

CRP-GLDC

Plan of Work and Budget 2021



RESEARCH PROGRAM ON
Grain Legumes and
Dryland Cereals



Alliance



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List of Acronyms

BGM	Botrytis grey mould
Bt	<i>Bacillus thuringiensis</i>
CapDev	Capacity Development
CBOs	Community-based organisations
CIAT	The International Center for Tropical Agriculture
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CNG	Crop Network Groups
CRP-GLDC	CGIAR Research Program on Grain Legumes and Dryland Cereals (pertaining to the program)
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DH	Doubled Haploids
EiB	Excellence in Breeding (platform)
ESA	Eastern and Southern Africa
FAW	Fall Armyworm
Fe	Iron
FP	Flagship Program
G x E	Genotype X Environment
GFI	Good Food Institute, USA
GLDC	Grain Legumes and Dryland Cereals (pertaining to crops, innovations, technologies)
GS	Genomic selection
HTPG	High Throughput Genotyping Project (platform)
IAR	Institute of Agricultural Research, Nigeria
ICAR	Indian Council of Agricultural Research
ICARDA	The International Center for Agricultural Research in the Dry Areas
ICM	Integrated Crop Management
IDO	Intermediate Development Outcome(s)
IEC	Information, Education, and Communication
IER	Institut d'Economie Rurale, Mali
IF	Innovation Fund
ILRI	International Livestock Research Institute
INERA	Institut de l'Environnement et des Recherches Agricoles, Burkina Faso
INRAN	Institut National de la Recherche Agronomique du Niger
IPM	Integrated Pest Management
IRD	Institut de recherche pour le développement
ISRA	Institut Sénégalais de Recherches Agricoles, Senegal
KALRO	Kenya Agricultural and Livestock Research Organization
KVKs	Krishi Vigyan Kendras
KWASU	Kwara State University, Nigeria
MEL	Monitoring, Evaluation, and Learning
MET	Multi-environment Testing
MoA	Memorandum of Agreement
MPAB	Markets and Partnerships in Agri-business
NARS	National Agricultural Research System(s)
NGOs	Nongovernmental organizations
NRM	Natural Resource Management

PABRA	Pan-Africa Bean Research Alliance
POWB	Plan of Work and Budget
QC	Quality control
QDS	Quality declared seed
QTL	Quantitative Trait Loci
RGA	Rapid Generation Advancement
SA	South Asia
SDG	Sustainable Development Goal
SLU	Swedish University of Agricultural Sciences
SNP	Single nucleotide polymorphism
SRF	Strategy and Results Framework
SSA	Sub-Saharan Africa
TARI	Tanzania Agricultural Research Institute
TIGR ² ESS	Transforming India's Green Revolution by Research and Empowerment for Sustainable food Supplies
ToC	Theory of Change
TPE	Target Population of Environments
USDA	United States Department of Agriculture
WCA	Western and Central Africa
WUR	Wageningen University of Science
Zn	Zinc

Cover Page

CGIAR Research Program on Grain Legumes and Dryland Cereals

Lead CGIAR Center: International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

Flagship Program 1: Priority Setting & Impact Acceleration

CGIAR Center: International Institute of Tropical Agriculture (IITA)

Flagship Program 3: Integrated Farm and Household

Management CGIAR Center: World Agroforestry (ICRAF)

Flagship Program 4: Variety and Hybrid Development

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

Flagship Program 5: Pre-breeding and Trait Discovery

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

Flagship Program 6: Common Bean

CGIAR Center: The Alliance of Bioversity International and CIAT (International Center for Tropical Agriculture)

Other participating CGIAR Centers:

- International Center for Agricultural Research in the Dry Areas (ICARDA)
- International Institute of Tropical Agriculture (IITA)
- World Agroforestry
- International Livestock Research Institute (ILRI)
- The Alliance of Bioversity International and CIAT

Other participating research institutions:

- Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Institut de recherche pour le développement (IRD)
- Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)

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1. Adjustments/ Changes to Theories of Change (ToC)

The ToC for FP1 and FP3 remain largely unchanged and the team is making efforts to ensure that progress is being made towards the set outcome targets. Together with the cross-cutting themes, FP4 uses CRP experiences to develop a more detailed and impactful ToC by identifying enablers that allow FP4 innovations to unfold their full potential. While there is no major update in the ToC of FP5, work will be done along with other FPs to incorporate FP6 into the CRP-GLDC's overall ToC. The FP6's ToC will remain unchanged in 2021.

2. Plans and Expected Progress Towards Outcomes

The following narrative presents CRP-GLDC's 2021 plans and expected progress towards outcomes by flagship program. While the cross-cutting themes have no dedicated narrative, they are nestled in the FP narrative's workplans for Gender and Youth, Capacity Development, and Markets and Partnerships in Agribusiness (MPAB) to show how cross-cutting activities are integrated at the FP level, sustain the FP work in 2021, and aid inter-FP collaboration. Despite the CRP closing a year earlier than scheduled, select achievable milestones originally proposed for 2022 have been included in this POWB (Table 2A), aimed at maximizing resource use efficiency.

FP1: Priority Setting and Impact Acceleration

The work in this FP is designed to improve targeting and responsiveness of research to market and household demands for greater technology adoption, food and nutrition security, resilience and poverty reduction. While the ex-ante impact evaluation work aims to inform research priority setting decisions by identifying promising lines of research based on their expected economic, poverty and nutrition security impacts, breeding priorities will be informed by market studies designed to identify the varietal attributes of GLDC crops that are highly preferred by actors along the value chain, including women. Outcomes of the varietal trait preference assessments will form the basis for development of product profiles defining the most important producer and end-user preferred traits for GLDC crops to be targeted by the breeders in FP4 and FP5. Priority traits that are the drivers of technology adoption by farmers, including women, will be identified as part of the larger effort to assess market and household demand that shape the uptake and market potential of agricultural technologies and production.

The work on aspirations is effectively contributing to targeting and scaling efforts aimed at matching GLDC technologies with heterogeneous households and groups, including women and youth. It is also enhancing our understanding of where and for whom in the drylands of SSA and South Asia agriculture will serve the main purpose of ensuring food and nutrition security versus where and for whom it provides potential for significant increases in incomes and wider economic growth. Evidence on what drives decision making and aspirations of rural households will help design more effective policies and development initiatives that trigger positive, lasting change within the communities. The work on urban nutrition aims to identify leverage points for increased consumption of GLDC crops by low-income populations in informal urban settlements in Eastern and Southern Africa (ESA) and will provide a critical entry point for CRP-GLDC to address urban malnutrition. Dietary behavior change interventions will be tested and consumer groups most responsive to GLDC crops will be identified.

Strategic gender research will support CRP-GLDC in the pursuit of inclusion and equity among women and

youth beneficiaries and stakeholders to strengthen the relevance and targeting of research outputs and enhance development impacts. Gender research issues have also been integrated into the work on trait prioritization and product profiles to identify gender-responsive trait preferences for key GLDC crops and countries that will in turn inform product profiles and breeding priorities. The crops and countries include cowpea in Nigeria, sorghum and groundnut in Tanzania, lentil in Ethiopia and chickpea and sorghum in India.

In an effort to implement an integrated and multi-faceted impact assessment and learning strategy for CRP-GLDC, FP1 will conduct four main streams of work aimed at generating evidence of CRP-GLDC's contribution to the Strategy and Results Framework (SRF) targets: (1) assess the adoption and welfare impacts of improved GLDC crop varieties such as groundnut in Nigeria, soybean in Malawi, improved sorghum and finger millet in Ethiopia, and Tanzania and lentil in Bangladesh and India, (2) assess the spatial extent of the adoption of GLDC technologies, (3) assess the soil health and resilience impacts of the adoption of GLDC technologies, and (4) estimate the impacts of GLDC technologies on dietary intake and nutrition. While the variety adoption and welfare impact studies are being carried out in collaboration with FP4, the soil health impacts of the adoption of GLDC crops are being carried out in collaboration with FP3. FP1 is also leading a cross-FP effort to revise CRP-GLDC's ToC and impact pathway following the inclusion of the common bean flagship (i.e., FP6) with Markets and Partnerships in Agri-business (MPAB) as a new cross-cutting theme to address key elements in FP2. Finally, FP1 undertakes monitoring, evaluation and learning (MEL)-related activities aimed at supporting the generation of evidence to demonstrate the added value of CRP-GLDC as a multi-crop research program.

