

Status and Proposed Next Steps for Research from the former GLDC proposal

Purpose

This paper presents the Draft Report of Findings and Recommendations of the Expert Panel commissioned by the System Management Board to reconsider the science included in the former GLDC (Grain Legumes Dryland Cereals) and provide recommendations (for this or other formulation of a program or programs that might be called for) to address the research for development needs for the crops and communities of the dryland ecosystems.

The report is in a draft format, with input having also been solicited from all the CGIAR entities listed in the “Way Forward” section at the end of the report and with the ISPC in order to further develop and refine its findings and recommendations before presentation of a final report to the System Council in an ad hoc virtual meeting on 30 March 2017.

Action Requested

The Board is invited to:

1. Broadly endorse the process that has been followed and the direction proposed by the report
2. Provide any high level technical inputs that may be included in the finalization of the document or consideration for its presentation to funders
3. Provide advice to the Working Group Chair and Executive Director on the framing of the call for a proposal and the later process for review and presentation to the System Council

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15 March, 2017

Draft Report of Findings and Recommendations GLDC Expert Panel

Introduction

This draft report has been prepared by a six-person team, consisting of three core panel members and three resource persons, all of whom have extensive experience working in agricultural development in dryland areas. Brief bios of panel members and resource persons are included in Annex 1. The team worked toward consensus positions on most key issues. Where consensus was not reached, this is explicitly mentioned in the report.

The purpose of this draft is to provide key actors, partners and stakeholders with an update on the team's current thinking and to solicit feed-back. Comments and suggestions will be greatly welcomed to help the team further develop and refine its findings and recommendations. A final report will be given to the ISPC and System Management Board, and presented to the System Council in late March. It aims to assist those entities to decide how to proceed in developing an Agri-Food System CRP that most effectively meets the needs of farmers and consumers living in the poorest and most environmentally threatened countries of the world's drylands.

Our approach to date has been to conduct a desk review of background materials assembled and provided to the team by the System Management Office. The core materials included the recent interim and full GLDC proposals, proposals for three earlier CRPs focused on the drylands, ISPC commentary on all of these documents, and recent literature on drylands agriculture. Two team teleconferences were held to calibrate our approaches to ensure coherence and consistency, and then to discuss and resolve outstanding issues on which there may not have been sufficient consensus regarding team conclusions on the way forward.

Our findings and recommendations are benchmarked on the most recent proposal submitted by ICRISAT in July 2016. By doing this we intend to provide a concrete context within which our findings and recommendations can be interpreted and understood, and thereby provide more precise, operational guidance as to how future proposals might be strengthened.

The materials were examined through the lens of 11 sets of framing questions (and sub-questions within each), which are provided in full in Annex 2:

1. Is there a sufficient evidence-based rationale for major international public investment on grain legumes and dryland cereals in the target areas?
2. Are the methods used to prioritize crops, countries and research themes appropriate and adequate?
3. Is the overall structure which combines technology research streams with research on the enabling environment using an innovations systems approach coherent?
4. Are the proposed research activities complete, and designed in ways which are likely to meet program goals?

5. Do the lead centers and proposed partnerships within the CRP combine to provide optimal overall capacity to fully meet the needs of the program?
6. Are the management and governance structures and processes clear and adequate to ensure efficient and effective implementation?
7. Are linkages to other CRPs sufficient to achieve the most important potential synergies and avoid duplication?
8. Are gender issues adequately conceptualized and incorporated into key program elements?
9. Are the proposed capacity development activities adequately conceptualized, designed and resourced?
10. Is the proposed design of the Monitoring, Evaluation, Impact Assessment and Learning (MEIAL) activities practical, and will it meet the needs of management and other stakeholders?
11. Are there alternative structures or approaches that could better guide the development of a CGIAR program or programs to meet the needs of agricultural development in the drylands?

Panel members and resources persons prepared written comments and suggestions responding to each of these broad question sets, which were synthesized to form the basis of the second teleconference. The report findings and recommendations are presented below according to the major framing questions (note that framing questions 5 and 6 dealing with partnerships have been combined below).

Summary of Headline Conclusions

The panel unanimously supports major investment by the CGIAR to improve agriculture in the drylands, but a much stronger case needs to be made. Among the 50 countries ranked lowest on the Global Hunger Index, half are either located entirely in the drylands or have major dryland populations. These countries are also the location of some of the world's most urgent environmental challenges, reflected in widespread degradation of land and soil resources, dwindling water supplies, threats to biodiversity, outmigration, and agricultural systems already under severe threat from climate change. Within the global drylands, the highest levels of poverty and food insecurity, and the most urgent environmental threats, are concentrated in the semi-arid and sub-humid zones of Sub-Saharan Africa (SSA) and South Asia.

There is a compelling need for international investment in agricultural research to address these challenges. Compared to productivity improvements achieved during recent decades for the world's major crops, productivity growth for the most important dryland crops has been slow and uneven, particularly in SSA, reflecting in part the limited global investment to improve these crops.

At the same time, national and regional entities have developed strategies to improve their agricultural sectors, and there is growing political commitment to increase funding to the sector, thereby positioning themselves to play important partnership roles. Regional institutions have emerged to bridge some of these weaknesses and have created new avenues for both upstream research and downstream development. Nevertheless, and acknowledging important exceptions especially in South Asia,

many national research institutions in the drylands remain weak and badly underfunded, and thus not able to resolve their challenges working alone.

Investing more in complementary international research that works through close and empowering partnerships with national and regional research and development organizations is urgently needed to fill the gap. Determining where and how a CRP can contribute its comparative advantages in this new landscape is even more important for judicious use of public resources.

There are compelling conceptual, functional and implementation linkages between the streams of research focused on crop technology development and on improving the enabling environment. This argues for a closely integrated agri-food systems approach within a single CRP. Improved crop technologies will not be widely or sustainably adopted unless farmers have affordable access to inputs, information and finance, and can market their surplus production at attractive prices, and unless gender considerations are adequately incorporated in both the development and commercialization of new technologies. And this requires major improvements in markets, institutions and policies. Each piece of the puzzle must be brought together across value chains to sustainably improve crop productivity, reduce food insecurity among both producers and consumers, create equitable agricultural systems at scale, and increase farmer incomes in ways that facilitate their transition to a business orientation. Similarly, crop technology development must be guided by evolving market signals as consumer preferences change and as new opportunities in national, regional and global markets continue to emerge. In short, the linkages between the technology and markets/institutions/policy streams need to be close, systematic and interactive. These linkages are not yet defined with sufficient operational detail in the current proposal.

Strong complementarities between dryland cereals and legumes at both the field and household levels also argue for combining crop improvement programs into a single, strategically integrated CRP. The panel is convinced that multiple synergies between cereals and grain legumes, provide a sound basis for a coherent and well-coordinated CRP. At the field-level, the synergies between cereals and grain legumes include managing the nitrogen economy of dryland systems; maintaining soil organic matter as land use intensifies; efficiently managing soil and water resources under increasing stress; recycling nutrients from deep in the soil profile; improving plant nutrition as fallows decline; and managing diseases and pests such as *Striga* through cropping sequences.

At the household-level, farmers pursue diversified mixed-cropping strategies to manage risks, make more efficient use of their land and labor through intercropping, and to provide family members with a diet balanced in carbohydrates and low cost proteins. And in the agro-pastoral systems of the semi-arid tropics, cereal by-products provide critical feed and forage for multi-purpose household livestock holdings. These multiple interactions at both field and household levels must inform the objectives and approaches used to improve the genetics, management and enabling systems for both sets of crops.

Having said this, the panel finds that the current proposal fails to make a sufficiently compelling rationale for the merger of the former dryland cereals and grain legume CRPs into one.

The panel concludes that the most effective and efficient way for the CGIAR to contribute to enhancing the lives and livelihoods of dryland populations is through an Agri-Food Systems CRP sharply focused on increasing the productivity, resilience and profitability of the most important cereals and grain legumes in the semi-arid and sub-humid agroecologies of SSA and South Asia. This represents an important strategic pivot away from the current CRP proposal that aimed at improving the productivity of a basket of cereal and grain legume crops, and their associated support systems, globally. The panel believes that a sharper geographic focus will make more efficient use of investors' funds and achieve larger impact in a shorter period. A geographical framing that focuses on representative African and South Asian countries with major dryland agroecologies strengthens the rationale and feasibility for closer cooperation with national and regional organizations, and provides a stronger and more coherent frame within which to integrate the work of component flagship programs. It also focuses the work of the CRP on those regions of the world where poverty, food insecurity and malnutrition are greatest.

Although at the farm level, this revised framing would retain a clear focus on the genetic improvement and management of a set of priority crops, the panel recommends that the CRP approach take a whole farm household perspective that explicitly considers competitive and/or complementary relationships with other agricultural enterprises, such as livestock, trees and other crops when assessing how best to improve household livelihoods. In contexts where other crop, livestock or tree enterprises provide promising avenues to improve household income and food and nutritional security or reduce risk, those enterprises should be accommodated, and efforts focused on determining and exploiting points of complementarity with cereals and grain legumes. This will require close and reframed cooperation with other CRPs. Similarly, the CRP would work to protect and build the resilience of the natural resource base in those farming systems within which the target crops are grown.

There are at least two immediate and significant implications of this agroecological and geographic reframing. First, the set of priority crops on which this CRP would focus needs to be revisited. Crop selection should be based on the current (and emerging future) importance of crops within the reframed agroecologies. This suggests that the inclusion within this CRP of common bean among the priority crops should be reconsidered due to their much greater significance in more humid areas. Second, the reframing also means that the target and spillover countries should be reconsidered. The inclusion of Morocco as a target country, which in any case is not a low-income food-deficit country, should be reconsidered. Spillover countries also need to be revisited to include primarily those that share common agroecological conditions, and with which spillover activities can be conducted most efficiently and with greatest impact.

It is in this context that the panel suggests that the CGIAR reflect on whether future barley research could be more efficiently and effectively addressed within the current drylands CRP or within WHEAT. We note that both barley and wheat belong to Triticeae, share important similarities in technical breeding approaches, are grown in similar production environments, and have a long and successful history of collaborative work between ICARDA and CIMMYT for many years. Although there is significant barley production in Ethiopia and India, both of which fall within the

proposed geography of this CRP, major production areas in West Asia and North Africa would be excluded, at least as target countries. We are fully aware that any changes in CRP crop mandates at this point in time would involve complicated and difficult adjustments at multiple levels. Thus the panel raises this issue not as a recommendation but rather as a question to be considered by the CGIAR and relevant centers.

