CGIAR Advisory Services

2021 Synthesis Report: Annexes

Contents

2021 Synthesis Report: [LINK TO FULL REPORT]

Annex 1: CRP Participation by Center

A1.1: CRP Participation by Center, Phase 1

Table extracted from Birner and Byerlee (2016) showing involvement of Centers and Lead Center (LC) for each CRP.

Objective Improve	CRP / Center	AfricaRice	Bioversity	CIAT	CIFOR	CIMMYT	CIP	ICARDA	ICRISAT	IFPRI	IITA	ILRI	IRRI	IWMI	ICRAF	WORLDFISH	Total
Productivity, Profitability, Sustainability, Resilience of Entire Farming Systems	DS							LC									8
	HT										LC						7
	AAS															LC	3
Policies and Markets	PIM									LC							12
Yields and Profits from Crops, Fish, and Livestock	Wheat					LC											2
	Maize					LC											2
	GRiSP												LC				3
	RTB						LC										4
	GL								LC								4
	DC								LC								2
	L&F											LC					4
Nutrition and Diets	A4NH									LC							9
Environ., Integrity, Adapt to and Mitigate Climate Change	WLE													LC			11
	FTA				LC												4
	CCAFS			LC													15
Preserve Genetic Crop Diversity	GeneB		LC														11
Total CRPs per Center		3	10	12	2	5	8	9	8	4	9	8	3	6	8	6	

ORANGE= Commodity Center, **GREEN**= Eco regional Center, **BLUE**= Natural Resource Management Center, **Yellow**= Policy Center

A1.2: CRP Participation by Center, Phase 2

Data extracted from CRP 2020 evaluation reports

Phase 2:	CRP / Center	AfricaRice	Bioversity	CIAT	CIFOR	CIMMYT	CIP	ICARDA	ICRAF	ICRISAT	IFPRI	IITA	ILRI	IRRI	IWMI	WorldFish	External managers & main partners*
Innovation in agri-food systems	1. RICE	■	■	■										●			CIRAD. IRD, JIRCAS
	2. MAIZE					●						●					Many partners
	3. WHEAT					●		■									ACIAR, BBSRC, ICAR
	4. GLDC		■	■				■	■	●		■	■				IRD, CIRAD, CSIRO, NGOs
	5. FTA		■	■	●				■								CATIE, CIRAD, INBAR, Tropenbos Int
	6. FISH														■	●	WUR, NRI, JCU
	7. LIVESTOCK		■	■				■					●				SLU, GIZ
	8. RTB		■	■			●					■					CIRAD, IRD, INRA, Vitropic
Global Integrating Programs	9. PIM		■	■	■	■	■	■	■	■	●	■	■	■	■	■	KIT, MSU, WUR, Oxford Univ. World Vision
	10. WLE		■	■				■	■	■	■				●		FAO, RUAF
	11. A4NH		■	■							●	■	■				WUR, LSHTM
	12. CCAFS	■	■	●	■	■	■	■	■	■	■	■	■	■	■	■	27 partners
Platforms	13. GENEBANKS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	Crop Trust
	14. BIG DATA	■	■	●	■	■	■	■	■	■	■	■	■	■	■	■	
	15. EIB	■	■	■	■	●	■	■	■	■	■	■	■	■	■	■	
	16. GENDER	■	■	■	■	■	■	■	■	■	■	●	■	■	■	■	
Total CRPs per Center/Lead		7	13	13/2	6/1	8/3	6/1	10	9	8/1	2	10/2	9/1	8/1	8/1	7/1	

Key: ● Lead/host Center ■ Key partner

* All programs cite the involvement of hundreds of implementing partners, including NARES, ARIs, universities, regional and international organizations, NGOs, farmer organizations, and private sector organizations.

Annex 2: CRP and Objectives and Flagship Projects

The following data were extracted from external evaluation reports and CRP reports.

CRP	CRP Objectives - Phase 2	Phase 1- Flagship Projects	Phase 2 - Flagship Projects
WHEAT	WHEAT seeks to improve the livelihood of smallholders in wheat agri-food systems against the backdrop of increasingly virulent biotic stresses, less water, more erratic rainfall and rising temperatures.	FP1: Maximizing value for money and social inclusivity through prioritization of WHEAT R4D investments. FP2: Novel diversity to faster adapt wheat to climate change and resource constraints FP3: Global partnership to accelerate genetic gain in farmers' field FP4: Sustainable intensification of wheat-based cropping systems. FP5: Human and institutional capacities for seed systems and scaling out	FP1: Horizontal guidance to WHEAT FP2: Tools for improving genetic gains and breeding efficiency FP3: Improved varieties of spring bread, durum wheat, triticale and winter and facultative bread wheat FP4: Wheat-systems agronomy to close yield gaps and improve the efficiency in the use of resources
MAIZE	MAIZE works with partners to achieve strategic impact on maize-based farming systems in Africa, South Asia, and Latin America and implement a strategic international research-for development (R4D) approach, to increase incomes and food security for poor maize producers and consumers while enhancing the sustainability of maize-based production systems and the natural resource base.	FP1: Sustainable intensification and income opportunities for the poor. FP2: Novel tools, technologies and traits for improving genetic gains and breeding efficiency FP3: Stress resilient and nutritious maize FP4: Aligning with strengthening maize seed systems for effective product delivery. FP5: Inclusive and profitable maize futures.	FP1: Enhancing MAIZE's R4D Strategy for Impact FP2: Novel Diversity and Tools for Increasing Genetic Gains FP3: Stress Tolerant and Nutritious Maize FP4: Sustainable Intensification of Maize-based Systems for Improved Smallholder Livelihoods
RICE	Rice farming is associated with several and deep structural challenges, such as diminishing availability of resources (land, water, labor, and energy), climate change, and inequality. The CGIAR Research Program (CRP) RICE aims to address such challenges.	**Global Rice Science Partnerships (GRiSP)** FP1: Technology targeting, evaluation, and prioritization along the value chain FP2: Harnessing genetic diversity and development of genomics tools FP3: Accelerated development of new varieties FP4: Sustainable intensification along the value chain (includes management of rice-based production	**RICE:** FP1: Accelerating Impact and Equity FP2: Upgrading Rice Value Chains FP3: Sustainable Farming Systems FP4: Global Rice Array FP5: New Rice Varieties

		systems and post-harvest activities) FP5: Catalyzing scaling out and capacity building	
Roots, Tubers and Bananas (RTB)	More than 300 million people below the poverty line in developing countries depend on root, tuber and banana crops for food and income, particularly in Africa, Asia and the Americas. The CGIAR Research Program on Roots, Tubers and Bananas (RTB) is working globally to harness the untapped potential of those crops in order to improve food security, nutrition, income and climate change resilience of smallholders, especially women and youth.	FP1: Enhanced Genetic Resources FP2: Productive Varieties and Quality seed FP3: Resilient Crops. FP4: Nutritious Food and Added Value FP5: Integrated Livelihood Systems	FP1: Discovery Research for Enhanced Utilization of RTB Genetic Resources FP2: Adapted Productive Varieties and Quality Seed of RTB Crops FP3: Resilient RTB Crops FP4: Nutritious RTB Food and Added Value through Postharvest Interventions FP5: Improved Livelihoods at Scale
Grain Legumes & Dryland Cereals (GLDC)	To increase the productivity, profitability, resilience, and marketability of nutritious grain legumes (chickpea, cowpea, pigeonpea, groundnut, lentil, soybean) and cereals (sorghum, pearl millet, finger millet) grown in semi-arid and sub-humid dryland agro-ecologies of Sub-Saharan Africa and South Asia.	**Grain Legumes** FP1: Managing Productivity through crop interactions with biotic and abiotic constraints FP2: Determination of traits that address production constraints and opportunities FP3: Trait Deployment of those traits through breeding FP4: Seed systems, post-harvest processing and nutrition FP5: Capacity-Building and Partnerships Note: In the first phase, the CRP was structured along 8 product lines (each focusing on specific traits in a specific set of crops) **Dryland Cereals** FP1: Priority Setting & Adoption FP2: Improved Varieties & Hybrids FP3: Integrated Crop Management FP4: Seed Systems & Inputs Services FP5: Postharvest Value & Output Markets	FP1: Priority Setting and Impact Acceleration FP2: Transforming Agri-food Systems (not funded) FP3: Integrated Farm and Household Management FP4: Variety and Hybrid Development FP5: Pre-breeding and Trait Discovery FP6: Common Bean
LIVESTOCK	To create a well-nourished, equitable, and environmentally healthy world through livestock research for development. It builds on the previous Livestock and Fish CRP aiming to increase the productivity of livestock agri-food systems in sustainable ways, making meat, milk, and eggs more available and		FP1: Livestock Genetics FP2: Livestock Health FP3: Livestock Feeds & Forages FP4: Livestock & Environment FP5: Livestock livelihoods & Agri-food systems, Cross-cutting program for Gender and Capacity Development

	affordable across the developing world	**Livestock & Fish (L&F)** FP1: Animal Health FP2: Animal Genetics FP3: Feeds and Forages FP4: Systems Analysis for Sustainable Innovation FP5: Value Chain Transformation and Scaling	
FISH	Enabling sustainable increases in, and gender- and socially equitable livelihood returns from, aquaculture production without creating adverse socioeconomic or environmental impacts. Securing and enhancing the contribution of sustainable small-scale fisheries (SSFs) to gender-equitable poverty reduction and food security in priority geographies. Increasing the availability and consumption of safe and nutrient-dense fish, primarily for women of reproductive age, infants, and young children.		FP1: Sustainable Aquaculture FP2: Sustainable Small-Scale Fisheries
Water, Land & Ecosystems (WLE)	To provide the evidence base and solutions to help decision-makers scale up sustainable water, land and ecosystem management innovations and investments in agricultural landscapes that reduce risks and increase the resilience of women and men in developing countries.	FP1: Integrating Ecosystem Solutions into Policy and Investments FP2: Sustainably Increasing Land and Water Productivity FP3: Regenerating Degraded Agricultural Ecosystems FP4: Recovering and Reusing Resources in Urbanized Ecosystems FP5: Managing Water Resource Variability and Competing Use	FP1: Restoring Degraded Landscapes FP2: Land and Water Solutions for Sustainable Intensification FP3: Urban Linkages FP4: Managing Resource Variability, Risks and Competing Uses for Increased Resilience FP5: Enhancing Sustainability across Agricultural Systems
Forests, Trees & Agroforestry (FTA)	To support sustainable development by improving production systems, ensuring food security and nutrition, enhancing people's livelihoods, and addressing climate change.	FP1: Enhancing the contribution of forests, trees and agroforestry to production and incomes of forest dependent communities and smallholders FP2: Managing and conserving forest and tree resources for today's and tomorrow's needs FP3: Co-management of forests, agroforestry and trees in multifunctional and dynamic landscapes FP4: Climate change adaptation and mitigation FP5: Enhancing the contribution and reducing the negative impacts of globalized trade and investment	FP 1: Tree Genetic Resources to Bridge Production Gaps and Promote Resilience FP 2: Livelihood Systems FP 3: Sustainable Value Chains and Investments FP 4: Landscape Dynamics, Productivity, and Resilience FP 5: Climate Change Mitigation and Adaptation

Climate Change, Agriculture & Food Security (CCAFS)	To address challenges of climate change and food security by mobilizing CGIAR and partner science and expertise to achieve positive change with respect to climate-smart agriculture (CSA), food systems, and landscapes. Phase II (2017–20) builds on Phase I (2011–16).	FP1: Climate-smart agricultural practices FP2: Climate information services and climate-informed safety nets FP3: Low-emissions agricultural development FP4: Policies and institutions for climate-resilient food systems	FP1: Policies and Priorities for CSA FP2: Climate-Smart Technologies and Practices FP3: Low-Emissions Development FP4: Climate Services and Safety Nets Learning Platform- PL5: Gender and Social Inclusion LP6: Scaling Climate Smart-Agriculture.
Policies, Institutions & Markets (PIM)	Addresses the policy, institutional, and market constraints to sustainable and equitable economic development and rural transformation. PIM uses four main channels to address these constraints: global agenda setting, national policy support, program and market innovations, and capacity development.	FP1: Foresight Modeling FP2: Science Policy and Incentives for Innovation FP3: Adoption of Technology and Sustainable Intensification FP4: Policy and Public Expenditure FP5: Value Chains FP6: Social Protection FP7: Natural Resource Property Regimes FP8: Cross-cutting: Gender, Partnerships, and Capacity Strengthening	FP1- Technological Innovation and Sustainable Intensification FP2 - Economy wide Factors Affecting Agricultural Growth and Rural Transformation FP3 - Inclusive and Efficient Value Chains FP4 - Social Protection for Agriculture and Resilience FP5 - Governance of Natural Resources FP6 - Cross-cutting Gender Research and Coordination
Agriculture for Nutrition and Health (A4NH)	A4NH focuses on the potential for agriculture to significantly improve nutrition and health.	FP1: Biofortification FP2: Integrated Programs and Policies FP3: Value Chains for Enhanced Nutrition FP4: Agriculture-Associated Diseases	FP1: Food Systems for Healthier Diets FP2: Biofortification FP3: Food Safety FP4: Supporting Policies, Programs, and Enabling Action through Research (SPEAR) FP5–Improving Human Health.

Annex 3: Synthesis Methodology

A3.1: Overall Approach

This synthesis was designed as an entirely desk-based exercise; it followed a pre-determined process, guided by the validated terms of reference (February 2021). The overall approach is summative and formative. A predominately qualitative mixed-methods design was implemented to meet the objectives. The qualitative method involved conducting a systematic review using (descriptive) narrative analysis.[1] Data were aggregated and structured around a set of themes and sub-themes defined in the analytical framework. This approach is inspired by framework synthesis[2]: *"It utilizes an a priori 'framework'—informed by background material and team discussions—to extract and synthesize findings."* The quantitative method was applied concurrently with the qualitative method and used basic descriptive statistics on themes where quantitative data were judged to be consistently available and comparable across the evaluation reports (i.e., quality of science outputs, primarily scientific publications).

Based on preliminary exploration of documents, narrative synthesis was selected, following guidance from Popay et al. (2006): *"'Narrative synthesis´ is an approach to the **systematic review** and synthesis of findings from multiple studies that relies primarily on the use of words and text to summarize and explain the findings of the synthesis. Whilst narrative synthesis can involve the manipulation of statistical data, the defining characteristic is that it adopts a textual approach to the process of synthesis to 'tell the story' of the findings from the included studies. As used here 'narrative synthesis' refers to a process of synthesis that can be used in systematic reviews focusing on a wide range of questions, not only those relating to the effectiveness of a particular intervention."* Three steps were suggested following Petticrew & Roberts[3] (2006):

1. Organizing the studies into logical categories
2. Analyzing the findings within each of the categories
3. Synthesizing the findings across all included studies.

Like other analytical methods in qualitative research, document analysis requires that data be examined and interpreted in order to elicit meaning, gain understanding, and develop empirical knowledge.[4] Consistent with the reliance on document examination,[5] for this study **52 documents** were selected and analyzed, including evaluations, reviews, assessments, and syntheses (see Annex 4).

The validation of results and quality assurance relied on triangulating data from different sources. A multistage analysis of clustered evaluative studies was performed (see A3.2). Five component analysis by subject matter experts (SMEs) were conducted concurrently and served as the main input for the final

[1] Popay, J., Roberts, H., Sowden, A., Petticrew, M., Arai, L., Rodgers, M. & Britten, N. (2006). *Guidance on the Conduct of Narrative Synthesis in Systematic Reviews: A Product from the ESRC Methods Programme*. https://www.lancaster.ac.uk/media/lancaster-university/content-assets/documents/fhm/dhr/chir/NSsynthesisguidanceVersion1-April2006.pdf.

[222] Framework synthesis is based on framework analysis, which was outlined by Pope, Ziebland, and Mays and draws upon the work of Ritchie and Spencer and Miles and Huberman. Its rationale is that qualitative research produces large amounts of textual data in the form of transcripts, observational fieldnotes, and other texts. The sheer wealth of information poses a challenge for rigorous analysis. Framework synthesis offers a highly structured approach to organizing and analyzing data (e.g., indexing using numerical codes, rearranging data into charts). Framework synthesis is distinct from the other methods outlined here in that it uses an a priori framework—informed by background material and team discussions—to extract and synthesize findings. As such, it is largely a deductive approach, although, in addition to topics identified by the framework, new topics may be developed and incorporated as they emerge from the data. The synthetic product can be expressed in the form of a chart for each key dimension identified, which may be used to map the nature and range of the concept under study and find associations between themes and exceptions to these. Source: Barnett-Page, E., & Thomas, J. (2009). Methods for the synthesis of qualitative research: a critical review. *BMC Med Res Methodol* 9(59). https://doi.org/10.1186/1471-2288-9-59

[3] Petticrew & Roberts (2006). *Systematic Reviews in the Social Sciences*. Blackwell: Oxford.

