CGIAR Annual Report 2019

Excellence in Breeding PLATFORM

Tools, services and expertize to accelerate genetic gains of breeding programs targeting the developing world.

CGIAR | Excellence in Breeding Platform

Table of Contents

CGIAR Excellence in Breeding Platform (EiB)

Led by the International Maize and Wheat Improvement Center (CIMMYT)

Modules:

- Module 1: Product design and management
- Module 2: Optimizing breeding schemes
- Module 3: Genotyping / sequencing tools and services
- Module 4: Breeding operations and phenotyping
- Module 5: Bioinformatics, biometrics and data management

List of participating Centers and other key partners:

AbacusBio

Bayer Cropscience

AfricaRice

Biosciences eastern and central Africa - International Livestock Research Institute Hub

Bioversity International

International Center for Tropical Agriculture (CIAT)

CIMMYT

International Potato Center (CIP)

Cornell University

Corteva Agriscience

Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Diversity Arrays Technology (DArT)

The Crop Trust

Food and Agriculture Organization of the United Nations (FAO)

Institut de Recherche Pour le Développpment (IRD)

Institut National de la Recherche Agronomique (INRA)

Integrated Breeding Platform (IBP)

International Center for Agricultural Research in the Dry Areas (ICARDA)

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

International Institute of Tropical Agriculture (IITA)

International Livestock Research Institute (ILRI)

International Rice Research Institute (IRRI)

Intertek

James Hutton Institute

John Innes Centre

Kansas State University

Nottingham University

Oregon State University

Queensland University

Syngenta

United States Department of Agriculture (USDA)

Wageningen University

World Agroforestry Centre (ICRAF)

WorldFish

Part A: NARRATIVE SECTION

1. Key Results

1.1 Highlight Platform Achievements (max. 400 words)

Farmers and consumers in low- and middle-income countries can benefit from world-class breeding programs, according to a detailed vision developed by the CGIAR Excellence in Breeding Platform (EiB). Throughout 2019, the EiB team developed this vision in close contact with researchers from CGIAR and national agricultural research systems, funders and private sector partners. This included the development of detailed plans for strategic improvements to breeding by all CGIAR centers, and detailed assessments of nine NARS breeding programs in Africa.

EiB activities to support breeding program improvements continued apace in 2019. Market-driven breeding practices were embedded at all CGIAR centers and select NARS breeding programs, who altogether submitted over 200 provisional product profiles into an EiB database to assess current practices. Cross-functional product design teams were also promoted, and successfully implemented in seven breeding programs in Africa, including two NARS programs, while stage-and-gate product management systems were discussed in depth by CGIAR and NARS leadership at the 2019 Annual Meeting.

Support to optimize breeding schemes to deliver on market-driven breeding goals began towards the end of 2019, with IITA Cassava adopting new guidelines to alter crossing practices. Breeding operations and phenotyping capacities were assessed at eight research stations across four CGIAR centers, and a pilot operational excellence project completed on CIMMYT campus. EiB also conducted a CGIAR-wide survey to identify equipment needs, preferences and areas of improvement, which will inform budgets for modernization and standardization of equipment.

The project to provide a low-density genotyping platform became a self-sustaining service, brokering around $2 million worth of low-cost and high-quality genotyping data to date for CGIAR and national breeding programs to date. Its staff continues to train users and provides consultancy services to ensure genotyping is used effectively to speed up variety selection.

Connecting genotypic data from service providers with field data collection apps was a key focus of software development. The number of apps and data management services connected through the Breeding Advanced Programming Interface (BrAPI) project continues to grow.

Programmers from across CGIAR reached a key milestone in showing that the major data management software applications can be spun up in a single virtual environment, which will become the Enterprise Breeding System. It will be released in 2020 for use by breeding teams at CIMMYT and the International Rice Research Institute (IRRI). In addition to workshops and trainings, EiB sponsored seven sabbaticals, to support collaboration across institutions and the development of unified data management systems.

1.2 Platform Progress towards Outputs and Outcomes (spheres of control and influence)

1.2.1 Overall Platform progress (max 1000 words)

Overall, EiB has evolved from a provider of tools, services and know how to also providing consultancy, coordination and support for optimization and modernization across all of CGIAR breeding programs. In 2019, EiB continued to co-develop the agenda for breeding program modernization in CGIAR/NARS breeding systems with its partners, while supporting them to respond to the challenge and priorities set by the Crops to End Hunger (CtEH) set of major donors. In 2019, a major addition to the workplan was delivered when EiB staff co-developed plans for the optimization and modernization of all CGIAR and a selection of NARS breeding programs. This involved the development of a tool for documenting these plans, working with a large number of breeding programs and centers to develop the plans and two rounds of formal feedback from the whole EiB team to every plan developed. In addition, a key achievement in 2019 was to lay the groundwork for the optimization process for years to come by solidifying sponsorship for the process among senior CGIAR and NARS leaders, Funders, and the System Management Board. This culminated in an important three-day meeting in November with all the relevant stakeholders in addition to a separate meeting with DGs. The major progress to date that will enable EIB to achieve expected outputs includes:

- Continued close engagement of CGIAR and NARS leadership with EiB initiatives and concepts, both in Center/research station visits and the annual EiB meeting.
- Development of an overall vision for CGIAR and NARS breeding modernization, validated and discussed by leadership and donors at the 2019 EiB annual meeting.
- Completed BPAT assessments at all CGIAR centers, breeding operations and phenotyping assessments at eight CGIAR centers, and detailed NARS baseline assessments.
- Development of detailed improvement plans by CGIAR centers and some NARS.
- Additional CtEH funding made available for high-impact investments identified by EiB through the improvement plans initiative.
- Embedded market-driven breeding approaches to set better breeding targets as a necessary prerequisite to guide breeding program improvements.
- All major CGIAR breeding software projects coordinated and integrated through EiB module 5.
- Completed hiring of all module leadership positions, and an expansion of capacity to work with CGIAR and NARS breeding teams in alignment of CtEH objectives.
- Completed development of an online Toolbox from which to share Platform outputs.

The completion of the above milestones places EiB as a key source of expertize, coordination and influence in CGIAR and NARS breeding programs, and as an interlocutor between breeding programs and Funders. This enables EiB to work strategically to support delivery on CGIAR system-level outcomes, coherently across the range of breeding activities expressed in its five Modules, and at a cross-CGIAR scale.

1.2.2 Progress by modules

Product design & management (Module 1)

Module 1 has outlined best practice approaches and requirements for breeding programs to out together cross-functional teams of broad subject matter experts and value chain participants to design high-quality targeted product profiles, setting realistic breeding targets to meet the needs of the market, nutrition and gender, including the development of a provisional product profile collection tool and manual to support the exercise. These tools and approaches were promoted in visits and workshops held with CGIAR and NARS breeding programs, which led to the submission of over 200 provisional product profiles and the successful establishment of cross-functional product design teams at seven breeding programs in Africa: CIMMYT Maize, ICRISAT Sorghum, IITA Cassava, KALRO maize highlands and NARO banana and maize.