The diversity of soil and climate conditions, agricultural livelihood systems and market/institutional/policy environments within the semi-arid and sub-humid zones of SSA and South Asian drylands must be more rigorously characterized. A robust zonal typology should be developed based on this characterization, and used to shape the priorities and inform the program content of a new CRP. Zonal differences must be better understood, and captured in a simple but robust typology. Such a typology should be used as an operational tool to set priorities, as well as to structure and guide the planning and implementation of research in both the crop technology and enabling systems research going forward. These context zones could be used as a basis on which interdisciplinary zonal teams would formulate strategic research priorities within their respective zones, and develop and deliver research agendas better targeted to their specific challenges and opportunities. Research activities within most flagship programs and clusters of activity should be organized around an assessment of zonal priorities, perhaps at sub-CoA level, and zonal team leaders empowered and responsible for the integration of research elements across FPs and CoAs. As much as possible, these zones would correspond to key crop mega-environments¹, modified where necessary to capture significant differences in market, institutional and policy conditions. The main exceptions would be FP1 and FP5 for which the CoAs would more efficiently retain broader cross-zonal perspectives. Finally, the selection of target countries could be revisited to ensure that appropriate consideration is given to how well they represent recommendation domains across potential spillover countries.

The priority setting methods used to define crop and thematic priorities must be more dynamic, take into greater account spatial heterogeneity, and be more closely aligned with national and regional organizations. Priorities should be revisited and made more dynamic by incorporating results of foresight analyses and *ex ante* impact assessments. With rapid urbanization and the emergence of a growing urban middle class, consumer preferences are changing in ways that will significantly affect demand for dryland cereals and grain legumes over the next 10-20 years. New regional and international trade opportunities are also emerging which will further influence patterns of demand. Priorities must also recognize and fully incorporate information on how constraints and opportunities vary across agroecological and market/institutional/policy contexts within the semi-arid and sub-humid drylands. The relative importance of the priority crops, associated constraints and preferred traits will differ significantly across zones. A revised priority setting exercise should work more closely with national and regional organizations, as full partners, to capture these cross

¹ A megaenvironment: a large area of a single crop or cropping system in which genotype x environment interactions are non-significant, and to which a generic recommendation for optimizing crop growth can be applied. For crop improvement purposes a megaenvironment may be one contiguous area or several areas that are geographically separate but which share broadly similar environments and consumer requirements for major traits.

zonal differences, and to more closely align with their strategic priorities, further strengthen and complement their programs of research, and build co-ownership.

The panel has concluded that ICRISAT is best positioned to lead the development and implementation of such a reframed CRP. ICRISAT's decades long experience working on dryland cereals and grain legumes in Sub-Saharan Africa and South Asia, its expertise in many of the key areas for crop improvement, its networks, and the hard lessons learned developing two previous proposals, position it well to lead the development of the next CRP. But it must work more closely with other centers, and a wider set of partners, including the NARS and Sub-Regional Organizations (SROs), to design the program. The panel notes that the CRP provides an opportunity for ICRISAT to further rebalance the allocation of its resources with more emphasis on SSA where increased international investment is warranted, due in part to relatively weaker national research systems compared to those in South Asia. It must also develop much closer operational links to other CRPs, including most prominently PIM, LIVESTOCK, WLE, FTA, and MAIZE, during implementation. If it is to be successful in gaining approval, however, ICRISAT needs to develop a much more coherent, credible and compelling CRP proposal. In addition to the broad reframing recommended by the panel in the sections above, we have also made more granular recommendations which we believe will strengthen a new CRP proposal, and increase its program impacts, going forward. These are presented in the following sections.

Specific Findings and Recommendations

The sections below set out what the panel found to be major weaknesses in the most recent GLDC proposal, and key steps that need to be taken to strengthen the next submission.

1. The rationale for major international public investment on grain legumes and dryland cereals in the target areas

The panel is nearly unanimous that the current proposal does not make a convincing case for major public investment in the proposed set of activities aimed at supporting agricultural development in the drylands. Weaknesses in the rationale include the following:

1.1. Inadequate description of the human, ecological and institutional context and challenges

The previous proposal fails to provide a quantitative and qualitative profile of poverty, food insecurity, malnutrition and gender issues, compared to other major regions of the world, as well as information on past trends and future projections. The importance of the major crops to low income producers and consumers, women and youth, and how these are changing over time with urbanization, changing consumer preferences and emerging trade opportunities are not adequately presented.

The proposal also lacks a systematic characterization of the climate and soils, predominant farming systems, alternative food and feed sources, population pressure

and livestock numbers, the nature and dynamics of environmental threats, and how these parameters vary across different zones within the drylands, as well as information on past trends and future projections.

Also lacking are carefully documented yield gap analyses identifying the principal yield loss factors for the cereals and grain legumes as a justification for the breeding goals and agronomic interventions. It is currently unclear whether the major constraints are abiotic (water, heat, nitrogen, phosphorous, zinc), biotic (pests, diseases, *Striga*), soil organic matter, etc. and how their relative importance varies across crops and zones. The nature and importance of various types of risk in shaping farm-level decisions are also not adequately recognized. While general references to risk appear at several points in the proposal, the effect of risk on household investment and innovation decisions is poorly described and the implications inadequately considered. Concrete examples of risk, and how these impact on cropping system decisions, and in particular on decisions to invest in new crop technologies, would provide a more credible basis for risk mitigation research, including research on policy innovations such as crop insurance.

1.2 Lack of a convincing case that the CRP will produce major impacts and a competitive return on investment

A major deficiency in the previous proposal is the lack of a careful assessment of progress in research on the target crops and cropping systems over the past 30-40 years. At many points in the proposal, both for crop technology development work as well as for work on markets, institutions and policies, the impression is given that very little has been done. While the proposal implicitly acknowledges that past work in the drylands has not made major contributions toward meeting the System Level Outcomes (pg 21), it fails to critically examine the objectives and approaches of past technical research to determine what worked, what didn't work, under what conditions and why. A much more granular, rigorous, well documented, frank and insightful assessment of past research successes and failures is critically needed to benchmark projected gains, and most importantly to derive key strategic and tactical lessons to guide the way forward.

Rather than examining the adequacy of past research, the CRP argues that the main reason for limited impact has been failures in markets, institutions and policies. Yet it provides little evidence to support that conclusion. It can be argued that the low price and income elasticities of demand for the major cereals, pearl millet and sorghum, and changing consumer preferences with urbanization, are probably as or more important factors contributing to low farmer incentives for sustained productivity improvement of those cereals. The panel notes that the roles of gender disparities in limiting uptake of new technologies and resulting gender yield gaps are also not considered. Although the current proposal includes sections for each Flagship Program on "lessons learned and unintended consequences", the depth of discussion is often shallow, the value of lessons learned is uneven, and many of the findings are unlikely to lead to more innovative or more effective research directions.

The proposal fails to make a compelling evidence-based case that the proposed research initiatives can more successfully address the major production constraints

and achieve greater productivity gains than have been achieved in the past. Without specifying crop, zone or agronomic package, the proposal projects that research will achieve an annual yield gain of 2% and close yield gaps by 30%. These appear to be highly ambitious compared with past sorghum trends in Sub-Saharan Africa where yields have increased between 0.7% and 1.5% per year, and 0.5% in South Asia. Without even considering the time needed to develop and transfer final, well adapted products, it is not clear how the new programs would in only 6 years achieve yield gains that equal the gains derived over the past 20-30 years.

A realistic assessment of research and development costs, and more rigorous *ex ante* productivity gain projections resulting from CRP research, benchmarked against investment levels and productivity gains over past decades, would provide more credible evidence. Combining these results with price projections from foresight modeling, return on investment calculations could be generated and compared with return on investment (ROI) estimates for other crops and regions. Such analyses would be much more transparent and provide investors with the information they need to guide their investment decisions.

The GLDC framing places considerable emphasis on markets, institutions, policies and creating new processes and entrepreneurial innovation, but there are special challenges to estimate ROI for such work. Drawing from recent SPIA reviews that show where policy has or has not made a difference and why, as well as from similar impact assessments of policy research conducted by IFPRI, a future proposal could begin to conduct *ex ante* assessments now to provide best-guess ROI calculations for its work in the enabling conditions domain. This could be used to test whether or not its program design, and underlying assumptions, are justifiable and realistic.

1.3 Failure to demonstrate the comparative advantage of the CGIAR

There is no question that the lead CGIAR centers proposed in GLDC bring years of experience and deep capacities to conduct cutting edge work in the drylands, particularly for genetic improvement. But there is also a need for a more rigorous assessment of capabilities in NARS, universities, regional research organizations, development agencies and the private sector to develop and deliver new crop technologies and conduct applied research on markets, institutions and policies. In many instances, national and regional institutions have emerged to become important centers of innovation, and have become increasingly important as innovators in the crop improvement and institutional space. In Africa, for example, recent impact assessment work cited in DIVA shows a declining per cent of CGIAR germplasm in varietal releases for several GLDC crops over the past decade. In short, the CRP is operating in an innovation environment that is dramatically different from that of even ten years ago and it needs to more carefully assess how to position itself to contribute most effectively in this new environment.

1.4 Weak demonstration that the combined cereals, legumes and enabling systems activities produce a coherent and synergistic program

As stated earlier, the panel is convinced that multiple synergies between cereals and grain legumes, as well as the strong complementarities across Flagship Program (FP)

lines of research, argue for a single, coherent and well coordinated CRP. Having said that, the current proposal fails to make a sufficiently compelling rationale for the merger of the three former CRPs into one.

Earlier we briefly summarized some of the most important synergies between cereals and grain legumes at both the field and household levels. Similar arguments can be made for deep synergies between the crop technology and enabling environment streams of work. Efficient input and output markets, policies that incentivize production, and a supportive enabling environment in which agribusinesses can be established and thrive are all essential to ensuring that new productivity enhancing crop technologies are broadly and sustainably adopted.

The proposal could have built a much stronger case for a fully integrated program approach in its Theory of Change (ToC), but the ToCs at both full program and FP levels are often superficial and presented too generally to usefully guide planning as well as for efficient monitoring, evaluation and impact assessment. Many of the key intermediate steps along the results pathways are not presented, and as such it is impossible to identify many of the most important assumptions and challenges.

Moreover, there are many cross-linkages between FPs and CoAs that are not identified which could be used to demonstrate the value of one integrated CRP. For example, there should be considerable interactions among, and flows between, CoAs for FP3 on crop management and FP4 on crop improvement that involve fitting improved germplasm into cropping systems and into varying contexts – that is, exploiting G X E X Management interactions – that are not clearly identified, and for which research management structures, information flows and processes remain undefined.

1.5 Recommendations

A future proposal should include the following elements to make a more compelling case for international investment in the semi-arid and sub-humid agroecologies of SSA and South Asia:

1. A rigorous profile of poverty, food insecurity and malnutrition compared to other major regions of the world, including information on past trends and future projections; the importance of the major crops to low income producers and consumers, women and youth, and how these are changing over time with urbanization, changing consumer preferences and emerging trade opportunities.
2. Results of foresight analyses examining likely changes in supply and demand for the major dryland crops over the next 10-20 years to estimate impacts on prices and the incidence of poverty and food insecurity across countries.
3. A description of the extent and characteristics of semi-arid and sub-humid agroecologies in SSA and South Asia, including characterization of the climate and soils, predominant farming systems, alternative food and feed sources, population pressure and livestock numbers, the nature and dynamics of environmental threats to these ecologies including water and nutrient flows, and how these parameters vary across different sub-regions within those areas.