[4] Corbin, J., & Strauss, A. (2008). *Basics of Qualitative Research: Techniques to Developing Grounded Theory.* 3rd ed. Los Angeles: Sage. See also Rapley (2007), cited in Bowen, G. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal* 9, 27–40. 10.3316/QRJ0902027.

[5] Bowen, G. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal* 9, 27–40. 10.3316/QRJ0902027.

synthesis report. In addition, internal and external peer reviews helped strengthen the soundness of the articulated lessons learned and recommendations.

A3.2: Core Stages of the Synthesis

Stage 1: Sampling and Grouping of Documents

This synthesis covers evaluations and reviews completed and published between 2014 and December 2020 (see Annex 4). The evaluative evidence consists primarily of the 2020 CRP reviews and Independent Evaluation Arrangement's (IEA) evaluations, as well as a limited number of CRP-commissioned and thematic evaluations in support of formulation of recommendations and lessons learned. An additional reference document was the 2019 MOPAN review of CGIAR used to guide formulation of system-level lessons and recommendations. The strength of this synthesis lies in the fact that the evaluative studies that provided raw material to this synthesis were conducted using similar approaches and methodologies by SMEs and evaluation experts.

Criterion sampling, a type of **purposeful sampling**, widely used in qualitative research to identify and select information-rich cases related to the phenomenon of interest, was used. Based on the synthesis objectives and questions, 52 documents were selected (from among more than 60). The inclusion criteria called for documents with the potential to:

- Establish trends between the two CRP phases (from 2014 to 2019)
- Provide additional insights on specific topics through analyses of cross-cutting themes and issues (e.g., governance and management, partnerships, capacity development, gender, open data/access)
- Oversample for global-integrating programs (WLE, CCAFS, and A4NH) in light of the high proportion of agri-food system CRPs and strategic evidence needs going forward
- Identify the first points of data to enrich the evaluative evidence base.

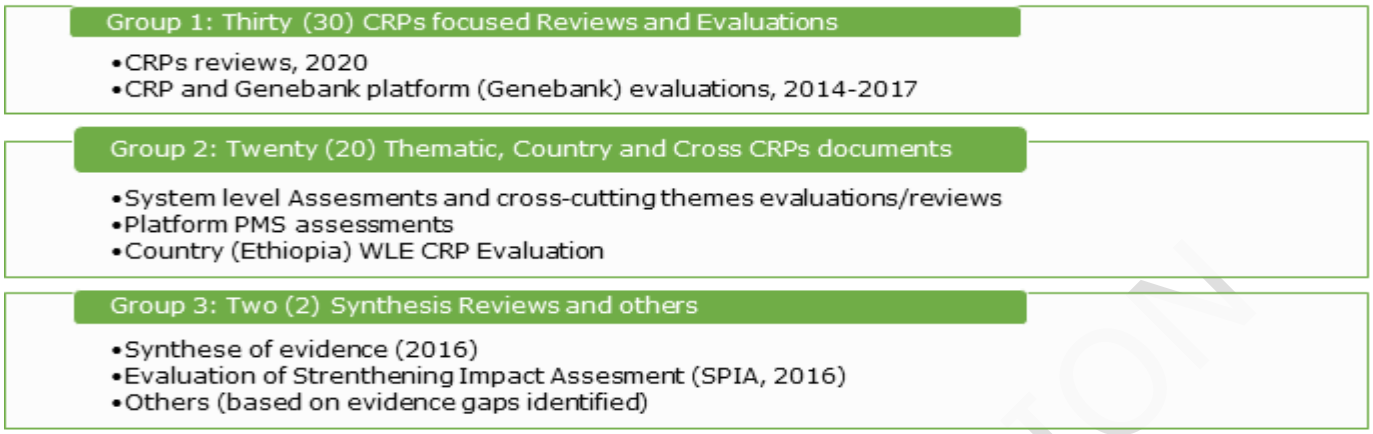
To strengthen the validity of findings by comparing across different sources and to help reduce unnecessary duplication, the synthesis team gathered the documents into three groups, based on type and focus. Grouping the studies this way made it easier to describe, analyze, and look for patterns within and across groups, as recommended by Popay (2006). Three document groups formed the basis of the three stages of coding and analysis process (see section called "Stage 3: Data Collection and Analysis"):

- Group 1 (**G1**): CRP-focused reviews and evaluations.
- Group 2 (**G2**): Thematic evaluations and assessments mainly covering CGIAR System-level and cross-cutting themes, including those of platforms. This group also included selected CRP performance assessment reports (PMSs), which were used for additional data points. This group was used as a second source of data to elaborate the findings obtained from analysis of G1 documents.
- Group 3 (**G3**): Previous syntheses and similar reports to cross-corroborate, where possible, findings that emerged from analyzing G1 and G2 documents. These were not systematically reviewed and thus were not part of the main corpus that was coded.

During the synthesis process, the team moved four documents from their initial group. Three documents[6] moved from G3 to G2 because of the relevance of their content at an earlier stage of analysis to triangulate and strengthen the findings. One document[7] was moved from G1 to G2 as it posed a high threat threat of bias.

[6] MOPAN 2019 Assessments- CGIAR.
[7] Outcome Evaluation of the work of the CGIAR research program on Land, Water and Ecosystems (WLE) on Soil and water management in Ethiopia-2019.

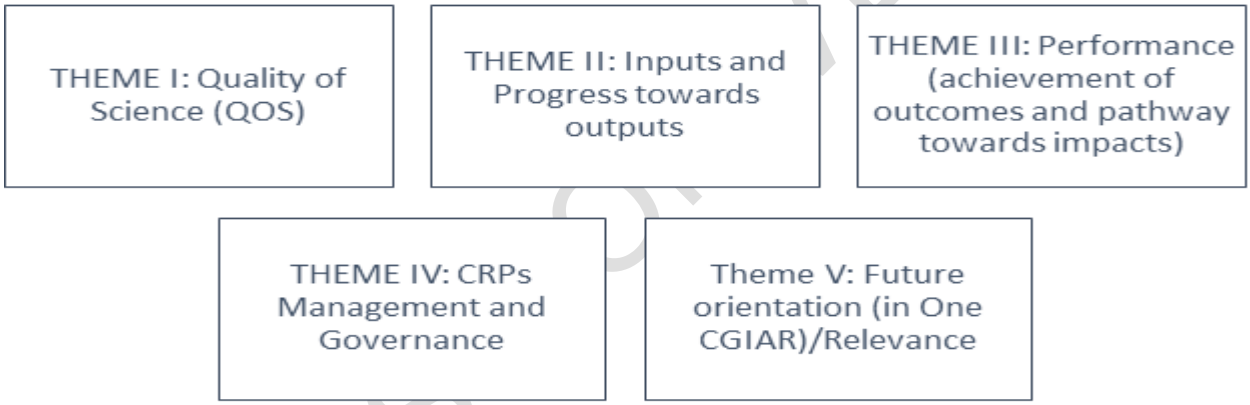
Figure A3.1: Three groups of documents by type and focus (revised)



Stage 2: Design of the Analytical Framework

The analytical framework shows how collected information was categorized and served as a reference to indicate the focus, the scales, the concepts, and related terms and definitions. The main levels of inquiry were converted into five major themes, based on the objective of the evaluation synthesis indicated in the terms of reference (ToRs) and mapping of the analyses forming the core basis of the 52 documents.

Figure A3.2: Five themes that framed the synthesis evaluation



Cross-relating findings with the key questions provided the analytical framework against which data were coded, extracted, compiled, and analyzed to answer the synthesis questions. This matrix (Table A3.1), which provided the basis for the analytical framework, was a logical and systematic way of handling the large amount of qualitative and quantitative data and of extracting important findings from across the evaluative studies. Notably, the data on which the study is based are necessarily confined to those available in the previous evaluations and do not address all aspects of potential interest with regard to the performance of the CRPs. This evidence gap was highlighted in the synthesis report.

In response to the synthesis objectives, a set of **sub-questions** was identified during the inception phase. To focus the study and frame the data-coding effort, sub-questions were organized under each of the five themes. Then, **sub-themes** and related features were identified to reflect the complex interactions between different governance and programmatic dimensions (CRPs, research centers, CGIAR System) and cross-cutting issues. The identification of sub-themes was also informed by a literature review, a preliminary exploration of the selected reports and key institutional documents such as the One CGIAR Research and Innovation Strategy 2030.

At the inception phase, it became clear that some criteria, indicators of reference, and standards had not been applied during the implementation of CRPs or, sometimes, during the implementation of evaluations. This situation required extra attention during the data collection process. Throughout coding, real-time decisions were made about assigning content to themes and sub-themes where these

were not explicitly mentioned; the list of key features[8] helped in drawing the boundaries of sub-themes. Furthermore, to address the variability in terminology used between reports, the synthesis team used as a reference the newest official CGIAR definitions, as stated in institutional documents (such as the CGIAR Performance and Results Management Framework 2022–2030). These definitions are integrated as footnotes to the analytical framework to allow fast-check consultation.

Table A3.1: Matrix of synthesis review questions and themes

Synthesis question/theme	THEME I: Quality of science (QoS)	THEME II: Inputs and outputs	THEME III: Performance	THEME IV: Management and governance	Theme V: Future orientation /relevance
1. What trends and lessons can be learned between two phases of CRPs by comparable parameters?	X	X	X	X	X
2. What are the patterns and lessons from CGIAR System-wide issues that have strengthened and/or weakened the achievement of CRP/CGIAR results?			X	X	X
3. What are recommendations along the key priority themes of One CGIAR?	X	X	X	X	X
4. What are the key evidence gaps and needs for future evaluations?	x	x	X	x	X

The analytical framework (AF) in Table A3.2 lays out the themes and sub-themes by which the qualitative data were extracted and coded for subsequent combination and analysis. It also sets out the specific sub-questions addressed under each theme, which together aimed to establish how the CGIAR Research Programs and Platforms have delivered against their purposes.

The synthesis analysis was an iterative process and AF was not used as a static tool: sub-themes were separated or combined and rearranged during the process, in recognition of the lack of sharp boundaries between themes and sub-themes in the inception phase. Official definitions guided the assignment of data and findings to each topic, but there are some overlaps.

Table A3.2: Final analytical framework

Theme I: Quality of science (QoS) and quality of research for development (QoR4D)[9] **1.** How has QoS evolved between two CRP phases along three dimensions—inputs, outputs, and process? **2.** To what extent has QoS evolved along two of the four QoR4D elements—legitimacy and credibility?	
Sub-themes	
1.1 QoS: Research inputs	1.3 QoS: Quality of research outputs
1.2 QoS: Research management/process	1.4 QoR4D elements: legitimacy and credibility
1.5 Cross-cutting themes (gender, climate change/environment, capacity building, external partnerships, youth)	
Theme II: Inputs and progress toward outputs[10] **3.** How appropriate have inputs been for desired results? **4.** To what extent have planned outputs been achieved, and how do results compare between phases?	

[8] The list of key features is not included in this report, but it is available upon request.
[9] ISPC 2017, ISDC 2020. https://cas.cgiar.org/isdc/publications/quality-research-development-cgiar-context-1

[10] Outputs refer to knowledge or technical or institutional advances produced by CGIAR research, engagement, and/or capacity development activities. Examples of outputs include new research methods, policy analyses, gene maps, new crop varieties and breeds, or other products of research work, as well as know-how and new ideas.

5. How have the outputs aligned to the outcomes, including sub-IDOs and IDOs, and worked up to SLOs?	
Subthemes	
2.1 Inputs	2.3 Innovations (including technologies)[11]
2.2 Outputs	2.4 Cross-cutting themes (gender, climate change/environment, capacity building, external partnerships, youth)
Theme III: Performance (achievement of objectives, outcomes,[12] and pathway toward impacts[13]) and sustainability **6.** What patterns and trends have occurred around CRPs' achievement of system-level outcomes (quantitative and qualitative) within and between the two phases? **7.** What lessons about scaling up of CRP innovations have been noted across the two phases (e.g., drivers, potential)? **8.** What are the key lessons on delivering to cross-cutting themes (gender, capacity development, youth, partnerships, and climate change adaptation and mitigation) across the two phases? **9.** What have been the patterns in key facilitating and inhibiting factors in progress toward outcomes between the two phases (by levels: Center/CRP/CGIAR and spheres of control)? **10.** What lessons have been learned on successes and challenges related to impact pathways along theories of change (TOCs) and CGIAR as a whole?	
Subthemes	
3.1 CRP outcomes and process toward impact pathways	
3.2 CRP designs and theories of change (TOCs)	
3.3 Innovations (including technologies)	
3.4 International public goods (IPGs) and CRP comparative advantage/added value	
3.5 Cross-cutting (gender, climate change/environment, capacity building, external partnerships, youth)	
3.6 Policies[14] and institutions	
3.7 Sustainability (considerations/mechanisms)	
3.8 Risks and opportunities	
Theme IV: Management and governance **11.** What attributes of the CRPs' management and governance supported or constrained their effectiveness and efficiency? **12.** What are the lessons from application of multi-funding stream resource delivery mechanisms (namely, pooled, program-directed, and bilateral, known in CGIAR as W1, W2, W3-bilateral)? **13.** How adequate have monitoring, evaluation, learning, and impact assessment (MELIA) mechanisms been in assessing CRP and CGIAR performance and for decision making? **14.** In what ways have the CRPs added value to CGIAR's role as compared with Centers, and how sustainable are these?	
Subthemes	
4.1 Management	4.4 Monitoring and evaluation (M&E) and knowledge management (KM)
4.2 Governance	4.5 Communication and coordination
4.3 Efficiency	4.6 Management of cross-cutting themes
Theme V: Future orientation (in One CGIAR)/relevance **15.** What strategic and programmatic evidence is key to inform the design and implementation of new CGIAR research initiatives along the five impact areas and three interlinked strategic action areas? **16.** What are the key lessons toward seven ways of working under the new strategy?	

[11] Innovation systems are the interlinked set of people, processes, assets, social institutions, and commercial markets that enable the introduction and scaling of new ideas, products, services, and solutions to deliver impact. (…) Innovations are new ideas, products, services, and solutions capable of facilitating impact through innovation systems involving multiple partners and enablers. This will involve multiple partners and enablers. Source: CGIAR Performance and Results Management Framework 2022–2030.

[12] Outcomes refer to changes in knowledge, skills, attitudes, and/or relationships that manifest as changes in the behavior of output users to which a combination of research outputs and related activities have contributed.

[13] Impacts refer to durable changes in the condition of people and their environment brought about by a chain of events or change in how a system functions to which research, innovations, and related activities have contributed.

[14] CGIAR defines "policies" as "policies, legal instruments, investments or curriculum modified in design or implementation, informed by CGIAR research." CGIAR results dashboard

17. What are the lessons learned on the use of evidence for decision-making and for stage-gating? Where are the evidence gaps?
Subthemes
5.1 Five impact areas
5.2 Seven ways of working
5.3 Relevance
5.4 Strategic Action Area: Systems transformation
5.5 Strategic Action Area: Resilient agri-food systems
5.6 Strategic Action Area: Genetic innovations

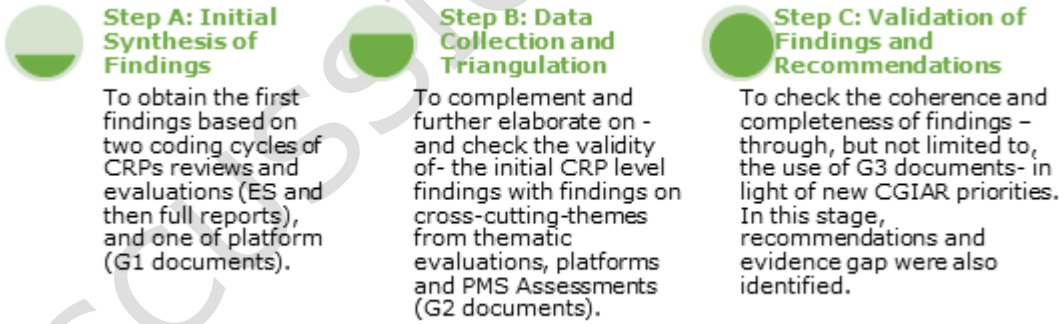
Stage 3: Data Collection and Analysis

For this study, **a three-step consecutive process** was adopted for data collection and analysis, based on document grouping (CRP-focused studies [G1], thematic/cross-cutting issues studies [G2], and synthesis reviews [G3]).

