

ISPC Assessment of the Grain Legumes and Dryland Cereals Agri-food Systems CRP-II revised proposal (2017-2022)

ISPC CRP RATING¹ (September 2017): B+

Background

The ISPC commentaries on the first drafts of the GLDC proposal (July 2016; September 2016) highlighted five main concerns that needed to be addressed in subsequent revisions. The concerns were:

- clarifying the target domain of the CRP to better distinguish between the competing narratives of the multi-commodity improvement approach and the agro-ecosystem/farming systems approach,
- establishing a clear set of research priorities,
- developing a sequencing and feedback strategy among the flagships,
- identifying and justifying essential trait discovery and breeding targets, and
- demonstrating commitment to cross-system exchange of knowledge and experience on working with the seed sector.

Due to the difficulties experienced by the proponents of GLDC to adequately address the recommendations of the ISPC, the System Management Board (SMB) commissioned an Expert Panel to reconsider the scientific basis of the proposal and to provide recommendations to address the research for development needs for the crops and communities of the dryland ecosystems. The Expert Panel Report (March 2017) made a number of key recommendations that needed to be addressed in a revised proposal. These included the need to i) provide a convincing argument on the complementarities between cereals and legumes, ii) generate additional analyses and wider consultations to support the arguments and justifications made, iii) provide clearer problem statements for FP1 and FP2, iv) clarify how development outcomes will reach beyond farmers, v) offer a better synthesis of lessons learned, and vi) put greater emphasis on supporting national priorities that will drive change in agri-food systems.

Most importantly, the Expert Panel Report recommended that the geographical focus of GLDC should be narrowed to include only semi-arid and sub-humid systems in South Asia (SA) and sub-Saharan Africa (SSA). It further recommended that ICRISAT should lead the new proposal. The SMB accepted these recommendations and ICRISAT was invited to develop a revised and refocused proposal which was submitted in August 2017.

Summary

The revised GLDC proposal has made satisfactory progress in addressing issues raised by the ISPC and the Expert Panel. ICRISAT commissioned 10 expert studies which provided very useful input into the revised proposal in many areas including a synthesis of lessons learned and complementarities between legumes and cereals; a greater emphasis in places on supporting national and regional priorities through stakeholder consultations; and the need to clarify how development outcomes will reach beyond farmers.

¹ A+: Outstanding - of the highest quality, at the forefront of research in the field (fully evolved, exceeds expectations; recommended unconditionally).

A: Excellent – high quality research and a strongly compelling proposal that is at an advanced stage of evolution as a CRP, with strong leadership which can be relied on to continue making improvements.

A-: Very good – a sound and compelling proposal displaying high quality research and drawing on established areas of strength, which could benefit from a more forward-looking vision.

B+: Good – a sound research proposal but one which is largely framed by ‘business as usual’ and is deficient in some key aspects of a CRP that can contribute to System-wide SLOs.

B: Fair – Elements of a sound proposal but has one or more serious flaws rendering it uncompetitive; not recommended without significant change.

C: Unsatisfactory – Does not make an effective case for the significance or quality of the proposed research.

GLDC is now a sound proposal with a revised focus on the semi-arid and sub-humid agro-ecologies of SSA and SA. However, the ISPC identifies the following as issues that affect the overall rating of the CRP proposal:

- The goals of the CRP remain generally aspirational, as GDLC proposes to help in “transforming agri-food systems”. While the overall logic is reasonable, the proposal is still lacking a coherent argument on how the individual research components and flagships will collectively add up to a transformative process.
- Most FPs are reasonably well-written and present supporting arguments for the research planned. FP4 scored as strong, and FP1, FP3 and FP5 are rated as moderate due to outstanding issues that have yet to be resolved. However, FP2 is judged to be weak. In addition, there is a pervasive lack of clarity on how all of the stated objectives will be achieved, who the partners, outside of other CRPs, will be, and how the planned activities will be funded owing to the substantial funding gap of US\$ 260.1 million.
- Given the importance and complexity of the GLDC CRP, ISPC considers that the role of the CRP Director cannot be adequately met with just 20% of the time of the ICRISAT DDG-Research. Success will demand strong and dedicated leadership, and cost-savings should not be used as a criterion alone.
- A weakness of the current proposal is the lack of clarity on what is likely to be achieved with the available funding – at least for 2018-2019 where agreed W3 and bilateral funding is known, and what constitutes additional aspirations if further funding is secured.

Taking into consideration all of these factors, the ISPC has rated this proposal as a B+,

Overall analysis of the full proposal as an integral part of the CRP portfolio

Strategic relevance

GLDC aims to increase the productivity, profitability, resilience, and marketability of critical and nutritious grain legumes (chickpea, cowpea, pigeonpea, groundnut, lentil, soybean) and cereals (sorghum, pearl millet, finger millet) grown within the semi-arid and sub-humid dryland agro-ecologies of SSA and SA. Studies on poverty and malnutrition as well as climate change and soil degradation have shown this agro-ecological and geographical focus to be well-justified. The strategic relevance of this CGIAR Research Program (CRP) proposal is generally well articulated.

Crop improvement and management, as well as marketing and innovation systems, are integrated in the revised proposal, which enhances its potential to achieve impact. However, the goals of the CRP remain largely aspirational, as GDLC proposes to help in “transforming agri-food systems”. While the overall logic is reasonable, the proposal still lacks a coherent argument on how the individual research components will collectively add up to a transformative process. Impact pathways range from improving nutrition through farmer’s own consumption of improved varieties, to improving income through participation in value chains. However, the activities to support these and other pathways have not been adequately linked to the prioritization process. As a result, it is still unclear what the main thrust of the CRP will be. Numerous assumptions are made, e.g., ‘*we will focus on places where most malnourished people are, and since GLDC crops are nutritious, malnutrition will fall.*’ Given that the first two propositions have always been true, it is unclear how the third proposition would hold true, assuming there has already been ongoing work on these crops for these areas.

The effectiveness of the proposed approach will depend on winning buy-in not only from GLDC scientists and partners, but also from development partners who will be essential to achieving the envisioned level of scaling both up and out. This is somewhat risky; if scale-out partners are not interested in integrating the prioritized commodity improvement products into their value chains, then the impact of GLDC will be compromised. GLDC will need to be very proactive in partnering with and convincing their scale-out partners.