The list of key milestones that FP1 is planning to achieve in 2021 has been updated (Table 2A). They include: (1) identification of gender-responsive trait preferences in key GLDC crops to inform product profiles and breeding priorities; (2) outline principles of technological match with heterogeneous household contexts; (3) design and pilot inclusive and equitable innovation systems to accelerate impacts for women and young people, including policy interactions; (4) undertake specific as well as synthesized estimation of impacts on the System Level Outcomes and targets as per the Theory of Change for GLDC and (5) implement the working strategy for evidencing the outcomes and impacts of CRP-GLDC.

FP3: Integrated Farm and Household Management

In the area of biotic and abiotic stresses, biological control agents against the cowpea pod borer which have shown a good potential in reducing pest populations in experimental releases in Benin and Burkina Faso, will continue to be released in Mali, Niger and Nigeria. In general, our pest control approach that is devoid of chemical insecticides will benefit women cowpea farmers who have much less access to conventional pesticides and be particularly attractive to the youth as a sustainable approach. The five sorghum accessions that showed resistance to the fall armyworm (FAW) with scores ranging from 2 to 3 on a 1 to 9 scale will continue to be studied to understand the underlying mechanisms of resistance, and the information passed on to breeders.

Preferred varieties and diverse crop combinations and sequences have been identified for increased productivity through participatory cropping systems trials across agro-ecologies. The evidence-based legume systems technology will be promoted on farmers' fields to harness the synergies between systems (intercropping, rotation, etc.), advantages and resource requirements of the component crop genotypes for efficient resource use and increased productivity. These activities have a major capacity building component that has allowed farmers to gain knowledge and skills on crop mixes and best crop production practices. Efforts will continue to promote and scale up adoption to increase diversity within cropping

systems and to improve soil management practices. In addition, integrated farm household datasets that were collected in Burkina Faso and Ethiopia with a focus on variables of livelihood typologies, innovation adoption, impacts of legume-based technological interventions on smallholder production and livelihood performance will be used to develop a decision support system. An agent-based model and nutrient balance/flow models will be promoted to assess ex-ante impacts of innovation practices on crop production efficiency and household livelihoods and identify best-fit options. A map-based guide on options for farm designs to improve nutrient stocks and effective cycles will be developed for stakeholders.

At the household and farm levels, good progress has been made in parameterizing and validating farming systems models for South Asia (SA) and Sub-Saharan Africa (SSA). Hands-on capacity has been built among the national agricultural research system (NARS) and regional project partners. This work will continue with extension systems to mainstream systems tools for decision support to better target sustainable intensification interventions. A comprehensive farming systems sustainability assessment framework and tool developed and tested in one location to support the co-designing of resilient farming systems in GLDC regions will be tested in more locations in SA and SSA while also building stakeholders' capacity and awareness to capitalize on these tools. We will continue to strengthen capacity in system dynamics tools to support value chain actors and policymakers to boost the integration of smallholders into agricultural value chains. This will lead to promoting nutrition-oriented and resilient value chains. We continue to generate evidence on NRM impacts of GLDC cropping systems to support the promotion of resilient farming systems in SSA and SA. In 2021, evidence-based portfolio of options for sustainable intensification and systems decision support tools will continue to be promoted to enable policymakers, development actors and smallholders to enhance the resilience of farming systems and improve rural livelihoods aligning with targets of the Sustainable Development Goals (SDGs).

An online Gender Integration workshop held during 1-3 September 2020 allowed each cluster of actions to develop their own areas of research in the gender domain. The team will produce a review as a legacy paper on how GLDC-based farming systems have affected gender differentiated categories. In MPAB, identification of opportunities around sorghum/millet utilization to improve the nutritional security and resilience of smallholder households will continue as joint activities. Finally, we will continue to work with FP1 on institutions and impact whereas the work on systems modelling scenarios of FP3 will inform FP4 and FP5 of desirable crop traits under a changing climate. Similarly, the work on varieties' dissemination will continue and feedback provided to FP4 and FP5.

FP4: Variety and Hybrid Development

Two Innovation Fund (IF) initiatives supported under FP4 are advancing towards self-sustainability. The Crop Network Groups (CNG) established under CRP-GLDC in Africa and Asia are progressing in that direction and learn from PABRA mode. A seed consortium model in India for sorghum is self-sustaining with 300,000 farmers having accessed improved sorghum varieties in 2020. FP4 collaborates with FP1 and MPAB to understand the drivers for a successful seed consortium in India for sorghum, and for the remarkable adoption rate of 95% of legumes in India, Bangladesh and Myanmar.

Crop product profiles were designed with the available information and following a workshop conducted by CRP-GLDC, where FP1 is providing support in defining market segmentation to guide investment decisions for crop products. The identification of gender preferred traits will inform the development of targeted product profiles and breeding work. Gender and value chain studies guide the gender-responsive approach that is required in the breeding of GLDC crops to achieve gender equity and food security.

New cultivars of GLDC crops include: (1) biofortified cultivars of sorghum, lentil, and pearl millet with enhanced grain iron (Fe) and zinc (Zn) content, (2) high oleic groundnut cultivars for the food industry, (3) high protein soybean, (4) machine-harvestable chickpea, (5) lentils driving women and youth entrepreneurship, and (6) early maturing cowpea varieties. The FP4 team continues to partner with the private seed sector and other agencies to deliver these new varieties to benefit producers and consumers achieve a wider reach. With a strong focus on climate change adaptation of GLDC crops, improved cultivars with climate-smart traits will be delivered for testing and subsequent release in target countries. For resilient crop-livestock systems, FP4 continues to collaborate with ILRI to improve crop cultivars for fodder quality traits.

To enhance the rate of genetic gain by reducing the breeding cycle time, Rapid Generation Advancement (RGA) protocols have been standardized and deployed at both ICRISAT and ICARDA where they will be scaled up through an expansion of infrastructure to increase the proportion of populations moving through RGA. Breeding schema optimization will be done to adjust to RGA and for early generation multi-environment testing (MET). FP4 will strengthen MET by establishing testing sites with an efficient system of trialing to guide selection decisions in CRP-GLDC breeding. A key focus area for FP4 is the characterization of Target Population of Environments (TPEs) to guide MET in target countries. TPE analyses have great potential to be adopted by breeding programs. FP4 continues to collaborate with the Excellence in Breeding (EiB) platform to adopt best crop breeding practices at the CGIAR and NARS levels and use imaging tools for phenotyping.

The GLDC crop cultivars developed using forward breeding approaches have been commercialized with cost-effective services provided by the High Throughput Genotyping (HTPG) platform, and the development of Genomic Selection (GS) models that are in progress. The deployment of Quality Control (QC) for hybridity confirmation and to assess the genetic purity of lines moving from testing to early generation seed increase is a priority in 2021 in collaboration with the FP5 team.

The work on target GLDC seed value chains to identify production constraints faced by different actors, ensure the timely availability of affordable quality seed and explore opportunities to remove bottlenecks will be synthesized in 2021. Findings point to the need for more cost-effective capacity building approaches for farmer seed producers and other actors along the value chain to improve seed quality, marketing and utilization; and for policy and legal support that promote the production and marketing of alternative and more smallholder farmer-friendly quality assurance protocols, such as quality declared seed (QDS).