4. The results of climate change models that provide likely climate scenarios across the sub-regions, and what these mean in terms of production levels, risks, challenges and opportunities for major crop and livestock options.
5. Yield gap analyses for the major cereals and grain legumes by mega-environment.
6. Gender gap analyses for these crops.
7. Greater discussion of various types of risk in shaping farm-level decisions and their implications in developing risk mitigating techniques and institutional innovations.
8. Rigorous assessment of past research progress, highlighting successes and failures, both to benchmark projected gains, and to derive strategic and tactical lessons to guide future program design.
9. Drawing on yield gap analyses and probable adoption patterns, *ex ante* impact assessments of the major lines of technical research, by crop, constraint and zone. Comparisons with the results of *ex post* impact assessment to test realism.
10. Combining the results of Recommendation 9 above with price projections from foresight analyses, calculation of returns on investment for major new lines of research.
11. *Ex ante* assessments and best-guess ROI calculations for proposed work on policy research and value chain development.
12. An updated landscaping and assessment of the capacities of alternative service providers, globally and within the region, for the main lines of research. Some evidence of the cost effectiveness of the centers and major partners.
13. A more convincing argument, in the text and as presented in the Theories of Change, demonstrating strong complementarities between both cereals and grain legumes, and lines of research to underpin the value of a single coherent CRP.

2. Prioritization of crops, countries and themes

The panel is unanimous that the approaches used to determine program priorities across crops, countries and research themes are incomplete and require consideration of additional factors and methods.

2.1 Prioritization of priority crops does not take into adequate consideration temporal change and spatial variation

The static congruence analysis used to select the 8 priority crops based on their current economic importance provides only a baseline starting point for more dynamic analyses. Additional foresight analyses are needed that project future crop demand scenarios over the next 10-20 years taking into consideration economic growth and rising incomes, demographic change, changes in consumer preferences, likely trade scenarios, and new marketable end-product uses. Results from climate change models should also be employed to identify where new production constraints and opportunities are likely to emerge for the major dryland crops in coming years.

The point has already been made that the set of focus crops for this CRP should be based on the importance of the cereals and grain legumes within the reframed geography, that is the semi-arid tropics and sub-humid zones of SSA and South Asia. Variation in the importance of these crops, and their associated production constraints, across these dryland agroecologies, do not appear to be adequately incorporated. At the highest level, for example, there appears to be little differentiation between SSA and South Asia, despite enormous structural differences between the two regions. Similarly, within the SSA drylands, the importance of widely different farming systems, crop-specific production constraints and opportunities vary widely between as well as within the semi-arid and sub-humid zones. In short, crop priorities need to be fine-tuned to smaller and better specified environments.

There is little evidence that inputs from stakeholders at farm, national and regional levels were obtained, and whether weight has been given to the results of strategic priority setting exercises already completed at national and regional levels. Close alignment with national and regional strategies will greatly enhance the quality, leverage and impact of the CGIAR's work in the drylands. It is strongly recommended that the future CGIAR research agenda in these areas be fully informed by the priorities defined in recent years by regional, sub-regional, and national institutions, and that there be a systematic effort to align the CGIAR agenda with those strategic priorities.

It is not clear how likelihood of success, and in what time frame, were included in the priority setting. Nor is it clear how the strengths of regional and national programs in crop specific research were considered. Both need clarification to better define the most appropriate roles and activities of the centers and their partners.

The panel agreed that the argument that target crops should be selected based on their common weak enabling environment is inappropriate and unconvincing, and strongly recommended to reverse the logic. Rather than arguing that work on dryland crops within a single CRP is justified because they share similar market, institutional and policy constraints, it should be argued that work within dryland areas is justified by the high level of poverty, food insecurity and environmental challenges, and that significant progress in resolving each problem can be made by improving the resilience, productivity and profitability of a key set of priority crops.

In short, the focus should be on the main cereals and grain legumes grown in the unique physical and climatic environments of the semi-arid and sub-humid SSA and South Asian drylands. One, but only one, necessary element in achieving these goals is to resolve failures in both input and output markets, to develop alternative end uses for which robust market demand exists or can be created, and to reform institutions, regulations and policies which inhibit development across value chains.

Finally, crop priorities as reflected in budgetary allocations are not presented in the proposal, but should be.

2.2 Prioritization of target and spillover countries needs to be clarified and made more strategic to maximize efficiency and impact

The criteria used in selecting target countries are not entirely clear. Although productivity is one criterion, it is not clear whether selection was done on the basis of high or low baseline productivity. Selection based on large yield gaps that could be closed through research would be a better criterion, and crop models could help to estimate such gaps. The use of poverty and malnutrition indicators is also not entirely clear. Presumably it would be high baseline measurements for both. However, whether these were measured using the rates of poverty and malnutrition below threshold levels, or using the absolute numbers and depth of poverty and malnutrition is unclear. The latter would be the more appropriate indicator.

The selection of target countries that are representative of conditions across the broader semi-arid and sub-humid geographies would result in greater efficiency and impact when transferring results to spillover countries. It is not clear to what extent the views and recommendations of national bodies and sub-regional organizations (SROs) were solicited and considered in selecting target and spillover countries. Their guidance would be crucial to ensure that the CGIAR efforts are integral parts of larger regional programs. In this regard we note that most SROs have explicit regional responsibilities to facilitate the transfer and outscaling of research results, and thus would be natural partners in transfer phases.

Finally, there would be advantages to select target countries where there are strong NARS partners who can play lead roles in technology development, market and policy analysis, and implementation of innovation platforms. Working closely with such NARS would improve cost effectiveness, post-project sustainability, capacity building and both immediate and long-term chances of success.

2.3 Prioritization of themes

The panel agrees that there is a sound conceptual logic to the overall FP structure: that is, developing better adapted and higher yielding germplasm, addressing agronomic constraints that allow the materials to express their genetic potential, and bringing the elements together in coherent farming systems within a more conducive enabling environment. But it is impossible to assess what priority has actually been given to these major program elements on the basis of budget allocations alone, without additional information on the full-time equivalents (FTE) of scientists' time assigned to each program. These should be provided in future submissions.

Moreover, priorities should be driven by return on investment and, as argued above, this requires gap analyses combined with *ex ante* impact assessments. Much more systematic and evidence-based *ex ante* impact analyses of specific research initiatives should be conducted. These results can then be used to generate ROI projections for different themes, and in turn applied to adjust thematic priorities to arrive at more efficient budget allocations. It is important that the major parameters for such *ex ante* analyses should be benchmarked and calibrated using indicators of progress achieved through similar research in the earlier CRPs and by the same centers to triangulate for reasonableness.

To accurately capture likely impacts, the yield gap and *ex ante* analyses should be focused on zones within the drylands that exhibit similar sets of agroecologies, farming systems and enabling condition constraints. These can in turn lead to widely different priorities for different regions. Thus using sorghum as an example, comparing priorities for South Asia and SSA, broadly speaking, two very different sets of priorities might emerge. African priorities might be around soil and water conservation and utilization, community seed systems, stable yield in extensive land use systems, protecting soil fertility and reducing the impact of *Striga*; while Asian priorities might be more focused on hybrid production, increasing yield potential, expanding private seed companies, well-developed forage markets, and intensive land use. Within SSA, similar differences in thematic priorities would be identified in the agro-pastoral systems of the semi-arid zones compared to the sub-humid zones dominated by cereal and root crop farming systems.

The past proposal anticipated that FP1 will conduct some if not all of these priority setting analyses in the early years of the CRP. This means that FPs 2-5 should be prudent in initiating long-term activities that would be difficult to pivot when new priorities emerge, and instead initiate sequenced activities in ways that can adjust to new information. The panel recommends that ICRISAT accelerate its priority setting work during the preparation of the next proposal and build early results into the program design to the extent possible. This would include building on national and regional crop and thematic priorities.

A final set of considerations is whether the centers leading the CRP have a comparative advantage in each theme. The comparative advantages of both ICRISAT and ICARDA lie mainly in germplasm improvement and in strategic crop management. Their comparative advantage is less clear in seed systems, impact assessment, technology transfer and scaling up, and much less evident in product processing and establishment of new markets, institutions and industries. Close strategic partnerships must be formed at the planning stage with key private sector entities and development agencies to fill these gaps. Moreover, work on markets, institutions and policies (part of FP2) and foresight and priority setting (part of FP1) may fit less well in this CRP unless steps are taken to dramatically increase capacities internally or through partnership arrangements. We return to this set of capacity issues below.

Similar questions can also be raised regarding the comparative advantage of the CGIAR centers even in applied germplasm improvement, the main focus of FP4. It is now generally recognized that the old research model of CGIAR centers developing finished improved varieties and hybrids for testing and evaluation by national programs has become less relevant. The strengths of national programs in South Asia, and for regional research programs and in some countries and for some dryland crops in SSA, suggest that the respective leadership roles of international, regional and national programs should be revisited. Leadership by strong regional and national programs may result in greater cost effectiveness and earlier impact, as well as building long-term research capacity, sustainability and self-reliance.

This raises the question of capacity building activities within GLDC, to which we return later. In general capacity development appears to be inadequately supported yet it is

critically important for sustained research output. The panel believes that our collective goal should be to work ourselves out of business, at least in terms of applied and adaptive research, and increasingly as well in expanding areas of strategic research. And one powerful way to do this is by increasing the proportion of project responsibilities and resources that are managed (under stringent standards of accountability) by the NARS and regional programs themselves. In this regard, we did not see any reference to resources allocated to NARS, or that were to be made available through competitive grants except through the Innovation Fund, which itself seems grossly under-resourced.

2.4 Recommendations

A future proposal should include the following elements when setting priorities for crops, countries and research themes:

14. Priority setting at crop, country and thematic levels must be more dynamic and forward looking, systematically incorporating results of foresight analyses, including projections from climate change models.
15. Crop and theme priorities should be reflected in data on how resources will be allocated, including both financial and FTE budgets.
16. Crop and theme priorities should be informed by data on how the importance of priority crops and production constraints varies across different semi-arid and sub-humid agroecologies and farming systems, and refined to smaller and better specified zonal environments to better design and target research initiatives.
17. Priorities must be fully informed by, and closely aligned with, the strategic priorities set by regional and national bodies.
18. Target countries should be selected in part on the basis that they represent important agroecologies and farming systems across geographies in the semi-arid and sub-humid drylands so as to improve efficiency and impact when transferring results.
19. Crop and thematic priorities need to be informed by rigorous yield gap analyses, *ex ante* impact analyses and ROI projections, benchmarked against past results.
20. Greater consideration needs to be given to the strengths of national and regional programs, as well as the theme-specific comparative advantages, and cost effectiveness, of the CGIAR centers, when defining CRP activities and roles within the research themes.