The crop × trait × country priority list (Table 4) would have made the argument regarding the complementarities between legumes and cereals more convincing if the list had included cereal × legume

combinations by country. In other words, in which countries will the cereal and legume synergies be most realized and for what specific traits?

Consideration of the 'grand challenges'

The proposal considers a number of societal grand challenges e.g., climate change, malnutrition, soil degradation, competition for land, post-harvest losses, ageing and changing workforce. In general, the assertions made are standard for CRPs. The commissioned expert studies have contributed to strengthen the arguments put forward. Each flagship also has an informative section on the specific grand challenges their research is targeting. What is possibly missing, for instance in the case of malnutrition, is a clear logic and articulation of how the presence of nutritious crops in places where nutrient needs are highest will lead to a transformation in the future, when their past presence has not, as per lessons learnt from previous research-for-development undertakings by CGIAR and its partners. While malnutrition is dealt with in a number of places, micronutrient deficiencies do not appear as high priority in the list presented in Table 4.

Evidence of capturing inter-CRP synergies

Although the three CRPs that were merged to form GLDC had already developed cross-CRP collaboration during Phase 1, changes in emphasis and activities in the revised proposal necessitate new or expanded collaborations with other CRPs. This will be done in an environment where other CRPs have already been working in Phase 2 for a year (by 2018) and may not have the staff and resources available to develop new collaborations with GLDC. Much of the collaboration planned with other CRPs is on crop-specific work

Rigor and credibility of the scientific arguments

GLDC aims at integrating existing capacity in crop improvement science, farming systems research and social science with R4D that fosters wider market and policy opportunities within the targeted agri-food systems. The redesign of the CRP has placed the multi-commodity improvement approach into an innovations systems/value chain system approach. The argument for the redesign is logical with more information provided on the kind of opportunities that will be selected in value chains and the kind of research that may be carried out. These research areas include production and post-production technology applications, business models, post-harvest infrastructure, value chains, social norms and organization, partnerships, benefit-sharing agreements, governance and institutional arrangements, and organizational and public policy options.

The 'response to reviewers' clearly spells out the degree to which CGIAR partners tried to address ISPC comments, including the commissioning of 10 papers, and much improved theoretical analysis of problems. It relies a great deal on site coordination, shared infrastructure as the vehicle for research synergy, and multiple uses of crops (food-fodder, for example). The science quality has improved, as well as attention to the need for understanding policy environments, how to scale up impacts (science of scaling), and the need to integrate socioeconomic perspectives into all facets of an agri-food system CRP. Some of the aspirational targets cited are very optimistic and based on little serious analysis. The demand projections are based on the IMPACT model and show increasing demand for all GLDC commodities, even though past trends suggest a decline in the importance of some of these crops in target countries.

As the proponents noted (page 4 of the proposal) "*the CRP's value proposition is based on a rationale of logical synergies between sorghum, millets and the grain legumes grown in common agroecologies.*" However, it is unclear where and who grows soybean or lentils with sorghum and millets. The total cumulative share of the economic importance of finger millet, lentil and soybean (page 7) is reported to account only for 6.4% of the share value of production, suggesting relatively minor potential impact of investments for research on these three crops across the 14 target countries. In addition, the past history of adoption is weak and the proposal is unable to come up with many examples of success, outside of India, that would make the case for these crops as potential drivers of rural transformation.

Individual FPs add up to a CRP that offers more value than the sum of individual FPs

In general, the level of integration described in the narratives of the FPs and the reference to knowledge flows and collaboration suggests that the FPs will add up to a CRP that offers more value than the sum of the individual FPs. However, the information flows in Figure 5 (page 14) are confusing and do not fit

with the narrative. FP2 is intended to be central to most decisions that are made in the rest of GLDC. It feeds information about opportunities to FP1 and FP4 but seemingly not to FP5 although this is mentioned in the narrative. Information flow is from FP3 to FP2 but not *vice versa*. This does not fit with the narrative that indicates that information will flow from FP2 to FP3 and to FP5. In addition, as FP2 will identify opportunities for priorities and feed these to FP3, FP4 and FP5 then two FPs will be involved in identifying opportunities. Figure 6 on the program structure and flows of information (page 19) is not of much help as it shows that information flows both ways between all connections. There is still a need for a rethink on which information flows actually drive decision making in GLDC. These figures do not meet ISPC recommendation for clarity on the sequencing and feedback of information among the FPs.

Identifying potential synergies between FPs is only the first step in the planning exercise. The real challenge will be to make sure that the synergies are effectively achieved in practice. While the management and organizational structure has sufficient scope to maximize cooperation, the only way to judge the cross-FP linkages will be implementation.

Lessons learned

Each FP narrative has a section on lessons learned from past research and how activities and targets will be revised to address deficiencies and solve problems. For example, in addressing lack of adoption of some improved cultivars, FP1 will look at both poorly functioning seed systems as well as attributes preferred by farmers and consumers. FP2 will take advantage of a renewed emphasis on nutritional security to focus on new opportunities for smallholders to produce nutritionally dense GLDC crops. FP4 has learned that a combination of formal and informal seed systems is needed for GLDC crops.

The commissioned paper on “*Past performance and lessons learned*” (Orr et al, 2017a) provides an excellent assessment of technologies that were successful and why, as well as some that failed. The overriding reason for success seems to be based on the existence or fostering of functional markets and institutions and a conducive policy environment. This is a critical message for GLDC for the research that needs to be carried out in Phase 2. This effort responds to the Expert Panel recommendation to provide a better synthesis of lessons learned. ICRISAT has also provided a comprehensive response to the recommendations made on various versions of GLDC by the ISPC, Expert Panel and the Fund Effectiveness Working Group.

There are few lessons presented on aspects other than trait breeding (landrace trait sourcing, participatory plant breeding, dual-purpose crops, early cultivars, gender-responsive plant breeding). Examples of lessons learnt on agronomic research or markets-institutions-policy are scanty. This could be partly justified by the fact that most previous work was not in that domain, but one could also expect to see lessons learned related to that lack to be highlighted.