All CGIAR BPAT assessments were reviewed for inclusion of Module 1 components, which were also included in center level improvement plans, both as a prerequisite for the success of budgeted breeding program improvements but also as an investment target where appropriate. Through CtEH, a grant scheme is being developed to hire product managers to support CGIAR centers and NARS to embed market-driven breeding practices supported by Module 1.

Module 1 also adapted the best practice stage-and-gate concept to public sector breeding program management in order to increase the ability of breeding programs to adopt and deliver on market-driven goals. This was done by introducing concepts from the private sector and forming dedicated teams within CGIAR breeding programs to develop their own stage-gate processes for each different crop class targeted by CGIAR, a process that continues in 2020.

Optimizing breeding schemes (Module 2)

Module 2 develops tools and promotes approaches that apply sound quantitative genetics principles to optimize breeding schemes. The goals of breeding scheme optimization are defined, firstly, in the consensus-based vision for CGIAR and NARS breeding developed with EiB partners in CGIAR, NARS and the private sector, and secondly through the definition of prioritized market-driven breeding goals through Module 1.

In 2019, Module 2 completed hiring of a dedicated leadership, and immediately started work on tools to support breeding programs to systematically document breeding processes as a basis to continuously identify optimizations, both to breeding processes and in the form of investments in breeding program capacities.

Engagement with CGIAR breeding programs to document their breeding schemes began in 2019 and will continue through 2020 and has already resulted in the adoption of a new crossing strategy by the IITA cassava breeding program. Visits were held with breeding programs to discuss alternative breeding schemes based on available tools, opportunities (e.g. partnerships, predictive tools) and logistical constraints (e.g. phytosanitary delays); potential projects will be formalized in 2020 with breeding scheme simulation incorporated. A Community of Practice (CoP) of breeding scheme optimization was also formed to start global discussions on crossing, evaluation and selection strategies.

Genotyping / sequencing tools and services (Module 3)

Module 3 provides access to high-quality and low-cost genotyping services alongside technical support, consultancies and advice to mainstream the routine use of appropriate genotyping for breeding programs to more effectively and efficiently achieve their goals.

The progressive integration of low-density genotyping into CGIAR and NARS breeding operations is evidenced by the increased number of data points generated by the EiB-brokered genotyping service: 3.5 million in 2019 for a total of 7.5 million between 2016 to 2019. This represents a total business volume of US $2 million since 2016, with the result that the low-density genotyping platform is now a financially self-sustaining project that can provide long-term capacity for low-cost and high-quality genotyping within the CGIAR.

For mid-density genotyping, a consultant was hired to scope service providers, leading to four competitive tenders and a final contract awarded to Intertek-DArT to provide a DArTAG custom amplicon solution. A mid-density genotyping pilot in rice (diploid) and potato (tetraploid) crops yielded promising results. Findings from the pilot experiments will be used to help expedite and streamline future mid-density panel development and data reporting.

All Module 3-supported genotyping services are supported by training and logistics to ensure effective application, including six training workshops for new and ongoing users held in South Asia and Arica with ICRISAT as a lead implementing partner. An ICAR-BMGF funded initiative extended Module 3 support in South Asia in terms of access to shared genotyping services and technical support for the development of genotyping strategies in eight crops. To expand support to various crops in Africa, a regional genotyping coordinator was recruited towards the end of 2019.

Quality control (QC) and marker assisted selection (MAS) were mainstreamed in crops identified as priorities by the CtEH initiative (Maize, Rice, Wheat, Cassava) in collaboration with respective lead CGIAR centers. Marker datasheets for all QC and diagnostic markers currently offered under the low-density genotyping service were completed. A database of marker datasheets is being developed for sharing through the EiB toolbox, in addition to the online portals of the respective crop centers.

To further support the integration of genotyping in CGIAR breeding, there was significant Module 3 engagement in the development of center level improvement plans that will drive future activities and investments.

Breeding operations and phenotyping (Module 4)

Module 4 provides ongoing assessment of breeding operations and phenotyping capacities and investment needs in CGIAR and NARS breeding programs in addition to promoting operational excellence practices through training and associated tools. In the future, these activities are expected to result in support for equipment purchasing, service provision, regional shared capacity building and support networks.

In 2019 Breeding operations and phenotyping capacities were assessed at eight research stations across four CGIAR centers, while EiB provided advice on planned investments in operations and phenotyping capacity in CGIAR and NARS improvement plans.

A CGIAR-wide project on operational excellence was first piloted on the CIMMYT campus. Staff received training in Six Sigma techniques, identified bottlenecks within their areas of work and started projects to address them. EiB also organized a visit for CGIAR and NARS cassava and yam breeders based in Africa and Colombia to visit public and private sector breeding programs in Brazil to exchange knowledge of innovative clonal crop breeding techniques and applied operational excellence practices. Plot cost recording tools were evaluated, with software developed by the University of Queensland chosen for adoption by the CIMMYT maize breeding program.

Cross-CGIAR activities included a survey of equipment needs and preferences, and the development of a list of trusted grain quality analysis service providers, in alignment with EiB genotyping and sequencing support. Development of a shared cloud-based image processing and analysis platform began, with the development of protocols for image acquisition and the search for service providers to design a web-based platform.

Bioinformatics, biometrics and data management (Module 5)

Module 5 works to integrate and develop the breeding software and data management tools available to support modern breeding approaches in CGIAR and NARS, in addition to providing training and capacity building. The main focus of development in this period was to integrate field data collection apps (Fieldbook) and genotyping service support apps (the Genomic Open-source Breeding informatics initiative – GOBii, and the Breeding Management System – BMS) alongside data management systems through the Breeding API (BrAPI). Each of the software projects under the umbrella of Module 5 is documenting use cases and collecting requirements to guide future development.

The development of a unified Enterprise Breeding System (EBS) reached a major milestone with the validation of a development and operations pipeline and demonstration of joint deployment of Breeding 4 Results (B4R) and GOBii alongside the EBS service gateway.

The Module 5 community of practice was very active in 2019. In February a Module 5 developers meeting took place to discuss improved collaboration and joint development, followed by a CoP meeting in May to discuss the needs of polyploid crops.

The 7th BrAPI Community Hackathon took place in April, focusing on the release of BrAPI V 2.0, high-throughput phenotyping and agronomy support, and compatibility for external standards; in 2019, the BrAPI project crossed the threshold at which user issues are being resolved faster than they arise. In July a workshop was held to provide in depth training for genomic data modeling and R Shiny development. Finally, 7 sabbaticals were focused on software and app development were funded to increase project coordination and collaboration across institutes.

1.2.3 Variance from Planned Program for this year (max 450 words)

Overall, EiB has evolved from a provider of tools, services and know how to also providing consultancy, coordination and support for improvement and modernization across all of CGIAR breeding programs.