FP5: Pre-breeding and Trait Discovery

FP5 focuses on exploiting the untapped natural or induced genetic diversity of cultivated germplasm, wild relatives and landraces by developing and using cutting-edge tools and techniques for trait discovery, trait mapping, trait characterization/dissection, and trait deployment in crop modernization. This is done with the aim of accelerating the rate of genetic gains in GLDC crops under mixed cereal-legume-tree-livestock systems in the semi-arid and sub-humid regions of SSA and SA. Recent technological and resource advances in genomics, genetics, trait discovery, breeding, RGA, genome editing technologies, and rapid achievement of homozygosity in major cereal crops provide excellent opportunities in GLDC crops working closely with FP4. Hence in 2021, FP5 will prioritize activities related to trait discovery, functional validation of traits and pre-breeding by exploiting natural and/or systematically induced variations for prioritized traits in combination with modern genomics, transgenics, phenomics and breeding tools for accelerated, precise, cost-effective and efficient breeding of new varieties, continuing activities from the previous years.

CoA5.1 (Pre-breeding) will focus on advancing prioritized traits for pre-breeding in ongoing activities on

exploring the natural diversity in wild/unadapted germplasm. In 2021, the focus will be on screening exotic germplasm for heat and drought in cowpea, for rust and nutrient use efficiency in soybean, for drought in groundnut etc. Besides, the characterization and advancement of already available transgenic events for traits such as *Bacillus thuringiensis (Bt)* in pigeonpea, where natural diversity is not available will continue. For trait discovery, CoA5.2 will continue work on the mapping and dissection of at least one top priority trait in each target crop, emphasizing on marker development, validation and deployment for at least one priority trait in five GLDC crops. In addition, development, validation and deployment of GS in two GLDC mandate crops will continue. The progress made in QC panel development and initial validation on germplasm/breeding lines panels will be advanced further for deployment in breeding programs in at least four GLDC crops. Advancing introgression (molecular breeding) lines in one cereal and two legumes harboring Quantitative Trait Loci (QTL)/genomic regions controlling the desired traits in elite lines will be the focus. As part of developing enabling technologies, CoA5.3 will continue activities on establishing the platform for genome editing, proof of concept/deployment of second-generation transformation (QuickCrop from Corteva Agriscience) in sorghum and pearl millet, and systematic mutant population and RGA in at least two more GLDC crops. Refinement of gold standard reference genome assembly in at least three pearl millet lines will be achieved in collaboration with Corteva Agriscience. FP5 will work closely with other FPs and cross-cutting themes to deliver on planned joint activities. Activities in capacity development will continue by supporting the training of students and researchers (especially NARS partners), organizing training courses, seminars, workshops, symposia, supporting exchange visits, data management, etc. The knowledge generated from FP5 activities will be applied in the modernization of crop improvement and also be disseminated and shared in the form of reports, datasets, scientific publications and presentations at various fora.

FP6: Common Bean

In 2021, FP6 through the work in Latin and Central America and Pan-Africa Bean Research Alliance ([PABRA](#)) will intensify five bean research and development areas. Firstly, NARS' capacity to implement [demand-led breeding](#) to respond to farmer and bean market demands will be strengthened. The activity will expand to include nutritional breeding by raising iron levels through interspecific sources. Secondly, we expect to consolidate GS work during the course of the year to optimize genetic gain. The resilience of bean production systems will be built by expanding the use [of digital agro-climatic services](#). Thirdly, the development of women and youth-owned service providers/enterprises to deliver multiple bean-based products to transform bean value chains, such as [women entrepreneurs empowered through beans](#) to supply highly nutritious bean-based products including school feeding that [make rural schools a better place to learn and thrive](#) will be supported. Fourth, the use of [farmer digital platform will be expanded to deliver financial inclusion](#). Partnerships will be strengthened/created to include the private sector, public policymakers in areas of nutrition, agriculture and climate and advanced laboratories in universities. Engagement with donors will seek to create synergies between PABRA and their development projects. To strengthen researchers' ability, FP6 will contribute to the development and delivery of a training course on 'Creating Impact at Scale' and specifically conceptualize and deliver the module on 'An introduction to Monitoring and Evaluation'. FP6 will also leverage other donors, government, producers and private investments to strengthen bean value chain development, particularly in scaling up proven seed and complementary technologies, highly nutritious products and harness the market to increase smallholders' incomes.

Tables

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
1	Increased availability of diverse nutrient-rich foods	Outcome 1. Improved targeting and responsiveness of research to market and household demands in the face of climate change for greater technology adoption, food and nutrition security, resilience, and poverty reduction	Multidimensional ex-ante evaluation of GLDC research and technology options completed and results shared with GLDC staff and partners	Same as 2020	Refined GLDC program with adjusted work plans for 2021 featuring priority research options and countries	NA	NA	NA	NA	Medium	4. Internal resources - risk that key staff, infrastructure or equipment not available at time needed
1	Conducive agricultural policy environment	Outcome 1. Improved targeting and responsiveness of research to market and household demands in the face of climate change for greater technology adoption, food and nutrition security, resilience, and poverty reduction	Gender-responsive trait preferences identified for key GLDC crops to inform product profiles and breeding priorities	Reworded from proposal	Preliminary ex-ante case study results that will be shared with GLDC researchers and stakeholders at the annual review and planning meeting	2	0	0	0	Medium	4. Internal resources - risk that key staff, infrastructure or equipment not available at time needed
1	Increased livelihood opportunities	Outcome 2. Market and household demand identified, and trade-offs assessed for more inclusive value chains that improve income and nutrition status in target regions	Principles of technological match to heterogeneous household contexts outlined	Reworded from proposal	Assessment of changes in strategies and implications for matching household needs and market and value chain demand	1	1	1	0	Medium	4. Internal resources - risk that key staff, infrastructure or equipment not available at time needed
1	Increased livelihood opportunities	Outcome 2. Market and household demand identified, and trade-offs assessed for more inclusive value chains that improve income and nutrition status in target regions	Underlying principles established for diversity assessment and matching of technologies across contexts	Same as 2020	Published options on how to meet diverse target group needs in GLDC research and scaling	1	1	1	0	Medium	4. Internal resources - risk that key staff, infrastructure or equipment not available at time needed
1	Improved capacity of women and young people to participate in decision-making	Outcome 3. Inclusive and equitable technologies and innovation systems established for accelerated and broadened impact across the agri-food system	Inclusive and equitable innovation system for accelerating impacts for women and young people designed and piloted, including policy interactions	Same as 2020	Innovation systems for empowering women and youth design reports sex disaggregated and gender relevant datasets policy brief	2	1	1	0	Medium	4. Internal resources - risk that key staff, infrastructure or equipment not available at time needed