Site integration

The new proposal does a better job of articulating why site integration matters to issues of integration at a food system level. Table 2 (Annex 3.7) lists CRP × activity × country for GLDC’s site integration with other CRPs. The information given indicates that some of these site integration activities are continued from Phase 1, e.g. for PIM, CCAFS, LIVESTOCK, and A4NH. Tables 1 and 2 indicate a serious commitment to site integration for the benefit of CRPs and their partners. Although missing from the narrative on inter-CRP collaboration, the Tables list several activities that will be undertaken between GLDC and FTA including developing improved varieties for tree-based systems and modelling impacts of tree-based options for land restoration and intensification. It is not clear why collaboration is only planned on nutrition research with CRP on Agriculture for Nutrition and Health (A4NH) in India, when there ought to be collaboration on nutrition, value chains, etc. The same could be said for the restriction of site integration with PIM in Ethiopia.

1. Theory of Change and Impact Pathway

The main concern of the ISPC on the original GLDC proposal (ISPC, 2016) was that the Theory of Change (ToC) was too generic. It did not reflect the specificities of drylands, avoided engaging with the complexity of how this CRP will achieve impact, and there was inadequate discussion of the differing roles played by the crops in different locations and contexts. In the revised ToC, GLDC argues that “*household-level outcomes of food security, resilience and poverty reduction depend on the ability of*

smallholder farmers and other actors to tackle system-level change in agri-food system regimes.” However, institutional, market, policy and governance problems often prevent changes that can result in improvements in agri-food systems that benefit small holders. Hence “*socio-economic science, contemporary development practice and scaling partners must be well integrated within GLDC to unlock opportunities in the context of their differing innovation capacities and agri-food system regimes”*.”

In principle, no one would disagree with the logic of this ToC. However, the key question is to what extent this CRP will be able to effectively tackle the problems with contemporary development practices and engage convincingly with scaling partners that result in the transformation and sustainability of GLDC agri-food systems. The ToC has little articulation of what research will lead to what impacts via what mechanisms. It acknowledges that crop improvement and farming systems research are necessary but not sufficient investments for smallholders to overcome their challenges. There is still confusion over whether the grain legume and dryland cereal commodities are being cultivated primarily for home consumption (which motivates arguments about nutrition) or whether they are being cultivated for market sales and income generation. It seems somewhat implausible that these are the crops that will drive a rural transformation in the target areas. It also seems too vague to serve as a valid basis for prioritization of research to generate evidence to understand and support key links in the impact pathway

Figure 5 (page 14) shows the Impact Pathway of GLDC. There are two impact pathways, namely, the Integrative solutions pathway and the Scaling and sustaining pathway. Is there a need for having two impact pathways in GLDC? FP1, 3, 4 and 5 make most contributions to the Integrative solutions pathway while FP2 makes most contribution to the Scaling and sustaining pathway based on the outcomes of the Integrative solutions pathway. While it is important to acknowledge that achieving CRP targets will require change well beyond the project target sites and countries, the way the pathways are presented in Figure 5 suggests that the capacity development outcomes described in Pathway 2 are not present or important in Pathway 1. This is not the case, and is another reflection of the lack of real integration of FP2 with the rest of the CRP. Although it is clear that the Expert Panel’s recommendation to clarify how development outcomes will reach beyond farmers has been taken seriously by GLDC, there remain questions about how far GLDC can be involved effectively in the process beyond scaling-up and –out (via Impact Pathway 1). This is also discussed under FP2.

2. Cross-cutting themes

Gender and Youth

GLDC has used the opportunity of Phase 2 to strengthen its focus on gender integration and social exclusion in the drylands. This will be based in “*continued learning and improvement in gender research, analysis, intervention and reporting”*”. FP1 highlights CoA1.3, which is specifically targeted at gender research. The narrative gives a number of specific examples of the planned gender research agenda for each FP and how it is aligned to key issues on the impact pathway. The gender strategy is expanded further in Annex 3.4, and it is clear that gender issues have been considered within the proposed research framework.

In its assessment of the previous GLDC proposal, ISPC expressed concern regarding the narrow focus on youth issues – mainly digital agriculture – without sufficient explanation as to how this would make dryland farming more attractive to youth. The ISPC suggested a need to consider other issues such as child labour, rural processing and youth unemployment. The revised proposal shows that more effort has been made to develop a youth strategy which addresses these issues. This effort has been informed by recent studies on youth in agriculture including one by MAIZE (Ripoll et al., 2017) which developed a framework for addressing youth inclusion in rural transformation. GLDC will focus on “understanding the ‘youth in the drylands’ – who they are, who is staying in agriculture, who is leaving agriculture, who is coming back to agriculture once they have left and the pathways they follow in engaging with dryland agriculture”.

Enabling environment

Considerable attention has been given to the enabling environment in the revised GLDC proposal, especially in terms of the Markets-Institutions-Policy rubric which must be functional if technologies are to be adopted. The importance of the enabling environment features throughout the narratives of FP1 and FP2; it is part of CoA1.4 in FP1 and is also a key outcome (C1-Enabling environment improved in the

impact pathway). However, there has clearly been little substantive discussion with either PIM or A4NH about policy outcomes, potential research topics, tools to use, etc. to get a sense of how to enable transformation in these food system ecologies beyond incremental yield growth.

Capacity development

In its commentaries on the GLDC proposal, the ISPC (2016) expressed some concerns on the lack of capacity of this CRP and its NARES partners to deliver on some of the activities described, especially the research on innovations systems. The expert panel also raised concerns about limited ambition in the vision statement, lack of operational detail, and limited information on the planned levels of investment in capacity development. GLDC has now given much more emphasis to capacity development in the program narrative and the revised Annex 3.3. The CRP plans to form a Capacity Development Task Force of facilitators which will identify opportunities and facilitate the capacity building required especially within the CRP. It will improve the capabilities of GLDC staff and their key partners to implement capacity development. The GLDC shows a clear commitment to capacity development throughout most if not all research activities. This will no doubt contribute to its outputs and outcomes. The amount of capacity development planned is very ambitious and may require significant resources. The planned budget of US\$ 250K seems to be very small for what is required.

