EiB CGIAR Platform Plan of Work and Budget (POWB)

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AfricaRice	
Bioversity International	
International Center for Tropical Agriculture (CIAT)	
CIMMYT	
International Potato Center (CIP)	
Cornell University	
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	
Diversity Arrays Technology	
DuPont Pioneer	
Global Crop Diversity Trust (GCDT)	
Food and Agriculture Organization of the United Nations (FAO)	
International Center for Agricultural Research in the Dry Areas (ICARDA)	
Institut National de la Recherche Agronomique (INRA)	
International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)	

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International Institute of Tropical Agriculture (IITA)	
International Livestock Research Institute (ILRI)	
Integrated Breeding Platform (IBP)	
International Rice Research Institute (IRRI)	
James Hutton Institute	
John Innes Centre	
Nottingham University	
Oregon State University	
Queensland University	
Swedish University of Agricultural Sciences (SLU)	
Syngenta	
United States Department of Agriculture (USDA)	
Wageningen University	
World Agroforestry Centre (ICRAF)	
WorldFish	

1. Expected Key Results

1.1 Adjustments/ Changes to Your Theories of Change:

There was no change to the Theory of Change. The 2022 Platform outcomes within Table A have been altered so that each Module is aligned with a single overall outcome rather than multiple outcomes.

1.2 Expected Platform Outputs:

In 2018 and through expanded budgetary support by the Bill & Melinda Gates Foundation (BMGF), EiB will fill several new positions (Module 1: Breeding Program Management Specialist; Product Manager, NARS Linkage Coordinator; Module 2: Breeding Program Optimization Specialist; Module 3: Genotyping Applications Specialist; Module 3: Logistics Manager; Module 4: Process Engineering/Automation/ Mechanization Specialist; Module 5: System Analyst).

To establish clearly defined interrelations between EiB and agri-food system CGIAR research program (AFS CRP) breeding teams, in 2017 EiB developed a membership concept. Beginning 2018, EiB personnel and EiB-contracted consultants will engage with CGIAR and national agricultural research system (NARS) member teams, both virtually and through on-site interactions, to enable them to increase rates of genetic gain with seven core areas of focus: (i) Clear product profiles; (ii) A stage gate process "from breeding cross-to-farm"; (iii) Appropriate breeding schemes commensurate with level of investment, best practices and tools available; (iv) Routine genetic gains assessment; (v) Lower-cost, better targeted genotypic data supporting larger, more cost-effective programs; (vi) Lower-cost, better targeted phenotypic data supporting larger, more cost-effective programs; (vii) Bioinformatics tools that support automation, data integration and decision making.

Member breeding teams will begin to characterize their breeding programs to better understand their current ways of working, challenges, and opportunities to maximize rates of genetic gain. For many centers, the Breeding Program Assessment Tool (BPAT) will serve as a solid foundation to better understand strengths and weaknesses, and develop their specific ambition for change. The same characterization framework will be used to make breeding targets more transparent and monitor improvements across different species over time. This community-driven effort implies a significant change to the largely independent operation of breeding programs within the CGIAR during the last 50 years. It will require engagement at the level of breeding teams and with center/AFS CRP leadership.

The Toolbox V1.2 will become publicly available online. It hosts best-practice tools and approaches, supports community interactions and provides access to the Platform learning management system (LMS). By now, all Modules have identified and prioritized best practice and use case documentation that will be developed in collaboration with AFS contributors and the private sector to support breeding program improvements. Such information includes, for example: templates for product profiles and cost-benefit analyses; best practices for genetic gains assessment; decision support for the use of forward markers, genomic selection or secondary traits in breeding programs; training materials for how to capture data associated with breeding program performance or the use of managed stress environments; and information on the effective use of external service providers.

During 2017 the capacity development strategy (synonymous with the actual implementation strategy of EiB interventions among member teams) was aligned with a range of existing projects (such as the High Throughput Genotyping Project (HTPG) and the Genomics and Open-source Breeding Informatics Initiative (GOBii)) to focus on member breeding teams at four regional hubs: (i) South Asia, (ii) Eastern and Southern Africa, (iii) West and Central Africa, and (iv) Latin America. Beyond making tools and best practice information public through the Toolbox, the tools, materials and approaches will be used and fine-tuned as part of implementation workshops conducted in collaboration with member teams at these four hubs.

During 2018, the Platform will continue its efforts to link up AFS-related breeding programs and germplasm banks with external providers for lower cost genotyping/sequencing applications and equipment that support higher plot throughput. Building up on a landscape analysis of bioinformatics resources used in AFS-affiliated breeding programs, previously fragmented bioinformatics initiatives now pursue a joint strategy to develop inter-compatible software tools and databases aligned with prioritized use cases. Advice will be given to member teams regarding which existing bioinformatics resources may best fit their needs.