The three steps provided the evidence to answer the key questions, with a focus on strengthening the validity of findings and addressing limitations and potential biases. **The process alternated coding and analysis** to identify themes and trends across the agri-food topics, as well as any topics becoming apparent through the analytical process.

Given the differences in scope, design, vocabulary, and coverage of the sampled documents, an active coding model was followed that involved active engagement with each document through note taking (comments). In addition, the coding process was collaborative (involving four coders familiar with CGIAR) and flexible (the codebook was continually updated throughout the process as new information became available or new nuances within the codes emerged). The initial structure of the codebook closely reflected the structure of the analytical framework. Where applicable, the coding was also performed in a way that allowed both quantitative and qualitative extraction and analysis of the information recorded. Quantitative analysis included statistical analysis on the numbers and frequencies of certain kinds of information (e.g., QoS outputs, CRP milestones).

Figure A3.3: Three data collection and analysis steps, by objective



Bibliometric analysis: Under theme I, the synthesis considered scientific credibility and legitimacy, two of the four elements constituting the quality of research for development (Qo4RD) framework (ISPC, 2017; ISDC, 2020). Analysis of bibliometric data was a key quantitative method. The analysis aimed to compare data underpinning priority indicators for the QoS (theme I) for 2015/16 and 2020 bibliometric analysis to highlight trends over time and across CRPs that invite further qualitative inquiry. The exercise allowed us to produce analytical graphs of trends between 2016 and 2020 data for congruent areas of analysis identified as *citation analysis, the most-cited article, journal frequency, and the H Index across* the following CRPs: PIM, WHEAT, MAIZE, CCAFS, RTB, and WLE. The qualitative data extracted from the CRP-level evidence (G1) enabled further understanding of QoS-related outputs (see Annex 6 for additional detail on bibliometrics).

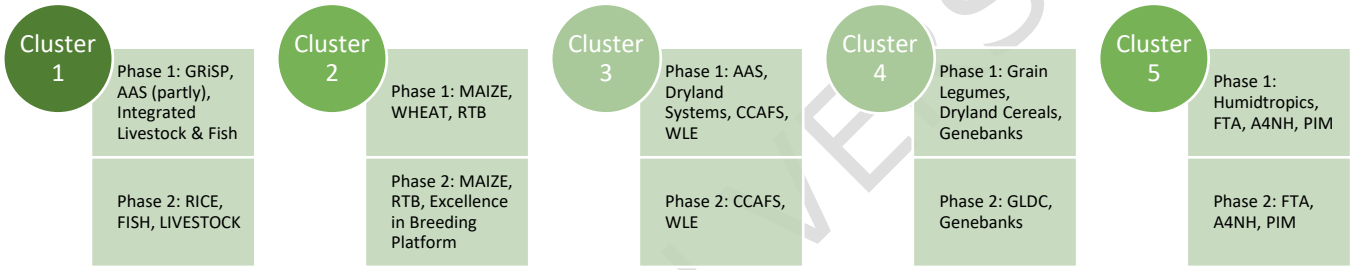
For this synthesis, the software package MAXQDA was used for multiple purposes. The software allowed us to store and manage the selected evaluation documents. It allowed us to look at specific coded data separately, with memos and comments for formulating and reflecting interpretations. This tool allowed analysis of specific themes as determined by the evaluation questions and then

the analytical framework. The software facilitated the identification of recurring themes in the documents, by making it possible to use codes and sub-codes to mark the themes and sub-themes, to rearrange the codes hierarchically to reflect their relation to each other, and to edit the names of themes as new nuances were discovered during the coding exercise.

Finally, the synthesis questions were used to inform decisions about how to assemble the group of documents into five clusters that formed the base for the five SME component analysis reports. Studies were grouped according to a combination of the following criteria:

- The phase and scope of the CRP
- The setting or context of the CRP (i.e., lead Center)
- The type of CRP (global integrating CRPs, CRPs, and Platforms)
- The appropriate matching of CRPs' scope with SMEs' areas of specialization, so that the evidence would be brought together and analyzed by experts in the relevant fields.

Figure A3.4: Five clusters for component analysis (Step A), by SME



Step A: Initial Synthesis of Findings

a. A framework-based coding of G1 Executive Summaries (ESs) was conducted to identify prominent trends across the themes and sub-themes (see analytical framework). Coding the ESs allowed the synthesis team to get started fast with a manageable amount of data and helped avoid duplication with information included in reports. Concurrently, a Bibliometric analysis for the QoS theme was performed separately.

b. An initial compilation of findings was completed by SMEs and peer reviewed internally. The initial draft (using a common template) reflected emerging patterns and trends across the themes and sub-themes and contrasted the two phases of CRPs. Based on the information collected, the analytical framework and codebook were updated (see revised analytical framework).

c. Framework coding of the full 30 reports (ESs excluded) was performed; this coding was intended to bring more depth to the prominent trends identified. Initially, a selective coding was planned for this step to allow for a deep dive into the data. The synthesis team decided to code all the evidence related to the themes and sub-themes to ensure that the formulation of the main findings embraced diversity and nuance.

d. Initial analysis of findings by group (cluster) of CRPs was conducted.

The core outputs consisted of five draft reports of component analysis by SMEs.

Table A3.3: Codebook used to code G1 reports (excluding ES) in MAXQDA

Background

	Evaluation/review, Evaluand/CRP, Limitations	
Theme 1: Quality of science (QoS)		
	1.1 QoS: Inputs	1.3 QoS: Research outputs
	1.2 QoS: Management/research process	
Theme 2: Progress toward Outputs		
	2.1 Inputs	2.3 Innovations (including technologies)
	2.2 Outputs	2.3.1 Technologies
Theme 3: Performance		
	3.1 Outcomes	3.3 Innovations (including technologies)
	3.2 ToC, design, and progress along impact areas	3.4 Policies
Theme 4: Implementation, Governance, and Management		
	4.1 Management	4.4 MELIA, reporting, and KM
	4.2 Governance	4.5 Communication and coordination
	4.3 Efficiency	
Theme 5: Cross-Cutting Themes		
	5.1 Climate change/environment/natural resource management (NRM)	
	5.1.1 Environment/NRM	5.1.2 Climate change
	5.2 Gender	
	5.2.1 Inputs and outputs	5.2.3 Gender outcomes
	5.2.2 Governance and management	
	5.3 Capacity development	
	5.3.1 Inputs, outputs, and management	5.3.2 Outcomes
	5.4 Partnerships (external to CGIAR)	
	5.4.1 Outputs	5.4.3 Outcomes
	5.4.2 Governance, management, and communication	
	5.5 Youth	
Theme 6: Others		
	6.1 International public goods (IPGs)	6.4 Risks and opportunities
	6.2 CRP comparative advantage/added value	6.5 CRP relevance
	6.3 Sustainability	
Theme 7: Recommendations		
Theme 8: Lessons Learned		

Step B: Data Compilation and Triangulation

e. A framework coding of the G2 thematic evaluations was conducted. Initially, the coding model planned for this step was elaborative (selective), based on the need for information in light of the initial findings. The synthesis team coded all the G1 findings complementing with new codes added to reflect specific issues related to cross-cutting themes and emergent issues relevant to the evaluation questions.

f. Initial CRP-level findings were enriched and triangulated in relation to cross-cutting themes, platforms, etc.

g. Trend analysis of bibliometric data was conducted, where feasible.

h. Data analysis was used to contrast qualitative and quantitative findings (for the QoS theme), explore relationships in the data, and further elaborate and add nuance to initial findings.

i. Five reports (component analysis) were drafted, reflecting preliminary findings, by CRP group.

j. External peer review of component analysis SME reports was conducted.

Five reports of component analysis by SMEs were finalized to be used as the main input for drafting the final synthesis report.

Step C: Validation of Findings and Recommendations

k. The synthesis report was drafted based on the five component analyses.

l. Data were triangulated with the synthesis reviews.

m. Findings were analyzed with an eye toward future orientations, impact areas, strategy 2030, and other topics.

n. Recommendations were collaboratively elaborated by the synthesis team.

o. Findings and recommendations were validated with CRP and platform leaders.

p. Evidence gaps and recommendations for future CGIAR research were identified.

q. External and internal peer reviews were conducted for quality assurance.

The synthesis report was then drafted, validated, and shared.

A3.3: Limitations and Mitigation Measures

The synthesis was constrained by limited time and focused only on synthesizing existing reviews. It was therefore framed by the analyses and key evaluation questions from sampled CRP and other evaluations. Given the heterogeneity of the first-phase CRPs and the significant changes in the CRPs making up the second-phase portfolio, direct comparability was not possible, as acknowledged in the inception phase, especially because the CRP reviews themselves differed in scope between the two phases. Key information on limitations and mitigation measures are noted in Table A3.4.

Table A3.4: Limitations and mitigation measures

N	Limitation/potential bias	How it was totally or partially addressed
1	A large amount of data can impair the quality of analysis owing to time constraints.	The analysis followed a multistage process of data compilation and analysis. Coding the ESs first allowed the team to get started fast with a manageable amount of data. In addition, the group of documents was divided into five clusters that formed the base for the five-component analysis. Synthesis team members worked in parallel and in harmony to ensure coherence and complementarity. A sophisticated off-the-shelf software package was used to process and store the coded data. The extracted data were prepared for analysis in a structured format (Excel sheets) reflecting the codebook structure and thus the analytical framework; the use of Excel's filtering function against specific indicators (codes) helped greatly reduce the data to be analyzed in each step.
2	Heterogeneity existed in operating context, CRP typology, interventions, and evaluations' scope and methodologies.	The multistage analysis started with CRP-focused evidence and findings and then examined CRPs by group to finally feed the final synthesis. The analysis and synthesis have systematically acknowledged references and findings around linkages with specific contexts and settings. The synthesis team dropped the selective coding model as planned in the inception phase to guarantee that the analysis captures all aspects that have led to successes and failures. Indeed, contextual information that had the potential to influence reported achievements or shortcomings was given a high importance.

N	Limitation/potential bias	How it was totally or partially addressed
3	There was limited consistency in targets and milestones. The SRF changed between the two CRP phases, 2011 and 2016-2025, and no mapping has been conducted between the two. The 2016–2025 SRF is being complemented by the 2022–2030 Performance and Results Management Framework (PRMF) in support of the new CGIAR Research and Innovation Strategy.	The analysis relied primarily on qualitative evidence related to assessing CRPs and themes against evaluation criteria used iacrpss evaluations. To the extent possible, quantitative measurements were considered in triangulation, based on evidence provided. This was only possible for limited number of CRPs (those with two phases) and indicators (bibiometrics). Other quantitative evidence on IDOs and SLOs was analyzed to the extent covered in evaluations, given the focus of the synthsis on use of secondary data. The approach synthesized and analyzed evidence from the two phases but also recognized that the overarching Strategy and Results Framework (SRF), intended to provide a long-term vision, was itself amended significantly between the two phases. As evidence indicates, the targets set by CGIAR in the 2016–2030 SRF at its highest levels are classified as aspirational or indicative in nature.
4	CRP-level ToCs varied within and between the two CRP phases. There were limitations in the measures used for determining outcomes beyond productivity gains (e.g., in environmental and socioeconomic changes).	Developing a theory of how the intervention works, why, and for whom is recommended to ground narrative synthesis.[18] The team used the evidence generated based on the theories included in the previous evaluations and the data on uptake pathways as available. Inferences made were contextualized within the relevant frameworks and theories, with a focus on tracing the patterns, trends, gaps, and impeding and enabling factors as well as lessons.
5	Terminology varied across reports.	The PRMF 2022–2030 was used as a reference for MEAL-related concepts and terminology, as this synthesis is intended to inform future CGIAR orientations and decisions. We acknowledge this document was not used before (it becomes effective in 2022). Throughout, documents in which terminology differed from that in the PRMF were coded carefully and collaboratively between the coders to harmonize the coding process and ensure coherence. When there was ambiguity, real-time decision were made and documented in the final codebook (see Table 5). CGIAR's themes do not have sharp boundaries. Therefore, extra attention was given to assigning themes during coding to ensure coherence and comparability.
6	The quality of previous evaluations and the limited pathways to study results present threats to the validity and credibility of findings.	The evaluation team ensured that the process leading to trends and patterns was fully transparent. It is possible to track the reasoning that led to final findings by going through the available coded data (Excel files), the CRP-specific findings (the annexes of the components analysis), and the five component analyses related to the five groups of CRPs. It was beyond the scope of this synthesis to conduct a quality assessment of the evaluations. The quality of the selected documents cannot be re-evaluated with the time and resources available. We acknowledge that this limitation could be considered a threat to validity of results, and so evidence gaps, ambiguities, and discrepancies have been noted where encountered (see section about Limitations in component analysis). When the evidence frequency is weak—e.g., only a few reviews or evaluations talk about an issue—then it becomes important to assess the robustness of this limited evidence to avoid compromising the quality of the meta-review. The team invested additional effort in managing and interrogating instances of limited evidence.

N	Limitation/potential bias	How it was totally or partially addressed
		Supplementary and targeted additional data collection allowed the team to triangulate further data in some instances. The chosen narrative approach and the diversity of SME expertise assured different perspectives on interpreting the evidence, helping to synthesize findings in a way that captures complexity, dynamics, and relationships. Inferences were checked by contrasting with other data sources. Triangulation involved comparing the inferences relating to the themes through multiple stages—two CRP phases, thematic evaluations, and the synthesis and assessments respectively to improve the validity of the findings.
7	The synthesis found weak evidence in some cases and an absence of data in some.	An absence of evidence was not judged as evidence that a particular issue was absent or insignificant. An ongoing collaborative effort (between synthesis team members) to assess the quality of evidence was performed when available evidence from the evaluations was not assessed as strong or robust enough. Strategic recommendations on evidence gaps were provided where applicable and relevant for the content and objectivse of this exercise.
8	Legacy research imposed some limitations: the delivery of outcomes and impacts in AR4D has a 10- to 25-year lag, the reporting systems were changing over time, and the object/nexus of reporting was changing (from Center to CRP).	When the CRPs began, legacy programs on rice, wheat, maize, WLE, and CCAFS were already underway and acknowledged, whereas other CRPs were begun with no previous large-scale research process acknowledged (even when it may have existed). While all CRPs were evaluated or reviewed within the time frame for research inputs and outputs, pathways to outcomes were at different stages of development. The synthesis report highlighted this issue to acknowledge that not all CRPs began at the same time, and it is thus not realistic to expect equal scales of outcomes.
9	There was a potential for publication bias.	Data triangulation involved seeking the same information or findings from different sources and documents and from analysis by diverse experts. Additional attention was given to gaps in the record that SMEs flagged as potentially indicating a publication bias. Peer reviewers were used. The inclusion of MOPAN assessment (commissioned by an external organization) also helped mitigate this bias.
10	Subject matter expert bias	The synthesis did not re-evaluate individual CRPs, and the SMEs were there to analyze existing evidence and explore thematic issues rather than to assess individual research strands. Senior evaluator led the design and application of the synthesis methodology and the subsequent processing of evidence. SMEs were provided with the necessary structured evidence to analyze and to answer synthesis questions and sub-questions. Cross-disciplinary approach within the team was, and cross-peer-reviews provided transparency about the process leading to trends and patterns. CAS Secretariat evaluation function team conducted Quality Assurance and engaged external peer reviewers, listed in the main report.