3. Program structure

The panel unanimously agrees that the Flagship Program structure is generally sound, and that there are large potential synergies between the main elements of the CRP agenda (technology development and markets/institutions/policies; cereals and legumes; genetics and resource management research). But it is concerned whether those synergies can be adequately achieved in the program as it is designed, especially when considering the context variation across the priority dryland agroecologies.

3.1 Whether program synergies can be realized given the proposed structure and management processes

Panel members recognize that at least some of the impetus to combine research agendas that had been included in the three precursor CRPs came from the CGIAR itself. This was driven in part by the need to reduce the number of CRPs, and thus transactions costs across the System, but also in an effort to combine program elements with high potential synergy. The main logic of bringing together research on dryland cereals and grain legumes should be that they are grown in similar agroecologies, and more importantly that they form essential and highly complementary elements in strategies to sustainably intensify farming systems at the field level, and to improve nutrition at the household level.

The panel also finds that there are equally strong conceptual, functional and implementational synergies between the technology development and enabling environment streams of research. New technologies will not be widely or sustainably adopted unless farmers have affordable access to complementary inputs and can market their surplus profitably.

Indeed, one of the most attractive features of this CRP is that it combines the push approaches (technology focused research aimed at improving the productivity, sustainability and resilience of dryland production systems) with pull approaches (market development, institutional innovation and policy reforms) to sustain and scale out adoption. While the former has been the forte of the CGIAR for the past half a century, the latter represents a rethink demanded from Phase II CRPs to achieve greater impact at scale. The challenge is whether, and if so how, these synergies can actually be realized across the highly variable contexts that characterize the semi-arid and sub-humid drylands in SSA and South Asia.

Although the proposal has identified the most important potential synergies between FPs, the challenge will be to ensure these synergies are achieved efficiently in practice. The challenge is magnified by the fact that FP and CoA leadership is distributed across different institutions and locations. Organizational research has found that a critically important – and often “killer” – factor that contributes to solving applied problems is the co-location of scientists within a single institution and in close proximity to facilitate conversation, continual exchange and ad hoc problem solving. The diverse set of institutions, and research locations, that are housed under this geographically distributed CRP run counter to these findings.

Whether these challenges can be overcome is in part a question of the management structures and processes that are put in place to ensure timely exchange of the right information, joint planning and decision making, and collaborative implementation. As presented, the panel is concerned that there is a strong likelihood that rigid FP silos will emerge. The proposal does not specify the decision-making or reporting lines that will be used to manage the operational linkages that connect the activities and staff of different FPs. It appears that relationships between the FPs will be managed primarily within the PMC, under the chairmanship of the CRP Director. It will be essential that the Director is empowered to provide strong leadership, to ensure that cross-FP cooperation and information flows are well structured and sufficiently formalized,

particularly because these relationships will probably not be given high priority by individual FP leaders. Frequent reporting and planning meetings that cut across FPs will be crucial. It is equally important that the CRP Director monitors the level of cooperation, and puts in place and enforces sufficient incentives to encourage cross FP cooperation. Perhaps most importantly, the Director must also create a shared CRP culture that values what each FP and CoA brings to solving a common set of goals.

One option proposed by the panel to overcome these obstacles and encourage closer synergy at field level would be to establish teams, with adequately empowered leadership, for particular geographies whether at country or zonal levels. It would be the responsibility of those teams to ensure that the activities and results of different FPs and CoAs come together synergistically to achieve concrete impact on the ground. Leadership of those teams would have to be fully empowered by the CRP Director to exercise those functions effectively.

3.2 Additional steps will be necessary to incorporate heterogeneity across the drylands in program design and implementation

Although the broad diversity of agroecological conditions is acknowledged in several sections of the proposal, variation in climate and soils is not quantitatively described. What these mean not only for agricultural potential, but as importantly for farm-level risks, must be more fully considered in program design. As importantly, the socio-economic and political variability reflected in markets, institutions, policies, culture and political stability are barely mentioned. Unlike the agroecological diversity, the socio-cultural-political issues are not only likely to be more diverse but also more dynamic during the term of this research program. This includes political instability and threat of conflict within a number of dryland countries. While there are challenges in synthesizing these complex systems, more effort must be placed in understanding and summarizing how the political, economic, social and technological issues relevant to this CRP vary across the target agroecologies.

We have already discussed the vast contextual differences between the drylands of South Asia and SSA. With the GLDC lead institution based in India, but a large share of work being done in Africa, it is critically important to avoid “headquarters bias” that could distort African programs. But differences within these major regions are equally important. Within Africa, for example, countries in East Africa, that have well established agro-industry sectors and better enabling environments for agribusinesses, will require different interventions compared to most countries in West Africa where less progress has been made in developing a vibrant agro-business sector and where policy disincentives are still strong. The contextual heterogeneity within semi-arid and sub-humid drylands needs to be more systematically analyzed and formally incorporated into the research agenda of each FP to ensure that CoA activities are adequately customized to address the needs of each context.

The panel has recommended that one promising approach is to develop a typology of mega-environments – incorporating a range of factors including agroecologies, major farming systems, and key economic parameters. The objective would be to use distinct contexts to refine priority setting, to design and focus research activities for greater

relevance and impact, to rationalize and make more efficient technology testing, and to improve the targeting of research transfer and outreach to better defined recommendation domains. A typology of perhaps 5-6 zones might well be sufficient at the outset. Much of the data to develop such a typology is already available, or can be quickly generated from secondary sources. This work would build on the Earth Observation Systems data and Target Populations of Environment work that has already been included in the GLDC, but for agroecological parameters only. As argued in the previous section, the typology should be used to establish teams, with adequately empowered leadership, responsible for particular zones. It would be the responsibility of those teams to ensure that the activities and results of different FPs and CoAs come together to achieve concrete change in the field.

Such zonal teams could proactively engage strong national programs with special expertise to play lead research roles, for example in FP3, Integrated Farm and Household Management. Similarly in FP4, Variety and Hybrid Development, greater responsibility for trait integration could be assigned to national programs that have adequate capacities. This approach would ensure that new varieties and other technologies express the traits most relevant to the agroecological niches and local farmer and consumer preferences.

As stated earlier, we recognize that FP1 explicitly calls for defining agroecological zones complemented by an analysis of socioeconomic constraints as part of its program to prioritize crops and research activities. Our concern is that the results of this work will not be available in time to adequately influence the agenda and priorities of FPs 2-5. The panel strongly recommends that an initial typology, based on existing data, be developed early in the formulation of the next proposal, and that its results be drawn on to help guide the priorities and lines of work within each FP. Close reference to, and alignment with, regional and national strategic priorities will be important. We are confident that ICRISAT, with more than 40 years of experience, working with its principal partners and drawing on global big data, is well positioned to deliver these additional provisional results quickly. Moreover, ICARDA has already done considerable work to developed systems typologies that could be built upon. Once FP1 is fully operational and produces better information, those priorities and activities can be further refined.

3.3 Recommendations

A future proposal should consider the following steps to ensure fully functional synergies are achieved across program activities, and that program activities are adequately refined and integrated to meet the needs of different locations.

21. The CRP Director must have the requisite management skills and be empowered to enforce cross-FP collaboration, involving timely information sharing, frequent meetings of FP and CoA leadership, joint decision making, and full cooperation during implementation. This also implies a high level of collaboration with the Directors of the various crop programs in ICRISAT, CIAT, ICARDA and IITA.

22. The Director must closely monitor the level of cooperation, put in place adequate incentives and create a CRP culture that values working toward shared goals.
23. The heterogeneity across the semi-arid and sub-humid drylands of SSA and South Asia should be more systematically analyzed and used to construct a typology of relatively homogeneous zones. The typology should be used to frame the research agenda of each FP to ensure that CoAs are adequately customized to address context-specific needs. The typology should be constructed with reference to agroecology, farming systems, crop mega-environments and relevant economic parameters.
24. An initial typology, based on existing data and informed by regional and national priorities and plans, should be developed early in the formulation of the next proposal, and its results used to guide initial priorities and lines of work within each FP.
25. The next proposal should consider the formation of zonal teams responsible for ensuring that the activities and results of different FPs and CoAs are adequately integrated to achieve concrete impacts at the ground level.

4. Program content

The panel believes that the program set out in the GLDC proposal broadly covers most high priority activities. Nevertheless, it suggests that some gaps exist and some areas could be further developed and presented more effectively.

4.1 Greater reference to previous research is needed to build on what is known and to refine future directions

A major weakness throughout the proposal is the lack of reference to previous research. In many sections the impression is given that little work has already been done on priority themes. A detailed summary of what is already known the major gaps in knowledge, and the key hypotheses that will guide future work are not set out in a way which builds confidence that adequate lessons have been learned from past successes and failures. This is true with regard to past work on crop improvement, and is particularly glaring for the markets, institutions and policy work. Much greater specificity is needed to give assurance that past lessons have been fully incorporated into shaping future research directions.

4.2 Apparent gaps and duplication, and issues of research design and operational detail across lines of work

FP1

The CoA1.1 and CoA1.4 priority setting approach (as set out in the GLDC proposal Box 1) is most appropriate for crop technology interventions, but requires considerable adaptation for research on markets, institutions and policy. Methods developed at IFPRI in the past could be adapted here. Those approaches may also require modification when examining interventions in mixed crop-livestock systems.

Additionally, the approaches depend primarily upon retrospective data and may not adequately provide forward looking analyses under conditions of rapidly changing consumer preferences, new market situations and environmental change. Although stakeholder consultations are mentioned, it is not acknowledged how national and regional strategic priorities will be incorporated into the priority setting work. It is critically important that these stakeholders have major influence in setting priorities for work that directly affects their populations.

Although CoA 1.2 sets out preconditions for successful technology dissemination and adoption it would also be valuable to conduct research on why farmers dis-adopt technologies after testing them. Understanding dis-adoption is key to technology refinement and would provide valuable complementary information to FPs 3 and 4.

FP2

The panel raises questions as to how exactly innovation systems methods are intended to be used to improve enabling environments. Although the overarching principles of innovation systems approaches are welcome to address complex and increasingly dynamic systems, the manner in which they are presented tends to obfuscate the underlying challenges and how more conventional economics and business methods remain relevant and still need to be applied. The presentation often projects a lack of focus and vagueness, and makes it impossible to understand exactly what will be done, with whom, how and at what levels in value chains. For example: “This cluster (2.3) will identify, with critical actors, innovative governance mechanisms based on assessments of multidimensional outcomes related to GLDC...”, and “The cluster does not focus on specific governance mechanisms as it intends to be open for the creativity, which evolves in multi-stakeholder processes”. Exactly what, who and why? Greater clarity would be welcome.

If the proposed approaches are to have impact improving markets, institutions and policies in target and across spillover countries, a useful first step is to recognize the varying development stages (and reform phases) at which they currently stand in different national contexts, and then tailor interventions accordingly. To take account of both temporal and geographic variability some scenario planning might well be a useful approach.