1.3 Plans by Platform Modules:

A. Module 1. Excellence in Breeding

The 2018 Plan for Module 1. **Excellence in Breeding** is as follows:

- Benchmark the product advancement process, the variety/breed replacement concept and the ability to assess genetic gains as part of the breeding and trialing program across CGIAR breeding programs.
- Develop best practices for genetic gain assessment, and the finalize product advancement process and the variety/breed replacement concept in collaboration with member breeding programs.
- Create and establish a standardized variety/breed advancement process and standard product profiles with CGIAR/AFS CRP management and CGIAR/AFS CRP breeding program leaders as part of members' breeding programs.
- Conduct systematic visits to key CGIAR sites or AFS CRP meetings to promote a more uniform approach to breeding program management among CGIAR and national agricultural research and extension system (NARES) partners. As face-to-face meetings are not always possible, EiB Module 1 will need to assess alternative means of advancing Module 1 learnings.
- Train members to collect and assess data related to the progress of breeding programs. Establish an annual update of program assessment and metrics implemented as part of the members' annual variety/breed advancement process.
- Develop a process manual and product/outcome-driven strategy and capture that strategy in the EiB Module 1 Toolbox section.
- Improve understanding of the BPAT assessment tool; develop a preliminary list of recommendations for strategic investments across the CGIAR, with aggregate analysis provided to the Funders Group. This will be supported by the BPAT assessment, EiB Module 1 gap analysis and common breeding program needs.
- Memorialize the 2017/2018 developments. This includes but is not limited to the active product pipelines linked to the breed/variety that has been identified for replacement and a gap analysis of current breeding programs. All databases should be searchable within and outside of the CGIAR system.
- Make NARES programs aware of the EiB agenda and benefits. Select 2-4 NARES partner breeding programs to become EiB members and work alongside CGIAR members.
- Conduct a workshop with socio-economists and seed specialists to provide input on germplasm-related product assessment.

B. Module 2. Trait Discovery and Breeding Tools and Services

The 2018 Plan for Module 2. **Trait Discovery and Breeding Tools and Services** is as follows:

- Identify and hire a Module lead/ Breeding Program Optimization Specialist.
- Work with individual breeding programs (and the BPAT) to document a detailed description of the current breeding scheme and all associated data relevant to the performance of that scheme (cost of operations, data quality, heritabilities, correlations between test sites and

target population of environments, correlations between secondary traits and primary traits, etc.).

- Develop training materials, to be made available through the Toolbox, that describe how to capture data associated with breeding program performance.
- Through regional visits and virtual interactions, engage with individual CGIAR member breeding programs to identify ambitions for change to eventually inform individualized plans for trade-off and simulation analyses that maximize rates of genetic gains.
- Develop the specifications for simulation tools to enable breeders to make trade-off analyses and breeding decisions with a higher likelihood of success; coordinate with the development team.
- Demonstrate a high level of collaboration with the BMGF Computer Simulation Modeling Team, including BMGF support to BPAT, to develop more sophisticated breeding decision support tools that enable breeders to consider alternate decision pathways in response to complex breeding schemes.

C. Module 3. Genotyping/sequencing Tools and Services

The 2018 Plan for Module 3. **Genotyping/sequencing Tools and Services** is as follows:

- Document use cases, decision trees and implementation guidelines for marker-assisted selection (MAS), genomic selection (GS) and quality control (QC) in forward breeding, to be hosted by the Toolbox. In addition, document tissue sampling systems, laboratory information management systems (LIMS), and interactions with service providers in the Toolbox.
- Engage individual CGIAR and NARS member teams in regional courses and workshops on the cost-effective, mainstreamed application of MAS, GS and QC within their particular breeding schemes. Receive feedback from members on how to further streamline processes with genotyping/sequencing service providers and through the improvement of bioinformatics tools.
- Conduct cost/benefit analysis for MAS and GS workflows for potato, rice, and maize in interaction with the respective CGIAR breeding teams in support of optimizing breeding approaches.
- Establish and initiate a monitoring framework to evaluate the percentage of stage 3.1 equivalent test candidates that are being genotyped.
- Develop and initiate a strategy to provide Practical Haplotype Graph (PHG)-level bioinformatics for all CGIAR crops supported by EiB.
- Establish a new contract with Intertek to provide access to cost-effective genotyping/sequencing services and tissue/seed sampling systems; 50,000 samples will be available for genomic selection.
- Provide logistics support to CGIAR and NARS breeding teams for the effective use of low cost genotyping/sequencing services. Specifically, a needs forecast for high-throughput genotyping, GS, and QC will take place and 400,000 samples will be available through Intertek lab.
- Further streamline processes with genotyping/sequencing service providers (Intertek in particular) including in collaboration with Module 5.
- Fully incorporate the HTPG project (which is currently independently managed) into EiB.