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
					[paper] on gender and social analysis informing intervention design						
1	Conducive agricultural policy environment	Outcome 4. Strong project design, execution, monitoring and evaluation systems and tools consistently applied in GLDC scaling projects, with demonstrable progress on enhanced adoption and impact	Evaluation documenting the strengths, shortcomings, and key lessons learnt on GLDC scaling approaches and impacts	Same as 2020	Evaluation report	1	1	1	1	Medium	3. Partnership - risk that partners won't be able to deliver a key piece on time
1	Conducive agricultural policy environment	Outcome 4. Strong project design, execution, monitoring and evaluation systems and tools consistently applied in GLDC scaling projects, with demonstrable progress on enhanced adoption and impact	The working strategy for evidencing the outcomes and impacts of GLDC implemented	Same as 2020	Working papers on impact assessment	1	0	1	0	Medium	4. Internal resources - risk that key staff, infrastructure or equipment not available at time needed
1	Conducive agricultural policy environment	Outcome 4. Strong project design, execution, monitoring and evaluation systems and tools consistently applied in GLDC scaling projects, with demonstrable progress on enhanced adoption and impact	Synthesized estimation of GLDC impacts on targets and roll out of implicit Theory of Change	New	working paper	NA	NA	NA	NA	Low	
1	Conducive agricultural policy environment	Outcome 4. Strong project design, execution, monitoring and evaluation systems and tools consistently applied in GLDC scaling projects, with demonstrable progress on enhanced adoption and impact	Specific estimation of GLDC's impact on soil organic carbon, fertility, and other NRM impacts	New	Publication	NA	NA	NA	NA	Low	
1	Conducive agricultural policy environment	Outcome 4. Strong project design, execution, monitoring and evaluation systems and tools consistently applied in GLDC scaling projects, with demonstrable progress on enhanced adoption and impact	Specific estimation of GLDC's impacts on nutritional outcomes and GLDC nutrition targets	New	Publication	NA	NA	NA	NA	Low	
3	Increased resilience of agro-ecosystems and communities, especially those including smallholders	Outcome 2. Cropping systems sustainably intensified and diversified	3,000 farmers in project sites increase the diversity within cropping systems and use water and soil management practices developed jointly by farmers and researchers	Reworded from proposal	Research and evaluation reports; training manuals, fact sheets and other extension materials	1	0	NA	NA	Medium	3. Partnership - risk that partners won't be able to deliver a key piece on time

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
3	Increased resilience of agro-ecosystems and communities, especially those including smallholders	Outcome 2. Cropping systems sustainably intensified and diversified	Agricultural system simulation models (agent-based model, nutrient balance/flow models) used to assess ex-ante impacts of innovation practices on crop production efficiency and household livelihoods, and best-bet options identified	Same as 2020	Operational models; reports on ex-post impact assessment with an efficiency focus; and publications (submitted journal article, conference proceedings, paper)	NA	NA	NA	NA	Medium	2. Financial - funding not fully confirmed or at risk of being cut
3	Increased resilience of agro-ecosystems and communities, especially those including smallholders	Outcome 2. Cropping systems sustainably intensified and diversified	Participatory field trials under smallholder conditions in different cropping systems under different environments evaluated	Same as 2020	Reports on field trials and publications	1	0	NA	1	Medium	5. Weather - for example, drought or heavy rain affecting field trials
3	Increased resilience of agro-ecosystems and communities, especially those including smallholders	Outcome 3. Tested, adapted and validated options applied for sustainable intensification and livelihood diversification by farmers	Portfolios of household activities, enterprises and management practices that materially and equitably enhance livelihoods (as defined at sub-IDO level) while minimizing negative externalities	Same as 2020	Publication, reports, technical document	1	NA	1	1	High	3. Partnership - risk that partners won't be able to deliver a key piece on time
3	Increased resilience of agro-ecosystems and communities, especially those including smallholders	Outcome 3. Tested, adapted and validated options applied for sustainable intensification and livelihood diversification by farmers	Suite of systems modelling tools/framework for co-designing resilient farming systems in GLDC regions	Same as 2020	Publications, reports	1	NA	NA	NA	High	3. Partnership - risk that partners won't be able to deliver a key piece on time
3	Reduced production risk	Outcome 3. Tested, adapted and validated options applied for sustainable intensification and livelihood diversification by farmers	Awareness created among key stakeholders for trade-offs and synergies at scale related to alternative livelihood strategies	2022-proposed milestone, planned achievement in 2021	Publication, reports, technical document, review of partner documentation	1	1	1	1	High	3. Partnership - risk that partners won't be able to deliver a key piece on time

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
3	Reduced production risk	Outcome 3. Tested, adapted and validated options applied for sustainable intensification and livelihood diversification by farmers	Environmental and livelihood impacts of GLDC intervention tested at scale to avoid negative unintended consequences, and amplifying synergies contributing to poverty reduction, equitable access to development opportunities, and nutritional security identified taking into account ecosystem service	2022-proposed milestone, planned achievement in 2021	Publication, reports, technical document	1	0	1	1	Medium	3. Partnership - risk that partners won't be able to deliver a key piece on time
3	Reduced production risk	Outcome 3. Tested, adapted and validated options applied for sustainable intensification and livelihood diversification by farmers	Evidence that household interventions can generate beneficial impacts on CGIAR sub-IDs at scale	2022-proposed milestone, planned achievement in 2021	Publication, reports, technical document, third party surveys	1	0	1	1	Medium	3. Partnership - risk that partners won't be able to deliver a key piece on time
3	Reduced production risk	Outcome 3. Tested, adapted and validated options applied for sustainable intensification and livelihood diversification by farmers	Improved understanding of the social-ecological factors strongly affecting livelihood system impacts in the drylands	2022-proposed milestone, planned achievement in 2021	Publication, reports, technical document	1	0	1	0	Medium	3. Partnership - risk that partners won't be able to deliver a key piece on time
3	Reduced production risk	Outcome 4. Pest and diseases controlled safely and with reduced agro-chemical inputs	Efficacy of promising Integrated Pest Management (IPM) components and NRM options (evaluated in 2020) confirmed at pilot sites	Identical to proposal	Publication, reports, technical document	1	1	1	1	Medium	3. Partnership - risk that partners won't be able to deliver a key piece on time
4	Reduced pre- and post-harvest losses, including those because of climate change	Outcome 1. New varieties & allied innovations improving productivity & production potential, agribusiness opportunity & stabilize food supply	New populations/lines for adaptation to heat and water deficit stress and emerging diseases in climate change scenarios developed	New	Memorandum of Agreement (MoA) reports; publication; reports by the CGIAR and partner	NA	NA	1	2	Low (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	5. Weather - for example, drought or heavy rain affecting field trials

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FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
4	Enhanced genetic gains	Outcome 1. New varieties & allied innovations improving productivity & production potential, agribusiness opportunity & stabilize food supply	Phase I genetic materials deployed in GLDC crop improvement by CGIAR centers - annually 8 crops X 3 trait clusters X 2 regions tested by NARS	New	MoA reports; publication; reports by the CGIAR and partner	NA	NA	1	1	Low (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	3. Partnership - risk that partners won't be able to deliver a key piece on time
4	Reduced production risk	Outcome 1. New varieties & allied innovations improving productivity & production potential, agribusiness opportunity & stabilize food supply	Two resilient varieties per region (ESA, WCA and SA) released by NARS partners in any of the target countries (India, Myanmar, Ethiopia, Uganda, Burkina Faso, Ghana)	New	MoA reports; reports by the CGIAR and partner	0	0	0	1	Low (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	3. Partnership - risk that partners won't be able to deliver a key piece on time
4	Increased availability of diverse nutrient-rich foods	Outcome 1. New varieties & allied innovations improving productivity & production potential, agribusiness opportunity & stabilize food supply	Four new varieties with enhanced nutrient levels (Fe, Zn, oil, protein, high oleic) developed and released	New	MoA reports; reports by the CGIAR and partner	1	NA	0	0	Low (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	3. Partnership - risk that partners won't be able to deliver a key piece on time
4	Technologies that reduce women's labor and energy expenditure developed and disseminated	Outcome 1. New varieties & allied innovations improving productivity & production potential, agribusiness opportunity & stabilize food supply	Snap millets that are easy to harvest and shell, machine amenable varieties for harvesting, pesticide use, etc.	2022-proposed milestone, planned achievement in 2021	MoA reports; reports by the CGIAR and partner	1	1	NA	NA	Low (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	3. Partnership - risk that partners won't be able to deliver a key piece on time

