on indicators for relevant Sustainable Development Goals. The indicators should be limited in number, clearly defined, widely used and understood, measurable, and amenable to aggregation across geographies.

With additional effort, and in consultation with partners, a set of indicators for system-level goals can be established. Geographic domains of measurement will have to be selected, since most relevant indicators cannot be measured at global level. Targets will be set in relation to the domains of measurement. This work can be undertaken in the months following the November 2014 meeting of the Funders' Forum.

In earlier interaction with the Fund Council and ISPC, a working group of the science leaders proposed the following approach to establish and measure system-level indicators:

- Select a limited set closely correlated with the goals of CGIAR and consistent with indicators likely to feature in the Sustainable Development Goals process, but not necessarily identical to the latter.
- Countries will in general be the unit of measurement, selected according to the density of CGIAR presence on the ground and interest of countries to partner. In selected cases, NRM indicators may be measurable on a global basis.
- Countries will select and define their specific indicators, and set their own targets.
- Country-level statistical services will do the measurement, with technical assistance from outside bodies, including CGIAR, as needed.
- CGIAR [and CRPs] will report on contribution validated by countries, and will not seek attribution back to CGIAR.

The working group suggested that an initial set of ten countries be selected with reference to the mapping exercise identifying countries of co-location of CGIAR activities. The measurement process would be considered a learning exercise for all involved, with mid-course adjustment as needed and expansion to additional countries as warranted.

Such an approach to measurement would serve the system as a whole, but would not be suitable for the more granular work at CRP level. Constituent programs within CGIAR would supplement this effort, with their own monitoring and evaluation and specific indicators, drawing linkage through impact pathways to contribution to system-level goals. Reporting at the level of national units will not be appropriate in the case of some research activities in specific geographies. CRPs are responsible for monitoring delivery of outputs and tracking their uptake and use by boundary partners. Each CRP will develop a specific results framework outlining expected results and corresponding metrics, impact pathways and theories of change, procedures for internal and external evaluation, and a framework for learning and adaptation. In many cases, specific indicators capturing the impact of programs on women and young people will be feasible and appropriate. Thus,

the overall system of accountability would encompass two interlinked tiers: one for the system and another for individual programs.

An approach such as the one described above would serve to introduce results-based management into CGIAR by first establishing a mechanism for measuring agreed indicators, and then tracking contribution to their change. Should a more elaborated system of results-based management be required in the future, it could build on lessons learned from this first phase.

Figure 1: Vision, mission, goals, objectives and sub-objectives of CGIAR results framework