Across all modules, significant time was redirected towards supporting Centers to develop high quality improvement plans, reflecting the reinforced priority that CtEH implies for this outcome. This also had an impact on specific Module activities. In Module 1, additional focus was dedicated to the establishment of a high-quality product advancement meeting, while some outcomes were taken up by other EiB modules and the inclusion of gender data in breeding approached through collaboration with the CGIAR Gender & Breeding initiative. The delayed hiring of a dedicated module 2 lead led to some activities being postponed to 2020. New donor funding became available for Module 3 to expand activities in Africa and Asia, while a more focused approach was adopted to target breeding programs identified as priorities by CtEH donors. In Module 4, a part-time collaborator was hired to advance progress on near-infrared spectroscopy uses and calibration efforts, in addition to identifying nutritional analysis service providers. In Module 5, Work in the area of ontologies has been replaced by an approach for common APIs; Big Data Platform CoPs continue to work on ontologies and participate in their implementation in the development of BrAPI.

1.3 Cross-cutting dimensions (at Platform level)

1.3.1 Gender (max. 750 words)

EiB promotes a market- and demand-driven approach to breeding that requires breeding programs to set targets and assess progress using better socioeconomic/market data, and to incorporate cross-functional input in the breeding process. The EiB-developed product profile template explicitly asks for socioeconomics and gender experts to be listed within the product design team, while EiB is working on specific projects to provide breeding programs tools to incorporate gender. This includes an agreement reached with the Gender & Breeding Initiative in November (GBI) 2019 to develop a pilot study to validate tools for breeders to better integrate gender in product design and development, and another pilot with AbacusBio to apply their economic trait assessment approach, which includes a method to identify different customer segments and needs, in the context of sweetpotato and cassava in Nigeria and Uganda; both projects were led and funded by EiB.

1.3.2 Youth and other aspects of Social inclusion / “Leaving No-one Behind” (max 600 words)

No further activities directly applicable.

1.3.3 Capacity Development (max. 300 words)

In total, 274 CGIAR and NARS staff took place in EiB capacity development activities in 2019 (71 female and 203 male).[1]

108 CGIAR and NARS breeding program staff in Africa (31% female) received training in the development and application of product profiles in breeding programs. The concept and application of stage-gate systems was presented in depth to the 57 CGIAR and NARS breeding program leaders at the EiB 2019 annual meeting, including through role-play exercises.

While all Module 2 training activities begin in 2020, training materials were developed and presented to breeding programs at the end of 2019. A Module 2 community of practice was established with online meetings in two time zones attracting between 20 and 70 participants.

For Module 3, a total of 6 training workshops (3 in South Asia and 3 in Africa) on sampling logistics were conducted along with numerous small focus group discussions, held both virtually and in-person, to support efficient use of genotyping resources.

Across Module 4, three major trainings took place in 2019. In Ethiopia there were 17 attendees at a workshop to analyZe bottlenecks and challenges in implementing quality analysis, mirroring a similar workshop that took place in Asia in 2018 and planting the seed of a future quality analysis CoP. A tour of clonal crop breeding facilities in Brazil was attended by 11 members of the cassava and yam breeding community. Finally, the first Operational Excellence workshop was launched on CIMMYT campus with 19 attendees (42% female).

In Module 5, six participants from CGIAR Centers and IBP completed sabbaticals in CGIAR Centers and higher education institutes to focus on projects such as apps related to BrAPI, crop databases and genotyping workflows. Training on data management and bioinformatics targeted at polyploid crops was provided to 12 participants, while a further 12 participants received training in the application of machine learning and deep learning algorithms for genomic prediction and crop-related data science. Finally, there were 14 participants in a BrAPI hackathon hosted in the Netherlands.

1.3.4 Climate Change

No directly applicable activities.

[1] Participants do not include Module 3 trainings; these trainings took advantage of workshops separately organized by local organizations, with EiB sponsoring some participants.

2. Effectiveness and Efficiency

2.1 Management and governance (max. 300 words)

In 2019, the Steering Committee was expanded to include additional members: four funder representatives and two private sector representatives; this change occurred as a result of CtEH funding. The Expert Advisory Groups were eliminated as all Centers in 2019 have a representative in the Steering Committee.

2.2 Partnerships

2.2.1. Highlights of External Partnerships (300 words)

In 2019, a partnership was formalized with AbacusBio, who will provide economic trait assessment services and advice to CGIAR and NARS breeding program. This has begun with a competitive pilot scheme that was awarded to CIP for the economic assessment of sweetpotato and cassava traits in Uganda and Nigeria. Agreements were made with groups involved in product profiles in Africa, such as the SFSA Demand Led Breeding initiative to harmonize the product profile template and tools used in a broad working group.

To initiate the use of breeding scheme simulation in CGIAR and NARS, the Roslin Institute supports EiB with relevant software and access to staff time to run simulations and communicate with breeding programs. To initiate a mid-density shared genotyping service, contracts were signed with Intertek and DArT as service providers.

EiB has an agreement with IRD for consultancy services in the area of breeding operations and phenotyping, such as image capture SoPs, quality trait analysis and breeding program costing. Experiential Excellence was contracted as an EiB partner in the development of an operational excellence strategy and provision of a workshop curriculum to CGIAR centers.

2.2.2. Cross-CGIAR Partnerships (300 words)

EiB works across the CGIAR to jointly set a vision for breeding program improvement and develop shared means for doing so. For example, this includes the development of shared services and capacity, whether for the system as a whole or for specific crops/regions, as appropriate. In terms of agreed joint projects, in November 2019 an agreement was reached with the Gender & Breeding Initiative (GBI) to develop a pilot study to validate tools for breeders to better integrate gender in product design and development. Most work undertaken by EiB is through CGIAR institutions or in direct collaboration with them.

2.3. Intellectual Assets (max. 250 words)

Have any intellectual assets been strategically managed by the PTF (together with the relevant Center) this year?

To contribute to the Intermediate Development Outcomes (IDOs) of the Agri-Food System CRPs, and thereby to the Systems Level Outcomes (SLOs) of the CGIAR, EiB has implemented the EiB Toolbox, a

knowledge database that allows EiB members, contributors, and third parties, to access different types of Intellectual Assets (IA) in support of breeding activities. The Toolbox gathers IA developed by CGIAR Centers and a variety of partners; and therefore, various licensing schemes. To enhance adequate IA management, the toolbox management team adopted the following measures:

- Content hosted and directly made available through the EiB Toolbox is restricted to content available through standard open licenses or managed as International Public Goods and developed by the EiB Lead Center.
- For content owned by EiB Members to ensure proper attribution, access to the most updated version and the associated license, the Toolbox provides links to the repositories where the IA is made available.

EiB relies on the distribution of good quality knowledge, know-how, information, and tools, with the least possible restrictions. Thus, EiB requires active sharing from a wide community. To balance the need of sharing different types of IA with the stewardship associated with hosting and making IA available, controls in place include the management of the Toolbox through different level of permissions to users and members, with special emphasis on ability to share or access IA in the Toolbox

Indicate any published patents and/or plant variety right applications (or equivalent)

N/A

List any critical issues or challenges encountered in the management of intellectual assets

In addition to those listed in the EiB proposal, a new challenge relates to the ability to stay up to date regarding stewardship associated to the online hosting and dissemination of contents/IA and the raising bar in different regions around the world.