D. Module 4. Phenotyping Tools and Services

The 2018 Plan for Module 4. **Phenotyping Tools and Services** is as follows:

- Recruit a mechanical/automation engineer to: (i) complete the development and implementation of barcoding and data digitalization in all member breeding programs; (ii) develop an action plan to increase the level of mechanization and automation in member

breeding programs; (iii) carry out regional workshops on Module 4 tools; and (iv) develop approaches to increase plot throughput/reduce costs through mechanization, automation, and high-throughput phenotyping.

- Conduct expert workshops on how to join efforts on quality analysis (grain, crop residues), towards solutions to the increasing demand for such phenotypic assessments, aiming possibly at the development of regional hubs for quality analysis, and networking efforts in terms of near-infrared spectroscopy (NIRS) calibration.
- Document successful use cases (including learnings and failures) in the Toolbox: NIRS for assessing stover quality; NIRS & X-ray fluorescence (XRF) calibrations as part of HarvestMaster automation; drone-based approaches in phenotyping; deciding what makes a secondary trait useful for breeding; approaches to use historical information for genotype-environment interaction (GxE) analysis; purposes and use of managed stress environments in breeding.
- Establish data management approaches and ontologies needed for data-intensive phenotyping approaches and methods.
- Interact with private sector partners: (i) to develop a complete harvest package including NIRS assessment, and (ii) for assistance to data processing of high-throughput phenotyping images.
- During regional member workshops, hold discussions with members regarding approaches to target environment definition, use of managed stress environments, the development of partnership networks for strengthening multi-environment trialing systems, and opportunities to acquire tested equipment at lower prices.

E. Module 5. Bioinformatics and Data Management Tools and Services

The 2018 Plan for Module 5. **Bioinformatics and Data Management Tools and Services** is as follows:

- Map breeding applications for each software currently used by AFS-affiliated breeding programs to the Architecture of the "Enterprise Breeding Management System" to work towards a CGIAR-wide aligned bioinformatics strategy.
- Through regional workshops, online consultations and the community of practice (CoP), support member programs in making informed decisions on breeding software implementation, among those currently available.
- Execute consultancies for: (i) the establishment of successful models for sustainable support for open-source software; (ii) genotypic and germplasm ontology mapping.
- Coordinate the Breeding API (BrAPI) initiative and initiate joint development processes for use cases involving two or more applications/databases, focusing in 2018 on: (i) sample tracking for genotyping, and (ii) field data collection apps.
- Establish effective approaches within the EiB Toolbox and external platforms (GitHub and DockerHub) for sharing/distribution of software and best practices, such as by the EiB Toolbox containing information on instances of the Galaxy platform.
- Provide access to bioinformatics and biometrics advice, services and resources, as requested by members.
- Capacity development and CoP engagement through several workshops: (i) BrAPI Hackathon; (ii) R & Shinny, Galaxy, Advanced statistical modeling; (iii) PhenoharmonIS; (iv) genotyping and phenotyping use case development and validation; (v) analytics pipeline.
- Support short-term sabbaticals of junior biometricians, bioinformaticians and data managers to centers of excellence (CGIAR or advanced research institutes (ARIs))

F. Toolbox

The 2018 Plan for the **Toolbox** is as follows:

- Upload initial best practice documentation and associated tools developed within the individual Modules and made available to EiB members in V1.2 of the Toolbox, assess their use and

Module needs and improve Toolbox accordingly, leading to updated versions of the Toolbox.
- Develop basic course building components available for Module Leader testing as a Beta version in V1.2 of the toolbox.
- Integrate LMS developed in 2017 into the Toolbox interface.

1.4. Cross-cutting Dimensions

EiB activities are cross-cutting across all AFS breeding activities. There will times where EiB works closely with individual breeding teams from one specific crop, but this will be on cross cutting issues and addressed by implementing cross cutting solutions.

1.4.1 Gender, Youth and Capacity Development:

Gender considerations are most vital to EiB in the area of establishing product profiles that lead to addressing needs for varieties and breeds by men and women farmers. This priority has also been identified in the Gender in Breeding Initiative, and EiB will build up on the insights from the Gender in Breeding Initiative to achieve this. The overall composition of EiB users is dependent on the composition of CGIAR and NARS member breeding teams. The gender composition will become apparent during 2018 as breeding teams register as members to EiB.