Annex 4: List of Documents Analyzed for the Synthesis

S/n	CRP/Topic Abbreviation	Title	Year Published	Type (Review, evaluation, outcome evaluation, other)
GROUP 1: CRP/Platform Evaluations and Review				
1.	RICE	CRP 2020 Review - Rice	2020	Review
2	GRiSP	Evaluation of The CGIAR Research Program on Global Rice Science Partnership (GRiSP)- 2016	2016	Evaluation
3.	MAIZE	CRP 2020 Review - Maize	2020	Review
4.	MAIZE	Evaluation of The CGIAR Research Program on Maize – 2015	2015	Evaluation
5.	WHEAT	CRP 2020 Review - WHEAT	2020	Review
6	WHEAT	Evaluation of The CGIAR Research Program on WHEAT - 2015	2015	Evaluation
7	AAS	Evaluation of The CGIAR Research Program on Aquatic Agricultural Systems - 2015	2015	Evaluation
8	FISH	CRP 2020 Review - FISH	2020	Review
9	LIVESTOCK	CRP 2020 Review - Livestock	2020	Review
10	LIVESTOCK & FISH	Evaluation of The CGIAR Research Program on Livestock and FISH - 2016	2016	Evaluation
11	GLDC	CRP 2020 Review-Grain Legumes and Dryland Cereal (GLDC)	2020	Review
12	HUMIDTROPICS	External Evaluation (CCEE) Commissioned by HUMIDTROPICS, A CGIAR Research Program Led by IITA - 2016	2016	Evaluation
13	RTB	CRP 2020 Review-Roots, Tubers and Bananas (RTB)	2020	Review

14	RTB	Evaluation of The CGIAR Research Program on Roots, Tubers and Bananas (RTB)	2015	Evaluation
15	GRAIN LEGUMES	CRP Commissioned External Evaluation (CCEE): Grain Legumes	2016	Evaluation
16	DRYLAND SYSTEM	CRP Commissioned External Evaluation (CCEE): Dryland Systems	2015	Evaluation
17	DRYLAND CEREALS	CRP Commissioned External Evaluation of The CGIAR Research Program on Dryland Cereals-2016	2016	Evaluation
18	A4NH	CRP 2020 Review-Agriculture for Nutrition and Health.	2020	Review
19	A4NH	Independent CRP- Commissioned External Evaluation of The CGIAR Research Program on Agriculture for Nutrition and Health (A4NH) - 2015	2015	Evaluation
20	FTA	CRP 2020 Review-Forests, Trees and Agroforestry (FTA)	2020	Review
21	FTA	Evaluation of The CGIAR Research Program "Forests, Trees, And Agroforestry" (FTA) - 2014	2014	Evaluation
22	PIM	CRP 2020 Review-Policies, Institutions and Markets (PIM)	2020	Review
23	PIM	Evaluation of The CGIAR Research Program "Policies, Institutes, And Markets" (PIM) - 2015	2015	Evaluation
24	CCAFS	CGIAR Research Program 2020 Reviews-Climate Change, Agriculture & Food Security (CCAFS)	2020	Review
25	CCAFS	Evaluation of The CGIAR Research Program on Climate Change, Agriculture and Food Security - 2016	2016	Evaluation
26	WLE	CRP 2020 Review-Water, Land and Ecosystems (WLE)	2020	Review
27	WLE	Evaluation of The CGIAR Research Program on Water, Land, and Ecosystems (WLE) - 2016	2016	Evaluation
28	GENEBANK	Evaluation of GENEBANKS (a CGIAR Research Support Program) - 2017	2017	Evaluation
29	CCAFS	CGIAR Review 2018 CCAFS Case Study Climate Change, Agriculture and Food Security	2018	Case study
30	A4NH	Evaluation Study of the IFPRI/A4NH Research Program on Diet Quality and Health of The Poor - 2019	2019	Evaluation
Group 2: Thematic/Cross Cutting and CRP Assessments				
31	WLE	Outcome Evaluation of the work of the CGIAR research program on Land, Water and Ecosystems (WLE) on Soil and water management In Ethiopia-2019	2019	Evaluation
32	GOVERNANCE, MANAGEMENT	Review of CGIAR Research Programs Governance and Management 2014	2014	Review
33	PARTNERSHIPS	Evaluation of Partnerships In CGIAR - 2017	2017	Evaluation

34	CAPDEV	Evaluation of Capacity Development activities of CGIAR - 2017	2017 Evaluation
35	GENDER II	Evaluation of Gender in CGIAR Workplace - 2017	2017 Evaluation
36	GENDER II	Evaluation of Gender in CGIAR Research - 2017	2017 Evaluation
37	RBM	Evaluation of Results-Based Management in CGIAR - 2018	2017 Evaluation
38	INTELLECTUAL ASSETS PRINCIPLES	Review of CGIAR Intellectual Assets Principles - 2017	2017 Review
39	OPEN ACCESS/ OPEN DATA	Review of CGIAR's Open Access/Open Data Policy and Implementation Support - 2018	2018 Review
40	BIGDATA	CGIAR Platform PMS Pilot Assessment Report, Big Data	2019 Assessment
41	EXCELLENCE IN BREEDING	CGIAR Platform PMS Pilot Assessment Report, Excellence in Breeding	2019 Assessment
42	GENEBANK	CGIAR Platform PMS Pilot Assessment Report, GENEBANK Platform	2019 Assessment
43	MAIZE	CGIAR Pilot Assessment Report, Maize CRP	2019 Assessment
44	WHEAT	CGIAR Pilot Assessment Report, WHEAT CRP	2019 Assessment
45	RTB	CGIAR Pilot Assessment Report, RTB CRP	2019 Assessment
46	PIM	CGIAR PMS Pilot Assessment Report, PIM CRP	2019 Assessment
47	FTA	CGIAR PMS Pilot Assessment Report, FTA CRP	2019 Assessment

Group 3: Synthesis/Reviews				
48	MOPAN	MOPAN 2019 Assessments- CGIAR	2020	Assessment
49	ALL	Impact of CGIAR's Agricultural Research for Development: Findings and Lessons from The SIAC Program	2019	Synthesis
50	ALL	Synthesis and Lessons Learned From 15 CRP Evaluations - 2016	2016	Synthesis
51	5 CRPS	Synthesis and Lessons Learned from 5 CRP Evaluations - 2016	2016	Synthesis
52	ALL	CGIAR Performance Management Standards: Pilot Assessment	2019	Assessment

Annex 5: Executive Summaries of Reports by Subject Matter Experts

A5.1: Executive Summary Cluster 1

SME: Deborah Templeton

The purpose of this synthesis is to draw out from the 2014-2016 CRP Evaluations and the 2020 CRP Reviews, trends and lessons learned at the CRP- and the CGIAR system-level; make recommendations on the future orientation of One CGIAR; and provide information on the key evidence gaps and needs for future evaluations. It covers three phase 1 (AAS, L&W and GRiSP) and three phase 2 (Livestock, FISH and RICE) CRPs.

Key trends and lessons from CRPs

The creation of these CRPs resulted in a significant increase in the collaboration between Centers, non-CGIAR core partners and with other CRPs. This collaboration has broadened the scope of the research and encouraged a more multidisciplinary approach to problem solving. There was also an increased effort to more fully understand both the needs of the next and end stage users, and the increasingly complex and urgent threats to food systems, nutrition and water security, which led to a more pro-poor, inclusive and climate-change-ready research portfolios across and within these CRPs.

Gender in research grew in importance during the first funding phase and while shortfalls in core funding may have resulted in a decreased momentum in some CRPs during phase 2, progress was still made. A sound gender strategy and a strong team headed by a senior gender scientist, with concomitant funding resources, is necessary to maintain focus on, and support of, gender in CGIAR research.

Capacity development, primarily undertaken through bilaterally funded projects, featured strongly across the CRPs throughout both phases. Nevertheless, the extent to which the capacity development activities addressed the needs of the individuals or institutions, particularly those operating within the national research and development system, isn't clear.

Funding shortfalls and an enhanced focus on the global climate and food crisis increased the CRPs reliance on partners along the R4D pathways resulting in not only a greater number of partners but also the establishment of some new and innovative partnerships. While both capacity development and partnerships are vital components of the CRPs, a more a strategic results-based approach is warranted if the full benefits of either are to be realized.

While planning and delivering on research targets is challenging in an unstable and relatively complex financial environment, Livestock, FISH and RICE proved to be adaptive and innovative in addressing financial challenges, however, this adaptation has come at a cost in terms of lost research time.

Patterns and lessons from CGIAR system-wide issues

One challenge that the 2008 CGIAR reform was expected to address was the growing dependence on bilateral funding across the CGIAR system. Indeed a strong incentive for collaboration was the expectation that the CRP's would operate within a more stable and more flexible funding environment. However, over the two phases, funding became increasingly uncertain as evidence by unexpected funding cuts to W1/W2 funds and delays in payment, which resulted in an even greater reliance on bilateral funds.

As this cluster of CRPs moved into their second phase, their capacity to develop ToCs that align outputs with sub-IDOs, IDOs and SLO increased significantly. These ToCs were largely descriptive and commonly used for planning and communication purposes but rarely for tracking and measuring progress or for learning. The CRP's have also undertaken a number of impact assessments (albeit relatively narrow in focus and to varying degrees of robustness) but the extent to which the results of these assessment feed into priority setting exercises or into current research activities is unclear. In addition, reporting systems (including MARLO) are considered to be overly complex, very time-consuming, require a duplication of effort without providing a clear representation of CRP progress or lessons learned. A more streamlined results-based management system, and an increased CGIAR system-wide support of monitoring, evaluation, impact assessment for leaning is warranted.

Recommendations

Three action areas

Recommendation 1: To deliver substantive and game-changing outputs and outcomes, each action area should focus on a limited number of key research themes and ensure that it has the inputs to deliver against those themes.

Five impact areas

Recommendation 2: One CGIAR should ensure that it can access a high-quality expertise from a wide range of disciplines that can collaborate effectively and efficiently to deliver integrated solutions on the five impact areas.

Recommendation 3: One CGIAR should ensure that user-friendly MELIA systems are in place and imbue a culture of monitoring evaluation and impact assessment for accountability and learning.

Recommendation 4: One CGIAR should develop a comprehensive impact assessment strategy that recognizes: (1) the varying needs of the key evaluation audiences; (2) the multiple purposes of the impact assessment; (3) the range of methodological frameworks; (4) data collection requirements and analytical techniques; and (5) the expertise, skills and funds required.

Seven ways of working

Recommendation 5: One CGIAR should mandate a common, high-quality and enforceable approach to research ethics.

Recommendation 6: One CGIAR should mandate a standard code of research conduct.

Recommendation 7: If One CGIAR hopes to achieve measurable benefits across five impact areas by 'drawing on global, best in class, capabilities and ways of working', it should undertake an in-house capacity gaps analysis to determine if and where scientific inputs, including human resources, need strengthening.

Recommendation 8: One CGIAR should seek partnerships with institutions that have a different profile and skill-base to that of CGIAR traditional partners.

Recommendation 9: One CGIAR should broker regional reciprocity agreements between countries to fast-track the registration and release of germplasm across national borders.

Recommendation 10: Given the challenge in supporting fundamental multiyear longitudinal research with short-term funding, Genetic Innovation should capitalize on the potential of being a large program by developing a comprehensive agenda that will attract committed long-term investment in exploratory research to ensure a continuous flow of technologies and knowledge into the trait discovery and breeding pipelines.

Key evidence gaps and needs

There is a lack of evidence on the degree to which foresight and priority setting work informs the CRPs research portfolio. A clear picture of progress along the ToCs is not readily available because sub-IDOs and IDOs are not consistently used to measure progress. Also, while the CRPs all have examples of impact assessment analysis¾to varying degrees of robustness¾more work is required in this area for learning as well as for accountability. In sum, what this adds up to is a limited picture of what has worked really well, what hasn't and why.

More information on the strategy behind, and the impact of, CapDev and partnerships could inform the design and implementation of One CGIAR.

A5.2: Executive Summary Cluster 2

SME: Carlos Iglesias

All together, MAIZE, WHEAT and RTB *(**ALL CRP's when referring to the three CRP's**)* represent the most significant endeavor to solve major global agriculture and food production constraints through science, broad partnerships, and significant donor support for 2.5 billion of the poorest people in the developing world, who depend on those crops for more than 30% of their calorie intake. Since their inception, the CRP's have aimed at enhancing synergies across scientists, institutions, crops, and regions to improve the efficiency with which relevant scientific outputs are produced and delivered for intended impact.

Highlights and successes over the two phases

The main highlights and successes for ALL CRPs include:

- A high level of integration, improving collaborative culture across Centers and partnering institutions, and across crops in the case of RTB,
- A commendable publication record and with high quality of science,
- Significant improvements related to the refinement in target market prioritization and target product profile definition,
- The modernization of breeding programs through implementation of molecular and digital tools,
- The release of improved germplasm with tolerance to major stresses, enhanced production potential, adapted to major uses and higher nutritional levels,
- The development of uniform, accessible and friendly data bases,
- A dynamic network of partnerships and collaborative projects, having built broad partnerships to address high priority R&D areas (NARES, ARIs, Private Sector, etc.),
- Increased consideration to gender when designing research and evaluating impact,
- MAIZE and WHEAT have excelled in their research towards Sustainable Intensification, while RTB have made significant inroads into improved seed systems for vegetatively propagated crops, and the incorporation of post-harvest and food processing as guiding principles in RTB breeding,
- A trend to improve the connection between research and desired impact through the adoption of ToC,
- Delivering significant capacity development of partner institutions, mainly through bilaterally funded projects,
- Flagship programs have resulted in improved research focus and a cradle for stronger synergies and partnerships.

Achievements related to the CGIAR's cross-cutting themes included, increased consideration to **gender** when planning and executing research, and in CapDev for both MAIZE and RTB; a significant number of **capacity development** events, the majority supported by bilaterally funded projects; the implementation of a sound and well-researched **youth** strategy by MAIZE, while RTB & WHEAT need greater consideration of youth; strong **parthernships** across ALL CRP's, enabling strong linkages among centers, ARIs, universities, and regional and national organizations; and **climate change adaptation/mitigation** incorporated as a cross-cutting theme in Phase II, and already featuring high in MAIZE and somehow high in RTB, with a stronger connection to CCAFS is needed.

Achievement of outcomes was facilitated by having the ToC developed as a roadmap towards impact for most FP's; the availability of small CRP competitive grants which helped build strong linkages within project teams; and the consolidation of strong partnerships with ARI's which complemented the CRP's scientific capabilities, as well as with NARES which helped prioritize and execute research, as well as delivering outcomes. M&G has been mostly effective despite complex administrative and financial arrangements, with some cross-center disparities (CIMMYT and ICARDA in WHEAT; IITA's lower share of CRP resources as highlighted for both MAIZE and WHEAT).

Key challenges

Amid all the progress reported throught Phase I and II, key challenges have constrained the achievement of outcomes for ALL CRP's. Key challenges relate to:

- Limited, uncertain and untimely levels of W1/2 funding; a high level of bilateral funding for long-term SLO's,
- Restricted focus on social aspects and how outputs could alleviate poverty and improve lives of most disadvantaged,
- The need for greater effective and meaningfull inclusiveness of target communities and National Programs,
- Siloing within and across CRP's as well as partnering institutions remains a key challenge.
- Cross-FP synergies still remain low and need attention,
- Difficulties associated with reporting and scientist's performance assessment done at Center level and not at CRP level,
- A limited level of inclusiveness in prioritizing research areas (market targets, TPP's, etc.), particularly when it comes to downstream players at the National level and specially the resource-poor sectors,
- Missing support from social scientists across CRPs,
- Lack of timely adoption studies and impact indicators; while in certain cases, impact studies lack proper quality and credibility (MAIZE),
- Lack of measurable and specific targets for milestone completion,
- The need for more equal partnerships with NARES, in order to help them upgrade their capacity and position them better to deliver target outcomes,
- Strong focus on science, without a comprehensive and/or sustained effort for engagement with cross-cutting themes, and a lack of understanding on how each supports and benefits the scientific achievements, and how outputs could transform into meaningful outcomes that impact the lives of those that need the most,
- WHEAT's level of milestones completion lacking clarity and accuracy,
- Lack direct involvement of the most interested parties in defining and/or validating markets and product profiles in MAIZE (NARSs, private seed companies, and others in direct contact with farmers, processors, and consumers),
- Further exploration needed for the development of a private "seed" sector in RTB crops and the capacity for farmers to pay for better seed.

The outstanding amount of activities and outcomes generated by the CRP's should be summarized as a collection of collective knowledge assets (as RTB has done with the Golden Eggs), to help position themselves to play an important future role in the One CGIAR organization.

Global development challenges clearly drive WHEAT's R4D strategies while funding opportunities drive FPs scientific project activities. High dependency on bilateral funding coming from a few large donors adds considerable risk to the long-term sustainability of this type of research which has very long impact pathways and where the delivery pipeline is dependent on investment on innovation at the upstream. The funding mechanisms require greater transparency.

Further improvements are required for resolving constraints along the impact pathways and for extending opportunities for WHEAT program-wide arrangements to accelerate output diffusion and associated outcomes.

Transparency in communications and reporting for accountability needs further work in order to eliminate confusion and misunderstanding particularly between the Consortium and the Lead Center over a number of issues.

Recommendations for new ways of working

(1) Embracing a systems transformation approach, seeking multiple benefits across Impact Areas

The continuous growth in productivity of maize, will result from the performance optimization from the interaction between genotypes, environments and management practices. Although all those areas are addressed separately across ALL CRP's, the real system transformation will come from its integration; for the optimization of the genotype by environment by crop management interactiong.

Generate better documentation supporting adoption claims, given that available results of impact on development goals of maize improvement research are still mostly indicative.