2.4 Monitoring, Evaluation, Impact Assessment and Learning (MELIA) (max. 200 words)

In 2019, EiB was again represented on the CGIAR Monitoring, Evaluation and Learning Community of Practice and was able to contribute to the finalization of a CGIAR MEL Glossary, the interoperability of two planning and reporting systems, the refinement of a quality assurance process for annual reporting, the establishment of a CGIAR MELIA support pack, progress on how to implement the projected benefits indicator, agreement on streamlining planning and reporting on MELIA studies, and the creation of new sub-groups to tackle issues in 2020. The Community of Practice also provided excellent opportunities to share best practices and learning amongst monitoring, evaluation and learning specialists.

- EIB is now fully utilizing MARLO for planning, monitoring research progress, and reporting on platform results.
- The EiB team took part in a project management training aimed at strengthening project management capacity, as well as monitoring, evaluation and learning.

- EiB is taking into account lessons learned from the CGIAR's pilot of performance management standards and is making improvements accordingly to strengthen processes and better document decision making.

2.5 Efficiency (max. 250 words)

Efficiency gains have been reached at the Project Management Level. To date, 243 CIMMYT staff have been trained in Project Management and Monitoring, Evaluation and Learning tools for projects as part of the PM@CIMMYT, an initiative that seeks to provide project management guidance, tools, and support to ensure effective management of projects at CIMMYT. As part of this initiative, staff have access to the Teamwork project management tool, to support task management, communication, and collaboration within projects. Through the metrics collected, we consistently track around 100 active users each month uploading files, adding comments, and assigning and completing tasks; and more than 200 users to date who have accessed the platform over 15 times.

This year, CIMMYT also launched the PM Minimum Expectations, which guide project leaders on the project management practices and tools considered essential to support the implementation projects of different sizes, in alignment with the CGIAR Performance Management Standards and a gap analysis conducted for additional funders. After collecting a baseline and providing support and guidance to projects, the completion rate has continually improved over the course of 2019. Further support will be provided in 2020 and beyond to reach 100% and ensure that new projects are incorporated into this framework as part of our commitment to continuous improvement.

At the Platform level, efficiency gains have also been implemented. Module 1 has used already existing CGIAR initiative on Gender, GBI, and existing Gender expertise in the CGIAR to incorporate Gender in CGIAR product design than hiring out more gender expertise. Furthermore, a private company (AbacusBio) was contracted to carry out economic assessment of traits for pilot CGIAR breeding programs rather than starting from zero to design and implement an economic trait assessment system.

Module 3 has adjusted approaches to training and capacity building via active participation in various donor funded and crop-specific projects. As a result, it was possible to significantly reduce workshop and meeting costs while providing customized logistic solutions to various crop programs based on geography and scale of operation.

Module 4: Phenotyping Tools and Services has provided technical recommendations for Capital Expenditures acquisition (CAPEX). Currently, the CGIAR system does not have either a standard practice nor the experience to develop financial business case for Capital acquisition, in most cases generating underutilized equipment and a high cost of maintenance and depreciation. In 2019, Module 4 reviewed and presented recommendations for critical CGIAR projects, such as Greenhouses and Growth chamber for CIMMYT wheat breeding program in Toluca station, seed process line at ICRISAT headquarter in Hyderabad, etc. The Continuous improvement workshop is the most important initiative related to create efficiency. By adopting the continuous improvement methodologies, the participants could define bottlenecks and wastes on the process. An example of the result is the reduction on the insect infestation in the cold room, which was achieve by defining better protocols and procedures to control.

2.6 Management of Risks to Your Platform (max. 250 words)

A key risk for EiB is the requirement that that breeders must be adequately funded and willing to learn, adopt and adapt documented tools. EiB has therefore developed a key role as interlocutor between breeding programs and funders, using visits to identify bottlenecks to progress, supporting the development of improvement plans to identify strategic investments and supporting activities that will improve the likelihood of investment success, including distinct improvement steps, expected costs, timeframes, roles and responsibilities, and the alignment of these suggested improvements with BPAT recommendations or other recommendations as appropriate. A second key risk is the need for management buy-in, support and leadership of breeding program modernization: while improvement plans were introduced at the 2018 Annual Meeting, the 2019 Annual meeting focused on management buy-in and support for planned changes and priorities.

Module 1 is currently without dedicated leadership (from Q1 2020): this risk has been mitigated by hiring an external headhunter to assist in the recruitment process and sourcing a highly experienced expert consultant to fill the gap while a replacement leader is still to be hired.

2.7 Use of W1-2 Funding (Max. 250 words)

W1/W2 funding has been key in allowing EiB to evolve from a provider of tools, services and know how to also providing coordination and support for improvement and modernization across all of CGIAR breeding. Specifically, W1/W2 funding was essential in EiB hosting the 2019 Annual meeting focused on gaining sponsorship from senior CGIAR leaders, Funders and the SMB. This meeting was also used to achieve consensus on the definition of a modern breeding program including components, structures and functions from key CGIAR, NARs, Private Sector and Funder Stakeholders. Furthermore, W1/W2 funding was important in Low-density shared genotyping service successfully delivered over 3.5 million data points for CGIAR crop networks with an estimated worth of US $1.0M in 2019. Mid-density shared genotyping service was successfully identified, rice (diploid) and potato (diploid) were the first two pilot crops on the platform. Multiple genotyping payment accounts were being established by partner CGIAR centers and various donor funded projects. This was a strong indicator for uptake of shared genotyping services and integration into routine breeding operations.

3. Financial Summary

EiB's financial status and health is strong, in 2019 the Platform had a W1/W2 carry- over of US $2.6M and W3/bilateral a carry-over of US $567,591. The final Plan for W1/W2 was USD $2.0M higher than expected (US $1.7M to US $3.6M), as the additional SD $2.0M came in late in the year (November 2019) EiB was unable to spend these funds in the last two months of 2019. In 2020, EiB expects to fully use the US $2.0M carryover to continue critical activities across CGIAR and NARs centers.

The CteH funds received in 2019 at the request of the donors were not fully distributed to the CGIAR Centers until a strategy was fully endorsed by all donors. In 2019, EiB received additional CteH funds from USAID (US $5.5M) and DFID (US $2.2M). In 2020, EiB will distribute funding to Centers within the high priority crops list established by donors.