3. Budget

In assessing the budget in 2016, the ISPC highlighted the difficulty of this CRP to develop a coherent project portfolio when 90% of its funds were from W3 and bilateral sources. With only 10% from W1/W2, it was considered difficult for the CRP to respond to the ISPC's major concerns, including that it risks becoming donor-driven. In identifying this problem, although the ISPC did not make concrete suggestions to resolve it, it concluded that the intellectual challenges facing this CRP must be addressed simultaneously with a conversation about greater W1/W2 funding through improving donor confidence in its ability to achieve its objectives. The budget breakdown in the revised CRP has slightly improved with 15% of funds from W1/W2. This has only slightly aided GLDC to develop a coherent portfolio especially one based on its priorities if donors have different ones. The funds requested are in line with other CRPs and seem appropriate for the planned activities and expected outcomes. However, the funding gap is substantial at US\$ 260.1 million of the total of US\$ 413 million. There is a funding gap of US\$ 24.7 million (30%) for 2018 alone.

The proportion of funding allocated to some FPs has changed considerably from the 2016 proposal. The percentage of the budget allocated to FP2 and FP3 is more or less the same but the budget of FP1 has decreased from 13.4% to 8.2% and the budget of FP5 has decreased from 15.4% to 10.6%. In contrast, the budget of FP4 has increased from 29.3% to 39.7%. Since this CRP gives high priority to plant breeding, it seems that the balance relates to the expected outcomes. But these changes also probably reflect changes in W3 and bilateral sources but it merits further explanation. Have activities planned previously under FP1 and FP5 been dropped or reduced due to budget shortfalls and in such case, what effect would this have on their ability to achieve expected outcomes?

The budget allocation for CRP management is US\$ 12 million, which is the same level requested in 2016 - but for one year less (in other words an increase in real terms). This means that the percentage of allocation to management has increased from 2.3% to 2.9% despite the fact that the percentage of management time for the program director has decreased from full-time staff to 20%.

4. Leadership and partnership

GLDC will be led by the Deputy-Director General (DDG)-Research of ICRISAT who is an experienced scientist in dryland systems. However, only 20% of his time will be allocated to this role. Most of the daily management will be done by a full-time program manager. The narrative describes this arrangement as cost-effective and that similar arrangements have been established in WHEAT and MAIZE. However, the leadership /management arrangements for these two CRPs do not describe part-time management. GLDC is a much more complex CRP than others, as it is dealing with nine crops, seven CGIAR centres, and has had difficult interactions including the lack of information flow and learning across FPs and regions, as well as limited disciplinary integration (especially with social scientists) and poor linkages across regions. The ISPC considers that the role of the CRP director cannot be adequately met with just

20% of the time of the ICRISAT DDG-Research. Cost-saving should not be used as a criterion alone. Success will demand strong and committed leadership.

In its 2016 commentary, the ISPC noted the need to strengthen socioeconomics, priority setting and impact acceleration in FP1; the need for experienced systems agronomists in FP4; and the need to strengthen marker-aided breeding expertise in FP3. A brief assessment of the proposed leaders of the FPs suggests that only some of these recommendations have been addressed. FP2 is to be led by an international leading expert in innovation systems. The other members of the team include two members from CSIRO who have innovation systems experience but none of the CGIAR staff have innovation systems/value chain experience. The leader of FP1 has expertise in impact assessment but does not appear to have specific experience in priority setting. FP3 is now led by a forest ecophysiologicalist. His team includes a soil microbiologist, an entomologist, a systems modeler, and three members with dryland systems experience although only one in agronomy. Further comments on this are given under FP3 but the ISPC would question whether a forest ecophysiologicalist is the most appropriate leader of this FP when crop-based research under a farming systems approach should be the main focus.

FP4 is led by a groundnut breeder, and his team includes several breeders with phenotyping experience as well as one scientist with experience in community seed systems. The seed systems expertise is substantially strengthened through the inclusion of a specialist with expertise in small holder seed systems however specific experience in working with the private sector is lacking. FP5 is led by a scientist with substantial experience in genomics and trait discovery in a multinational seed company. Several of the team have experience in marker-aided breeding including two scientists from CIRAD.

With possible exception of FP5, the location of the team leaders does not seem to reflect the overall distribution of the scientists under each FP. While there are obviously other factors to be considered in appointing team leaders, this separation of leadership and key scientist might present some coordination challenges. There seems to be a mismatch between the location of scientists and the target countries of GLDC. For six of the target countries, namely Burkina Faso, Mali, Niger, Sudan, Tanzania and Myanmar, there is not a single scientist on the team that is based in those countries. While it is understandable that the partnership has to draw from existing scientists who are best qualified for the job, some country-level representation would be useful to ensure smooth implementation and minimize travel costs. Alternatively, a country-level coordinator might be necessary.

The ISPC commentary on the 2016 proposal complimented GLDC on the identification of partnership typologies for different kinds of activities e.g. discovery, crop improvement and product development and seed scaling however limited effort had been made to identify new partners for innovations systems and value chain activities. The Expert Panel identified the need for wider consultation with partners in the development of the revised and refocused CRP. The donors asked for more evidence of engagement with SROs. It is clear that GLDC has taken these recommendations seriously. GLDC will be implemented through collaboration of seven CGIAR centres, Apex and Sub-Regional Organizations, the NARES in each target country, NGOs, ARIs, Farmer Producer Organizations (FPOs) and private sector companies. A partial list of partners who endorsed the GLDC proposal and agreed to support implementation is provided in Table 7. GLDC priorities have been cross-checked with strategies and priorities from sub-regional organizations (SRO) and regional fora. GLDC sees SROs as instrumental in scaling out benefits from CRP interventions within similar agro-ecological zones to neighboring countries. Many of the partners have shown excellent commitment. For instance, CSIRO and CIRAD/IRD have committed funds and staff time bringing new skills and experience.

GLDC has not explicitly analyzed its comparative advantage with regard to alternative suppliers and relies on the endorsement of the Expert Panel report. That said, the centers collaborating in GLDC have a long history of productive and well-regarded partnerships. This provides it with stature and credibility in attracting new partners who can contribute necessary skills where GLDC does not have comparative advantage, e.g. development NGOs and private agri-businesses. GLDC rightly acknowledges that scaling out innovations depends on forming good partnerships with these groups. Other components of comparative advantage for any CRP include having scientists and facilities located in target countries where the research will be carried out as well as easy access to substantial well-conserved genetic

resources collections. What is probably lacking in this section and in all the FP narratives is an assessment of the scientific comparative advantage versus alternative suppliers.