With the overall Theory of Change targeting capacity development for breeding program optimization and the use of modern tools, young people are expected to be inspired by the EiB agenda and engage as contributors. Capacity development will occur through training workshops, one-on-one consultation, training material made available through the Toolbox, hands-on experience generated as a result of EiB making new tools and services available to the AFS breeding community, and the facilitation of exchange programs with between experts and novices. Distinct 2018 activities target young/junior staff, such as short-term sabbaticals within Module 5.

1.4.2 Open Data and Intellectual Assets:

The Toolbox will be the main avenue for sharing EiB open data and intellectual assets. It is being divided between (i) a public area and (ii) a restricted area accessible to contributors and members only. Anybody is free to sign up as a contributor meanwhile members need to sign a membership agreement. The public area will contain all capacity development material, best practice documentation, access to software and databases, and other tools. While all EiB funded components will be made open access, it will respect license restrictions of external contributors. Contributors' sites will host preliminary versions made accessible for testing or review by registered contributors. Members' sites will contain member specific information such as individual breeding program information, breeding schemes and genetic trends assessments which will be viewable by other members. Members' information will be shared in an aggregate manner with the public. During 2018, the Toolbox will be further developed based on needs identified in the individual Modules and use by the wider community.

2. Planning for Platform Effectiveness and Efficiency

2.1 Platform Staffing in 2018:

At the beginning of 2018 EiB had the following staff:
- Michael Quinn (1.0 FTE)
- Brenda Bautista (1.0 FTE)
- Solomon Hailemelekot Sirak (1.0 FTE)
- George Kotch (0.25 FTE)
- Sarah Hearne (0.2 FTE)
- Mike Olsen (0.2 FTE)

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- Vincent Vadez (0.2 FTE)
- Kelly Robbins (0.2 FTE)
- Peter Selby (1 FTE)

In addition, Itzel Saldivar Lemus (Legal & Open Access), Shaylyn Gaffney (Monitoring and Evaluation (M&E) / Results-Based Management Framework) and Alejandro Silva Monroy (Finance) provide part-time services to EiB.

During 2018 EiB will also hire the following full-time positions:

- Module 1: Breeding Program Management Specialist (1 FTE)
- Module 1: Product Manager (1 FTE)
- Module 1: NARS Linkage Coordinator (1 FTE)
- Module 2: Breeding Program Optimization Specialist (1 FTE)
- Module 3: Ng Enghwa, Genotyping Applications Specialist (currently associated with HTPG; 1 FTE)
- Module 3: Logistics Manager (currently associated with HTPG; 1 FTE)
- Module 4: Process Engineering/Automation/Mechanization specialist (1 FTE)
- Module 5: System Analyst (initially associated with IBP; 1 FTE)

2.2 Financial Plan for 2018, including use of W1/2:

During 2017, EiB was able to increase its budget from US$ 2 million to US$ 6 million annually due to the Oct 2017 – Sep 2022 contribution from BMGF. Overall US$ 10 million is required annually as a minimum to implement the EiB concept (Base Budget), hence EiB is currently at 60% of base funding. W1&W2 support will sponsor salaries and activities associated with current positions and all Toolbox-related activities. BMGF will sponsor salaries and activities associated with the new positions hired in 2018. Costs of workshops will be shared between W1&W2 and the BMGF grant. The BMGF grant will also support consultancies on: (i) Product concept, variety replacement strategy, variety advancement process, program optimization; (ii) Breeding program optimization; (iii) Cost-benefit analysis and use of genotyping in distinct breeding programs (iv) Mechanization/equipment/GPS specialists; (v) Use case analysis and biometrics advice. It will fund the continuation of several currently isolated projects that are aligned with the EiB mandate, in particular the HTPG project currently executed by ICRISAT, the Breeding Management Software (BMS) development currently executed by IBP, and the Genomic and Open-source Breeding Informatics Initiative currently executed by Cornell University.

2.3 Collaboration and Integration

2.3.1 New Key External Partnerships:

EiB is working toward developing external partnerships with Monsanto, Pioneer, Syngenta, KWS and Limagrain. These partnerships are being sought to provide pro-bono consultancy support to distinct EiB members implementing best practices developed as part of EiB.

Other relationships such as with the University of Queensland (UQ) and IBP will be strengthened. The relationship with UQ will assist EiB to understand – through the BPAT – the improvements that are required within each breeding program. The relationship with IBP will enable EiB to further develop the BMS as standalone (for NARS and smaller CGIAR programs) and enterprise systems software (for breeding programs implementing genomic selection and other data intensive applications).