Changes in the enabling environment can often be constrained by deeply seated and highly sensitive political factors, but the challenges – and traps – posed by such factors are not explicitly recognized in the proposed work. A significant addition of political economy work is needed if sustainable changes in policy formulation and implementation are to be achieved at scale.

The panel believes that research could be strengthened by deepening activities on enabling environments for agribusiness and agro-industry development; that is, the set of policies, institutions, support services, regulatory frameworks and other conditions that together create the general business setting within which enterprises can start and thrive. The current impact pathway and theory of change appear to implicitly assume that either private sector value chains already exist, or that they will easily emerge. Experience in many contexts demonstrate that neither of these

assumptions is generally true. While the term "enabling environments" is mentioned in several sections (e.g. in CoA1.4), the discussion does not give assurance that the concept is adequately operationalized and fully integrated into the proposal. There is no specific discussion of how enabling environments will be evaluated, promoted or maintained. The GLDC could usefully refer to recent and current work in UNIDO, FAO and the World Bank to learn from their case studies and analytical frameworks, and borrow and adapt methods as appropriate.

This work could be further strengthened by a systematic analysis of markets using conventional market performance methods. Analyses could examine regional and international trade constraints and potentials, including regulatory issues of food safety, and grades and standards. Assessment of financial market constraints and opportunities also appears to be absent.

Finally, although it may only be an issue of presentation, there appears to be overlap between CoA 2.1 and 2.2, which should be clarified.

FP3

The research agenda should be more strongly linked to, and shaped by, rigorous yield gaps analyses by crop and agroecological zone to determine the emphasis to be given to biotic and abiotic stresses, genetic yield potential, and crop, soil and water management approaches.

The panel believes it will be important to include farm-level economic analysis to assess the competitiveness of new technologies on whole household incomes and risk management strategies. Economists should work closely with agronomists and breeders to refine objectives and accelerate impact. The extent to which this would be done is unclear. The panel also suggests that the household-level analyses include non-cropping options, including non-farm rural employment, and tree and livestock systems, as these alternative enterprises represent competition for scarce time and non-labor resources, especially in more marginal dryland contexts. Potential conflicts and complementarities between these enterprises need to be identified and incorporated into research planning.

There appears to be overlap between CoAs 3.1 and 3.2. Greater clarity is needed to define boundaries and functional linkages. It is not entirely clear where on-farm varietal testing will or should take place, that is, CoA 3.3 or in component 3 of CoA 4.3. Similarly, there appears to be overlap of work proposed in aspects of CoA 3.2 IPM work and FP4 since genetic tolerance or resistance is a key element in IPM strategies. Boundaries and functional linkages must be developed to ensure efficient execution and exploitation of potential synergies.

Finally, because the proposal expresses interest in maximizing levels of biological nitrogen fixation, it would be interesting to assess the feasibility of developing small scale methods to produce, conserve, transport and apply Rhizobia under dryland conditions. This could generate local small business opportunities for development in FP2.

FP4

The proposal should set out a list of prioritized crop-specific traits for selection in different dryland zones, even at a general level. For example, setting out the weight to be given to yield potential vs. biotic and abiotic stress resistance for each priority crop based on past experience. And looking forward, it is not clear from the proposal whether FP4 will take into sufficient consideration how climate change is affecting pest profiles and how these changes will be monitored and fed into adjusting crop breeding objectives. In short, clear product foci must be defined needed for each crop and zone combination, and this includes forage as well as grain for dual purpose species.

In general, greater consideration should be given to the value of stover for both the dryland cereals and grain legumes, particularly for work targeting semi-arid agropastoral systems. Work needs to be done to determine the relative economic returns to the farmer from stover vs. grain, by farm type and agroecological zone, and this information must be included when setting breeding goals such as developing dual purpose vs high grain yield cultivars. Similarly, greater attention should be given to the nutritional value of stover, and how nutritional quality can be genetically enhanced and managed. Gender considerations will be particularly important when assessing the value of stover vs. grain

Similarly, more attention needs to be given to whether the strategy of developing broadly adapted varieties has greater chances of success and impact compared to breeding for more narrowly defined agroecological conditions. Experience in West Africa often shows that targeting narrowly defined recommendation domains are often more effective.

The proposal must set out stronger links with the private sector in seed production, specifically for sorghum and millet hybrids. Having private seed companies engaged is very much a win-win situation for both farmers and seed companies. It is not unusual that commercial companies help produce seed of non-hybrid crops as part of their marketing efforts and public relations outreach.

Multilocation testing of early generation germplasm and elite varieties should be considered in greater detail to test for resilience and broad adaptation, as well as to determine tolerance or resistance to the major biotic and abiotic stresses. More generally, the challenges to phenotyping in dryland environments should be given greater attention, including specifying targets of site numbers to be developed to required standards. There are few high quality and strategically located phenotyping sites in the semi-arid areas of Africa and new sites require careful selection and constant management to ensure uniformity, especially under managed levels of stress. High throughput phenotyping is mentioned but few details are presented. Remote sensing methods using drones are rapidly changing the phenotyping methods, and merit greater discussion.

Rapid turnover of improved varieties is one of the best responses to the challenges of climate change. A recognition of the effects of climate change requires that future research consider how the rate of turnover of varieties can be sharply increased and performance stability over years and locations improved. Using private sector seed

producers and hybrids where possible, as well as public messaging are ways turnover can be accelerated.

Biofortification potential should be explored across all target crops, but framed to reduce or eliminate yield drag to provide incentives for farmers to grow biofortified crops, and to ensure identifiability from farm to consumer so the value-added has some chance of being captured at the farm level. This will require close cooperation with FP2. The role of soil nutrient management in influencing concentrations of nutrients in the grain should also be explored.

Although most advanced breeding programs are beginning to use genomic selection as a real-time method during varietal development, there is no indication in FP4 whether there are plans to move forward with this methodology in its main breeding programs (it is included in FP5 only).

FP5

The panel found that FP5 was well presented and captured the most important advanced techniques appropriate for the dryland crops. Although transgenics are referred to in the proposal, it is only in a generic sense with no indication of the traits and crops for which transgenes might become a priority. The panel notes that Bt and herbicide resistant versions of some important dryland crops are already available, and work is on-going to enhance nutritional quality in sorghum. Future proposals should clarify its policy regarding transgenics, as well as for gene editing approaches.

4.3 Recommendations

The panel recommends the following steps to improve both the content and presentation of the proposed research agenda.

26. Clarify the methods that will be applied to conduct both *ex ante* and *ex post* impact analysis of work on markets, institutions and policies, as well as in mixed crop-livestock systems.
27. Clarify how national and regional strategic priorities will be incorporated into the priority setting activities of FP1.
28. Explain more precisely how innovation systems approaches and innovations platforms will be used in work to improve the enabling environment, and how more conventional markets, institutional and policy analyses will fit into and complement the innovation systems approaches in FP2.
29. Political economy methods should be considered to illuminate non-market forces driving decision making at policy levels in FP2.
30. Household-level economic analysis should be used to assess the competitiveness of new technologies against competing enterprises and their impacts on whole household incomes and on risk management strategies in FP3.
31. FP4 should set out a list of prioritized crop-specific traits for selection in different production environments. Product focus is needed for each crop, and this includes forage as well as grain for dual purpose species.

32. FP4 should clarify how it will balance the development of broadly adapted varieties vs. breeding for more narrowly defined agroecological conditions.
33. The challenges to phenotyping in dryland environments should be given greater attention, including specifying trait targets and site numbers to be developed to required standards.
34. FP4 should set out stronger links with the private sector in seed production, specifically for sorghum and millet hybrids, and with community seed systems for non-hybrids.
35. Greater consideration should be given to the value of stover quantity and quality in agro-pastoral systems, and set breeding objectives accordingly.
36. Future work should explore the potential for biofortification across all target crops, but designed to reduce or eliminate yield drag, and to ensure identifiability from farm to consumer.
37. Future proposals should clarify policy regarding the development of transgenics, as well as for gene editing approaches.

5. Comparative advantage and partnerships

The panel agrees that for efficiency and impact, a program as broad and complex as that proposed for GLDC must identify and establish close working relationships with the most relevant “best in field” partners, and that roles should be assigned based on assessments of institutional comparative advantages. But the panel raises questions as to the basis for partner selection, assignment of roles and how the high number of partnerships will be managed.

5.1 Partner identification

Most of the GLDC leadership and principal partners appear to be legacies of the three Phase 1 CRPs. It is not clear the extent to which a systematic and updated landscaping has been conducted of institutions and programs working in closely related areas. Panel members suggested that consideration be given to assessing the potential of partnerships with the following: University of Queensland – DEEDI and CSIRO who are implementing BMGF funded sorghum projects in Ethiopia; CERAAS in West Africa; a number of large value chain projects being funded in USAID’s Feed the Future program; several US universities working in the USAID funded Sorghum and Millet Innovation Lab; Peanut and Mycotoxin Innovation Lab; Legume Innovation Lab; Climate Resilient Cowpea Innovation Lab; the Sustainable Intensification Innovation Lab; and a wider set of private sector companies and associations in agribusiness and the finance sector, the latter including banks, venture capital and private equity firms. In the areas of monitoring, evaluation and impact assessment partnerships should be considered with Social Services Direct, Cultural Practice, TANGO and ALINE. In the gender domain, the International Center for Research on Women and AWARD could be valuable partners.

The proposal says little about partnerships with development organizations to test promising new technologies, in seed production and input provision, to accelerate and expand uptake, and to deepen demand through piloting development of new products. Key international NGOs that should be considered include CARE, CRS and World

Vision, all of whom have long experience working in dryland agricultural systems. But as importantly, partnerships with regional research groups such as ITA in Senegal, local NGOs, and community groups should be explored, particularly in target countries.

Although the partnership descriptions included under each FP give some information on the primary roles of each partner, there is insufficient detail on exactly what is going to be done beyond broad and fairly general descriptions such as “collaborating in capacity development” or “develop adaptive models”. An additional more granular sub-layer of activities is needed to clearly define what these broad activities entail and who will do what and where.

The roles of the private sector must be developed more thoroughly under the FP activities. There are very few instances where private enterprises (or bodies representing the private sector) are listed as major partners in operationalizing the CoAs. For a CRP that aspires to have a strong market and agribusiness orientation, the roles of private sector entities should be more fully set out. Possible partners might include National Seed Traders Associations and the African Seed Traders Association (AFSTA), which could help link new varieties to active seed companies. AFTSA, only mentioned once in the CRP, could play a decisive role in promoting cooperation with the broader African seed industry. Multinational seed companies can also play important roles in testing new germplasm and in providing high quality test sites. The Hybrid Parents Research Consortium (HPRC) model, established by ICRISAT in 2000, could be built upon and further expanded in the new CRP.