The governance and management of GLDC follow recommendations of the IEA (April 2014).

5. Flagships

Flagship 1: Priority setting and impact acceleration [Score: Moderate]

This FP will ensure that GLDC research is demand-driven, outcome-focused, inclusive and scalable with high potential for large impact contributing to the SRF and SLOs.

Some of the 10 commissioned studies on *ex ante* impact assessment, foresight analysis, lessons learned and unpacking demand have helped to inform the narrative of this FP. The combination of priority setting and impact evaluation in this FP are intended to accelerate adoption and impacts of GLDC technologies and innovations (Figure 1.2 page 33). The ToC of FP1 is well-articulated and plausible providing the key assumptions listed (page 32) are addressed. Priority setting is long-term and built upon in-depth scientific *ex-ante* impact and foresight analysis, which has already begun. Although FP1 states that it will work closely with FP2, the planned activities suggest there is a danger of overlap with FP2 on scaling-out and priority setting. Most importantly, FP1 will work with FP2 where action research is to be undertaken in specific value chains in collaboration with NGOs and the private sector. However, the value chains are not specified, although most of the funding for research activities is from W3 and bilateral and thus the priority value chains are known.

The pathways from FP outputs to intermediate outcomes to sub-IDs and IDO 1.3 (Increased incomes and employments) are clear. But these ambitions can only be realized with a realistic and explicit plan for how proponents seek to 'transform' these hugely challenging ecosystems. The response to reviewers' notes for FP1 that they commissioned a paper that allowed the authors to create a matrix of country × crop × trait to determine their priorities. What they explicitly did not respond to was ISPC's call for a clear assessment of demand, not just supply. As a result, the prioritization matrix ends up focusing on grain yield gains as the driver of returns to investment in GLDC. Articulation of challenges is not the same as clear understanding of demand patterns going forward.

The bottom of Figure 1.2 shows how the Integrative solutions pathway will feed into the scaling and sustaining pathway which supports the earlier comment that in reality they are two parts of the same impact pathway. Although there is no explicit section on the alignment of activities and outcomes with national and regional priorities and initiatives, the planned engagement with national and regional stakeholders from the beginning to the end of the planned research strongly suggest that their priorities will be well-aligned with those of GLDC.

The section on Lessons learned and unintended consequences is taken from the Orr et al (2017) study on Past performance and lessons learned which shows that the narrative has been informed by this study (see section 1.6 above)

Foresight and *ex ante* analysis for targeting and prioritization and *ex ante* yield impact analysis of promising and alternative GLDC technologies using the methods developed in the Global Futures and Strategic Foresight of PIM will be the main research methods used by this FP. Several specific examples are given of the kind of research to be undertaken such as DNA fingerprinting to track GLDC cultivars in adoption studies. The application of proven approaches seems sound but they are not especially novel having been already used by other programs and initiatives.

As indicated above, the Orr et al (2017) paper has provided examples of lessons learned for FP1. There is evidence of building on previous work and changing approaches but not on any activities being dropped based on past learning. This is relevant as the revised 5-year (2018–2022) budget for FP1 is US\$ 34.1 million compared to US\$ 69.8 million in the 2016 6-year (2017–2022) proposal. The proposal would have been stronger if it had laid out explicitly the activities that were altered from the previous version, and why and whether this will affect the planned outputs and outcomes.

FP1 states that “*its partners have long-standing experience working in the targeted agri-food systems and regions*”. This is correct and important for the credibility of the CRP and its ability to attract new partners but a more convincing case for the comparative advantage of the CRP in this area would strengthen the proposal. The research agenda as articulated does not spell out how the key research gaps will be filled. The response to reviewers justifies part of its geographic and crop focus based on bilateral priorities; i.e., they argue that bilateral work will indirectly support GLDC to achieve its targets. That raises questions about how well choices will focus on W1/W2 priorities.

Gender issues have been well-considered under CoA 1.3 on Enhancing gender integration and social inclusion in the drylands. The GLDC gender expert is a member of the FP1 team. Research on youth is also a part of CoA 1.3 but there is no mention in the narrative of the proposed research activities. There is also no mention of specific activities in FP1 I in the youth strategy.

The importance of the enabling environment is considered under CoA 1.4, but this might not be sufficient for an agri-food systems CRP (see section 3.2 above).

Capacity development was given considerable emphasis in the introductory part of the narrative. Section 1.10 of FP1 gives a number of examples of the type of capacity development planned with some detail on gender analyses. One would expect more novelty and more information on the type of capacity building required by national innovation systems stakeholders.

The funding gap for FP1 is US\$ 20.1 million – about 60% of the total budget. With such a funding gap, it is not possible to assess whether the funds requested seem appropriate as the expected outcomes are very uncertain.

Flagship 2: Transforming agri-food systems [Score: Weak]

FP2 will strengthen agri-food system mechanisms to respond and adapt to context-specific and evolving needs of women, men and young farmers, value chain and governance actors.

The title, structure and focus of this FP have changed substantially from the 2016 proposal. The focus of the FP is now to be the previous CoA 2.2 on scaling for transforming agri-food systems. The FP issues that are key to the success of the CRP and is led by a highly competent scientists in this field. However the proposal is rather generic and does not adequately integrate specific issues of the GLDC agri-food systems. In addition it is not effectively integrated into the overall CRP design.

The new configuration of FP2 does reduce overlap with FP1 and helps to respond to the Fund Effectiveness Working Group’s concerns about the need for clear problem statements for FP1 and FP2. FP2 will concentrate on off-farm utilization of GLDC crops. However, the focus on off farm utilization is quite narrow and mostly supply driven. The case for public investment is weak and the scope for the generation of international public goods (IPGs) limited. The argument for why better off-farm utilization is important to achieve intended impact is not clearly articulated.. The logic seems to be that it is needed to incentivize adoption of technology by farmers but this contradicts other assertions, such as that market demand is strong and growing for these crops.