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
4	Reduced market barriers	Outcome 1. New varieties & allied innovations improving productivity & production potential, agribusiness opportunity & stabilize food supply	TPE analysis has been scaled up to more breeding teams (assuming funding is allocated)	New	Publication; reports, technical document	0	0	1	1	Low (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	2. Financial - funding not fully confirmed or at risk of being cut
4	Increased resilience of agro-ecosystems and communities, especially those including smallholders	Outcome 2. Robust and responsive global to national breeding systems produce and deliver novel varieties and allied innovations at appropriate scale and scope	Improved legumes and dryland cereals meet current, emerging and diverse demand for food and feed leading to increased competitiveness of GLDC commodities	Identical to proposal	MoA reports; publication, reports by the CGIAR and partner	1	NA	1	1	Medium (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	1. Research/science - inherent risk in unknown cutting-edge research or science
4	Increased capacity of beneficiaries to adopt research outputs	Outcome 2. Robust and responsive global to national breeding systems produce and deliver novel varieties and allied innovations at appropriate scale and scope	Participatory breeding methods and Innovation platforms used in 2018 in partnership with FP2 and FP3 involving communities and partners in target countries. The new varieties will be the building block for such activities.	Identical to proposal	Research reports; training manuals and other IEC material; local partners (including NARS, NGOs and CBOs) engaged; infrastructure developed; and partnerships leveraged	0	NA	2	0	Low (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	3. Partnership - risk that partners won't be able to deliver a key piece on time
4	Increased capacity for innovation in partner research organizations	Outcome 2. Robust and responsive global to national breeding systems produce and deliver novel varieties and allied innovations at appropriate scale and scope	Review 2 GLDC crop product profiles for SSA and SA guided by the market segmentation in target countries	Changed	MoA reports, reports by the CGIAR and partner	NA	NA	1	NA	Low (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	2. Financial - funding not fully confirmed or at risk of being cut

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
4	Enhanced institutional capacity of partner research organizations	Outcome 2. Robust and responsive global to national breeding systems produce and deliver novel varieties and allied innovations at appropriate scale and scope	NARS partners trained in participatory breeding methods, as well as gender and its role in the adoption of new varieties. Other skill set includes marker-assisted breeding in partnership with FP5. Annually, at least 100 staff trained -- 10 per crop for Africa and Asia.	2022-proposed milestone, planned achievement in 2021.	Training reports (with gender disaggregation); training manuals, fact sheets and other IEC material; number of female and youth farmers trained; infrastructure developed, etc.	1	NA	2	0	Medium (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	7. Others- COVID19 Pandemic
4	Increased capacity for innovation in partner development organizations and in poor and vulnerable communities	Outcome 2. Robust and responsive global to national breeding systems produce and deliver novel varieties and allied innovations at appropriate scale and scope	NARS staff trained in new advances and analytics, limited infrastructure development. Annually, at least 100 staff trained -- 10 per crop for Africa and Asia.	2022-proposed milestone, planned achievement in 2021.	Training reports (with gender disaggregation); training manuals, fact sheets and other IEC material; number of female and youth farmers trained; infrastructure developed, etc.	1	NA	2	0	Medium (Note: Uncertainty over the structure and functions in One CGIAR can cause delays)	7. Others- COVID19 Pandemic
5	Increased conservation and use of genetic resources	Outcome 1. Pre-breeding products through the use of gene banks and other sources and modern tools to increase genetic diversity in breeding programs globally	Development of segregating populations to develop intermediate products for 1 priority trait in 2 crops	Identical to proposal	2 publications, and intermediate pre-breeding products available to breeders for 1 trait in 2 crops	NA	NA	1	NA	Medium	1. Research/science - inherent risk in unknown cutting-edge research or science
5	Increased conservation and use of genetic resources	Outcome 1. Pre-breeding products through the use of gene banks and other sources and modern tools to increase genetic diversity in breeding programs globally	Characterization and selection of intermediate products in 2 traits in 2 crops and made available to breeding programs	2022-proposed milestone, planned achievement in 2021.	2 publications/reports, intermediate pre-breeding products available to breeders for 2 traits in 2 crops	NA	NA	1	NA	Medium	1. Research/science - inherent risk in unknown cutting-edge research or science
5	Enhanced genetic gains	Outcome 2. Trait discovery and development based on genomics and phenomics to generate new markers to support trait integration through the use of modern enabling technologies and forward breeding	The validated markers used in forward breeding programs as required by breeding pipelines for target GLDC countries	2022-proposed milestone, planned achievement in 2021.	4 publications, forward breeding a routine in 5 crops, 1 marker-assisted product in 3 crops	NA	NA	1	NA	Medium	1. Research/science - inherent risk in unknown cutting-edge research or science

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
5	Enhanced genetic gains	Outcome 2. Trait discovery and development based on genomics and phenomics to generate new markers to support trait integration through the use of modern enabling technologies and forward breeding	The validated markers are used in forward breeding programs in 2 major cereals and 3 major legumes as required by breeding pipelines for target CRP-GLDC countries	2022-proposed milestone, planned achievement in 2021.	4 publications, forward breeding a routine in 4 crops, 1 marker-assisted breeding product in 3 crops	NA	NA	1	NA	Medium	1. Research/science - inherent risk in unknown cutting-edge research or science
5	Enhanced genetic gains	Outcome 2. Trait discovery and development based on genomics and phenomics to generate new markers to support trait integration through the use of modern enabling technologies and forward breeding	Promising markers are validated and those found useful are promoted to forward breeding programs as required by breeding pipelines for target GLDC countries	Identical to proposal	4 publications, forward breeding a routine in 4 crops, 1 marker-assisted breeding product in 2 crops	NA	NA	1	NA	Low	
5	Enhanced institutional capacity of partner research organizations	Outcome 3. National researchers able to apply the acquired skills in other pre-breeding programs. Development of enabling technologies platforms to be used for rapid trait discovery, trait validation, trait development, and trait introgression	Develop and validate genomic selection tools for at least 1 cereal and 2 legumes	Reworded from proposal	Genomic selection developed and validated in at least 1 cereal and 2 legumes	NA	NA	1	NA	Medium	1. Research/science - inherent risk in unknown cutting-edge research or science
5	Increased capacity for innovation in partner development organizations and in poor and vulnerable communities	Outcome 3. National researchers able to apply the acquired skills in other pre-breeding programs. Development of enabling technologies platforms to be used for rapid trait discovery, trait validation, trait development, and trait introgression	Capacity development of partners in using various technologies in gene discovery and breeding	2022-proposed milestone, planned achievement in 2021.	10 training courses/workshops/Conferences; 25 students trained by 2022	NA	NA	2	NA	Low	
5	Increased capacity for innovation in partner development organizations and in poor and vulnerable communities	Outcome 3. National researchers able to apply the acquired skills in other pre-breeding programs. Development of enabling technologies platforms to be used for rapid trait discovery, trait validation, trait development, and trait introgression	Development/refinement of technologies for the development of double haploids and/or rapid generation turnover in at least 1 legume and 1 cereal	2022-proposed milestone, planned achievement in 2021.	2 publications, proof of concept for DH in 2 crops, multiple generation per year in 2 crops	NA	NA	1	NA	Medium	1. Research/science - inherent risk in unknown cutting-edge research or science
6	Closed yield gaps through improved agronomic and animal husbandry practices	FP6 General outcome	Researchers and partners apply data from annual stakeholder questionnaire to update breeding profiles	Same as 2020	Report on product profiles in MEL	1	NA	NA	NA	Medium	3. Partnership - risk that partners won't be able to deliver a key piece on time