Part B. TABLES

Table 1: Condensed list of policy contributions in this reporting year (Sphere of Influence)

Title of policy, legal instrument, investment or curriculum to which CGIAR contributed (max 30 words)	Description of policy, legal instrument, investment or curriculum to which CGIAR contributed (30 words). See guidance for what to cover.	Level of Maturity	Link to sub-IDOs (max. 2)	CGIAR cross-cutting marker score				Link to OICR (obligatory if Level of Maturity is 2 or 3) or link to evidence (e.g. PDF generated from MIS)
				Gender	Youth	Capdev	Climate Change	
N/A								

Table 2: List of Outcome/ Impact Case Reports from this reporting year (Sphere of Influence)

Title of Outcome/ Impact Case Report (OICR)	Link to full OICR	Maturity level	Status
N/A			

Table 3: Condensed list of innovations by stage for this reporting year

Title of innovation with link	Innovation Type	Stage of innovation	Geographic scope (with location)
N/A			

Table 4: Summary of status of Planned Outcomes and Milestones (Sphere of Influence-Control)

Module	Module Outcomes 2022	Sub-IDOs	Summary narrative on progress against each Module outcome this year.	Milestone	2019 milestones status	Provide evidence for completed milestones (refer back to means of verification, and link to evidence wherever possible) or explanation for extended, cancelled or changed	Link to evidence
1	1 Outcome: Member breeding programs have gender and (seed, product) market informed product profiles in place that are aligned with drivers of variety adoption.		Both member CGIAR and NARS breeding programs have been introduced (via workshop trainings) to the process of accurately developing market informed product profiles. All member breeding programs now have, and have submitted provisional product profiles into the Module 1 Product Profile tool. A total in excess of 200 product profiles are in the tool from various member programs across the globe on a wide range of crops.	2019 - (i) Best practices agreed and documented for market/value chain/gender analysis for the purpose of defining product profiles. (ii) Provisional product profiles are in place for all member programs.	Complete	Best practice manual published which is aligned to the product profile tool. Over 200 provisional product profiles submitted to the Product profile tool.	Product replacement strategy manual Product profile tool

				2019 - CGIAR breeding programs with BPAT assessments completed finalize improvement/ optimization plans for (a) current resource levels and (b) current resources plus a one-time grant for capital and training.	Complete	All member breeding programs submitted BPAT assessment reports and Improvement plans. Module 1 reviewed all Improvement Plans from member breeding programs, assessing the resource levels needed for better product design.	Available in internal EiB project management system.
	1 Outcome: CGIAR breeding programs complete optimization plans for (a) current resource levels. The plan appropriate to circumstances will be implemented.	Increase capacity of beneficiaries to adopt research outputs	All CGIAR member breeding programs completed and submitted Improvement plans with current resource level indications. All member Improvement plans reviewed and send back to members with recommendations for implementation.	2019 - (i) Introduction on Operational Excellence across the CGIAR platform as part of the breeding lead workshop (ii) CGIAR research leaders participate in workshops with private sector breeding managers to gain an understanding of modern breeding program management.	Changed	This milestone of Operational Excellence is being handled under Module 4. Training of CGIAR research leaders with private sector breeding managers has been cancelled. The research leaders are being	

						engaged directly under EiB capacity development support.	
	1 Outcome: Member breeding programs have gender and (seed, product) market informed product profiles in place that are aligned with drivers of variety adoption.	Technologies that reduce women`s labor and energy expenditure adopted	Both member CGIAR and NARS breeding programs have been introduced (via workshop trainings) to the process of accurately developing market informed product profiles. All member breeding programs now have, and have submitted provisional product profiles into the Module 1 Product Profile tool. A total in excess of 200 product profiles are in the tool from various member programs across the globe on a wide range of crops.	2019 - (i) Best practices agreed and documented for market/value chain/gender analysis for the purpose of defining product profiles. (ii)Provisional product profiles are in place for all member programs.	Complete	Best practice manual published which is aligned to the product profile tool. Over 200 provisional product profiles submitted to the Product profile tool.	Product replacement strategy manual Product profile tool
	1 Outcome: A standard template and stage gate advancement system for monitoring breeding program performance and implementation of best practices in breeding programs.	Adoption of CGIAR materials with enhanced genetic gains	The Stage Gate advancement system concept was introduced to CGIAR Member breeding programs. Work on coming up with a standard template customized to member breeding programs continues in year 2020.	2019 - Year #1 - (i) Member breeding programs establish a format and process for implementing a stage gate system in their breeding program. (ii) Best practices discussed and developed for appropriate incentivization of breeding team members based on individual and	Extended	Work on these milestones is being carried out in 2020 after the concepts were introduced at elementary level in 2019.	

				breeding team performance relative to overall genetic gain and varietal replacement indicators and metrics. Year 2: (i) Mentor member programs to implement inter-disciplinary team based stage gate advancement system. (ii) Mentor member programs to design and implement individual breeding team member KPIs to align with target breeding program performance metrics.			
	1 Outcome: An effective support service is developed to key national breeding institutes and systems in developing and implementing plans to deliver higher rates of Genetic Gains.	Increased household capacity to cope with shocks	This outcome on NARS breeding institutes is being handled under the NARS Coordination module.	2019 - BMGF and University of Queensland ensure that 4 NARS in SA and SSA are able to conduct BPAT assessments.	Changed		
2	2 Outcome: Identification of high value predictive tools for use in member breeding programs	Increased household capacity to cope with shocks	We have made progress by developing guidelines in several of the topics require to optimize the	2019 - i) Use cases of successful implementation of predictive tools providing value towards breeding for product profiles documented. (ii) Use cases of failed	Extended		

			breeding schemes. There needs to be more work on the focused activities to actively drive change.	attempts of development of predictive tools documented. (iii) Develop and document guidelines for the development, validation and implementation of any predictive tool into the breeding process. Guidelines will include assessment of the repeatability, genetic correlation with the target trait and a cost-benefit analysis.			
	2 Outcome: Documentation and implementation of best practices for trait breeding, aligned with core breeding strategies.	Increase capacity of beneficiaries to adopt research outputs	There was a lack of internal staff and resources to contribute significantly to this outcome in 2019, and it will be prioritized in 2020.	2019 - (i) Members document trait and core breeding pipelines in Toolbox. (ii) A framework of guidelines for integrating trait breeding with core breeding developed, documented and uploaded to the toolbox.	Extended	There was a lack of internal staff and resources to contribute significantly to this milestone in 2019, and it will be prioritized in 2020.	
	2 Outcome: Breeding strategy optimization.	Increased household capacity to cope with shocks	There was a lack of internal staff and resources to contribute significantly to this outcome in 2019, and it will be prioritized in 2020.	2019 - (i) Members document breeding strategy in Toolbox. (ii) Discussion of alternative breeding schemes based on available tools, opportunities (e.g. partnerships, predictive tools) and logistical constraints	Extended	The documentation of breeding programs is not complete. Additional staff time is required to complete this	