FP2’s ToC is articulated through two impact pathways which are actually two parts of a larger impact pathway. Firstly, it argues that if off-farm utilization opportunities are supported through technological, business, market, institutional and policy innovations, the private and public sectors and civil society organizations will be encouraged to invest in them. Secondly, if links between critical market, research, policy and consumer stakeholders can be strengthened, it would increase the collective capacity to drive and govern agri-food system changes that respond to farmers, business and society’s needs and would stimulate research responses that support these changes – ultimately leading to transformed agri-food systems. The ToC seems implausible based on the proposed research, assumptions made, capabilities and track record. The FP contribution to SLOs is not clearly articulated and not obvious, given the IDOs and sub-IDOs selected. A number of assumptions are put forward to underlie the ToC which are highly reliant on convincing stakeholders and partners to take actions which are essential to the success of the FP – but outside the control of GLDC. Hence it implies serious risks. More importantly, the feasibility and

practicalities of creating the enabling conditions and capacities for sustained impact at scale into the future for wider transformational changes in agri-food systems are unknown.

The ISPC is not convinced that this FP will in fact succeed in filling relevant research gaps. The science lacks strong economic or other social science theory or evidence. There are no conceptual frameworks that generate testable hypotheses, and the research questions (starting from the overarching question for the FP; i.e., “*what processes, practices and tools and institutional arrangements unlock crop utilization opportunities and catalyze the transformation of agri-food systems in dryland ecologies?*”) do not seem scientifically testable. The response to reviewers states that “*The work on policy research and value chain development is yet to be selected and depends on opportunities identified by partners*” indicating the FP does not yet have a clear science agenda

The success of FP2 strongly depends on partnerships with organizations which have the mandate and the capacity to implement technological and institutional innovations. These include academic, public, private, civil society and international development organizations. Collaboration with PIM is considered important but no other CRPs are mentioned. There are no clear linkages of FP2 with other AFS CRPs on food system interventions and no mention of A4NH FP1 (food systems for healthier diets, in which they prioritize these same crops) despite obvious synergies.

FP1 and collaboration with PIM will identify the priority opportunities for FP2 – which is desirable. But there is a concern about the lack of an explicit plan for the work of FP2 to signal areas of priority to FP4 and FP5 regarding the crop traits and seed systems opportunities, or identifying those on-farm interventions to be tested. Given the current formulation in the proposal, it is not clear that FP2 could provide meaningful feedback on traits to breeders. It is also unclear whether value chain work will be done mostly under FP1 or FP2, and whether FP2 will produce post-harvest technologies or just models and tools. Further clarity would be needed on the interaction and potential overlap between FP2 and FP1, including consideration of moving some of the FP2 research components into FP1.

It is not possible to judge the relevance of institutional partnership, as it is not yet clear which specific partners will be involved and what exactly those partners will contribute as value-added and enhance the probability of impact in relation to agri-food systems research. . The direct involvement of CSIRO in GLDC does clearly add value to FP2.

The revised budget for FP2 is US\$ 62.8 million compared to US\$ 87.4 million in the 2016 proposal. Considering the reduced timeframe (by one year) the budget is slightly lower at 15.2% of the total compared to 16.7% in the 2016 proposal. CSIRO will contribute US\$ 6.8 million. However, the funding gap is huge at US\$ 40.4 million. With such a funding gap, it is not possible to assess whether the funds requested seem appropriate as the expected outcomes are very uncertain.

Flagship 3: Integrated farm and household management [Score: Moderate]

FP3 will improve the profitability, productivity and sustainability of smallholder farming systems using on-farm and in-household innovation to ensure household nutritional security and enhanced income generation through integrated crop, tree and livestock production systems

This FP research-for-development aims to close yield gaps and to diversify crop production for balanced diets through improved agronomic and animal husbandry practices (sub-IDO 1.4.2). Another goal refers to reducing biotic and abiotic stresses to achieve higher productivity and to provide an opportunity for farmers to reduce the use of pesticides and herbicides and thereby addressing health concerns. It links to grand challenges such as climate variability and change, dryland farming risks or land degradation, among others. FP3 claims to provide “*the platform to translate crop-specific research into tested, farmer-led cropping systems that improve overall system performance to include not only production efficiency but also risk management, resilience, inclusiveness, profitability, acceptability and improved nutrition*”. Addressing issues beyond the farm and household levels will rely on close collaboration with other CRPs, especially WLE, PIM, FTA and CCAFS. The focus on crop-livestock systems is appropriate for sub-humid and semi-arid agro-ecologies where such systems predominate. However, clarity on the livestock research activities is needed. Apart from West Africa, where trees are often part of crop-livestock

systems, there is a question on the importance given to trees vis-à-vis crops and livestock in other regions, especially if they have minimal economic value..

The ToC is well articulated but also very ambitious. The complexities in improving crop livestock systems are substantial even without the additional complexities of crop mixtures, inter-crops and trees. The impact pathway would be feasible providing the assumptions can be validated and system complexities can be addressed. There is no specific reference to alignment of the problems to be addressed and expected outcomes with national and regional SDG priorities.

Participatory approaches will be used to better target interventions on land, water, crop, tree and livestock diversity management via an options × context × farming system performance. Communities of practice will be formed to develop agro-information system standards and best practices. Modelling platforms will be used to better understand temporal and spatial dynamics and therefore trade-offs and risk. This is sound, if not especially novel, science.. There are concerns about the capabilities of the proposed team to address the livestock component of the target crop-livestock systems. The narrative gives emphasis to the importance of improving the yield and quality of stover and halum in sorghum, pearl millet, groundnut and cowpea although these traits are not yet listed as priorities. It does not specify any other livestock interventions in these systems. The potential success of GLDC work on the livestock component of crop-livestock systems will depend on recruiting livestock scientists; rapid development of partnerships with the livestock sections of relevant NARES; and forging closer links with ILRI and inter-CRP activities with LIVESTOCK. The Expert Panel recommended the need to enhance the activities on livestock – and GLDC has not fully responded to this request in the current proposal.

FP3 is led by a tree eco-physiologist; the team include a soil microbiologist, an entomologist, a systems modeler, and three members with dryland systems experience although only one in agronomy.