The sustainability of CRP's being able to continuously provide solutions that the intermediate and ultimate beneficiaries need will require strong leadership, effective communication, strong management and staff focused towards outcome-oriented program objectives and more coordinated efforts to integrate and optimize all prerequisites for effective breeding and sustainable intensification among the broader research and development partnerships brought together by the CRP's.

Adopting an RBM approach could open the way for effective and greater system transformation, but itmay require behavioral changes in designing proposals and aligning M&E plans to activity-based budgets to ensure accountability in resource utilization.

(2) Leveraging ambitious partnerships for change. ALL CRPs are comparatively small when compared to universities or national programs in the developing world. The CG has the power to leverage scientific input from partners, and to target research towards solving problems that constraint economic and social development in target regions. Their power lies in enabling partnerships that provide scientific complementarity, leverage infrastructure, and facilitate delivery of outcomes towards the intended impact. OneCG should protect the most valuable partnerships that the CRP's have enabled.

(3) Positioning regions, countries, and landscapes as central dimensions. MAIZE and WHEAT CRPs are not recognized by downstream players as much as the leading regional centers are (i.e. CIMMYT, IITA, ICARDA), and the new organization will have to recognize that and seek to benefit from the regional connections developed by Centers.

(4) Generating scientific evidence on multiple transformation pathways. Modernization of plant breeding programs across ALL CRP's should accelerate and it will result in coordinated and simultaneous enhanced progress in different crops, and different regions.

(5) Targeting risk-management and resilience as critical qualities. Leverage the work done in breeding for resistance to biotic and abiotic stresses along with the information and recommendations generated by the Sustainable Intensification FPs in MAIZE and WHEAT to help farmers reduce risk and increase productivity while helping maintain or improve environmental conditions for future production.

(6) Harnessing innovative finance. Disproportionate levels of bilateral financing seems to be the major pain point for ALL CRP's. There is a need for a higher level of core funding which could in turn reduce the considerable administrative burden upon scientists and expand opportunities for exploring innovative research outside the borders of billateraly financed research.

(7) Making the digital revolution central to our way of working. The development of comprehensive OA databases, which could be readily accessible and friendly, should be accelerated. Similarly, progress towards broad applications of digital phenotyping has been slow, but in the right direction, and it will need to be scaled.

A5.3: Executive Summary Cluster 3

SME: David Molden

This report examined the Climate Change, Agriculture, and Food Security (CCAFS), Water Land and Ecosystems (WLE), Aquatic Agricultural Systems (AAS) and Drylands Systems (referred to as Drylands in the text), a suite of CRPs that originally constituted four of five CGIAR "Systems" programs. Later, CCAFS and WLE evolved into global cross-cutting integrating programs across CGIAR, but Drylands and AAS were discontinued. Six review documents were used for this report, including reviews of all four programs carried out during 2015 and 2016, then reviews in 2020 carried out for WLE and CFAS, and these were supplemented by an EU-IFAD review of CCAFS in 2018, and a WLE review of work in Ethiopia in 2019[15]. All four CRPs provide significant lessons for the future of One CGIAR, and while there were commonalities, there were also a range of approaches and experiences, as well as successes and failures that are captured.

Key trends and lessons

A strength of all CRPs was the professional staff and publications. Both CCAFS and WLE consistently delivered a high quality of science across their two phases, but there were challenges for AAS and Drylands.

The amount and reliability of funding, a critical input, was an issue across CRPs. While CCAFS received the highest W1/2 funds of any CRP, WLE was one of the lowest, and all received cuts with Drylands receiving cuts in 2015 larger than any other CRP.

Despite funding, WLE's outputs "was remarkably high given its comparative funding disadvantage" and CCAFS outputs and findings were found to be numerous and diverse, and the papers were generally "judged to be of high methodological rigor." Both AAS and Drylands publications were assessed as achieving high standards, but the Drylands review stated pointed out low or moderate output per researcher.

Systems approaches are critical to all of these CRPs, and the experience varied in employing these approaches with CCAFS and WLE demonstrating good practice. WLE improved in its ability to synthesize and aggregate over the two phases with more strategic input, and by 2020, "WLE adds value to the research conducted by Centers by contributing to strategic research design." The Drylands program was criticized for its conceptualization of Dryland systems. AAS took a novel approach and challenged the conventional approaches of CGIAR and called for a more integrated, innovative view of how to achieve development in agricultural systems. AAS emphasized Research in Development (RinD) and Participatory Action Research (PAR), but the review stated that there was little indication that its process was leading to interdisciplinary systems-research oriented approach in practice. However, there were challenges in implementation discussed below, and ultimately, it missed the opportunity to demonstrate whether its approaches would deliver results.

There was little systematic assessment of legitimacy and credibility, however there was evidence in terms of partnerships, ethics, review mechanisms, and mentoring of staff. A strength was the network of partners of all CRPs, and the close fieldwork with partners adding to legitimacy. Across reviews, ethics was mentioned only for WLE where in 2020 the WLE an Institutional Review Board. Its close interactions with communities at its field sites aided the legitimacy of AAS and Drylands research.

Both CCAFS and WLE developed means to engage staff, funding, and teams to deliver an impressive array of outputs and outcomes. CCAFS "has influenced policies and investments at different scales, building a global presence; contributed to raising climate and agriculture up the international agenda; and helped to strengthen capacity, policies, and investments. It has successfully facilitated science-policy interactions through diverse partnerships and enabling more impact-oriented research that is appropriate to decision-makers' needs." Both CCAFS and WLE were able to influence global agendas including UNFCCC processes and IBES and several other global agendas.

A range of issues came up in the use of inputs across CRPs, including for AAS, unevenly distributing professionals over research sites, and a low ratio between senior to junior researchers; and a heavy reliance on bilateral W3 funds for Drylands and AAS. For Drylands there was weak engagement with

[15] These are referred to in the report as CCAFS, 2016; WLE, 2016; Drylands, 2015; AAS, 2016; CCAFs, 2018; WLE, 2019; CCAFS, 2020, and WLE, 2020.

policy makers and the reviewers could draw no firm conclusions on the sustainability of interventions. By 2016, the WLE review stated that "WLE is producing outcomes at the regional and global levels that contribute effectively to the sustainable management of land, water, and ecosystems." The 2020 CCAFS review stated that the CCAFS CRP successfully facilitated science-policy interactions through diverse partnerships and enabled more impact-oriented research that is appropriate to decision-makers' needs and through partnerships and capacity development, combined with an emphasis on scaling and gender-transformative change, it engaged in successful science-policy interactions from global to local scales. The CCAFS 2018 review stated that "the original contribution of the CCAFS "is not in the design of technologies themselves, but in their integration on the ground with participatory methods to address the climate risk, and in the capacity of monitoring their results in an integrative (systemic) manner." CCAFS used social media with amplifying affects, reaching millions.

While there was potential for upscaling in AAS and Drylands, there were several issues. The original framing of AAS pointed to areas of high ecological productivity but at the same time a high prevalence of poverty. However, the review stated that this framing was de-emphasized; that there was limited emphasis on systems productivity; and a lack of focus on poor and marginalized people. For Drylands, the reviewers commented that research activities were aimed at discovering incremental improvements in existing farming systems, and not discovering game-changing innovations. A few facilitating and inhibiting factors included the trajectory set by the initial design; how integrated the program was across scales and disciplines, within and outside the CGIAR, and with decisionmakers; and well-functioning partnerships. For AAS the reviewers could not properly assess contributions to development outcomes and impact because of the short duration of the program, and this would also be true for Drylands.

There were mixed reviews and experiences, but lots of learning, both with Theories of Change (ToC) and Monitoring, Evaluation and Learning Experiences. While good practices were noted, there was less use of the TOCs for management.

Governance and management experience also varied widely across CRPs. While WLE, Drylands, and AAS had very close relations with the Lead Centers, CCAFS evolved into a more independent structure, with its Project Management Unit (PMU) outside the lead Center. CCAFS was able to engage with all CGIAR Centers. On the other hand, AAS and Drylands were highly dependent on their Lead Centers on governance, and a high percentage of funding went to the Lead Center. WLE is governed by an Independent Steering Committee, which brought together appropriate expertise and included a majority of independent expert members.

The mix of funding W1/2/3 was handled differently by the different programs. W3 funds were important for all CRPs for many activities but relying on W3 funding alone would not lead to a coherent program. WLE and CCAFS used the W1 and W2 funds in a catalytic and strategic manner with WLE using them to initiate new lines of research, gap filling, and adding value to projects funded by other sources. However, Drylands and AAS used the funds primarily to support research funds and hubs that did not have access to bilateral projects. WLE allocated funds based on a fixed proportion agreed by partners, but this constrained WLE's ability to operate in a strategic or agile fashion. To overcome this CCAFS introduced competitive funding for its W1 and W2 funds, so that the percentage of funds to centers was not fixed but rather based on performance and the concepts presented.

CCAFS and WLE both demonstrated skills in Systems and integrative research and managed to transcend the work of any one Center. However, the WLE 2020 review stated that "WLE as a global integrating program has not been fully realized." The concepts, systems, team and partnerships provide a good basis in the transition to One CGIAR.

Work on gender was emphasized across CRPs, and significant progress and outputs were produced; however, there were recommendations on strengthening incorporation of gender inequity issues and including more of a feminist and social science perspective. Youth received little attention during the two phases, although Drylands prepared the first youth strategy of the CRPs. While capacity development was important for all CRPs, and numbers of trainees was impressive, reviewers commented about strategic approaches and documentation of effectiveness. Partnerships were significant across CRPs, although there were differences in approaches, and uncertainty of funding was a key issue impacting partnerships. CCAFS was successful in developing climate change as a topic across CGIAR and highlighting the importance of agriculture in climate change and mitigation discussions across scales.

Key challenges

Key challenges faced by CRPs were the quantity and reliability of funding. It was challenging to have an appropriate focus, on the poor and marginalized, and this was discussed in several places in the reviews.

There was a biophysical bias, and reviewers pointed to the need for more social science and political economy inputs for the CRPs. The conceptualization and implementation of system approaches varied across CRPs, and implementation of research Participatory Rural appraisal and Research in Development proved challenging for AAS.

Some challenges constraining CRPs were the high dependence of Center-led projects, and a lack of cohesion of activities within CRPs. Incentives for collaboration across CGIAR was flagged as an issue, with collaboration across Centers variable across CRPs. CCAFS collaborating with all centers, WLE improved collaboration, and AAS and Drylands showed limited collaboration.

Facilitating factors included clarity and transparency in governance and management arrangements; clarity of roles between Centers and CRPs; and creating a results and outcomes ethos. There were several reports of rapport with communities and engagement of national systems, important for increasing ownership and legitimacy. WLE and CCAFs were effective in engaging policy with science. Over the time of the CRPs, there has been a favorable context for climate change, and CCAFs and WLE were able to respond. There were many positive experiences with communications and establishing a learning culture.

Recommendations:

System Transformation

Use research and policy engagement on climate change, natural resources management, and biodiversity to foster system transformation as part of a broader integrating effort across CGIAR.

Resilient Agri-Food Systems

a) Identify landscapes and river basins for long-term place-based research in areas of the triple challenge of food production, human well-being, and conserving ecosystem services. Work at multiple scales, with a range of partners and decisionmakers, and embrace transdisciplinary approaches. Co-locate activities across CGIAR in these landscapes, and coordinate efforts with stakeholders at various scales.
b) Target resilience building by placing much more effort in understanding the interlinked dynamics of ecosystems, biodiversity, natural resources management and livelihoods. Engage significantly more than at present with agro-ecosystem and agro-biodiversity conservation.
c) Understand vulnerabilities to environmental shocks & risks (e.g., climate change, land degradation, water scarcity) and consider livelihood strategies beyond agricultural production.
d) Incorporate elements of Drylands and AAS in future agenda. Further consider the role of RinD and PRA.

Seven Ways of Working

a) Engage stakeholders in foresight exercises to set the research agenda owned by communities and policy makers concerned.
b) Further strengthen coordinated engagement in global processes.
c) Youth: Identify opportunities for employment across agricultural value chains, and link this to sustainable practices. Engage with the strong voices of youth on climate change and biodiversity.
d) Building on existing work, strengthen the use of Information Technology, keeping pace with technological development (artificial intelligence, big data, remote sensing, GIS) to develop applications with developmental needs (insurance, climate services, real time management, land use change). Ensure that these technologies enhance opportunity for the poor and disadvantaged.
e) Develop and use new and different metrics (e.g., building resiliency, achieving outcomes and impact in complex systems, research legitimacy).

A5.4: Executive Summary Cluster 4

SME: Nigel Maxted

The purpose of this synthesis is to draw out from the 2014-2016 CRP Evaluations and the 2020 CRP Reviews, trends and lessons learned at the CRP—and the CGIAR system-level; make recommendations on the future orientation of One CGIAR; and provide information on the key evidence gaps and needs for future evaluations.

This SME report, towards the evaluation synthesis, is a subset related to 4 CRP, the Phase 1 of two CRPs: Dryland cereals, Grain Legumes, which were merged under the Phase 2 into Grain Legumes and Dryland cereals CRP, and Genebanks that all ran for a single phase to then be transformed into a platform. The transitions have made it impossible to compare Phase 1 and 2 activities for the CRPs in scope.

Key trends and lessons from CRPs

Overall, the three CRPs (Dryland cereals, Grain Legumes- Phase 1, and Grain Legumes and Dryland cereals- Phase 2) cover a central and crucial area of CGIAR, and each CRP has been successful in delivering significant outputs. However, the Lessons learnt from the CRPs evaluated include: a more complementary participatory approach to CRP outputs can stimulate CRP outcomes, encouraging greater impact, scientific outputs must be balanced by policy interventions to support implementation of the scientific outputs, a complementary mixture of advanced and appropriate low technology solutions can achieve beneficial results, insufficient involvement of NARs and NARES in CRP output generation and implementation unnecessarily restricts outcomes and impact, CRPs need to develop a strategy(s) for scaling up and scaling out research results to broaden stakeholder and countries take-up, and improving breeders' access to germplasm enhances germplasm exploitation.

The fourth CRP Genebanks is unique in that it is run with the non-CGIAR based Global Crop Diversity Trust, acting as a CRP manager: it does not engage in research, is engaged exclusively in *ex situ* conservation and provide the genetic diversity service for other CRPs. Lessons learnt from this CRP include: that the Genebanks CRP may be viewed as a service provider to A4NH and Livestock, in that is provides the essential diverse germplasm from CRPs breeders generate novel varieties, therefore communication is key to Genebanks CRP activities; the CRP Genebanks because of its unique management context requires bespoke performance reporting indicators; the CRP Genebanks funding requires updating to ensure it is still appropriate and meets today demands; the on-line publication of CRP generated characterization & evaluation data would enhance germplasm exploitation; improving breeders' access to germplasm would enhance germplasm exploitation; meeting end users' requirements for diverse germplasm cannot be met by *ex situ* conserved germplasm alone; the GRIN-Global information management system promoted by the Genebanks CRP should be extended to facilitate the inclusion of *in situ* as well as *ex situ* conserved population data; and the Genebanks Platform needs to address the challenge of leading in situ and on-farm population maintenance to fundamentally enhance CGIAR genebanks global role in germplasm provision

Patterns and lessons from CGIAR system-wide issues

The lessons learnt around CGIAR system-wide issues include: scientific outputs must be balanced by policy interventions to support the production of the scientific outputs; security of funding is required if novel technology is to be employed in generating CRP outputs; cross cutting issues such as gender, youth and capacity building must be taken seriously if CRP impact is to be maximized; a more complementary participatory approach to CRP outputs can stimulate CRP outcomes, encouraging greater impact; inappropriate CRP management design that fails to distinguish between overlapping CRPs and centers management structures and responsibilities leads to unnecessary conflict and failure to achieve maximum impact; insufficient involvement of NARs and NARES in CRP output generation and implementation restricts outcomes and impact; insufficient involvement of other CRPs in individual CRPs activities unnecessarily restricts outcomes and impact; CRPs should be ready and able to apply adaptive research management when the need arises, focusing too exclusively on advanced technological solutions may impinge broader output take-up and reduce overall impact, while a mixture of advanced technological with other appropriate technology for individual problems is key; there is a need for each CRP to develop a strategy for scaling up and scaling out research results to broaden stakeholder and countries take-up; context sensitive CRP output should be tailored to meet end user requires and so improve uptake; and to guarantee climate change resilience requires targeted breeding with germplasm containing adaptive traits for climate change mitigation.

Recommendations

The recommendation made are based on the evidence presented in the evaluation reports of the CRPs reviewed.

Three action areas

a) Genebanks Platform to review opportunities for complementary in situ conservation of crop wild relative and landrace populations.

b) Review climate change impact on CRP/Platform activities and impact.

c) Prepare guidance on how to scaling up and out research outputs.

d) Ensure scientific and social-scientific innovations are supported by policy interventions.