EiB will continue the relationship with Intertek that has been established through the HTPG Project and this relationship is likely to strengthen as EiB incorporates HTPG in its portfolio. Through this

relationship HTPG and EiB are able to offer low cost genotyping for forward marker assisted selection and quality control purposes for EiB members and users. EiB will also be exploring options for providing low cost whole genome profiling for genomic selection applications. This will involve consideration of a number of service providers, including Diversity Arrays Technology (DArT) with whom EiB has already established a relationship through Module 5.

The relationship with Cornell University will continue to strengthen, particularly as EiB begins to work more closely with GOBII and the Next Gen Cassava project.

2.3.2 New Contributions Expected from the Platform:

Consistent with the above point, it is expected that Monsanto, Pioneer, and Syngenta in particular, potentially also alongside KWS and Limagrain, will provide significant contribution in the way of self-sponsored consultancy support services. Other service providers will be considered to provide whole genome profiling which may also result in additional contributions. Private sector collaboration will be sought as part of Module 4: (i) to develop a complete harvest package including NIRS assessment, and (ii) for assistance to data processing of high-throughput phenotyping images.

2.3.3 New Cross-Platform Interactions:

EiB will engage with the Gender and Breeding Initiative in particular to enable member breeding teams to implement product profiles that consider gender-disaggregated market needs. This will result in variety replacement strategies within the CGIAR that consider the needs of both men and women. It is assumed that the Gender and Breeding Initiative has collected information in terms of understanding the breeding output needs of women and so it is expected that this interaction will result in better quality product profiles. In terms of reciprocity, EiB will provide the Gender and Breeding Initiative with a pipeline for impact that it may not otherwise have.

EiB will continue to interact with both the Big Data Platform and the Genebanks Platform as described in the three Platform proposals. The Expert Advisory Group includes distinct members that participate in two Platforms (Genebanks and EiB; or Big Data and EiB) which effectively enables to identify areas of common interest, synergies and responsibilities.

2.3.4 Expected Efforts on Country Coordination:

In 2018, the Platform will host trainings/workshops for Platform members from CGIAR centers and 2 - 4 NARS programs in the Asia, Africa, and Latin America regions. This work will align and strengthen efforts of AFS CRPs.

2.4 Monitoring, Evaluation, and Learning:

Monitoring will focus on milestones, outputs, and output- and outcome-based indicators. During 2018, members will begin to use the Toolbox to document standardized information in a members-only area which makes progress in implementing improvements visible, aligned with the templates and approaches for breeding program management as finalized in Module 1. Also, the part-time Platform M&E specialist will work with the AFS CRPs and the CGIAR Monitoring Evaluation and Learning (MEL) workgroup, to align indicators and reporting for them to become more widely known and implemented tools.

The Platform Steering Committee, Module Leaders and the Contributor meeting will have important roles to play in overseeing the systematic monitoring, analysis and transparent reporting of user feedback, and ensuring that management decisions are made accordingly.

3. Platform Management

3.1 Management of Risks to Your Platform:

In 2017, a member agreement was introduced to formalize the collaboration between EiB and AFS breeding programs. Experiences in 2018 will show to what extent the membership agreement and associated EiB activities (now solely focused on members) incentivize development and implementation of best practices by EiB member breeding programs. In addition, the progress and outcomes around the CGIAR Funders Initiative during 2018 will be crucial to ensure buy-in of funders and alignment over CGIAR breeding program evolution and funding requirements.

3.2 Platform Management and Governance:

Changes in the organization of the EiB have taken place. The focus of Module 2 has been broadened from "Trait Discovery and the Toolbox" to "Optimization of Breeding Schemes" with effective implementation of trait pipelines as one component. It has further been clarified that the Toolbox will support all five modules and will exist as its own entity within the Platform.

TABLES

Table A: Planned Milestones

| Module | 2022 Platform outcomes (from proposal) | Milestone* | Budget | | Assessment of risk to achievement** (L/M/H) | Means of verification |
			W1/2	W3/bilateral		
1: Breeding Program Excellence	Creation of clear product profiles, a stage gate process "from breeding cross-to-farm", and appropriate breeding schemes commensurate with level of investment, best practices and tools available results in accelerated breeding cycles and rates of genetic gain per unit time that are 25% greater than current approaches.	1. Members document current product profiles. 2. Members agree on standardized templates and approaches for defining and further improving product profiles. 3. Member breeding programs establish a format and process for implementing a stage gate system in their breeding program. 4. Review of current approaches to assessing rate of genetic gains within member programs. 5. Benchmark and plan which CGIAR breeding programs have BPAT assessments completed. 6. Center leadership and participating breeding programs sign membership agreement documenting commitment to the EiB modernization process. 7. Pilot NARS identified to become EiB members. 8. NARS linkage coordinator and Product	$287,278	$ 387,146	The assessment risk of achievement is **medium** as breeding program buy-in is crucial to achieving the milestones.	Standard templates and approaches will be uploaded in the Toolbox. BPAT reviews will be made available to EiB as part of the member agreement. Members will upload breeding program descriptions in the Toolbox which, over time, will allow M&E of outcomes.