There is evidence that FP3 has learnt from previous research and is building on findings and successes from Phase 1. These include the need to build stakeholder capacity for valuing the land and the services it provides; the progression from the genotype (G) × environment (E) × management (M) approach to the options × context × farming system performance approach; the scale- and context-specific nature of the portfolios of sustainable farming systems options and their adoption drivers; and the need for innovation platforms linked across flagships to improve communication and knowledge sharing across GLDC.

Although FP3 fills relevant research gaps through the planned research with partners (mostly unspecified) in the target countries, it is not possible to judge if the CGIAR and the leading institute have a comparative advantage in one or more research areas. Comparative advantage is not mentioned in FP3.

Links have been established and collaboration agreed with WLE, PIM, CCAFS and A4NH as well as some of the agri-food systems CRPs and the CGIAR gender network. Other partners will be identified and selected based on identified gaps in competencies and experiences and will include national and local government, regional organizations, NGOs, private companies, farmer and consumer organizations, development agencies and ARIs.

Much of the narrative on gender in this FP is based on that provided under the CRP level gender section, and is not focused on the issues specific to FP3..There is indication the focus will be more on women’s labour and participation. Youth issues are coupled with those of gender, but without any clear strategy articulated.

The only mention of the enabling environment is associated with Table 3.1, which states that FP3 will address “*complementary innovations that are required in an enabling environment to facilitate innovations and adoption at the household and community scales*”. It is unclear what this means or how the FP will engage in building an enabling environment in which the innovations will be developed for adoption. The previous ISPC commentary on GLDC actually called for a better assessment of multiple forms of risk that threaten these specific agroecologies and food systems, and what FP3 would do to address them. The response to reviewers says that “*Mitigating risk is a critical issue for FP3*”, and only talks about risk management in the context of adaptation to climate change.

Although there is a commitment to capacity development, the activities described are generic. There are no details of specific areas of capacity development to planned FP3 research activities.

The revised budget is US\$ 89.5 million compared to US\$ 113.3 million in the 2016 proposal. Considering the reduced timeframe (by one year) the budget is very slightly lower at 21.5% of the total compared to 21.7% in the 2016 proposal. However, the funding gap is significant at US\$ 51.9 million. With such a funding gap, it is not possible to assess whether the funds requested seem appropriate.

Flagship 4: Variety and hybrid development [Score: Strong]

FP4 aims to ensure that high-yielding, nutrient-dense and market-preferred GLDC varieties and hybrids are locally available and utilized by women, men and young farmers and value chain actors.

FP4 is based on the value proposition that “*a pipeline of modern varieties and functional seed delivery systems will enhance agricultural sector growth in developing economies of Africa and Asia*” through inclusive livelihood opportunities for smallholder agriculture and higher productivity, market-oriented products and entrepreneurship. The narrative provides a good understanding of the challenges to achieving the above proposition including climate change; low productivity, profitability and high risks in target agro-ecologies; unlocking pathways to enhancing the nutritive value of GLDC crops; and enhancing opportunities for income generation and employment.

The overall targets are to reduce the yield gap by 30%; pre- and post-harvest losses by at least 10%; and to increase the availability of selected nutrient dense GLDC crop, which should “*enhance the household capacity to cope with environmental shocks and unlock enterprise opportunity especially for formal and informal seed systems and for women and youth*”. The ToC and the described activities seem plausible and are supported by some realistic assumptions, although a reduction of 30% of the grain yield gap is extremely ambitious.

The science is sound, although not any longer new in plant breeding, e.g., high throughput phenotyping, targeting environments, genomic selection, rapid generation turnover, participatory seed innovation or doubled-haploids are already being used for many crops. The proposal does not elaborate on what innovations are brought by engaging in a knowledge-led breeding approach for this CRP’s crops, and how along with seed system interventions they accelerate genetic gains and improve cultivar release pipelines.

The renewed focus on seed systems is welcome. Most importantly, in the past year or so there has been useful analysis of both success stories and failures in seed systems for GLDC crops. A number of seed models have been tested. There has also been identification of the gaps by crop and country. This information is being used to inform the research planned on seed systems in Phase 2. GLDC has made some attempt to address the ISPC’s recommendation for demonstrating commitment to cross-system exchange of knowledge and experience on working with the seed sector but more work would be needed in this area.

Gender issues are specifically addressed through four prioritized activities, which are all particularly relevant to the involvement of women in GLDC crops. The attempt to address youth issues is targeted at agri-business innovations that will attract youth.. Youth issues have not been used to shape the research agenda. There is no reference to the enabling environment. Capacity development in FP4 will focus on breeding capacity and delivery capacity through universities and through short courses and internships to build skill sets.

In contrast to the other FPs, the share of the GLDC budget to FP4 activities has notably increased from 29.3% (US\$ 153.1 million) to 39.7% (US\$ 164.3 million) bearing in mind that the latter budget is for 5 years while the previous was for 6 years. The funding gap, however, remains high; i.e., US\$ 120 million. With such a funding gap, it is not possible to assess whether the funds requested seem appropriate.

Flagship 5: Pre-breeding and trait discovery [Score: Moderate]

FP5 focuses on widening the genetic base of GLDC crops and provide an extensive tool kit of modern genomics, genetic enhancement, breeding tools and high precision phenotyping for efficient breeding.

According to this FP's narrative, the major reasons for the slow progress in realizing genetic gain in GLDC crops includes the slow adoption of modern technologies, narrow genetic base of current cultivars, and lack of appropriate cultivars with market-preferred traits. FP5 plans to address these constraints through a better understanding of market preferred traits, applying modern technologies to discover these traits in available genetic resources, and widening the genetic base of pipeline cultivars. The narrative provided for this FP does not allow for a thorough assessment of the plausibility of its ToC. The impact pathways arguments for breeding are fairly straightforward, at least up to delivery of traits.

The FP narrative states that "*Hence, FP5 focuses on exploiting the untapped genetic resources of wild relatives and landraces.*" The role of markets, demand and value chains is largely absent. The pre-selection even of cultivar traits has to take into account the business model and consumers' preferences. The use of wild species and landrace gene pools are not new for breeding grain legumes and dryland cereals.