Five impact areas

a) Contextualize CRP products to ensure application for diverse agricultural communities.

b) Ensure CRPs have security and sustainability of funding.

Seven ways of working

a) Systems transofrmation approach

   i. Ensure CRPs/Platforms apply adaptive management to research activities.

   ii. Ensure the work of all CRPs/Platforms are appropriately integrated.

b) Ambitious alliances for change

   i. Ensure CRPs/Platforms form mutually beneficial partnerships with commercial companies where appropriate.

c) Regions, countries and landscapes

   i. Review CRPs/Platforms activities to ensure working with NARs/NARES effectively.

   ii. Ensure NARES empowerment through active implementation of cross cutting issues.

d) Multiple transformational pathways

   i. Review Genebanks activities to ensure service provision to A4NH CRPs/Platforms.

e) Risk-management and resiliance

   i. Ensure Genebanks CRP offers contextualized germplasm provision that meets users needs.

f) Innovative finance

   i. Review the unique way in which the Genebanks Platform is funded.

g) Digital revolution

   i. Extend GRIN-Global collection management system to include *in situ*/on-farm population management data.

   ii. Build an online germplasm characterization/evaluation evidence-base.

   iii. Build a plant breeding evidence-base to improve breeding outcomes for diverse users.

Key evidence gaps and needs

The initial two and subsequently third CRPs (Dryland cereals and Grain Legumes, Grain Legumes and Dryland cereals) reviewed did not adhere closely to the reporting structure proposed, and neither did the Genebanks CRP (although the latter was given leave not to use the standard reporting formula), but it meant there were obvious evidence gaps:

a) It is unclear how successful the interaction was between breeding CRPs and the Genebanks CRP—this relationship should be reviewed to ensure access to germplasm does not limit varietal development by breeders.

b) There was a lack of evidence of whether CRPs received strategic advice on how to maximize scientific collaboration and benefit from interactions with local communities, NARES and NARs— such documentation should be prepared.

c) It was unclear what relationship existed between the wealth of genetic diversity found in nature and on-farm and that which is held *ex situ* in CGIAR genebanks—quantification of this relationship would help target additional in nature and on-farm diversity for active conservation and subsequently availability for breeders.

d) Despite the need for availability of and accessibility to a broader range of diversity for breeders' use, and the widespread threat to genetic diversity currently found *in situ* and on-farm, the CGIAR is currently not involved in *in situ* and on-farm conservation activities yet cannot afford these resources to be lost—a review of how the CGIAR might support active *in situ* and on-farm conservation, with integrated and complementary conservation *ex situ* should be undertaken.

e) There was a lack of evidence of a policy for data protection with regard to both intellectual property (e.g., traditional knowledge) and personal data (e.g., names of farmers)—the CGIAR should develop a clear data protection policy for CRPs if it does not already exist, or make sure that the implementation of an existing policy is transparent.

Operationalizing the above lessons, enacting the recommendations, and filling evidence gaps will help inform the design and implementation of One CGIAR, therefore helping ensure its future success.

A5.5: Executive Summary Cluster 5

SME: Julie Howard

This report synthesizes the key findings of CGIAR Research Program (CRP) evaluations conducted from 2014-16 and the 2020 Reviews on four CRPs: Agriculture for Nutrition and Health (A4NH), Policies, Institutions, and Markets (PIM), Forests, Trees, and Agroforestry (FTA), and Humidtropics. All except Humidtropics had two phases of programming.

Key trends and lessons from CRPs

The evaluations concluded that all CRPs had highly competent, productive CGIAR research leaders and staff across both phases. The output of high-impact, peer-reviewed scientific publications was high except for Humidtropics, whose evaluators noted the inadequacy of bibliometric analysis to assess the quality of R4D research outputs.

W1/W2 resource cuts, delays and uncertainties affected all the CRPs, but hit long-term, place-based, multidisciplinary research such as FTA's cross-cutting Sentinel Landscapes project and Humidtropics especially hard. A4NH and PIM were more successful in building and sustaining portfolios with more stable W3/bilateral resources, but the others faced disruptive program changes. Even as it declined, W1/W2 funding played a critical role in retaining a stable core of research staff in A4NH and PIM, and in developing new areas of research across all CRPs.

The CRPs relied heavily on legacy research, relationships, and infrastructure. Much of the infrastructure used by FTA and Humidtropics can be traced to previous programs and related host-country agreements. Both A4NH and PIM were heavily dominated by researchers, established programs, and bilateral funding attached to IFPRI. Research standards and ethics policies are normally the responsibility of Centers. Some host Centers had strong science quality processes and ethics policies (e.g., IFPRI) but they were not enforced consistently across CRPs.

Several evaluations noted a lack of focus on the poor and marginalized in CRP research. A4NH and PIM evaluators noted the limited social analysis and disaggregated data that would illuminate equity/distributional issues beyond gender.

All CRPs had a strong focus on partnerships and capacity building. New external institutional partnerships broadened research scope and yielded new and meaningful program collaborations. PIM emphasized active collaboration throughout the research process to ensure that its research outputs met the needs of next users. A4NH's Country Coordination and Engagement unit facilitated cross-program work and capacity building at the country level. Humidtropics emphasized multi-stakeholder processes to improve the relevance of social and technical innovations for specific agro-ecological systems. Although most CRPs had a strong focus on engaging partners and stakeholders, and on capacity development, strategies for this work were lacking that could have helped to guide priorities and resource allocation.

Across the CRPs, progress on outputs, outcomes and scaling by CRP and flagship reflected the different maturity levels among the programs. Humidtropics' evaluators noted the solid theoretical underpinnings of its new systems research approach, and found that it produced quality outputs (manuals, tools) to facilitate stakeholder engagement, but stated that it was too early to assess progress toward outcomes at the end of Phase 1.

The most advanced programs within A4NH, PIM and FTA were established years before the CRP. These three CRPs produced innovations as well as policy outputs that elevated CGIAR's visibility and contributed to policymaking at global, national, and regional levels. Within the CGIAR, A4NH led the incorporation of health/nutrition objectives and programming as a strategic focus for the CGIAR system. A4NH and PIM platforms have elevated gender research and capacities across the CGIAR. FTA expanded cross-Center collaborations around forestry/agroecosystem topics. PIM's foresight, value chain and technology adoption flagships provided platforms to link social scientists across Centers for expanded collaboration and communities of practice on critical topics.

Patterns and lessons from CGIAR system-wide issues

Lack of coherence in the use of ToC and metrics. In general, it is difficult to determine the linkages between Flagship objectives, outcomes, and the broader-level CGIAR SLOs they are intended to contribute to. This is because the CRPs used milestones to track their achievements that were not well-linked to their ToCs and the CGIAR SLOs. Milestones are set at a range of levels, from activity to impact, and thus do not provide a good indication of progress towards IDOs/SLOs. Similarly, although OICRs were helpful to highlight key achievements, by themselves they are inadequate to provide a comprehensive/accurate gauge of progress towards outcomes. While the work of the CRPs certainly contributed to outcomes, the evidence provided does not show the extent to which the results have contributed to the sub-IDOs, IDOs and SLOs specified in their ToCs.

Sustainability and scaling. Current CGIAR metrics for sustainability, scaling, and resilience are insufficient. For natural resources and systems research, progress indicators and impact assessment methodologies are challenging, and it takes significant time to achieve impacts, often exceeding the 3-5 year duration of a typical project.

Humidtropics and FTA emphasized the importance of multidisciplinary, place-based research, convening processes and engaging with diverse stakeholders to build mutual understanding, agreement and ownership of research priorities and programs. However, CGIAR and funder patience for the time and resources needed to establish these relationships and processes was limited. In addition, the skill set and type of engagement needed to move from outputs to impact at scale is very different from the training and background of most CGIAR scientists, which may have contributed to the difficulty in sustaining support for these approaches.

Impact of W1/W2 funding. The formation of CRPs was expected to lead to higher levels and more consistent W1/W2 funding, but this did not prove to be the case. The impacts were several. CRPs had to rely increasingly on bilateral funds, which are less flexible than W1/W2 funds and hard to use for strategic and cross-cutting activities, longer-term research, or to develop partnerships outside of the bilateral agreement. There was an opportunity cost for all the CRPs in terms of time to meet separate and uncoordinated reporting requirements, and the time and resources required to continually re-adjust budgets and reorganize programming to respond to W1/W2 resource uncertainties. The W1/W2 funding was critically important to knitting together an integrated program of research from, essentially, a collection of pre-existing projects and activities operated by a variety of partners. When W1/W2 dwindled significantly, as in the case of FTA (between FTA's two phases, the overall percentage of W1/W2 funds in the overall budget shrank from 39 to 10 percent), it also threatened the cohesion/integration of the CRP. FTA's 2020 evaluation noted that the portfolio lacked active research management and FTA appeared to revert back to project management by individual Centers that were responsive to bilateral donor requirements, minimally influenced by FTA objectives, priorities.

Recommendations

General

Recommendation 1: Develop and institute CGIAR-system wide processes in key areas including human resources, financial management, and science quality management, including ethics review

Recommendation 2: Develop system-wide strategies for partner engagement and for capacity development

Recommendation 3: Improve MEL systems and expand technical assistance to assist research initiatives to better manage their programs against ToC. This includes improved, practical indicators generally, with special attention to methods and indicators for assessing the quality of research which requires both science and development lenses. New measures should also better reflect intermediate progress in strategic areas such as partnership and network development (including stakeholder perceptions of engagement/ownership of research priorities), capacity development and policy impact, scaling and sustainability. On sustainability, for example, a key measure would include whether external partners have been equipped and empowered to take work forward on their own.

Recommendation 4: Assess CGIAR's comparative advantage with respect to discovery and delivery-type research across the strategic action areas. In areas where CGIAR is deficient, determine whether it will be more effective to develop in-house capacity to fill gaps, or seek strategic partnerships with external partners to fill them.

Three action areas

Systems Transformation

Recommendation 5: Increase the focus on understanding and addressing the equity impacts of policies, shocks, and solutions.

Recommendation 6: Develop research and science-policy engagement around a broader, integrating effort on transforming food systems that jointly considers nutrition/health, productivity, and climate change/environmental sustainability, rather than tackling these themes separately.

Recommendation 7: Systems transformation will require adoption of innovations at scale. Research on factors affecting scaling, and tools to facilitate scaling, are at early stages. CGIAR should significantly expand research on scaling and systems change.

Resilient Agri-Food Systems

Recommendation 8: Put priority on expanding longer-term, place-based, trans-disciplinary systems research. Ensure that tools developed during Humidtropics' systems analysis and stakeholder platform work are collected and made available CGIAR-wide. For new systems research, prioritize previous systems research sites and partnerships.

Recommendation 9: Improve measures of risk and resilience. Expand socio-economic work on risk management, including social protection measures and risk management for finance, e.g., index insurance and emerging blended finance approaches.

Genetic Innovation.

Recommendation 10: Mainstream biofortification work into the major CGIAR Centers focused on genetics.

Recommendation 11: Expand technical work and partnerships to improve regional crops and commodities that could contribute significantly to crop system diversification and expand access to affordable, healthy diets.

Seven ways of working

Recommendation 12: Increase operational research, evaluation and critical reflection on building and maintaining strategic partnerships and networks.

Recommendation 13: Place greater emphasis on co-developing priorities with research partners and sharing decision-making about research programs to ensure shared ownership. Improve CGIAR responsiveness to national agendas.

Recommendation 14: Expand resources and capacities for communication targeting non-scientific implementation partners and next users.

Recommendation 15: Put more focus on engaging the private sector in research for development/scaling.

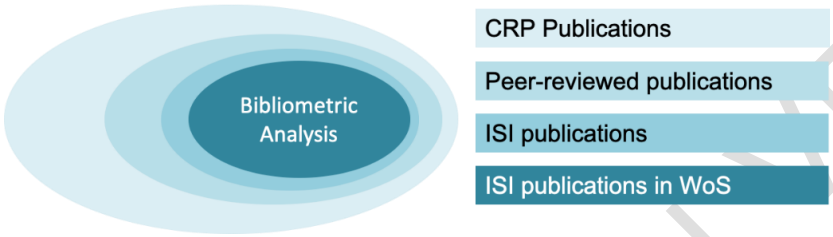
Annex 6: Analysis of Bibliometric Data

The objective of this high-level overview is to illustrate the use of bibliometric data, underpinning the exploration of Quality of Science (QoS) outputs between the 2015 synthesis[16] and pre-analyzed data from the 2020 reviews. Based on the indicator availability, a pre-analysis was conducted to facilitate the QoS output comparison.

Scope of analysis and limitations

The scope of the analyzed documents showed several differences between the 2015 and the 2020 reviews related to the ambiguous definition of the total number of entries as well as the number of journal articles in 2015. At the same time, the availability of data for the two periods differs (Figure A1). Finally, the 2015 analysis drew the data for all entries as well as the total number of journal publications from Google Scholar (layer 1 and 2 in Figure 1) while the 2020 review focused on ISI publications in Web of Science's Core Collection (layer 3 and 4 in Figure A6.1), qualifying the ability to draw conclusions.

Figure A6.1. Data sources for bibliometric analysis



Hence, the scope and readily available data from the 2015 data set determined limitations for comparison across the two periods of analysis (Tables A6.1)

[16] 2015 Synthesis report referenced in Annex 3

Table A6.1 Data characteristics for 2015 and 2020 data windows (PIM, WHEAT & MAIZE CRPs)

	PIM				WHEAT				MAIZE			
CRP Data Overview	PIM 2015	% of total	PIM 2020	% of total	WHEAT 2015	% of total	WHEAT 2020	% of total	MAIZE 2015	% of total	MAIZE 2020	% of total
Time period	2012-mid 2014		2017-2020		2012- mid 2014		2017-2020		2012-mid 2014		2016-2020	
Total number of entries	289		n/a	n/a	331				262			
Number of journal articles	118	41%	394	n/a	282	85%	434	n/a	238	91%	532	n/a
Number of ISI publications/percentage of journal articles			347	88%			354	82%			458	86%
Number of ISI publications found in WoS/ percentage of ISI publications			330	95%			354	100%			458	100%

Table A6.2 Data characteristics for 2015 and 2020 data windows (CCAFS, RTB & WLE)

Overview (CCAFS, RTB & WLE)	CCAFS 2015	% of total	CCAFS 2020	% of total	RTB 2015	% of total	RTB 2020	% of total	WLE 2015	% of total	WLE 2020	% of total
Time period	2010-2014		2017-2020		2012-2014		2016-2020		2012-2014		2017-2020	
Total number of entries	1204				925				1111			
Number of journal articles	474	39%	469	n/a	402	43%	425	n/a	449	40%	300	n/a
Number of ISI publications/percentage of journal articles			403	86%			380	89%			252	84%
Number of ISI publications found in WoS/ percentage of ISI publications			400	99%			371	98%			257	102%

Table A6.3 Data characteristics for 2015 data windows (FTA, AAS & L&F)

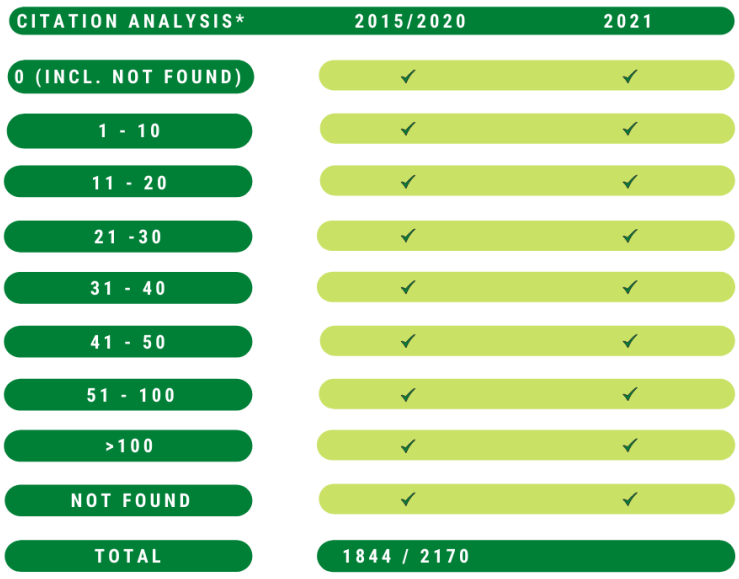
Overview (FTA, AAS & L&F)	FTA 2015	% of total	AAS 2015	% of total	L&F 2015	% of total
Time period	2011-2013		2009-2014		2010-mid 2015	
Total number of entries	1400		599		1092	
Number of journal articles	700	0,5	214	0,357	143	0,131
Number of ISI publications/percentage of journal articles	n/a	n/a	n/a	n/a	n/a	n/a
Number of ISI publications found in WoS/ percentage of ISI publications	n/a	n/a	n/a	n/a	n/a	n/a

Congruent areas of analysis between the 2015 and 2020 data reviews were identified as (1) citation analysis, (2) the most cited article, (3) journal frequency for the three most frequently published journals, and (4) the H-indices across the following CRPs (i.e., PIM, WHEAT, MAIZE, CCAFS, RTB and WLE), which will be further analyzed below.