				(e.g. phytosanitary delays). (iii) Identification of common questions to be resolved through simulation or further cost-benefit analyses		detailed task. EiB is in the process of recruiting two staff to be based in Africa to work with the core team and member breeding programs to complete this activity.	
	2 Outcome: Source innovative ideas through an incubator	Increase capacity of beneficiaries to adopt research outputs		2019 - Physical and virtual blue sky discussions associated with scientific meetings, to raise and discuss ideas for high-payoff approaches and discuss and design the incubation of project ideas. Allocation of modest resources to validate technologies in the incubator while jointly seeking additional funding to test more substantive “game changers”.			
	2 Outcome: Best practices and tools documented and made accessible to the applied breeding and trait discovery communities		Over 15 resources added/updated in the toolbox across a wide range of topics providing EiB stakeholders with access to data management systems, manuals, training	2019 - i) At least 15 best practices and tools developed/adapted/adopted by various Modules; incorporate new components, upgrade workflows, remove			

	through the web based toolbox.		resources, service providers, recommended equipment lists. Breeding program documentation is proceeding. We are completing the recruitment of two positions to accelerate the needed face to face dialogue with breeding programs to complete this activity. Resources developed by external projects such as GOBII, QAAFI, CIMMYT, KSUadded/updated in the toolbox across a wide range of topics providing EiB stakeholders with access to data management systems, costing tools, manuals and training resources.	obsolete components in collaboration with members; engage students in developing such information. ii) Members document current state of breeding program (iii) Tools from existing projects: Tools developed by Seeds of Discovery, GenomeHarvest, GS-RUSE and other projects submitted with documentation to the toolbox and, as applicable, integrated in Galaxy/Taverna.			
	2 Outcome: Foster toolbox adoption and its dynamic use.	Increased capacity of partner organizations, as evidenced by rate of investments in agricultural research	Forums for module specific and general queries and discussions implemented in the EiB toolbox enabling CoP communications.	2019 - CoPs document "missing" features in trait discovery, mobilization and precision breeding applications, including prioritization of needs across AFS and CoPs, develop use cases around missing features and work with the Bioinformatics Module to support the formation of technical user requirements for new bioinformatics and/or			

				biometrics tools and approaches.			
	2 Outcome: Review mechanisms for tools and practices implemented in web based toolbox to provide electronic community based feedback to EiB recommendations.	Increase capacity of beneficiaries to adopt research outputs	Reviewing of functionality in the toolbox was de-prioritized as strategic review of EiB engagement and prioritization conducted and legal implications of reviews considered. Work on revisons to the toolbox will begin in may 2020 and the review functions will be revisited and worked on at that time.	2019 - CoPs provide initial user-based feedback to documented tools and practices using online review system.			
	2 Outcome: Capacity development resources developed by EiB and reviewed by EiB made available to the community through the web based platform.		Discussions with CIMMYT KM team and an external developer on best practice to integrate the LMS developed and operated by them with the EiB system conducted. Existing high value training documentation and links provided directly via the toolbox as a resource to the EiB community. Strategic review of EiB engagement and prioritization conducted with a 2020 plan to initiate full implementation of LMS within the EiB structure from May 2020 and move old and new E-learning	2019 - (i) Identification of, and links to relevant external e-modules and courses (ii) Collection of member feedback to material provided (iii) Use of materials by AFS own training programs, BecA and other networks iv) Enhanced provision of short training and documentation of end user tools and pipelines through webinars, "YouTube" modules, and implementation manuals.			

			content to that system by end of 2020.				
3	3 Outcome: Use cases and implementation guidelines for MAS, GS and QC applications in forward breeding; tissue sampling systems, and LIMS documented in the toolbox; capacity enhancement through the development of courses and workshops.	Increase capacity of beneficiaries to adopt research outputs	Implementation guidelines for MAS, GS and QC have been modified in light of CtEH development. The newer approach is to support MAS, GS and QC pipelines within the context of modernized and unified breeding network which involves cross modular engagement within EiB with breeding teams to redesign MAS, GS and QC strategies. Generic sampling workflow and data analysis procedures are made available via EiB Toolbox.	2019 - (i) Comprehensive workshop on MAS/GS implementation conducted and planning for various crops applications. (ii) Genotyping application plans integrated into breeding team improvement plan documents	Changed	Partially delivered. Guidelines for MAS, QC and GS are deferred due to CtEH.	HTPG Toolbox page Galaxy Toolbox Page
	3 Outcome: Cost/benefit analysis of MAS and GS workflows are conducted for all EiB supported breeding teams and documented.	Improved access to financial and other services	Due to re-prioritization to support CtEH review, cost benefit analysis was deferred and will be carried out in conjunction with breeding operational review led by Module 4.	2019 - Support to member breeding programs implementing cost-benefit analyses of MAS and GS workflows.	Extended	Pending operational review with prioritization by crop under CtEH	Breeding costing tool
	3 Outcome: Implementation plans developed and executed	Increased capacity of partner organizations,	In light of CtEH reviews, the new direction was to support development of QC, MAS and GS protocols within the context of a	2019 - (i) Cost-effective forward QC and MAS plans developed within context of pipeline redesign, including	Changed	Instead of providing broad guidelines for MAS,	Improvement plans

	for all green-light QC, MAS and GS applications.	as evidenced by rate of investments in agricultural research	modernized breeding approach. I.e. with strong prioritization based on centralization of trait activities within network, leveraging shared genotyping services and implementation of trait stage gates for markers currently available as well as those under development. Marker datasheets for all available trait markers currently available under low density platform was compile and will be made available via EiB Toolbox.	parental genotype characterization. (ii) Cost-effective GS plans, with key parents profiled at high density. (i) Develop use cases and develop/contribute to implementation guidelines for genotyping application in discovery and breeding. (ii) Update and refine existing documents, remove those no longer appropriate/applicable or when reviews are negative. (iii) Contribute to courses and workshops.		QC and GS implementation, a more focused approach by crop was taken. Rice network was the first supported group to develop genotyping guidelines based on redesigned breeding strategy. Maize and wheat plans are currently under development.	
	3 Outcome: Contracts that provide access to cost-effective genotyping/sequencing services and tissue/seed sampling systems.	Improved access to financial and other services	Low density flexi pricing extended for 2019. A total of four service tenders meeting AFS requirements received by June of 2019. Decision was made by Module 3 steering committee to grant mid density service contract to Intertek/ DArT provider for $10 per sample mid density service using DArTAG platform.	2019 - $2.00 SNP genotyped sample; $10 genome profile.	Complete	Low and Mid density service contracts.	

	3 Outcome: Logistics support to effectively utilize genotyping/sequencing services provided to AFS breeding teams so they are able to avail low cost genotyping/sequencing options.	Reduced market barriers	A total of 6 logistic training workshops were held in South Asia and Africa targeting primarily new genotyping users and follow-ups with existing users. Over 3.5 million data points were delivered to AFS network via shared genotyping services with an estimated value of $1.0 million USD.	2019 - 500K SNP genotyped samples; 75K genome profiles. (i) Obtain and aggregate AFS demand for supplies/services. Determine cross-AFS; Genotyping platform preferences, Minimum genotyping quality criteria, Maximum permissible turnaround time for genotyping applications, Minimum number of samples required, Minimum volume of supplies required, Minimum marker conversion rate, Number of markers for marker conversion (ii) Use collated demand information to broker arrangements with service providers and solicit pricing feedback. (iii) Finalize brokering of supplies/services and obtain minimum order commitments. (iv) Obtain feedback from service providers and clients and document issues and feedback to form a review for the Trait Discovery and Breeding Toolbox.	Complete	Annual business volume reported under low density platform.	
					Cancelled		