The quality of the science is sound but also ambitious. Due to the inclusion of nine crops in GLDC a large number of traits are included in the breeding program. It will take careful organization and judicious use of resources to address all of them. Table 5.1 is useful in understanding that there is a realization that realistic targets are needed – not all crops will be able to benefit from cutting edge technologies by 2022. The leadership team of FP5 is impressive; the leader has substantial experience in genomics and trait discovery over a decade in multinational private sector. Several of the team have experience in marker-aided breeding including two scientists from CIRAD.

FP5 clearly builds on past research in Phase 1 and recent enabling breakthroughs such as the sequencing of a reference genome in several GLDC crops, the recent capability to undertake large-scale sequencing of germplasm collections, the regeneration of synthetic interspecific hybrids of the cultivated groundnut, discovery of desirable traits in wild lentil species, and wider use of hybrid technologies across crops and agro-ecologies.

Alignment with regional and national priorities is not specifically addressed in FP5 even in the partnership section. On the other hand, unlike most other FP narratives, an effort has been made to address the unintended consequences of discovering and breeding for particular traits. Of note, FP5 is aware of the potential trade-offs between markets and household nutrition. Smallholders may market the nutritionally enhanced varieties for increased income and eat poorer quality food as a result. This potential problem will be monitored by FP1, FP2 and FP3.

Two types of partner are recognized – those that deliver knowledge and expertise for deployment of genetic resources in breeding e.g. ARIs and those that assist in the development and delivery of outputs e.g. NARES. A large number of partners are listed, which will add value in terms of scientific contribution and ability to enhance the probability of impact. The Hybrid Parent Research Consortia are highlighted as successful public-private partnerships for sorghum, pearl millet and pigeon pea in India, while DuPont/Pioneer Hi-Bred is emphasized as a private company partner.

Appropriate consideration has been given to the areas of trait development of relevance to women and youth. Gender issues have been considered in shaping the research framework. It is more difficult to identify traits of interest to youth – reduced drudgery traits will help youth labour while preferred market traits could help facilitate youth engagement in the value chain. There is no direct recognition of the enabling environment. However, CoA3 considers enabling technologies which are essential for successful trait discovery.

Capacity development will focus on NARES partners through scientific workshops, short training courses, studentships, scholarships, seminars, and exchange visits. Infrastructure capacity will be developed for nutritional quality analysis. Funding seems to be already available through a BMGF project.

The revised budget for FP5 is US\$ 44.5 million compared to US\$ 80.4 million in the 2016 proposal. Considering the reduced timeframe (by one year) the budget is lower at 10.6% of the total compared to

15.4% in the 2016 proposal. However, the funding gap is large at US\$ 27.6 million. With such a funding gap, it is not possible to assess whether the funds requested seem appropriate.

6. Characterization of Flagships

FP	Main strengths	Weaknesses/Risks	Rating
<p>FP1: Priority setting and impact acceleration <i>Ensure that GLDC research is demand-driven, outcome-focused, inclusive and scalable with high potential for large impact contributing to the SRF and SLOs.</i></p>	<p>The ToC of FP1 is well-articulated and plausible providing the key assumptions listed are addressed.</p> <p>Priority setting is long-term and built upon in-depth scientific ex-ante impact and foresight analysis, which has already begun.</p> <p>Explicit incorporation of lessons learned</p>	<p>Inadequate consideration of demand side issues in prioritization.</p> <p>Lack of clear articulation of how the FP activities can achieve transformation in targeted agro-ecosystems</p> <p>Potential overlap between FP1 and FP2</p>	<p>Moderate</p>
<p>FP2: Transforming agri-food systems <i>FP2 will strengthen agri-food system mechanisms to respond and adapt to context-specific and evolving needs of women, men and young farmers, value chain and governance actors.</i></p>	<p>Issues addressed in FP are key to success of this CRP</p> <p>Commitment of key implementation partners to the FP</p> <p>Strong leadership.</p>	<p>Lack of clearly articulated ToC and impact pathways specific to GLDC</p> <p>Lack of integration to other FPs despite key role in shaping the science agenda and delivering key results</p> <p>Concerns about dependence on partnerships for delivery</p> <p>Potential overlap between FP1 and FP2</p>	<p>Weak</p>
<p>FP3: Integrated farm and household management</p>	<p>The ToC is well articulated but also very ambitious.</p>	<p>Concerns about the capabilities of the proposed team to address the livestock component of the target crop-livestock systems.</p>	<p>Moderate</p>

FP	Main strengths	Weaknesses/Risks	Rating
<p><i>FP3 will improve the profitability, productivity and sustainability of smallholder farming systems using on-farm and in-household innovation to ensure household nutritional security and enhanced income generation through integrated crop, tree and livestock production systems</i></p>	<p>Feasible impact pathway providing the assumptions can be validated.</p> <p>Evidence that FP3 has learnt from previous research and is building on findings and successes from Phase 1.</p>	<p>Lack of detail on how risks will be managed, despite its importance in the FP narrative</p> <p>Generic gender strategy not adapted to specificities of the FP and weak youth strategy</p>	
<p>FP4: Variety and hybrid development</p> <p><i>FP4 aims to ensure that high-yielding, nutrient-dense and market-preferred GLDC varieties and hybrids are locally available and utilized by women, men and young farmers and value chain actors.</i></p>	<p>The ToC and the described activities seem plausible and are supported by realistic assumptions</p> <p>Strong focus on seed systems and useful analysis of both success stories and failures in seed systems for GLDC crops incorporated into the proposal</p> <p>Gender issues specifically addressed through four prioritized activities</p>	<p>Target of reducing by 30% the grain yield gap is extremely ambitious.</p> <p>Lack of clarity on how knowledge-led breeding approaches for CRP's crops accelerate genetic gains and improve cultivar release pipelines.</p>	Strong
<p>FP5: Pre-breeding and trait discovery</p> <p><i>FP5 focuses on widening the genetic base of GLDC crops and provide an extensive tool kit of modern genomics, genetic enhancement, breeding tools and high precision phenotyping for efficient breeding</i></p>	<p>Clearly builds on past research in Phase 1 and recent enabling breakthroughs in the science of GLDC crops.</p> <p>Effort has been made to address the unintended consequences of discovering and breeding for particular traits</p> <p>Strong leadership</p>	<p>Narrative does not allow for assessment of validity of Theory of change.</p> <p>The role of markets, demand and value chains in determining trait selection is largely absent.</p>	Moderate