Data point availability

Tables A6.4 and A6.5 and Figure A6.2 show the data point availability for four indicators, i.e., (1) citation analysis, (2) most cited article, (3) journal frequency for the three most frequently published journals, and (4) H-indices (both ables A6). Please note that the period of analysis is 2.5-3 years for the majority of CRPs both in 2015 and 2020 (Table A4). 2020 data for Maize and RTB only contain a very limited number of publications from 2016, which is due to the fact that some publications are available online prior to the print version. However, as a limitation, CCAFS data from 2015 spans a five-year time period (2010-2015), which has to be taken into account at analysis, and has thus been excluded from the comparison.

Figure A6.2 Data point availability- Citation analysis



As for the citation analysis and the most cited articles (Table A6.5), the availability of data is congruent and good for both periods. A minor limitation may be that there were articles in the 2015 review that were not found and hence inflated the first category (less than 3% for all CRPs except for PIM, which had 14% of articles in 2015 that weren't found; see overview tab in accompanying excel). Qualitative data points that weren't included in the 2020 review can be verified through a qualitative assessment (i.e., lead CRP on most cited publication) or are not relevant to synthesis (i.e., other info).

Table A6.4 Data point availability (Number of journal articles)

Description	2015	2020	2021 Synthesis	Comments
Time period	2010- 2014	2016- 2020		
Total number of entries	4122	n/a	n/a	Total number of entries (i.e., germplasms, technical reports, etc.) should be available for 2020.
Number of journal articles	1963	2554	Available	
Number of ISI publications	n/a	2194	n/a	
Number of ISI publications found in WoS	n/a	2170		ISI publications and publications for citation analysis may be congruent.

Table A6.5 Data point availability - Most cited article

Description	2015	2020	2021
Most cited article - title	Available	Available	Available
Journal	Available	Available	Available
Lead*	Available	n/a	n/a
Year	Available	Available	Available
No of citations	Available	Available	Available
Other info**	Available	n/a	n/a
Cites between	Available	Available	Available

* Can be looked up for 2020.
**Key fact on publication, not vital for synthesis.
Source: Google scholar 2015 & WoS 2020

The good data availability for *journal frequency* is characterized by high levels of congruence across indicators (Table A6: top section). Articles in journals without *impact factors (IF)* are only partly available for 2015 and could be approximated by using non-ISI publications in 2020. With regard to the journal with the highest IF, this information is available whenever the CRP published in Science and Nature and could be looked up for other publications.

Finally, *h-indices* are available both for the 2015 and the 2020 analysis with a number of limitations (Table A6: bottom section). First, the sampling methods vary widely, leading to significant discrepancies across CRPs in 2015 and between the two windows of analysis. For example, in 2015, h-indices were collected for 138 principal investigators leading Window 1-Window 2 activities (PIM) and 45 researchers with a supervisory role (WHEAT). In 2020, h-indices of the 25 most productive authors (i.e., authors with the most publications during that period) were analyzed, regardless of their management position within the CRP. Second, in 2015 Scopus data was used while the 2020 review relied on Web of Science data.

Table A6.6 Data point availability (Journal frequency and H indices)

Journal frequency				
Description	**2015**	**2020**	**2021 Synthesis**	**Comments**
Time period	2010- 2014	2016- 2020		
Articles in journals without impact factor	Partly available	n/a	n/a	Non-ISI publications could be used as a proxy in 2020.
Most frequent journal	Available	Available	Available	
Impact factor	Available	Available	Available	
2nd most frequent	Available	Available	Available	
Impact factor	Available	Available	Available	

Journal frequency				
3rd most frequent	Available	Available	Available	
Impact factor	Available	Available	Available	
Highest impact journal published	Partly available	Partly available	n/a	Are available for 2020 wherever the CRP published in Science or Nature
Impact factor	Partly available	Partly available	n/a	
No of articles published	Partly available	Partly available	n/a	
NATURE	Available	Available	Available	
SCIENCE	Available	Available	Available	
TOTAL (NATURE and SCIENCE)	Available	Available	Available	
H Index				
Criteria	Varying; Often: "researchers with a supervisory role"	25 authors with most publications	Available	The 2015 data obtained from Scopus while the 2020 - from WoS.
Number of people	Available			
Highest H index	Available			
Discipline	Available	n/a	n/a	
Not found (0) for	Available	n/a	n/a	
Average (excluding those without H index)	Available	Partly available	Available	Average h indices are hard to compare. Further context is necessary.

Findings and conclusions by key indicators

The following discussion centers on four core bibliometric indicators, selected due to criteria and considering limitations above.

1. 0, incl. not found
2. 1-10
3. 11-20
4. 21-30
5. 31-40
6. 41-50
7. 51-100
8. >100

1. Citation Analysis: The citation analysis categorizes all CRP-specific publications based on the number of times they were cited during the respective analysis period across eight brackets:

Key finding: Key finding: When comparing the normalized distribution across citation brackets between 2015 and 2020, the increase in publications is disproportionately distributed. Notably, the percentage of articles with 0 citations has decreased by 36.1% from 25.11% to 16.05%. Articles in the 1-10 and 11-20 citation brackets have increased by 13.88% and 12.95%, respectively. Among the more cited brackets, 21-30 and 31-40 show decreases by 27.67% and 6.01% respectively. Finally, brackets with most highly cited papers (i.e., 41-50, 51-99 and >100) increased by 54.8%, 74.15% and 100%, respectively (Figure A2). While much less significant in absolute numbers, the latter data underscore the increase in highly cited publications since 2015. As mentioned above, only the analysis of CCAFS bibliometric data covers a significantly larger timespan vis-à-vis the other CRPs. As the number of years since publication influence the number of citations, we have not included the CCAFS data in Figure A6.3.

Figure A6.3 Total percentage change in distribution across normalized citation brackets between 2015 and 2020 (PIM, WHEAT, MAIZE, RTB, WLE)

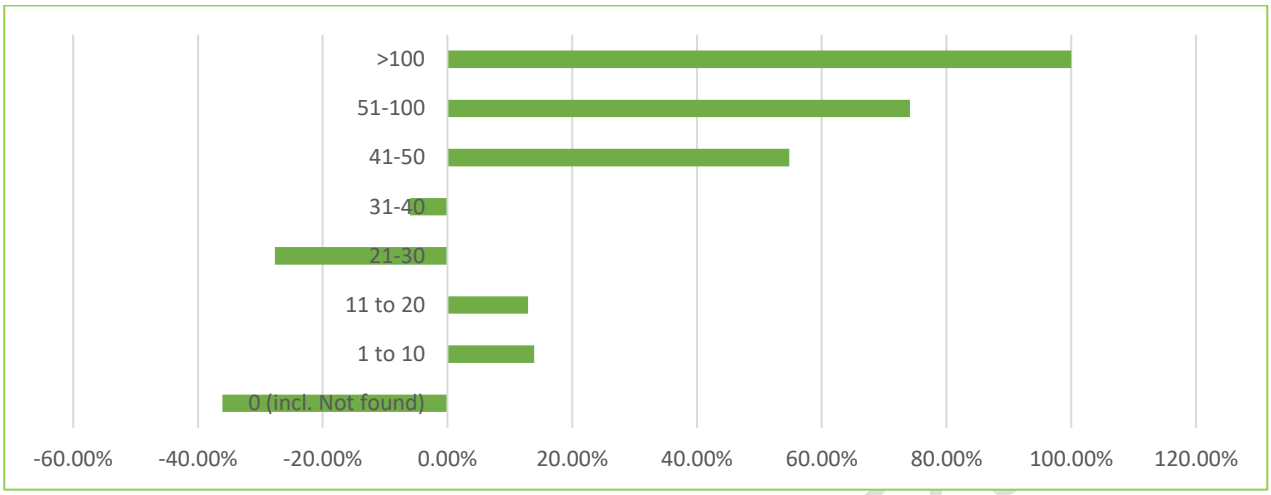
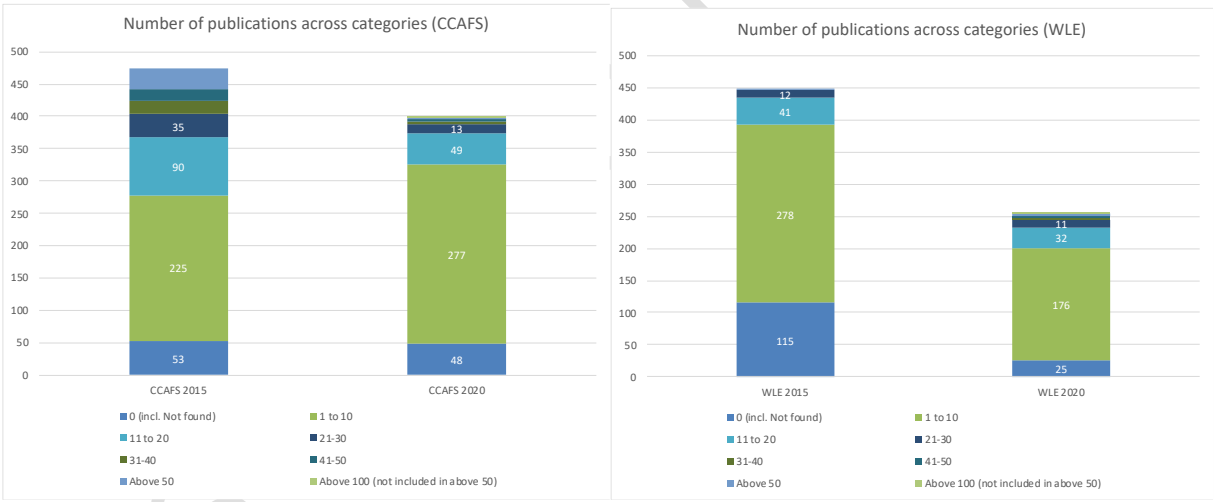
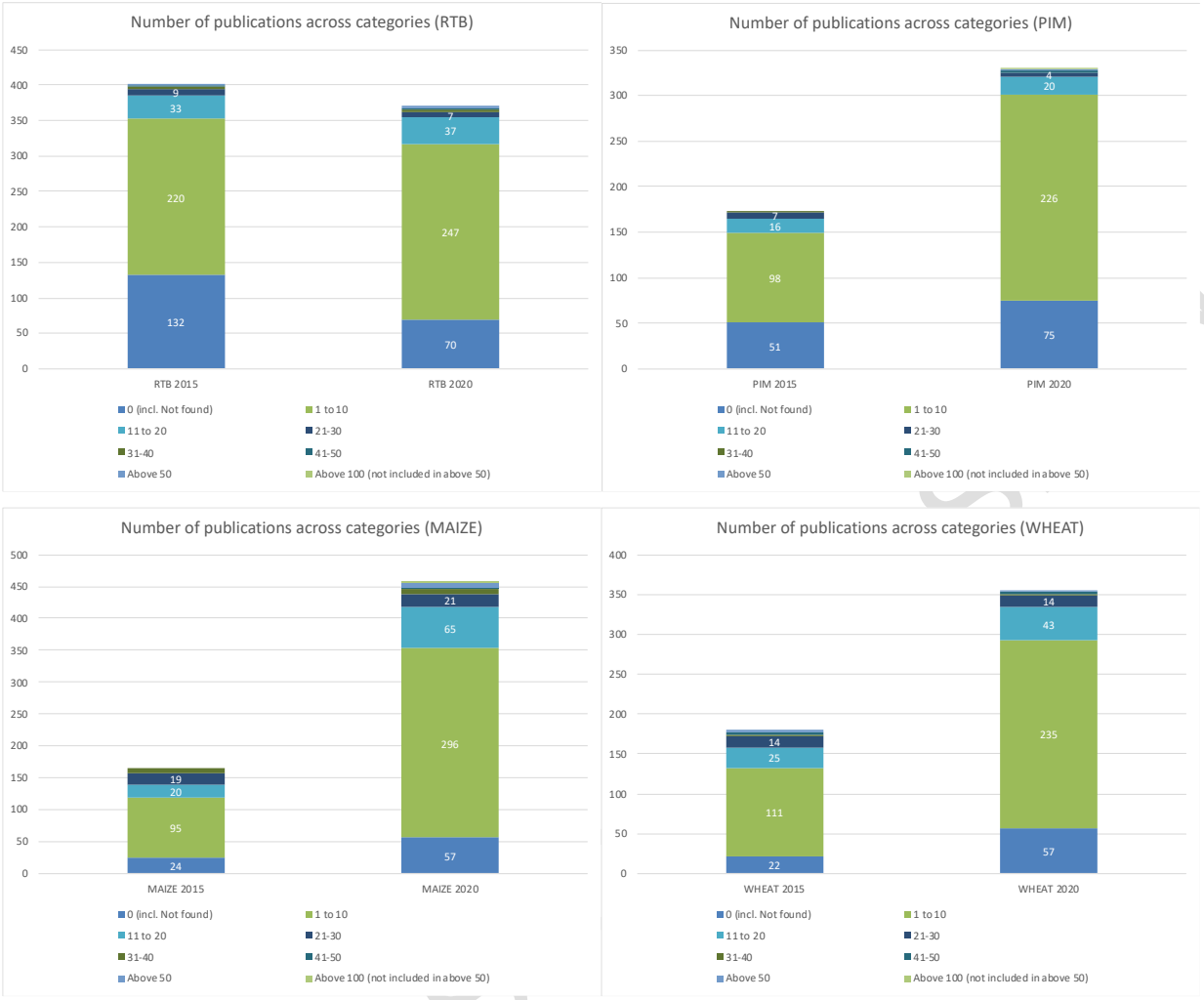


Figure A6.4 shows the variation per citation frequency in absolute numbers (i.e., not normalized) on the CRP-level. Descriptive data and visualization are displayed below[17].

Figures A6.4 Absolute number of publications across categories for each CRP



[17] Additional detail available in the tab 1_CitationAnalysis in the accompanying Excel Document



2. ***Most cited article:*** a CRP's most cited publication during the period of analysis- 2015 and 2020.

Key finding: On average the number of citations of the CRPs' most cited publications saw an increase of 11% from 137.67 to 153[18].

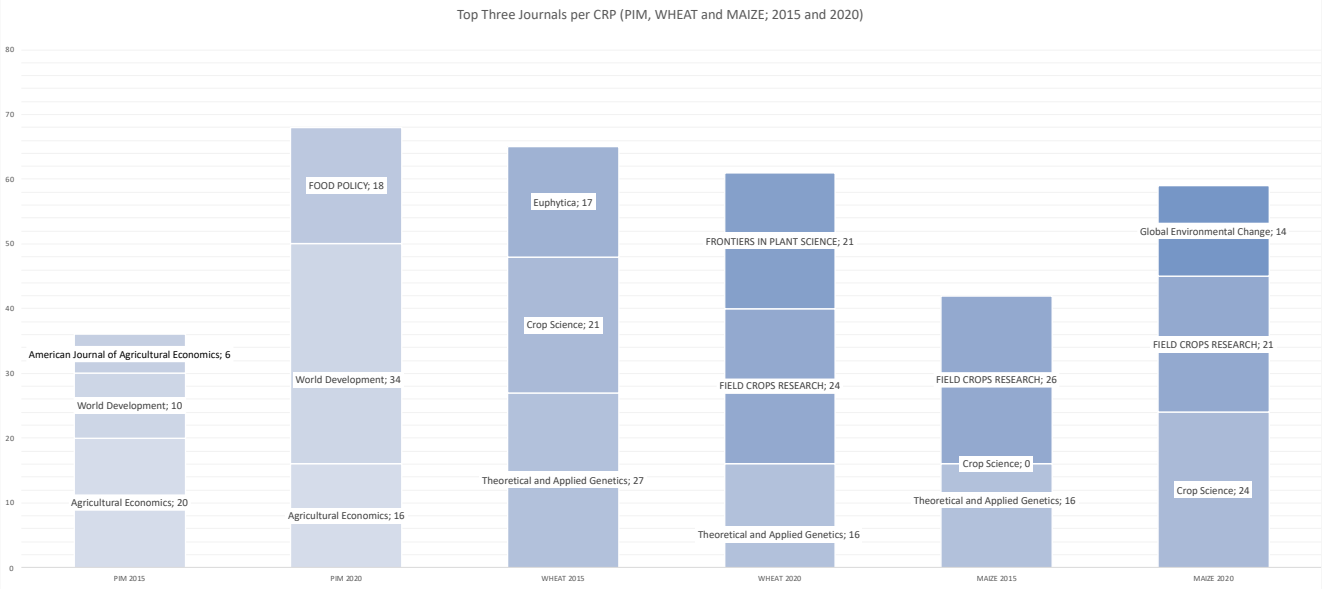
3. ***Journal Frequency:*** The number of publications in the three most frequently published journals for each CRP, including the impact factor.