	3 Outcome: Capacity enhancement.	Increase capacity of beneficiaries to adopt research outputs	This outcome is no longer applicable, some components of capacity enhancement now included in outcome 1,2 and 3.	2019 - Enlist expertise in marker conversion from SSRs/INDELS to SNP-based platforms.		Marker conversion is no longer needed in-house as this task is taken care of by genotyping vendors.	
	3 Outcome: Technology prospecting.	Increased household capacity to cope with shocks	This is no longer relevant due to shift of focus away from discovery to more production focused genotyping to support routine breeding operation. Content for EiB Toolbox is no longer focused on Trait Discovery and Breeding.	2019 - Prospect newer methods/approaches for sampling/genotyping; use inputs from participating AFS, ARIs, private sector partners and technology developers/providers; evaluate costs and constraints for application in discovery and breeding. Prepare annual review paper for posting in the Trait Discovery and Breeding Toolbox.	Cancelled	Discovery breeding is no longer a priority for Module 3. The new focus is to support breeding teams redesign and adopt molecular strategies in breeding operations.	
4	4 Outcome: Best-practice information in Toolbox and engineering support permits appropriate automation and mechanization of field trial and nursery management.	Reduce pre- and post-harvest losses, including those caused by climate change	Breeding Operations and Phenotyping Assessment was conducted in 11 stations, the delivery of these assessments helped breeding programs: 1) to define the improvement plans; 2) implement some quick wins such as, mechanization and procedures;	2019 - (i) Process engineering specialist hired. (ii) A completed diagnosis of the gaps, needs and best approaches to increase plot throughput/reduce costs through HT phenotyping, mechanization, automation. (iii) Identification of existing best practices and equipment	Extended		

			The Breeding Program Digitization equipment recommendation was published in the Toolbox; Basic standard operating procedures for UAV phenotyping was published in the toolbox; Start the adoption of University of Queensland costing tool to support breeding programs, Start the process with CIMMYT maize and IRRI A nutritional quality workshop was conducted in Ethiopia to understand demand and define action plan to provide support to NARs breeding programs Cassava and Yam breeders from CGIAR and NARs centers participated in the EiB-sponsored visit to Embrapa, Syngenta and Tereos Syral in Brazil; Continuous improvement workshop for Bioscience labs in CIMMYT, Mexico;	in use by various programs. (iv) Community of practice for HTP established			

				2019 - (i) Volumes, metrics of cost per plot and heritabilities established as a benchmark. (ii) Members provided with equipment advice and breeding management systems for barcoding and to capture data electronically. (iii) identification of equipment needs, prioritized by abilities to increase plot throughput (iv) Inventory of phenotyping capabilities for secondary traits, associated heritabilities, genetic correlations and costs	Extended	Tools and materials developed has been published in the toolbox	EiB Toolbox homepage
	4 Outcome: Contracts for cost-effective laboratory services for physico-chemical composition and nutritional properties; effective use of these services documented in the Toolbox.	Increased availability of diverse nutrient-rich foods	Started negotiation with vendors and collecting demand from Breeding programs.	2019 - (i) Identify candidates for laboratory services for physico-chemical composition and nutritional properties and assess costs and logistical issues; (ii) send test samples to prioritized laboratories; (iii) develop inventory of NIRS uses and join calibration efforts..	Extended	Tools and materials developed has been published in the toolbox	EiB Toolbox homepage
	4 Outcome: Establishment of best practices for phenotyping and	Increase capacity of beneficiaries to	Training material development began, while the CoP was cancelled.	2019 - (i) Prioritization and investment in Platform interventions including online	Changed	We changed because we understood that	

	environmental analysis through a community of practice.	adopt research outputs		learning tools and videos. (ii) Liaise with private sector and ARIs to access current state-of-the-art technology. (iii) (Phenotyping).		CoP wouldn't be efficient.	
	4 Outcome: Support services from ARIs for experimental design and analysis of precision and high- throughput phenotype data.		We will provide support based on product development pipeline, depending on each breeding scheme	2019 - Support services from ARIs for experimental design and analysis of precision and high- throughput phenotype data.	Changed	We will provide support based on product development pipeline, depending on each breeding scheme	
	4 Outcome: Support services from ARIs for GxExM analysis and Genotype-to-Phenotype predictions.	Increased household capacity to cope with shocks	This outcome will transfer to Module 2.	2019 - Consult with breeders and ARIs to identify approaches for GxE analysis – Priority setting.	Changed	It needs to go to module 2.	
5	5 Outcome: A common breeding API to integrate bioinformatics/biometrics tools and databases. Develop tools to facilitate modular and adaptable breeding pipelines and coordinate the development and	Increased capacity for innovations in partner research organizations	BrAPI is continuing to expand API definitions and adoption.	2019 - Workflow implemented for the case studies identified in Year 1.	Complete	In initial use cases around sample tracking and field data collection are moving forward with the development of	Coordinate Field Book Sample tracker

	implementation of a common BrAPI.					sample orchestrator and the BrAPI compliant PhenoApps. In a big step towards improved coordination and sustainability the GOBii development team will begin working as part of the EBS project in 2020.	
	5 Outcome: BMS, B4R, GOBII, Cassava/Sweet potato/Musa/YamBase and other breeding informatics systems are fully functional in all AFS breeding networks.	Increase capacity of beneficiaries to adopt research outputs	BrAPI is continuing to expand API definitions and adoption. Several breeding applications are now BrAPI compliant and being utilized with major breeding management systems.	2019 - Develop sustainable maintenance and life cycle plans for critical systems.	Complete	All systems developed are open-source with the code available online(with the exception of EBS which is still in early stages of development).	IBP Github Breedbase BrAPI Github GOBii Github Docker
	5 Outcome: New databases and tools to complement					Several BrAPI compliant	BrApps (Brapi.org)

	and expand the usefulness of existing bioinformatics initiatives aligned with prioritized breeding use cases.			2019 - Initiate development or acquisition of new database and tools to address key gaps.		applications have been developed and are available for free download.	Flapjack Github
				2019 - (i) Existing databases and tools assessed and updated (ii) Initiate development or acquisition of new database and tools to address key gaps. (iii) Implement strategic sustainability support.	Complete	All projects have made significant progress in the last year. BMS and EBS have developed and submitted 5-year road maps. The GOBii and EBS dev teams have been restructured to ensure more alignment.	Five-year roadmaps will be made available pending a redesign of the Module 5 page on the EiB website.
	5 Outcome: Metadata and data standards documented and regularly updated. Define and implement metadata and data standards to facilitate data flows between tools and data sharing.	Increased access to productive assets, including natural resources	Currently BMS is deployed in multiple centers for multiple crops, B4R is deployed and adopted at IRRI, and BreedBase has been adopted for RTB crops. EBS will be deployed to CIMMYT and IRRI in 2020 with plans to replace BMS in a phased approach.	2019 - (i) Strategy to manage and integrate meta-data.	Complete	This is being addressed through BrAPI definitions and the ontology CoP of the Big Data platform. Feedback from ontology experts is incorporated through BrAPI	BrAPI specifications BigData Ontologies COP

						hackathons and oversite of the BrAPI standard. Given the BrAPI initiative Module 5 will follow the lead of the Ontology CoP.	
	5 Outcome: A community of practice that provides access to bioinformatics and biometrics advice, services and resources.	Increased capacity of partner organizations, as evidenced by rate of investments in agricultural research	Several breeding applications are now BrAPI compliant and being utilized with major breeding management systems.	2019 - (i) Protocols, manuals, best practices based on recommendations of the CoPs developed and uploaded in Toolbox. (ii) Core operational guidelines updated as necessary. (iii) Common BrAPI updated as necessary. (iv) Capacity development strategy updated as necessary. (v) Review sustainability issues of selected tools. (vi) Support capacity building and the evaluation of new bioinformatics and biometrics tools and approaches in collaboration with distinct user groups and use cases prioritized in Modules 2-4. (vii) Training workshops for biometricians in CGIAR target countries to expand the number of resource persons.	Complete	Reports have been developed and will be made available in the redesigned Module 5 webpage.	