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
6	Diversified enterprise opportunities; Increased capacity for innovation in partner development organizations and in poor and vulnerable communities; Improved capacity of women and young people to participate in decision making	Outcome 1. Increased livelihood	Five multi-stakeholder bean business platforms strengthened by partners using the Corridor model to support trade for 2020 and 2021	Changed	Report on up-scaling in MEL	1	1	2	NA	Low	
6	Diversified enterprise opportunities; Increased capacity for innovation in partner development organizations and in poor and vulnerable communities; Improved capacity of women and young people to participate in decision making	Outcome 1. Increased livelihood	Capacity training completed with partners with 1,000 male and female entrepreneurs and farmers (cumulative for 2020 and 2021)	Changed	Report on up-scaling in MEL	2	1	2	NA	Low	
6	Diversified enterprise opportunities; Increased capacity for innovation in partner development organizations and in poor and vulnerable communities; Improved capacity of women and young people to participate in decision making	Outcome 1. Increased livelihood	Three multi-stakeholder bean business platforms established by partners using the Corridor model to support trade in 2021	New	Report on up-scaling in MEL	1	1	2	NA	Low	
6	Increased livelihood opportunities	Outcome 1. Increased livelihood	Researchers develop and share first crosses specifically for fast cooking time	Same as 2020	2019 report to Government of Canada	1	1	1	1	Low	

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
6	Diversified enterprise opportunities	Outcome 1. Increased livelihood	Researchers produce first breeding lines with non-darkening trait locus introgression in commercial Andean grain types	Same as 2020	Report on pre-breeding cluster in MEL	NA	NA	NA	NA	Medium	1. Research/ science - inherent risk in unknown cutting-edge research or science
6	More efficient use of inputs; Enhanced individual capacity in partner research organizations through training and exchange	Outcome 2. More efficient use of inputs	Researchers quantify potential for enhanced root penetration from <i>P. coccineus</i>	Same as 2020	Report on pre-breeding cluster in MEL	NA	NA	1	NA	Medium	3. Partnership - risk that partners won't be able to deliver a key piece on time
6	Reduce pre- and post-harvest losses, including those caused by climate change	Outcome 3. Reduced yield losses, including those caused by climate change	Researchers confirm 10 heat-tolerant lines selected from interspecific populations	Same as 2020	2020 report to Government of Canada	0	0	NA	2	Low	
6	Reduce pre- and post-harvest losses, including those caused by climate change	Outcome 3. Reduced yield losses, including those caused by climate change	Researchers confirm resistance to root (Pythium) and foliar (angular leaf spot, web blight) pathogens derived from <i>P. coccineus</i> / <i>P. dumosus</i>	Same as 2020	2020 report to Government of Canada	0	0	NA	1	Low	
6	Reduce pre- and post-harvest losses, including those caused by climate change	Outcome 3. Reduced yield losses, including those caused by climate change	Researchers introgress Mesoamerican genes to Andeans for disease and heat resistance	Same as 2020	2019 report to Government of Canada	0	0	0	0	Low	
6	Reduce pre- and post-harvest losses, including those caused by climate change	Outcome 3. Reduced yield losses, including those caused by climate change	Researchers analyze sequence of bridging genotype between tepary and common bean	Same as 2020	N/A	0	0	0	NA	Low	
6	Reduce pre- and post-harvest losses, including those caused by climate change	Outcome 3. Reduced yield losses, including those caused by climate change	Improved markers for BGYMV resistance availed in collaboration with United States Department of Agriculture (USDA)	Same as 2020	2020 report to Government of Canada	0	0	NA	NA	Low	
6	Reduce pre- and post-harvest losses, including those caused by climate change	Outcome 3. Reduced yield losses, including those caused by climate change	Researchers characterize limits on photosynthate transport under heat	Same as 2020	2020 report to Government of Canada	0	0	0	1	Low	

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
6	Reduce pre- and post-harvest losses, including those caused by climate change	Outcome 3. Reduced yield losses, including those caused by climate change	One climate-smart and environmentally friendly pre-and post-harvest integrated crop management (ICM) practice developed and recommended to partners	Same as 2020	2020 report to Government of Canada	0	0	0	2	Low	
6	Reduce pre- and post-harvest losses, including those caused by climate change; Enhanced capacity to deal with climactic risks and extremes	Outcome 3. Reduced yield losses, including those caused by climate change	Heat tolerance identified in interspecific progenies of common bean and tepary bean	Same as 2020	Report on breeding and phenotyping in MEL	NA	NA	NA	2	Medium	1.Research/ science - inherent risk in unknown cutting-edge research or science
6	Reduce pre- and post-harvest losses, including those caused by climate change; Improved forecasting of impacts of climate change and targeted technology development; Improved capacity of women and young people to participate in decision making	Outcome 3. Reduced yield losses, including those caused by climate change	Researchers and partners develop and disseminate five climate advisories for bean production	Same as 2020	Report on up-scaling in MEL	1	NA	NA	2	Low	
6	Reduce pre- and post-harvest losses, including those caused by climate change; Enhanced capacity to deal with climactic risks and extremes; Gender-equitable control of productive assets and resources	Outcome 3. Reduced yield losses, including those caused by climate change	Researchers identify and strengthen five functional seed enterprises for delivery of climate-smart varieties and complementary ICM technologies with information targeting hard to reach smallholder farmers	Same as 2020	Report on up-scaling in MEL	1	1	NA	2	Low	
6	Enhanced genetic gain	Outcome 4. Enhanced genetic gain	Researchers and partners evaluate at least 10,000 DNA samples at Intertek (cumulative for 2020 and 2021)	Changed	Report on breeding and phenotyping in MEL	NA	NA	NA	NA	Low	

Table 2A: Planned Milestones

FP	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
6	Adoption of CGIAR materials with enhanced genetic gains	Outcome 4. Enhanced genetic gain	Nurseries of at least 200 lines each for 2019, 2020 and 2021 established with at least 10 partners for multisite evaluation	Changed	2020 report to Government of Canada	0	0	0	1	Low	
6	Increased livelihood opportunities	Outcome 4. Enhanced genetic gain	Researchers advance and establish RGA for climbing beans	Same as 2020	2020 report to Government of Canada	0	0	0	0	Low	
6	Enhanced genetic gain; Enhanced capacity to deal with climactic risks and extremes	Outcome 4. Enhanced genetic gain	Researchers recover and analyze data from Genotype × Environment (G × E) trial	Same as 2020	Report on product profiles in MEL	NA	NA	NA	NA	Low	
6	Enhanced genetic gain	Outcome 4. Enhanced genetic gain	Researchers test genomic selection	Same as 2020	Report on breeding technology in MEL	NA	NA	NA	NA	Medium	1. Research/ science - inherent risk in unknown cutting-edge research or science
6	Increased availability of diverse nutrient-rich foods	Outcome 5. Increased availability of nutrient-rich food	At least 2,000 tons of seed of new micro-nutrient-rich bean varieties produced and disseminated by partners (cumulative for 2020 and 2021)	Changed	Report on up-scaling in MEL	1	NA	NA	NA	Low	
6	Increased availability of diverse nutrient-rich foods	Outcome 5. Increased availability of nutrient-rich food	Six consumer-preferred bean varieties including biofortified that are climate resilient and environmentally friendly developed at CIAT and released by partners	Same as 2020	Report on breeding and phenotyping in MEL	1	NA	NA	2	Low	