5.2 Roles assigned on the basis of comparative advantage

A synopsis of past work done and major achievements of the CRP’s principal CGIAR centers should be provided, perhaps in an annex, to more definitively establish their strengths in the areas of work under each FP and CoA. Specific questions regarding capacities for FP1 and FP2 are discussed below.

It is difficult to assess whether the roles and responsibilities of partner institutions align with their institutional strengths because their specific research tasks and responsibilities are not adequately defined. For example, the roles and locations for research activities by CIAT are not clear. The same applies to ICRAF’s work on agroforestry; CIMMYT’s work on maize; ILRI’s work on livestock systems; and IWMI’s work on water management. How do they fit into the broad program agenda and what exactly are they expected to produce within CoAs? Moreover, budget allocations to partner institutions together with FTEs for scientists from partners have not been provided, and as such it is not possible to determine whether or not they will have the resources to deliver.

5.3 Linkages with other CRPs

A wide range of logical collaborations are proposed with sister CRPs in various sections of the proposal. However, the enumeration of CRP partnerships is inconsistent between sections, and even within the same section between text and tabular presentations making it difficult to get an overview of what CRPs will actually

emerge as key partners across individual FPs. There also appear to be important gaps. For example, in FP2, there is no mention of LIVESTOCK. Given the importance of mixed crop-livestock systems in many dryland zones, this is a major oversight with implications in each of FP2's CoAs. Similarly, significant connections to LIVESTOCK are absent in FP3.

The proposal's descriptions of CRP partnerships generally appear to be aspirational and at very early stages of discussion rather than partnerships based on agreed, concrete plans of work. It is critical that formal agreements be reached on a range of operational issues, including:

- a common and coherent overarching strategy that derives from the interests of each CRP to address common, well formulated problems
- recognition of the strengths that each CRP brings to the collaboration,
- how collaborative plans will be developed and implementation managed, including field-level decision-making structures and procedures
- resource commitments made by each CRP towards collaborative actions
- who does what, where, and when
- at what levels and by what means CRPs will report
- joint determination of how the results will be deployed.

Most CRPs linkage descriptions provide very little of this detail. Rather most list general areas of cooperation but without the level of operational details necessary to be fully credible. Among the weakest are statements of collaboration with MAIZE, RICE, WHEAT, and RTB. Somewhat stronger descriptions are set out for PIM, LIVESTOCK and FISH, but even these do not provide sufficient operational detail. ICRISAT must rapidly advance its joint planning with sister CRPs to arrive at jointly agreed strategies and operational approaches.

Finally, the number and complexity of cross CRP collaborations are high, and probably exceeds the capacity of the CRP management and governance teams to plan, implement and monitor all of them effectively. This CRP should prioritize the most important sister CRPs with which it will collaborate based on a rigorous assessment of its priority program needs. For the highest priority CRPs, strategies, implementation plans and resource commitments for collaboration should be formally developed and agreed. For these, formal management structures and procedures must be put in place and adequately funded. With lower priority CRP collaborations, less intensive plans to regularly share tools, methods, advice and results should be developed and implemented.

Timely and open exchange of information between CRP scientists and leadership is critical for success. It will be important for high level representatives of priority CRPs to participate actively in annual reporting and planning meetings, and provide updates on areas of common concern. In addition, periodic joint meetings of the most concerned CRP team managers, involving major partner representatives, including national partners, will be important. Between meetings, frequent brief updates should be prepared by the CRP leader, and concerned FP and CoA leaders summarizing progress, challenges and lessons learned should be shared asking for feedback. Critically important will be creating a culture in GLDC that rewards effective

collaboration. The annual performance appraisal of the GLDC director should include indicators reflecting the quality of joint planning and collaboration among sister CRPs.

5.4 CRP linkages to increase capacities in FP1 and FP2

Although the staff proposed to lead FP 2 and its CoAs have excellent credentials, it is not clear that their experience is sufficiently deep in several of the key areas of work needed to improve the enabling environment: agricultural market and policy analysis, agribusiness, regulatory systems, consumer economics, finance, and trade; nor in applying innovation systems approaches. Similarly, from the information provided, it is not clear that the FP1 leadership has sufficient deep experience in foresight analysis, priority setting and impact assessment.

Although PIM is identified as a key partner in this work, the current GLDC proposal indicates that this will be focused mainly on joint development of tools and methods for value chain assessment and governance and scaling models. Such support is useful but almost certainly insufficient.

The panel believes that to strengthen these key areas of work, future proposals should develop closer and more active operational partnerships with IFPRI/PIM. GLDC's FP2 proposes work on value chains which is close to PIM's FP3, creating a natural space for collaboration. And GLDC's FP1 work on foresight and priority setting shares similar objectives to PIM's FP1, thus also creating a promising space for collaboration.

For FP2, it is suggested that GLDC leadership should immediately begin to explore with IFPRI the development of a joint research program with PIM. Because IFPRI's past work in this area does not reflect a strong focus on dryland regions or crops, GLDC economists would have to participate closely with PIM in the design of the joint work, and PIM must commit fully to giving adequate priority to the partnership. The outposting of a GLDC researcher to IFPRI/PIM should be considered to strengthen the relevance of the work and quality of the partnership.

Because FP1's work in foresight, priority setting and impact assessment must be closely linked to the technology development work in FPs 3 and 4, the panel suggests that the locus of FP1 leadership remain within the new drylands CRP. Similar to FP2, we suggest that the lead center should develop a close working collaboration with IFPRI/PIM that takes maximum advantage of IFPRI's past work on foresight and priority setting. Approaches that should be explored include developing a joint GLDC/PIM project and outposting an IFPRI staff to the new drylands CRP. IFPRI/PIM staff must also participate closely in developing the FP1 plan of work.

Finally, whatever arrangements are made to partner with IFPRI/PIM on FP1 or FP2, the panel believes that existing capacities within GLDC may need to be enhanced to make partnership with IFPRI/PIM more productive and to ensure that research results are fully internalized within the GLDC lead center. This could be done through recruitment of new staff if necessary.

5.5 Roles of NARS and regional organizations

A clear statement needs to be made on the roles of NARS in the next proposal. There is little evidence that national organizations in target and spillover countries engaged in significant ways to shape the GLDC priorities and strategy, nor that they will be adequately engaged as full partners in execution.

It is recommended that the next proposal pro-actively explore engagement with strong units within selected NARS to play lead roles in conducting strategic and applied research, and not rely upon NARS only for adaptive research and transfer activities, as it now appears. In selected cases, if adequate resources are provided and their regional mission is clearly defined, the panel believes that many such activities can be conducted at equivalent levels of quality as at CGIAR centers, and more cost effectively. At the same time this would contribute concretely to developing regional research capabilities over the medium and long term, and the next generation of regional science leaders. Similarly, the CRP should pro-actively engage with the SROs, empowering them to take a lead role in ensuring the transfer of research results from priority countries to spillover countries.

5.6 Managing the partnerships

Dozens of partners have been identified as critical under the broad GLDC umbrella. And it appears that many if not most of the staff from partner organizations will work from within the walls of their home institutions. This creates a complicated challenge to manage decision making, time allocation, information flows, conflicting incentive systems and ultimately accountability. It also poses an enormous challenge to creating a culture that builds a spirit of collaboration across institutions. As stated above in the context of cross-CRP collaboration, the GLDC proposal says very little about how the partnerships will be structured and formalized, and what processes will be employed to manage these challenges. At a minimum, formal agreements and structures must be in place that are transparent, efficient and effective.

5.7 Recommendations

The panel makes the following recommendations to strengthen the partnership arrangements needed to deliver the complex program of work.

38. A systematic and updated landscaping of institutions and programs should be conducted to identify best in class partners with clear comparative advantage to execute work in well defined priority areas.
39. More detailed information on the roles, responsibilities and deliverables of key partners should be provided to supplement the general descriptions already contained in the current proposal.
40. The future proposal should consider expanding partnerships with private sector entities and with development organizations.
41. The CRP leadership should approach IFPRI/PIM as soon as possible to explore opportunities to collaborate closely in FP1 and FP2, and to quickly develop agreements to engage IFPRI/PIM in expanded roles as described in the text.

42. The next proposal should identify and engage with strong units within selected NARS to play lead roles in conducting strategic and applied research.
43. The future proposal should also engage and develop collaborative agreements with the SROs, empowering them to take a lead role transferring research results from target to spillover countries.
44. Collaborative linkages with sister CRPs should be prioritized based on an assessment of the priority needs. For the highest priority CRPs, strategies, implementation plans and resource commitments for collaboration should be formally developed and agreed, and formal management structures and procedures put in place and adequately funded. With lower priority CRP collaborations, lighter plans to regularly share tools, methods, advice and results should be developed and implemented.

6. Governance and management

Although governance and management structures appear to follow IEA recommendations, the panel raises question on several aspects of how these functions will work in practice. These include whether the time allocation of program and cluster leaders is sufficient; need for clarity on the roles and responsibilities of management and governance entities, and their interface with center program leaders; and concerns with the roles of NARS and regional organizations.

6.1 Time allocation of CRP leadership

The original GLDC proposal sets out a complex program, involving 17 clusters of activities spread over 5 FPs (with multiple but critical FP and CoA linkages), focused on 8 priority crops, with activities in 14 target and 15 spillover countries, with dozens of partners, and pursuing synergies with several other CRPs. Success in such a complex endeavor requires close, proactive management to optimize synergies and product delivery. Facing these management challenges, the projected time commitments for FP and CoA leaders and co-leaders appear to be unrealistically low. It appears that less than 10 FTE of scientist time allocated to essential management and research functions. The panel believes that it would be prudent to revisit the management requirements, and allocate adequate leadership time to ensure efficient and effective operations.

6.2 Roles and responsibilities of key governance and management entities

Greater clarity is needed regarding the authority and procedures of the Independent Steering Committee (ISC). It is not clear whether it is purely advisory, or has decision-making authority with regard to work plans and budgets, staffing, etc.. An advisory role would seem to be more appropriate to avoid conflict with the Lead Center Board. There needs to be formal contracts and ToRs for ISC members. The GLDC might also consider requiring independent ISC members to prepare a report annually to the DG of the lead center to promote an accountable commitment to improve the functioning of the CRP.

Clarity is also needed regarding the composition, roles and procedures of the 9 person ISC sub-committee consisting of the 9 “independent” ISC members. Although these independent members are from non-CGIAR center organizations, it is not clear if they can be representatives of partner organizations that are receiving funding to support their participation in the CRP. If so, they would not be independent and would be exposed to potential conflict of interest. Furthermore, the sub-committee’s roles and responsibilities compared to those of the ISC are not clear. Since the 9 independent members constitute a majority of the (max) 16 person ISC in any case, it is suggested that unless their roles and influence are clearly defined, and their added value demonstrated, the CRP may wish to revisit whether the sub-committee should be formed.