Key finding: The number of publications published in the three most frequently published journals has increased by 3%, while the average Impact Factor of the three most frequently published journals has increased in two out of three cases where the data is available. In 2015, the most frequent journal was Theoretical and Applied Genetics with 43 articles (14.6% of publications in the three most published journals). The first place was taken by the journal Field Crops Research with 45 articles in 2020 (14.8% of publications in the three most published journals). Figures A6.5 show the top three most frequently published journals for each CRP, including the absolute number of publications in that journal during the period of analysis.

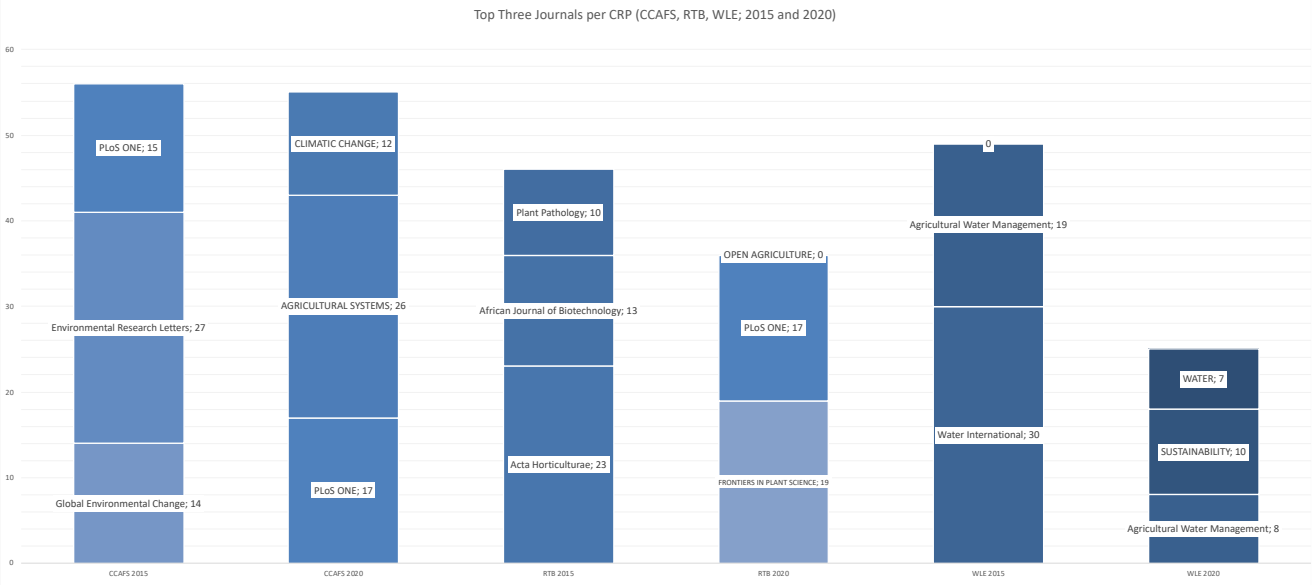
[18] See tab 2_MostCitedArticle in the accompanying Excel Document for more specific details

Figures A6.5.1 and A6.5.2. Top 3 journals per six CRPs between 2015 and 2020 (Part 1 and 2)

Part 1:



Part 2:



4. **H Index**: based on a subset of researchers at each CRP, including the number of people and the highest H Index within the selected group. The difference in sampling strategy criteria were as follows in table A6.7:

Key finding: The comparison between 2015 and 2020 is difficult as the subset of analyzed for each CRP varies between CRPs and between the two periods of analysis. In addition, the 2015 data was obtained from Scopus, while the 2020 data was obtained from Web of Science. If we only look at the maximum H Index, we see significant increases for all CRPs where data is available. More context is needed to draw any conclusions from this finding. Descriptive data and visualization are showed below TBC[19] provided in the tab 4_HIndex in the accompanying Excel Document for more specific details.

[19] Additional detail is provided in the tab 4_HIndex in the accompanying Excel Document.

Table A6.7 Sampling citeria for H indices

2015	2020
Researchers who are leading W1-2 activities (Principal Investigators) (PIM)	25 most productive authors (i.e., authors with most publications during analysis period)
Researchers with a supervisory role (Wheat and Maize)	
Flagship leaders, Regional Leaders and science leaders (CCAFS)	
Senior scientists within RTB, identified as the Product Line (and crop) leaders (RTB)	
WLE – missing	

Conclusions

The main caveat to acknowledge is that the data underlying the two syntheses stem from three different sources. Notably, the 2015 synthesis analysis draws its data from Scopus (h-indices) and Google Scholar (all other data sources). The data underlying the 2020 analysis stems from the Web of Science database. In addition, the analysis period was significantly longer in 2015 in the case of one CRP (i.e., CCAFS), limiting the overall comparability to five CRPs.

That said, among the four areas of comparison, the normalized citation analysis shows a few trends. We observe increases in the 1-10 and 11-20 citation brackets and significant increases in the 41-50, 54-100, and >100 citation brackets. Another positive sign is the decrease in publications that had 0 citations. Finally, further research is needed to better understand why the percentage of publications with 21-30 and 31-40 citations has fallen.

As per the journal frequency, we see a trend of publication concentration across the three most published journals when comparing the data from 2015 and 2020, which could indicate an improvement in QoS. Further, qualitative research is needed to understand the underlying causes.

As for the publications with most citations, while the number of citations of the CRPs' most cited publications saw an increase, it is hard to draw any conclusions beyond the normalized citation analysis above as we are looking at outliers. We would have to understand further how the average increase compares to overall increases in citations in the research field, as well as if the type of publication has influenced the number of citations obtained (i.e., review paper, etc.). A qualitative analysis of the scientific publications would be necessary to draw further conclusions.

Finally, as for the h-indices, despite a positive trend, further context is needed to draw any conclusions as the sampling strategies and the number of h-indices varies significantly within the 2015 synthesis and between the 2015 and 2020 analysis.

Recommendations

In light of the above, three key strategies are recommended, to mitigate difficulties in comparison for future synthesis analysis.

(1) *Data source:* To ensure comparability of the data underlying bibliometric analyses, we recommend maintaining the same data source over time. That is, CAS should provide access to the database of choice to ensure the highest quality and complete data. Google Scholar, Scopus, and Web of Science are possible choices. It would be optimal to use all three data sources and triangulate the results.

(2) *Timeliness of data:* To make periods comparable, we recommend obtaining the citation data annually following the release of the impact factors for the following year (i.e., in June of each year). This allows comparisons over time as publications gain in citations as the time since publication elapses.

(3) *Type of data:* We further recommend storing the data from each analysis in its raw format, containing - wherever possible - all metadata (i.e., BibTex format). This enables the replicability of bibliometric analyses even years after the completion. At the same time, this would allow new ways to visualize data as the field of statistical network analyses evolves and new software tools to apply these techniques emerge.

Annex 7: Profiles of the Synthesis Team

Dr. Mark Holderness: Team Leader

Former Executive Secretary of the Global Forum on Agricultural Research and Innovation and Agriculture Director for CABI International. Originally a plant pathologist, Mark has worked in international agricultural development for 36 years and in 60 countries, inspiring and catalyzing change in agri-food innovation systems, policies and programmes to better meet the needs of resource-poor farmers and rural communities. A recognised expert in building innovative partnerships for collective action across an ecosystem of hundreds of organisations and across public, private and civil sectors, he represented external partners into the reform and governance processes of the CGIAR from 2008-2018. He co-organized, with CGIAR, the highly successful GCARD processes of dialogue and action to transform and strengthen agricultural research for greater development impact. He was awarded '*Development Agriculturalist of the Year, 2018'* by the Tropical Agriculture Association, for an outstanding contribution to sustainable agricultural development.

Dr. Julie Howard: Synthesis Report Co-Author, SME Agricultural Economics, Research, Policy & Capacity Development

Dr. Julie Howard is an agricultural economist with over 30 years of policy research, advocacy and management experience related to agricultural research and global food security. For many years she was a faculty member with Michigan State University's Food Security Group; she led an NGO aimed at increasing US support for African agricultural development; and during the Obama Administration she was appointed as USAID's first Chief Scientist to direct the agricultural research, policy and capacity development programs of Feed the Future. She now serves as a senior adviser at the Center for Strategic and International Studies, as a board director, and co-chairs the Agriculture and Rural Development Working Group for the Scaling Community of Practice.

Ms. Ibtissem Jouini: Senior Evaluator

Ms. Jouini is a senior evaluator and researcher. She founded the EvalChange network in 2016: a group of independent consultants committed to making a lasting impact through their work giving special importance to the principles of gender equality, inclusiveness and human rights. Over the last years, Ms. Jouini has contributed and led numerous independent evaluations where she designed rigorous and tailored methodologies applying several qualitative methods. Previous to that, Ms. Jouini worked for international development organizations (UNDP, GIZ, USAID, AfDB) where she was involved in regional programs mainly related to the field of Governance. Ms. Jouini is a Tunisian national based in Spain.

Professor Carlos Iglesias: SME Plant Breeding

Carlos is the Director of the Plant Breeding Consortium at North Carolina State University, and a Professor in Horticultural Science since January 2020. Carlos grew up in a small farming community in SW Uruguay, getting his BSc at the University of Uruguay. He got his MSc and PhD in Plant Breeding at Iowa State University. Later in his career he got a MSc in Ag Econ from Purdue University and a MBA in Food and Agribusiness from Indiana University. Carlos' experience in both, the public and private sectors also includes the following roles: Global Cassava Germplasm Improvement Lead at CIAT (1989-98); Head of Hybrid Breeding and Seed Production at Weaver Popcorn (1998-2012); Head of Corn R&D LATAM (2012-15) and Head Wheat R&D and Seed Business North America (2015-2020). He has directly worked or managed programs in different species (corn, cassava, popcorn, wheat, peas) and has experience in more developed agriculture production systems (North America, Brazil/Argentina), as well as production in less developed regions of the world (Sub-Saharan Africa). He has been a consultant on root and tuber crops in Africa in the past decade. Carlos lives in Chapel Hill where his wife is getting a PhD from UNC. He is an avid baker, gardener and squash player.

Dr. Deborah Templeton: SME Agricultural Economist, Research Evaluation

Dr. Deborah Templeton is currently an Independent Researcher with a background In Research Evaluation and Impact Assessment. She spent her early career at the Australian Bureau of Agricultural and Resource Economics in Canberra, Australia. In 2000, she joined the Australian Centre for International Agricultural Research (ACIAR) in Canberra as a Senior Economist. From 2005-2008, she was the Impact Assessment Specialist at the International Rice Research Institute in Los Baños, Philippines. She then returned ACIAR and managed the Impact Assessment Program for a further five years. Since then she undertaken numerous consultancies with ACIAR and was a team member on the Evaluation Team for 2015 Evaluation for WHEAT. Dr. Templeton has a PhD in Agricultural Economics from University of New England, Australian, and was awarded the D.H. Drummond Thesis Prize for Economic Studies 2002.

Dr. David Molden: SME, Water and Natural Resource Management

Dr. David Molden served as Director General of the International Centre for Integrated Mountain Development (ICIMOD) from 2011 to 2020. Prior to ICIMOD, he was the Deputy Director General for Research at the International Water Management Institute (IWMI), where he worked from 1995 to 2011. His specialty is water resources and natural resources management, with interest and experience in working across disciplines and with stakeholders, and fostering linkages between science, policy and practice for sustainable development. He has life and work experience across Asia and Africa and has received several awards including the Outstanding Scientist Award of the CGIAR in 2009.

Professor Nigel Maxted: SME Plant Breeding and Plant Genetic Conservation

Prof. Nigel Maxted (Professor of Plant Genetic Conservation, at University of Birmingham) has professional expertise in conservation planning and in situ and ex situ plant genetic conservation. He achievements include: Coordinator/director of several national and international research projects addressing in situ and ex situ conservation of plant genetic resources in Europe, Asia and Africa. Successful coordination of four large EC funded projects (EU Biotech ESIN, FP5 PGR Forum, FP7 PGR Secure, H2020 Farmer's pride) and regularly consultants for leading international conservation agencies (FAO/CGIAR/ Global Environment Facility/United Nations). He is International Scientific Advisor for Bioversity International; Co-Chair of the IUCN SSC Crop Wild Relative Specialist Group; Chair of Wild Species Conservation in Genetic Reserves WG; Co-Chair for genetic resources for the Ecosystem Services Partnership; and Chair of the U.K. Plant Genetic Resources Group. Published over 350 scientific papers and 25 books, and most recently a textbook on Plant Genetic Conservation for CUP.

Annex 8: Conflict of Interest Statements

Original forms with signatures and additional detail are avaiavble upont request.

S/N	**Conflict of Interest Statements**	**Mark Holderness**	**Jouini Ibtissem**	**Julie Howard**
1	Main employer and any other organization that provides you with remuneration (which may be named participants in the project/ program/ proposal you are being asked to review/evaluate	Independent Adviser, Part-time Lecturer at University of Edinburgh	EvalChagne Network	Independent Consultant
2	Are you aware whether a relative, close friend, close colleague or someone with whom you have financial ties is receiving funding from or giving advice to a project/program/proposal you are being asked to review/evaluate?	Yes☐ Details:	Yes☐ Details:	Yes☐ Details:
		No☒	No☒	No☒
3	Does any project/program/proposal you are being asked to review/evaluate cite any of your own current research?	Yes☐ Details:	Yes☐ Details:	Yes☐ Details:
		No☒	No☒	
4	Does any project/program/proposal you are being asked to review/evaluate name researchers with whom you have active collaborations, recently published joint papers or are in regular email correspondence?	Yes☐ Details:	Yes☐ Details:	Yes☐ Details:
		No☒	No☒	No☒
5	Does any project/program/proposal you are being asked to review/evaluate name any of your past PhD students are active participants?	Yes☐ Details:	Yes☐ Details:	Yes☐ Details:
		No☒	No☒	No☒
6	I declare that the information provided on this statement is true and complete	Dated: 11 February 2021	Dated: 10 February 2021	Dated 9 March 2021

S/N	Conflict of Interest Statements	Carlos Iglesias	Deborah Jane Templeton	David Molden	Nigel Maxted
1	Main employer and any other organization that provides you with remuneration (which may be named participants in the project/program/proposal you are being asked to review/evaluate	Director of the Plant Breeding Consortium at North Carolina State University; ISC member for RTB, by consultancy	Independent	Independent	University of Birmingham, United Kingdom.
2	Are you aware whether a relative, close friend, close colleague or someone with whom you have financial ties is receiving funding from or giving advice to a project/program/proposal you are being asked to review/evaluate?	Yes☐ Details: n/a	Yes☐ Details: n/a	Yes☐ Details: n/a	Yes☒ 30 year working relationship with CGIAR Centers but based only on shared work interest.
		No☒	No☒	No☒	No☐
3	Does any project/program/proposal you are being asked to review/evaluate cite any of your own current research?	Yes☐ Details:	Yes☐ Details:	Yes☐ Details:	Yes☒ Over 500 publications on the subject of plant genetic resources… Unaware of any link in these to my current research
		No☒	No☒	No☒ Likely citation of research within CGIAR system.	No☐
4	Does any project/program/proposal you are being asked to review/evaluate name researchers with whom you have active collaborations, recently published joint papers or are in regular email correspondence?	Yes☒ Details: With the Director of RTB Program	Yes☐ Details:	Yes☐ Details:	Yes☒ Details: As stated above in my academic career.
		No☐	No☒	No☒	No☐
5	Does any project/program/proposal you are being asked to review/evaluate name any of your past PhD students are active participants?	Yes☐ Details:	Yes☐ Details:	Yes☐ Details:	Yes☒ Details: Actively collaborating on two research projects (Alliance and IITA), unaware of any link between these and current research
		No☒	No☒	No☒	No☐
6	I declare that the information provided on this statement is true and complete	Dated 23 Feb. 2021	Dated: 10 Feb. 2021	Dated: 14 Feb. 2021	Dated: 10 March 2021