Table 2B: Planned evaluations/reviews, impact assessments and learning exercises

CRP	FP	Status	2021 Planned studies/learning exercises	Geographic scope	Who is commissioning this study
CRP-GLDC	1	New	Analysis of the nutritional and production system impacts of the introduction of improved lentil varieties in India	Multinational (India, Bangladesh)	ICARDA
CRP-GLDC	1	Ongoing	Assess the nutritional/dietary impacts of GLDC crop varieties	Regional (South Asia, sub-Saharan Africa)	ICRAF
CRP-GLDC	1	New	Finalize the execution of the integrated and multi-faceted impact assessment and learning strategy for GLDC	Multinational (all CRP-GLDC priority countries)	ICRAF
CRP-GLDC	1	Ongoing	Assess the adoption and welfare impacts of improved sorghum and finger millet varieties in Ethiopia and Tanzania	Multinational (Ethiopia, Tanzania)	ICRISAT
CRP-GLDC	1	New	Identify preferred traits for groundnut and sorghum across the value chain actors in Tanzania	National (Tanzania)	ICRISAT
CRP-GLDC	3	Ongoing	Sustainability assessment of smallholder's farming system: Assessment of the impacts of sustainable intensification options	Multinational (Burkina Faso, India, Niger)	ICRISAT
CPR-GLDC	5	New	Impact of trait and QC SNPs markers applications in modernization of crop improvement programs	Regional (South Asia)	ICRISAT
CRP-GLDC	6	Ongoing	Assess the adoption and impacts of improved common bean productivity enhancing technologies on yields and on household welfare	National (Ethiopia)	Alliance of Bioversity International and CIAT
CRP-GLDC	6	New	Mid-term review of the operationalization of market-led functionality of bean corridors and its effect on private value chain businesses	Regional (ESA)	Alliance of Bioversity International and CIAT
CRP-GLDC	6	New	Analyzing bean market segments, the preferences and demand for important bean traits	Multinational (Ethiopia, Uganda)	Alliance of Bioversity International and CIAT

Table 2C: Planned major new collaborations (CGIAR internal, or with non-CGIAR collaborators)

Name of CRP or non-CGIAR collaborator	Brief description of collaboration (give and take among CRPs/PTFs/non-CGIAR collaborator) and value added (e.g. scientific or efficiency benefits)
Advanta Seed Company; Nielsen Seeds	Joint engagement with FP4 on activities of the Crop Network Groups (CNGs) and seed consortium
Akita University; Bangor University; Cognitive Edge; Commonwealth Scientific and Industrial Research Organisation; Egerton University; University of Cologne; University of Hohenheim; University of Natural Resources and Life Sciences, Vienna	Collaborate with FP1.2 for activities on one or a combination of them: joint publication, proposal writing and special issue editing
Billian Music Foundation; Green Forest Food Limited	Co-implementers of ongoing and new actions under FP1.2
Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD)	FP3 will collaborate on systems modelling and high-resolution mapping to improve the sustainability of farming systems
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	FP3 will work more closely on systems modelling and value chain research
Corteva Agriscience	Partnership with FP5 will focus on pearl millet genomics and trait discovery activities such as refinement of genome assemblies and enabling technologies such as genome editing for high priority intractable traits
Good Food Institute (GFI), USA	FP5 will work closely on trait discovery/mapping for protein quality in pearl millet
Haramaya University, Ethiopia	Shared work for Capacity Development (CapDev) activities
HIPHEN (a start-up from INRA-Avignon)	FP4 will work more closely with HIPHEN to continue validating the imaging-based phenotyping algorithm to measure sorghum crop growth indices with drone technology and pursue the EiB initiative to develop a data analysis pipeline to convert digital images captured by drone into crop indices towards breeding selection.
ICAR's Farm Science Centers (KVKs - Krishi Vigyan Kendras)	FP3 will tap KVKs to upscale context-specific resilient farming systems
International Center for Agricultural Research in the Dry Areas (ICARDA)	FP3 will work more closely with ICARDA on sustainable intensification technologies and gender research
International Livestock Research Institute (ILRI)	FP4 collaboration will focus on measuring the quality of crop residues of crops such as groundnut, sorghum, pearl millet and finger millet towards improving the fodder quality traits of GLDC crops
Indian Council of Agricultural Research (ICAR), India	FP3 will work on co-developing tools and analytics supporting resilient farming systems and inclusive value chains. FP4 will collaborate on multi-environment testing (MET) of GLDC crops and knowledge sharing. FP5 will work on several shared pre-breeding work.
Institut de l'Environnement et des Recherches Agricoles (INERA), Burkina Faso; Institut d'Economie Rurale (IER), Mali; Institute of Agricultural Research (IAR), Nigeria; Institut Sénégalais de Recherches Agricoles (ISRA), Senegal; Institut National de la Recherche Agronomique du Niger (INRAN), Niger; and other NARS in West African countries; Makerere University, Uganda	These organizations will collaborate with FP3 in developing technologies to sustainably intensify crop-livestock systems. FP4 will collaborate in multi-environment testing (MET) of GLDC crops and knowledge sharing with INERA, IER, IAR, other NARS in West Africa, and ISRA, in particular on field testing of higher density planting in pearl millet. This will include detailed measurements of effects on water saving and water use efficiency (ISRA). Makerere University collaboration will focus on knowledge sharing.

Table 2C: Planned major new collaborations (CGIAR internal, or with non-CGIAR collaborators)

Name of CRP or non-CGIAR collaborator	Brief description of collaboration (give and take among CRPs/PTFs/non-CGIAR collaborator) and value added (e.g. scientific or efficiency benefits)
Institute of Agricultural Research (IAR), Nigeria	FP3 collaboration will be around farm mechanization and sustainable intensification of crop-livestock systems
Intertek	Collaboration on Single nucleotide polymorphism (SNP) service provision for GLDC crop breeding (FP4) and genotyping and QC panel related activities (FP5)
Kenya Agricultural and Livestock Research Organization (KALRO)	FP3 will work more closely on adapting intensification approaches for legume cropping systems
Kwara State University (KWASU), Ilorin, Nigeria	FP3.1 partnership for the release of biocontrol agents against the legume pod borer
Mahalanobis National Crop Forecast Centre, India	Shared work on climate smart agriculture
Rothamsted Research	FP5 will work closely on TIGR ² ESS-related engagements
Swedish University of Agricultural Sciences (SLU), Wageningen University of Science (WUR)	FP3 will continue and expand work with SLU and WUR on developing and testing approaches for improving sustainability of farming and livelihood systems
Tanzania Agricultural Research Institute (TARI)	FP3 will work with TARI on developing strategies to manage climate and market risks
The Feed the Future Innovation Lab for Crop Improvement	CIAT is leading a Korean-funded regional project on bean breeding for drought tolerance in nine Latin American countries. We have initiated a training program on a statistical package called Mr. Bean, and are in discussions to incorporate this in the program of the Innovation Lab led by Costa Rica and Haiti that deals with beans and sorghum.
The Sainsbury Laboratory, UK	FP5 will collaborate on trait discovery activities in sorghum and pearl millet
University of Nebraska, Lincoln, USA	FP5 will collaborate on gene discovery under Innovation Fund activities

3. Financial plan for the coming year, including use of W1/2

As per the approved 2021 FINPLAN, the budget allocated for CRP-GLDC is US\$ 7.01 M. A total of US\$ 39,523,052 as W3/Bilaterals has been mapped by the CRP-GLDC participating centers for 2021, out of which US\$ 291,596 has been mapped to meet the objectives of FP2 that remained unfunded. FP6 (Common Bean) funding of US\$ 1,715,000 is being channeled via W3.

Table 3: Planned budget					
	Planned budget				Comments on major changes
	W1/2	W3/bilateral	Center Own fund	Total	
FP1	1,013,075	566,750	-	1,579,825	Includes FP and CoA Co-Leaders salaries and admin management contribution.
FP2		291,596	-	291,596	Though FP2 is not funded, activities planned under it are being carried out from W3/Bilateral projects.
FP3	1,601,840	7,380,654	-	8,982,494	Includes FP and CoA Co-Leaders salaries and admin management contribution.
FP4	2,444,745	21,813,222	-	24,257,967	
FP5	1,172,030	2,070,300	-	3,242,330	
FP6	-	7,400,530	-	7,400,530	FP6 funding of \$ 1,715,000 channeled through W3.
Additional cross-cutting activity on Markets and Partnerships in Agri-business (MPAB)	350,000	-	-	350,000	Includes salaries and operational cost.
CRP management & support cost	428,310	-	-	428,310	Includes PMU operational cost, communications cost and institutional overheads.
CRP Budget 2021	7,010,000	39,523,052	-	46,533,052	
Unspent carry-over of 2020	*202,302	-	-	202,302	A total sum of US\$ 202,302 (un-audited) is reported unspent due to the disruptive impact of the COVID-19 epidemic during 2020. This amount is 2.49% of the total 2020 CRP-GLDC budget of 8.14 M. This amount requires to be carried forward to 2021 in order to achieve the planned milestones and MELIA studies of 2020.
CRP Total 2021	7,212,302	39,523,052	-	46,735,354	

* Details are provided under Additional Finplan on page 22

Additional FinPlan

A total sum of US\$ 202,302 (un-audited) is reported unspent due to the disruptive impact of the COVID-19 epidemic during 2020. This amount is 2.49% of the total CRP-GLDC budget of 8.14 M. This amount requires to be carried forward to 2021 in order to achieve the planned milestones and MELIA studies of 2020. A list of milestones and MELIA studies that are required to be achieved in 2021 is provided below in annex-1 and 2. It is requested that the unspent amount of US\$ 202,302 be included in the planned allocation (W1/W2) of US\$7.01M in addition to the FINPLAN target for 2021 (*Ref. 2021 Revised CGIAR Research Financing Plan dated 2 December 2020*).