In the preceding phase 1 of the CRPs, the roles and responsibilities of the CRP Directors and center commodity directors were not sufficiently defined and understood with respect to decisions on budgets, staffing, program content and reporting. In some cases this led to unnecessary and costly friction. This raises the question of whether the CRP Director is to be given responsibility in these and other areas. Or is s(he) a CRP manager who liaises with center program directors, completes and submits CRP plans and reports, but has limited direct management responsibilities? It is recommended that the role of the CRP Director, decision making authority, and reporting lines (to the DG and DDG Research ICRISAT as lead center) be carefully spelled out in the proposal.

Clarity is also needed concerning the balance of authority between the CRP Director and the FP Directors regarding program level decision making. It would be preferred that greater power should reside with the GLDC Director in matters pertaining to cross-FP linkages to ensure close and effective functional collaboration between the FPs. The composition and expertise of the Research Management Unit should also be revisited. The proposal states that “all CoA leaders who are product line leaders in the CRP on Grain Legumes are also members of its Research Management Committee...the FP and CoA leaders comprise the FP4 management team that is responsible for oversight and management”, but all the proposed leaders are grain legume specialists with no provision made for equivalent expertise in cereals. This imbalance should be corrected.

Finally, a minor housekeeping point. The proposal must be more consistent in the titles given to the Independent Steering (Advisory?) Committee and the Research Management Unit (Committee?).

6.3 Roles of NARS and regional organizations in CRP governance

The principal mechanisms through which regional and national organizations were proposed to engage in the governance of the CRP is through the participation of FARA, ASARECA, ICAR, INRAN and EIAR on the ISC. However, without ISC’s terms of reference, it is not clear what influence they would exercise on the CRP programs. It is recommended that the ISC’s ToR provides these regional and national organizations with sufficient authority to ensure that CRP programs cooperate with, and are complementary to, regional and national strategies and priorities.

The proposal calls for research efforts to be focused on target countries, with mechanisms put in place to ensure an efficient transfer of results to spillover countries. However, the proposal does not specify the roles, if any, to be played by NARS in overseeing and managing GLDC activities within their respective countries. It is recommended that appropriate planning and coordination structures are put in place within each target country that give NARS leaders on-going voice and influence in planning and oversight of all activities within their respective countries.

Finally, as stated elsewhere in this report, the proposal hasn't anticipated a role for SROs to facilitate the transfer of research results across spillover countries. Planners preparing the new CRP should open conversations with relevant SROs to develop agreements, structures and procedures through which SROs can play lead roles in the acceleration and expansion of spillover.

6.4 Recommendations

The panel makes the following recommendations to clarify and strengthen management and governance arrangements.

45. The panel strongly recommends revisiting the FTE management requirements and allocating adequate leadership time to ensure efficient and effective operations.
46. Greater clarity is needed on the roles and authority of the ISC, and of the ISC sub-committee of independent members.
47. The ISC's ToR should provide regional and national organization members with sufficient agency to ensure that GLDC's programs are in close alignment with, and fully complementary to, regional and national strategies and priorities.
48. The CRP Director must be vested with sufficient authority, and accountability, to direct the CRP effectively, including ensuring that linkages between FPs operate efficiently.
49. The composition of the FP4 management team needs to be revisited to ensure adequate cereals expertise.
50. It is recommended that appropriate planning and coordination structures are put in place within each target country that give NARS leaders on-going voice and influence in planning and oversight of all activities within their respective countries.

7. Gender and youth

The panel appreciates the importance given to incorporating gender and youth considerations. It also appreciates GLDC's attempt to develop an approach that cuts across all FPs and most CoAs, and its planned efforts to raise gender awareness across all scientific staff in ways that lay the base for effective mainstreaming. Finally, the effort to include gender (and to a lesser extent youth) as a key element in the monitoring and evaluation work is commendable. Our comments are intended to identify areas in which this work can be strengthened to have greater impact.

7.1 Reframing gender and youth issues

The conceptual frame which GLDC uses to define the problem set is incomplete. Rather than identifying gender as focused only on women's issues, it should broaden its gender focus to include both women and men, as well as youth, thereby shifting the concern to achieving equity, and seeking changes in norms and behaviors for all three groups. Specifically, it would be better to place greater emphasis on engaging men and boys, and women themselves, to empower women both economically and socially, through a focus on decision making, control over assets and income, and greater agency in economic and social institutions.

The research concepts employed in GLDC could be updated by applying current thinking on gender approaches which distinguish gender exploitive, gender accommodating and gender transformative relationships and impacts. Through this lens, for example, it is possible to see that some of the interventions proposed in the current proposal that are aimed at improving household nutrition could become exploitative, having unintended consequences of increasing women's labor burden. More positively, this lens would also help in conducting *ex ante* assessments to identify interventions that have more transformative impacts.

Similarly, the core issues facing youth are inadequately specified, as are the strategies needed to engage them more fully and productively in activities across the value chain. Greater attention is needed to identify and understand the factors that constrain their access to land and other productive inputs, education, financial and other services, markets and gainful employment in value adding activities.

7.2 Approaches to incorporate gender and youth considerations

The extent to which gender issues have been incorporated into plans of work differ widely across FPs. Thus, FP4 does a reasonably thorough job of identifying the specific ways in which women's interests and preferences are considered in crop improvement programs, and how they must be involved at all stages of program design and implementation. In contrast, the treatment of gender issues in FPs 2 and 3 are more superficial, with inadequate specificity and contextualization, giving one less confidence that gender issues are understood and will be given sufficient attention. Having said that, the focus in FP3 on reducing labor drudgery for women is welcome, but hopefully a broad spectrum of possible solutions will be considered, including exploring the development of herbicide resistant crop varieties in FP4, and simple mechanization for threshing and planting.

Similarly, close attention needs to be given to monitor how labor times vary for men and women with the introduction of new technologies, both in *ex ante* and *ex post* assessments, and the gender yield gap that arises when women are assigned less favorable land, and have less access to other productive resources such as credit, inputs, information and extension services.

Given the CRP's focus on markets, institutions and policies, more critical thinking needs to be applied to defining strategies to engage men in changing social norms and behaviors in ways that empower women. For example, the risks of women being

displaced by men when what were formerly “women’s crops” become commercially attractive – a pattern seen repeatedly in the African drylands – should be explicitly addressed.

Finally, work in this area needs to take into account how gender issues vary across different dryland contexts as defined by culture, religion and community institutions, but also across crops, tasks and points along the value chain.

7.3 Broadening and strengthening partnerships on gender and youth

The next proposal would benefit greatly by the on-going inventory and analysis of past gender work to identify what approaches have worked, what haven’t, why, and what are the key lessons to guide future programming. We recognize that the centers probably do not have comparative advantage in this area, and thus recommend that close partnerships should be formed as soon as possible with more experienced organizations, preferably from within the regions, who have been working in gender in agriculture. These include AWARD, ICRW, universities; and development organizations such as CARE that are well known for cutting edge work on gender equity and women’s empowerment. These organizations will bring deeper knowledge and should be fully engaged in program design and implementation of gender and youth dimensions to help ensure that the most current thinking is fully and effectively applied.

We make the same point regarding GLDC plans to build awareness and capacity across its scientific staff to promote effective gender mainstreaming. Maximum use should be made of experienced regional partners in the internal capacity building effort.

7.4 Measuring progress on gender and youth

The proposal fails to mention whether, and if so how, it plans to use the Women’s Empowerment in Agriculture Index (WEIA) developed in part by IFPRI. This broad spectrum index should be a key part in the GLDC tool kit for use in *ex ante* impact assessment work to guide program design, and in *ex post* assessments to measure outcomes and impacts. The current focus of WEIA is to ensure that beneficiary aspirations are taken into consideration when defining and measuring outcomes. GLDC should engage in that process and/or explore the use of outcome mapping to improve the validity of its own gender outcome indicators.

7.5 Recommendations

The panel makes the following recommendations to strengthen the incorporation of gender and youth in program activities.

51. The conceptual frame within which gender and youth issues are addressed should be updated to better reflect the most current thinking.
52. The operationalization of gender issues in FPs 2 and 3 and should be much further developed.

53. The CRP should identify and partner with leading institutions working on gender and youth to refine its approaches to mainstream work in on-going research programs and to build gender capacity within the lead centers.
54. The Women's Empowerment in Agriculture Index (WEIA) should be considered for use by the CRP in *ex ante* impact assessment work to guide program design, and in *ex post* assessments to measure outcomes and impacts. Similarly, consideration should be given to more qualitative approaches such as outcome mapping.

8. Capacity development

The proposals for capacity development work within GLDC have a number of strengths. These include: focus on both individual and organizational capacities; collaboration with key regional organizations such as APAARI, RUFORUM and WACCI; recognizing the importance of both formal and informal, modern and traditional knowledge; inclusion of a gender focus; recognition of participatory technology development approaches; basing strategies on sound needs assessments; application of unconventional tools such as innovation platforms, incubation centers and entrepreneurship training. However, the panel raises concerns with several aspects of the program including the vision, lack of operational detail and resource commitments.

8.1 Limited ambition for capacity development

The GLDC vision statement for capacity building defines success as all partners having "in place human resources, institutions and systems" for "successfully carrying out their defined roles in the GLDC". The panel finds that this vision lacks sufficient long-term ambition. We believe it should aim higher, towards achieving a state where national and regional institutions are empowered to play strategic leadership roles in drylands development and ultimately to lead and resource autonomous research programs to the same standard as the centers. Measurable outcomes of the capacity development work during the life of the CRP should be defined against this measure.

8.2 Lack of operational detail

The capacity development section in the annex states that the program of work builds on lessons learned from past failures, without describing those failures, what the lessons were, and how the current program will do better. There is general lack of clarity and specificity on a wide range of operational issues. The proposal aims to be "strategic, holistic, inclusive, results oriented, internationally competitive and sustainable", without providing operational specifics on what this means on the ground and how it will be done in practice.

For example, although there is a call for short-term and long-term training, curriculum development and internships, few details are provided. Moreover, it is questionable whether or not the centers have comparative advantage in developing curricula. Whether there will be an adequate number of scholarships for MS and PhD students to contribute significantly to the CRP program is unclear. Or whether training of trainer approaches would be used to achieve more sustained impact at scale. FP5 focuses

on building capacities of CGIAR center labs, without explaining how this will improve capacities in national and regional programs, or whether similar work will be done in national program sites or other regional centers of excellence.

The lack of detail is particularly significant for capacity development in entrepreneurship, value addition, SME development, post-harvest handling, gender and women's empowerment and other topics that fall outside of traditional CGIAR training frameworks. New partnerships will have to be formed with entities that have both core competencies and successful experience in these areas. Training micro-enterprises that will deliver agro-inputs and purchase marketed surplus from farmers requires working with entirely new networks, using new skill sets and mindsets that cannot be built overnight. It is not clear how the CRP will build its own capacities to get to that point, and even less clear how they would take such work to scale.