		Manager hired.				
2: Breeding Scheme Optimization	Increased rates of genetic gain through use of best practices, optimization of breeding strategy and more effective use of resources (time, finances).	1. Breeding program optimization specialist hired. 2. Members begin to document trait and core breeding pipelines in Toolbox. Broad recommendations for breeders to consider when making key breeding decisions to be developed and posted to the toolbox and be presented to breeding teams & discussed during regional visits. 3. In collaboration with Modules 3 & 4, use cases of successful/failed implementation of predictive tools providing value towards breeding for product profiles documented. 4. Recommendations for strategic and structural division of resources (and activities) between pre-breeding and core breeding activities will be developed. This will include a clear description of the distinction between these activities. These will be posted to the toolbox, presented to senior management during a specific meeting targeting senior management and also to breeding teams during regional visits.	$390,000	$305,663	The achievement of all Module 2 milestones relies on EiB identifying and attracting a suitable person to lead Module 2 and, at least for the interim period until this position is filled, attracting suitable consultant(s) to assist with fulfilling these objectives. The level of risk is assessed as **medium** and significant.	All of the Module 2 milestones include either one or both of: tangible material which is developed and made available through the Toolbox, or; Material being developed and presented via regional visits and workshops. • A template for calculating costs of all breeding activities and operations • Best practices regarding use of selection for secondary traits
3: Genotyping/sequencing tools and services	Efficient and effective application of genomic technology,	1. 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	$250,000	$252,841	The assessment risk of achievement is **medium** as the application of	All use cases and training documents will be uploaded to and visible from the Toolbox. • MAS / Forward breeding introduction and training documents and links to relevant resources.

| | including better targeted genotypic data in breeding supports larger, more cost-effective programs and is mainstreamed within AFS networks, in order to accelerate the rate of genetic gain delivered in farmers' fields. | courses and workshops.

2. For developing the optimization tools in Module 1, cost/benefit analyses of MAS and GS workflows are conducted for all EiB supported breeding teams and documented.

3. Implementation plans developed and executed for all green-light MAS and GS applications.

4. Contracts that provide access to cost-effective genotyping/sequencing services and tissue/seed sampling systems.

5. Logistics support to effectively utilize genotyping/sequencing services provided to AFS breeding teams so they are able to avail of low cost genotyping/sequencing options. | | | genomic technology depends largely on breeding programs. | • HTPG-supported marker inventory.
• Operational guidelines for tissue sampling and logistics when using HTPG platform.
• One-page user guide created for each HTPG 10 marker set in use.
• MAS use case description documents.
• General information and use cases for QC.
• Genomic selection introduction and training documents and links to relevant resources. Genomic selection use cases for inbred, hybrid and clonal crops.
• Cost-benefit analysis of possible GS and MAS applications completed for rice, maize, and potato.
• Strategy to provide PHG-level bioinformatics for all EiB-supported crops.

Use of service providers will allow monitoring of genotyping trends among member breeding programs. |
| 4: Phenotyping tools and services | Lower-cost, better targeted phenotypic data supports larger, more cost-effective programs. | 1. Process Engineering/Automation/ Mechanization Specialist hired.

2. Identify gaps and address needs and best approaches to increase plot throughput/reduce costs through high-throughput phenotyping, mechanization, automation.

3. Identify existing best practices and equipment in use by various programs. | $252,692 | $244,875 | The assessment risk of achievement is **low**. | All use cases and training documents and links to relevant resources will be uploaded to and visible from the Toolbox.

• NIRS for assessing stover quality
• NIRS & XRF calibrations as part of HarvestMaster automation
• Drone-based approaches in phenotyping
• How to decide what makes a secondary |