				(viii) Broker access to proprietary software and computational capacity on a pay-per-use basis.			
	5 Outcome: Advance sustainable deployment and maintenance of tools and applications.	Increased access to productive assets, including natural resource	Several BrAPI compliant applications have been developed and are available for free download.	2019 - (i) Deployment plans implemented for Tier 1 crops. (ii) Support services for Tier 1 crops in place.	Complete	All systems developed are open-source with the code available online(with the exception of EBS which is still in early stages of development). All systems are moving towards docker deployment. EBS will deploy	IBP Github Breedbase Github BrAPI Github GOBii Github Docker

Table 5: Numbers of peer-reviewed publications from current reporting period

	Number	Percent
Peer-Reviewed publications	1	100%
Open Access	1	100%
ISI		0.0%

Table 6: Participants in CapDev Activities

Number of trainees	Female	Male
In short-term programs facilitated by CRP/PTF	73	201
In long-term programs facilitated by CRP/PTF	0	0
PhDs	0	0

Table 7: Key external partnerships

Lead Module	Brief description of partnership aims (30 words)	List of key partners in partnership. Do not use acronyms.	Main area of partnership (may choose multiple)
1	Partnership with AbacusBio to pilot a full-scale economic assessment of Sweetpotato & Cassava traits in Uganda and Nigeria, to evidence economic importance of traits to the pilot breeding programs.	• Abacus - Abacus Bio	• Research
1	Partnership with Syngenta Foundation for Sustainable Agriculture (SFSA, Demand Led Breeding) to develop a common harmonized too for product profile development, and later a common stage and gate system	• Syngenta Foundation for Sustainable Agriculture	• Research
2	The Roslin Institute is our main ally to deliver breeding scheme optimization capacity. They will provide FTEs to run simulations and communicate with the breeding programs.	• The Roslin Institute	• Delivery
2	Corteva provides support for improving the strategy by sharing knowledge on how they have done similar projects and provide	• Corteva	• Capacity Development

	technical and feet on the ground when required.		
2	Bayer provides support for improving the strategy by sharing knowledge on how they have done similar projects and provide technical and feet on the ground when required.	• Bayer BioScience Pvt. Ltd.	• Capacity Development
2	KWS provides support for improving the strategy by sharing knowledge on how they have done similar projects and provide technical and feet on the ground when required.	• KWS - Kenya Wildlife Services	• Capacity Development
3	Mid-density shared genotyping service	• Intertek • DArT - Diversity Arrays Technology	• Research

Table 8: Internal Cross-CGIAR Collaborations

Brief description of the collaboration	Name(s) of collaborating CRP(s), Platform(s) or Center(s)	Optional: Value added, in a few words
The EiB-GBI partnership, a partnership on piloting and integration of Gender into the product design tool and approach of module 1. The Gender in Breeding Initiative (GBI) is a CGIAR initiative on incorporation of Gender in CGIAR breeding programs. GBI is hosted in CIP.	Gender & Breeding Initiative (GBI) – Led by RTB	This will add value to varieties coming out of breeding programs if they are all encompassing to increase gender preferences.
This partnership allowed Module 1 to provide product design capacity building training to the GLDC's International Training course on "Breeding approaches for enhancing genetic gains in Grain Legumes and Dryland Cereals". The training course brings together NARS breeders from Africa and Asia.	GLDC	This partnership allowed Module 1 to provide product design capacity building training to the GLDC's International Training course on "Breeding approaches for enhancing genetic gains in Grain Legumes and Dryland Cereals"

Table 9: Monitoring, Evaluation, Learning and Impact Assessment (MELIA)

Studies/learning exercises planned for this year (from POWB)	Status	Type of study or activity	Description of activity / study	Links to MELIA publications
N/A				

Table 10: Update on Actions Taken in Response to Relevant Evaluations

Name of the evaluation	Recommendation number (from evaluation)	Text of recommendation (can be shortened)	Status of response to this recommendation	Concrete actions taken for this recommendation.	By whom (per action)	When (per action)	Link to evidence
N/A							

Table 11: Examples of W1/2 Use in this reporting period (2019)

Please give specific examples, one per row (including through set aside strategic research funds or partner funds)	Select broad area of use of W1/2 from the categories below - (drop down) Selecet only one category.
N/A	

Table 12: Platform Financial Report (In Thousands of US Dollars)

	Planned Budget 2019*			Actual expenditure*			Difference*			Comments
	W1/W2	W3/Bilateral	Total	W1/W2	W3/Bilateral	Total	W1/W2	W3/Bilateral	Total	
1 - Breeding Program Excellence	US$ 1,052.00	US$ 1,869.00	US$ 2,921.00	US$ 381.00	US$ 1,689.00	US$ 2,070.00	US$ 671.00	US$ 180.00	US$ 851.00	No Comments.
2 - Breeding Scheme Optimization	US$ 569.00	US$ 748.00	US$ 1,317.00	US$ 372.00	US$ 665.00	US$ 1,037.00	US$ 197.00	US$ 83.00	US$ 280.00	No Comments.
3 - Genotyping/sequencing tools and services	US$ 602.00	US$ 440.00	US$ 1,042.00	US$ 260.00	US$ 391.00	US$ 651.00	US$ 342.00	US$ 49.00	US$ 391.00	No comments.
4 - Phenotyping tools and services	US$ 493.00	US$ 836.00	US$ 1,329.00	US$ 72.00	US$ 743.00	US$ 815.00	US$ 421.00	US$ 93.00	US$ 514.00	No Comments.
5 - Bioinformatics and data management tools and services	US$ 825.00	US$ 748.00	US$ 1,573.00	US$ 283.00	US$ 665.00	US$ 948.00	US$ 542.00	US$ 83.00	US$ 625.00	No Comments.

Platform Management & Support Cost	US$ 575.00	US$ .00	US$ 575.00	US$ 191.00	US$ .00	US$ 191.00	US$ 384.00	US$ .00	US$ 384.00	No Comments
Platform Total	**US$ 4,116.00**	**US$ 4,641.00**	**US$ 8,757.00**	**US$ 1,559.00**	**US$ 4,153.00**	**US$ 5,712.00**	**US$ 2,557.00**	**US$ 488.00**	**US$ 3,045.00**	

Part C. Annexes

Table Annexes

FP	Detailed Annex
1: Breeding Program Excellence	
2: Breeding Scheme Optimization	
3: Genotyping/sequencing tools and services	
4: Phenotyping tools and services	
5: Bioinformatics and data management tools and services	
TB: Toolbox	