By Line Item	W1 & 2 (US\$)					Comments on major changes
	Budget 2020	Forecast 2020	Unspent Carryover	Budget 2021	Total Budget 2021	
Personnel	2,797,223	2,797,223	-	2,400,000	2,400,000	<i>Unspent carry-over of 2020 (US\$ 202,302) is included as additional Finplan in Budget 2021</i>
Collaborators Cost CGIAR Centers	18,000	18,000	-	15,000	15,000	
Collaborators Cost Partners	644,289	634,289	10,000	570,000	580,000	
Operating expenses	3,292,115	3,142,198	149,917	2,810,000	2,959,917	
Travel	153,249	141,046	12,203	120,000	132,203	
Capital and other equipment for project	74,081	72,710	1,371	60,000	61,371	
Closeout cost	-	-	-	60,000	60,000	
Sub total	6,978,956	6,805,464	173,492	6,035,000	6,208,492	
Institutional Overhead (as a % of DC)	1,161,075	1,132,265	28,810	975,000	1,003,810	
Total CRP-GLDC Budget	8,140,031	7,937,729	202,302	7,010,000	7,212,302	

Annex-1

List of milestones planned for 2020 to be carried over to 2021 due to the COVID-19 disruptions in activities											
	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting Markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
1	Increased availability of diverse nutrient-rich foods	Outcome 1. Improved targeting and responsiveness of research to market and household demands in the face of climate change for greater technology adoption, food and nutrition security, resilience, and poverty reduction	Multidimensional ex-ante evaluation of GLDC research and technology options completed and results shared with GLDC staff and partners	Same as 2020	Refined GLDC program with adjusted work plans for 2021 featuring priority research options and countries	NA	NA	NA	NA	Medium	4. Internal resources - risk that key staff, infrastructure or equipment not available at time needed
1	Increased livelihood opportunities	Outcome 2. Market and household demand identified, and trade-offs assessed for more inclusive value chains that improve income and nutrition status in target regions	Underlying principles established for diversity assessment and matching of technologies across contexts	Same as 2020	Published options of how to meet diverse target group needs in GLDC research and scaling	1	1	1	0	Medium	4. Internal resources - risk that key staff, infrastructure or equipment not available at time needed
1	Improved capacity of women and young people to participate in decision-making	Outcome 3. Inclusive and equitable technologies and innovation systems established for accelerated and broadened impact across the agri-food system	Inclusive and equitable innovation system for accelerating impacts for women and young people designed and piloted including policy interactions.	Same as 2020	Innovation systems for empowering women and youth design reports sex disaggregated and gender relevant datasets policy brief [paper] on gender and social analysis informing intervention design	2	1	1	0	Medium	4. Internal resources - risk that key staff, infrastructure or equipment not available at time needed

List of milestones planned for 2020 to be carried over to 2021 due to the COVID-19 disruptions in activities

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						Gender	Youth	CapDev	Climate change		
1	Conducive agricultural policy environment	Outcome 4. Strong project design, execution, monitoring and evaluation systems and tools consistently applied in GLDC scaling projects, with demonstrable progress on enhanced adoption and impact	Evaluation documenting the strengths, shortcomings, and key lessons learn on GLDC scaling approaches and impacts	Same as 2020	Evaluation report	1	1	1	1	Medium	3. Partnership - risk that partners won't be able to deliver a key piece on time
1	Conducive agricultural policy environment	Outcome 4. Strong project design, execution, monitoring and evaluation systems and tools consistently applied in GLDC scaling projects, with demonstrable progress on enhanced adoption and impact	The working strategy for evidencing the outcomes and impacts of GLDC implemented	Same as 2020	Working papers on impact assessment	1	0	1	0	Medium	4. Internal resources - risk that key staff, infrastructure or equipment not available at time needed
3	Increased resilience of agro-ecosystems and communities, especially those including smallholders	Outcome 2 Cropping systems sustainably intensified and diversified	Agricultural system simulation models (agent-based model, nutrient balance/flow models) used to assess ex-ante impacts of innovation practices on crop production efficiency and household livelihoods, and best-bet options identified	Same as 2020	a) Operational models, b) reports on ex-post impact assessment with an efficiency focus, c) publications (submitted journal article, conference proceeding paper)	NA	NA	NA	NA	Medium	2. Financial - funding not fully confirmed or at risk of being cut

List of milestones planned for 2020 to be carried over to 2021 due to the COVID-19 disruptions in activities

	Mapped to Sub-IDO	2022 FP outcomes	Milestone	Source	Means of verification	CGIAR Cross-Cutting Markers for the milestone				Assessment of risk to achieve that milestone (L/M/H)	For medium/high please indicate the main risk
						Gender	Youth	CapDev	Climate change		
3	Increased resilience of agro-ecosystems and communities, especially those including smallholders	Outcome 2. Cropping systems sustainably intensified and diversified	Participatory field trials under smallholder conditions in different cropping systems under different environments evaluated	Same as 2020	a) Reports on field trials and b) publications	1	0	NA	1	Medium	5. Weather - for example, drought or heavy rain affecting field trials
3	Increased resilience of agro-ecosystems and communities, especially those including smallholders	Outcome 3. Tested, adapted and validated options applied for sustainable intensification and livelihood diversification by farmers	Suite of systems modelling tools/framework for co-designing resilient farming systems in GLDC regions	Same as 2020	Publications, reports	1	NA	NA	NA	High	3. Partnership - risk that partners won't be able to deliver a key piece on time
3	Increased resilience of agro-ecosystems and communities, especially those including smallholders	Outcome 3. Tested, adapted and validated options applied for sustainable intensification and livelihood diversification by farmers	Portfolios of household activities, enterprises and management practices that materially and equitably enhance livelihoods (as defined at sub- IDO level) while minimizing negative externalities.	Same as 2020	Publication, Reports, technical document	1	NA	1	1	High	3. Partnership - risk that partners won't be able to deliver a key piece on time

Annex-2

List of ongoing MELIA studies of 2020 to be carried over to 2021 due to the COVID-19 disruptions in activities					
CRP	FP	Status	2021 Planned studies/learning exercises	Geographic scope	Who is commissioning this study
CRP-GLDC	1	Ongoing	Assess the nutritional/dietary impacts of GLDC crop varieties	Regional (South Asia, sub-Saharan Africa)	ICRAF
CRP-GLDC	1	Ongoing	Assess the adoption and welfare impacts of improved sorghum and finger millet varieties in Ethiopia and Tanzania	Multi-national (Ethiopia, Tanzania)	ICRISAT
CRP-GLDC	3	Ongoing	Sustainability assessment of smallholder's farming system: Assessment of the impacts of sustainable intensification options	Multinational (Burkina Faso, India, Niger)	ICRISAT



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