		4. Take stock of current use of laboratories, their capabilities and costs; prioritize needs 5. Community of practice for high-throughput phenotyping and NIRS established.				trait useful for breeding; • Approaches to use historical information for GxE analysis • Purposes and use of managed stress environments in breeding • Current use of laboratories, their capabilities and costs.
5: Bioinformatics and data management tools and services	Bioinformatics tools that support automation, data integration and decision making are fully integrated for use in AFS breeding networks	1. Breeding use cases reprioritized based on landscape analysis: sample tracking for genotyping and field data collection apps. 2. (i) Core Systems are certified BrAPI v1 compliant; (ii) Workflow implemented for the case studies identified in Year 1; (iii) Implementation of connectivity across the different tools/systems. 3. Exposure to and adoption of appropriate databases and software in member breeding programs. 4. (i) Report on the current landscape of databases, bioinformatics capabilities/software, and biometric capabilities/software; (ii) Documented gap analysis for the Year 1-2 case studies; (iii) Existing databases and tools assessed and updated; (iv) Development or acquisition of new database and tools. 5. (i) Identify key analyses and data required for selection candidate advancement and parental selection; (ii) Catalogue existing analysis tools and pipelines; (iii) Initiate open-source collaboration on breeding optimization suite.	$382,817	$313,810	The assessment risk of achievement is **low**.	Landscape analysis, training materials, software and best practices will be shared through the EiB Toolbox and external platforms (GitHub and DockerHub).

		6. Strategy to manage and integrate meta-data. 7. (i) CoP for statisticians and bioinformatics leaders; (ii) Annual Bioinformatics and Biometrics "Hackathon"; (iii) Core operational guidelines for bioinformatics and biometrics defined; (iv) Common BrAPI defined; (v) Capacity development strategy for bioinformatics and software adoption developed; (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) Execute training workshops for biometricians in CGIAR target countries to expand the number of resource persons.				
Toolbox	Best practice information made available to EiB members in V1.2 of the Toolbox and a Beta version of course building tool available for testing in V1.2 of the Toolbox.	1. Toolbox establishes a common infrastructure and frameworks for documentation of best practices, tools, workflows and resources with link to user review system. 2. Restricted domain developed in the Toolbox for members documenting their breeding programs and progress. 3. Communication with CoPs from relevant modules for upload of, and feedback to content. 4. Draft review guidelines and infrastructure developed. 5. Development of best practice	$50,000	$50,000	The assessment risk of achievement is **low**.	Toolbox as such

		documentation for e-learning based on materials used at regional workshops 6. Identification of and links to relevant external e-modules and courses.				

* Milestones include both outputs, output use and outcomes along the impact pathways as appropriate to the scale and maturity of the work. In this table A, please focus as much as possible on significant milestones towards outcomes which can be justified the completion at reporting.

**Please list the major risks focusing more on technical or geographic considerations that may hinder the expected delivery of results by the Platform.

Table B: Cross-cutting Aspect of Expected Outputs or Deliverables (OPTIONAL IN 2018 POWB)

Cross-cutting	Number (%) scored 2 (Principal)	Number (%) scored 1 (significant)	Number (%) scored 0	Total overall number of outputs
Gender	5%	0%	95%	34
Youth	0%	80%	20%	
CapDev	0%	100%	0%	

Table C: Platform Staffing (OPTIONAL IN 2018 POWB – not filled in)

Category	Female (FTE*)	Male (FTE)	Total FTE	% female (FTE)
Program director & flagship leaders				
Principal Investigators				
Other Senior Scientists (not PIs)				
Post-docs / junior scientists				
Research fellows				
Other science support staff				
TOTAL PLATFORM				

*FTE= Full Time Equivalent

Table D: Platform Planned Budget [Please fill the table based on the planed Platform budget for 2018.]

	Planned budget 2018			Comments on major changes
	W1/2	W3/bilateral	Total	
Module 1	$287,278.00	$387,146.16	$674,424.16	
Module 2	$390,000.00	$305,662.69	$695,662.69	
Module 3	$250,000.00	$252,841.50	$502,841.50	
Module 4	$252,692.00	$244,875.39	$497,567.39	
Module 5	$382,817.00	$313,810.89	$696,627.89	
Toolbox	$50,000.00	$50,000.00	$100,000.00	
Platform Management & Support Cost	$342,213.00	$312,475.27	$654,688.27	

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Platform Total	$1,955,000.00	$1,866,811.90	$3,821,811.90	

Note this budget does not include use of W1&W2 carry-over funds. They will be allocated to Module 3 ($323,436), 4 ($175,000), and 5 ($320,000).

Table E: Main Areas of W1/2 Expenditure (OPTIONAL in 2018 POWB – not filled in)

Expenditure area *	Estimated percentage of total W1/2 funding in 2018**	Space for your comments [please remove notes below]
Planned research: principal or sole funding source		
Planned research: Leveraging W3/bilateral funding		e.g. to strengthen the synthesis and international public goods nature of outputs by CRPs; or to respond to changes in research conditions including fluctuations in funding.
Catalyzing new research areas		e.g. foresight, proof of concept studies for novel areas of work
Gender		e.g. stand-alone programs, work by PMU, funding gender 'add ons' to other projects, and research projects tagged as 'principal' for gender. Research projects tagged with a 'significant' gender tag should be included under one of the first three rows above (research)
Youth		As for gender
Capacity development		As for gender
Start-up or maintenance of partnerships (internal or external)		
Monitoring, learning and self-evaluation		
Evaluation studies and Impact Assessment studies		Includes ex-ante assessments if these are specific studies, otherwise include under previous row
Emergency/contingency		e.g. immediate unplanned response to a new virulent disease, or moving germplasm collections as a result of conflict
Other		
TOTAL FUNDING		

(AMOUNT)		

*use these categories wherever possible, delete unneeded rows and add rows if none of these are suitable.

**we recognize that (i) some funding may fit more than one category but please try to apportion funding to its principal use and (ii) percentages may not add up to 100%

Table F: New Internal (CGIAR) Collaborations between the Platform and Programs and among Platforms

Name of CRP or Platform	Brief description of collaboration (give and take between Platform and CRPs) and value added*	Relevant Module
Gender in Breeding Initiative	Module 1 of EiB will work closely with the Gender in Breeding Initiative to promote gender-disaggregated product profiles.	Module 1
RICE CRP/TRB	EiB will be working closely and synergistically with the Rice CRP, and through the CRP, Transformative Rice Breeding (TRB) to achieve common objectives.	All modules
RTB CRP/ NextGenCassava	EiB will be working closely and synergistically with the RTB CRP, and through the CRP, NextGenCassava to achieve common objectives.	All modules
All AFS CRPs	There are many common objectives across each of the AFS CRPs and EiB. EiB will be taking every opportunity to work synergistically with the CRPs to enable breeding flagships to achieve their objectives.	All modules
Private breeding sector	To establish pro-bono mentorship programs for individual EiB members.	All modules

*e.g. scientific or efficiency benefits

Table G: Planned Monitoring, Evaluation, and Learning Exercises

Planned studies/learning exercises in 2018	Comments
Establish member sites in Toolbox	To capture baseline information of member breeding programs in support of M&E.
Contributor workshop	To receive feedback on EiB activities and set 2018 priorities (learning).

Table H: Platform-specific Indicators or Targets

Module	Indicator(s)
Module 1	Member breeding programs orient their breeding programs towards product profiles aligned with a clear variety replacement strategy.

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Module 1	Member breeding programs implement a formal advancement system using a common stage gate numbering system for easy assessment of pipeline strength across all CGIAR breeding programs.
Module 1	Member breeding programs routinely publish genetic gains for their crops.
Module 1	CGIAR and NARS breeding programs have implemented a complete end to end, internal breeding pipeline optimization review using the breeding program assessment tool (BPAT) and shared results with Platform personnel.
Module 1	Member breeding programs develop and present optimization plans.
Module 1	Member breeding programs supported by private sector consultancies.
Module 2	Member breeding programs using best practices to focus discovery, validation and implementation of predictive tools on those with high probability of success.
Module 2	Member breeding programs revising trait pipelines and personnel allocation based on objective criteria and in support of efficient core breeding operations.
Module 2	Member breeding programs implementing trade-off analyses to optimize breeding strategy.
Module 3	Downloads of best practices: use cases, implementation guidelines, tissue sampling approaches, LIMS, training modules.
Module 3	Member breeding programs conducting cost/benefit analysis for genotypic data applications.
Module 3	Economically favorable QC, MAS and GS applications implemented by EiB-participating breeding teams.
Module 3	Cost of single nucleotide polymorphism (SNP) genotyping samples for forward breeding applications (in US$) and genome profiles (in US$) within defined turn-around time and quality parameters.
Module 3	Number of SNP genotyped samples; breeding entries with genome profiles.
Module 4	Member breeding programs assessing total number of plots managed; cost per plot; heritability.
Module 4	Member breeding programs analyzing quality traits via concerted service agreement with external providers.
Module 5	Development is focused on priority breeding use cases and coordinated across development teams.
Module 5	BrAPI-enabled high priority use cases.
Module 5	Member breeding programs routinely loading phenotype and genotype data into EiB-supported data managements systems as part of routine breeding practices.
Module 5	Tools and databases that are accessible across AFS breeding programs.

Module 5	Use of breeding views that provide breeders easy access to decision support.
Module 5	Implementation of common ontologies and persistent unique identifiers (PUIDs) for germplasm, as indicated by BrAPI use.
Module 5	Use of protocols, manuals, and best practices in Toolbox. Access to prioritized biometrics and bioinformatics advice, services and resources.
Toolbox and EiB	Users and contributors to the online Toolbox.
Toolbox and EiB	Tools, best practices, training resources in the online Toolbox
Toolbox and EiB	# members, courses/workshops and workshop participants.