It is also unclear how the capacity development work will be managed and governed. Although it is stated that FP2 will coordinate the work and proposes the formation of a CD Task Force (the composition of which is not described), it is also proposed to use multi-stakeholder platforms (MSP) at both operational and strategic levels. Both such structures need to be better defined and details provided on what they would do and how they would be operationalized in ways that are both practical and cost effective, and to whom and how they would be accountable. The MSPs, in particular, appear to overlap with the strategic planning functions of a Capacity Development Task Force, and duplicate some oversight functions of the Independent Advisory Committee, Research Management Committee, and the operational research teams within the Clusters of Activities.

The panel recommends that capacity development efforts must be geared to deliver on a clear future vision in which national and regional programs take increasing levels of responsibility within GLDC. Collaborative action research in which national scientists play increasingly leading roles, as appropriate, should be a main vehicle. Capacity development initiatives need to be driven by needs assessments co-led by national and regional programs to ensure that the activities, outputs and outcomes of GLDC are relevant, aligned with national priorities, and fully owned by national governments and regional organizations. This may be what is intended by the MSPs, but as presented it is not clear.

8.3 Resource allocations to capacity development

Little solid information is provided on planned levels of investment in capacity development. Although there is an aspiration of allocating 10% of the GLDC budget for capacity building, it is not entirely clear how, and indeed if, this level of investment can be achieved. In various sections of the proposal it is stated that funds will be drawn from bilateral projects and an Innovation Fund which in total is funded at a level of only \$2 million. Thus, it remains unclear what level of priority the CRP actually assigns to capacity development within its broader program, at least as reflected in committed resources.

8.4 Recommendations

The panel makes the following recommendations to strengthen capacity development activities as presented in the proposal.

55. The CRP's capacity development goals should aim towards achieving a state where national and regional institutions are empowered to play strategic leadership roles in drylands development and ultimately to lead and resource autonomous research programs to the standard provided by GLDC.
56. Much greater operational detail should be provided on the activities and deliverables of the capacity building activities, how they are managed and governed, and whether or not they are adequately resourced.

9. Monitoring and evaluation

Panel members found MEIAL to be a complex and challenging approach for producing the information necessary to assess progress and to provide management with the timely information it needs to adjust program design and delivery. Members have concerns on the practicality of the proposed approach, and whether it can deliver value for money.

9.1 **Fit and feasibility of the MEIAL approach**

Views on MEIAL varied widely across panel members. One experienced panel member found that MEIAL would not be able to provide timely and sufficient information to guide management in making program adjustments on an on-going basis, and thus would not provide value for money. The member recommended that a simpler and less costly approach be used based on the time-bound milestones method used by the Bill and Melinda Gates Foundation. This would identify and track easily measured progress indicators towards a well-defined and agreed upon set of milestone deliverables.

Other panel members found that the MEIAL goals and conceptual framework are strong, with an explicit focus on real-time learning aimed at improving program design and delivery for increased efficiency and impact. An approach similar to MEIAL is believed to be needed given the complexity and geographic dispersion of GLDC activities and partners. An open access online MEIAL platform, if properly implemented by key players across the CRP, has the potential to provide a comprehensive and coherent M&E framework whose results are accessible by all key partners thus promoting broad ownership. The critical factors identified for success of the MEIAL approach are sound, including important roles of partners, the integration of participatory research results into immediate feedback loops, and especially promoting a culture that incentivizes learning and adaptation.

9.2 **Managing risks inherent in MEIAL**

All panel members agreed that the risks of this approach, however, must be identified and carefully managed. The on-going data input requirements to maintain a current digital platform are considerable, and could unintentionally lead to a "fill in the blanks"

and “check the box” mentality which doesn’t ensure deep, real time qualitative learning. And the open nature of the system creates a risk of conflicts of interest that could lead to entering biased data. The electronic interface must be user friendly to encourage utilization, and appropriate incentives should be considered to encourage timely inputting. Sufficient resources must be allocated to processing, triangulating, analyzing and interpreting the large amount of detailed data which will be generated to avoid delays in bringing the right information to management at the right times to guide program adaptation.

Future proposals should show how these risks will be mitigated and managed. It should also provide greater certainty on the levels and sources of funding, including FTE numbers dedicated to managing MEIAL, their capacities, location, reporting lines, and other issues that could influence whether or not management actually makes use of the information. The panel also believes that it will be important to explain better how national organizations, other partners and beneficiaries will shape the outcome targets, provide input and access results, and how gender equity and empowerment outcome indicators will be included.

A bottom line requirement for success when implementing MEIAL is the culture change that is acknowledged in the proposal. An uncompromising commitment to early and honest learning from dead ends and failures must be deeply instilled within the IAC, PMC, FP and CoA leadership and a follow-on accountability structure must be developed and carefully implemented. To this end the future CRP might consider organizing frequent and frank “making sense” reflection sessions that bring together key players in the FPs and CoAs – including partners – to objectively analyze results posted in the on-line platform. The goal of these sessions would be to learn what works, what doesn’t, where and why, and to recommend the necessary program adjustments.

9.3 Recommendations

57. Ways to further simplify MEIAL need to be explored and tested, as well as ways to improve cost effectiveness and its real-time delivery of key information.
58. Early training of all staff on the objectives of MEIAL, how to use it and how they will benefit must be undertaken before launch and maintained during implementation.
59. Sufficient incentives must be established to ensure timely entering of accurate clean data.
60. Sufficient staff should be assigned to process and analyze data, and to assist users when necessary.
61. Leadership at all levels of the CRP must work to create a deep culture change and commitment to honest, real time learning across all levels of staff.

10. The nature, scope and structure of revised proposal(s)

10.1 One or more CRPs

The panel was unanimous that future CGIAR programs in the drylands should be organized within a single CRP. Concern was initially expressed by some members as to whether it is optimal to merge the agendas of vastly different regions - South Asia and SSA in particular - into one CRP. Market, institutional, policy, research capacities, and farming systems differ in profound ways between those two regions. To ensure local relevance, focus and impact, it is essential to acknowledge and address those differences both programmatically and structurally.

The panel concluded that for FPs 2, 3 and 4, these differences would be most efficiently accommodated by organizing research activities under the CoAs to address the specific constraints and opportunities of distinct sub-regional zones. This would be less necessary for FPs 1 and 5, which can be geographically broader in scope. Such an approach, pursued within one CRP, would facilitate transfer of results and methods within zones, while achieving major efficiencies in both management and governance costs.

For reasons explained in earlier sections of this report, the panel also agreed that strong synergies at field and household levels fully justifies combining the dryland cereals and legumes into a single integrated CRP.

10.2 Are major structural changes necessary within the CRP?

The panel concluded that there are compelling reasons to retain the broad outlines of the GLDC FP themes that bring together crop technology development research with research to improve markets, institutions and policies. This is a much needed and timely rethink to address the urgent needs of poor rural households for more stable and productive farming options, while at the same time providing them with opportunities to emerge from poverty and move towards greater more business orientation. Efforts to explore and develop new end uses and markets for the target crops are critically important to create more elastic demand to sustain productivity improvements. And building new agribusinesses and improving markets is essential to ensuring that poor urban consumers have access to affordable food. These elements are interdependent and should be implemented in a strategically integrated and sequenced program of work.

Having said that, considerable additional work is needed to develop a more convincing proposal that frames the CGIAR's work on the most important dryland crops and their associated agri-food systems. The elements of a new proposal have been considered in some detail in earlier sections of this report. Among the most important are:

- The CRP should be reframed as an Agri-Food Systems CRP sharply focused on increasing the productivity, resilience and profitability of the most important cereals and grain legumes grown within the semi-arid and sub-humid agroecologies of SSA and South Asia. The panel concludes that this sharper

and more limited geographic and crop focus will make more efficient use of investors' funds and achieve larger impact in a shorter period.

- The high diversity of agroecological and enabling environments that characterize the drylands must be better characterized, and captured in a simple but robust zonal typology. Such a typology should be used as an operational tool to structure the planning and implementation of future research.
- Country, crop and thematic priorities should be revised incorporating more results of foresight analyses and *ex ante* impact assessments, consultation with national and regional bodies and considering how crops, constraints and opportunities vary in nature and importance across distinct dryland mega-environments.
- Work in the new CRP must be based on a much better understanding of what has been done in the past, what worked, what didn't, where and why. This requires a more comprehensive and careful diagnosis of past successes and failures to derive clear lessons at both strategic and tactical levels to frame the future research agenda.
- Linkages with other CRPs need to be more concretely formulated. Formal management and reporting structures must be established and agreed upon to facilitate efficient delivery by each partner CRP and ensure mutual accountability.
- Particular attention must be given to strengthening GLDC's capacity in the markets/institutions/policy domain, as well as in priority setting. New arrangements to ensure closer collaboration between GLDC and PIM are urgently needed.
- Because livestock is an important complementary, and in some cases competing, enterprise for farm households in the drylands, more systematic approaches need to be explored with the LIVESTOCK CRP that ensure closer and more productive joint research on crop-livestock interactions.
- Close and empowering relationships must be built with national and regional partners that provide pathways for them to play meaningful leadership roles in appropriate areas. Similarly, partnerships, based on comparative advantage, must be formed with a wider range of advanced research entities, private sector companies and associations, and development organizations.

10.3 Recommendations

62. A single CRP should consolidate and lead CGIAR research on the cereal and grain legume crops in the semi-arid and sub-humid drylands of SSA and South Asia. To distinguish the new CRP from GLDC, as well as from its precursor CRPs, center partners should consider branding the new program Dryland Cereals and Legumes (DCL).
63. A new proposal for this work should be developed, solidly based on additional analyses, broader consultations and expanded partnerships.
64. The panel strongly recommends that adequate human and financial resources should be mobilized and allocated to the rapid preparation of a sound, forward looking CRP strategy and, if approval is granted, that the revised CRP be fully supported by the CGIAR.

The Way Forward

The panel recommends that the following steps be initiated as soon as possible to move the process forward, aiming for the launch of a new CRP focused on meeting the needs of dryland populations in early 2018. In light of the considerable amount of additional preparatory analyses that must be completed, we are concerned that the time frame for the development of a new CRP proposal may be unreasonably short.

1. ICRISAT should immediately be requested to lead the design and implementation of a new CRP with a more focused crop and geographic scope. Given the tight time frame, a “go” decision is urgently needed.
2. The CGIAR, CIMMYT, ICARDA and ICRISAT should consider and decide upon the optimal CRP home for future barley research.
3. ICRISAT, working closely with ICARDA, IFPRI, and CCAFS, should develop an initial, forward looking typology of the major semi-arid and sub-humid zones in SSA and South Asia based on similar agroecologies and farming systems, and which face common agricultural and institutional constraints and opportunities.
4. Building on these partnerships and typology, ICRISAT should accelerate its priority setting analyses to develop a refined set of crop, country, and thematic priorities framed within the zonal typology.
5. As part of the renewed priority setting exercise, ICRISAT should engage with SROs and key national entities to determine their strategic priorities, and explore/agree ways to enhance collaboration within a new CRP.
6. ICRISAT should engage with sister CRPs – particularly PIM, LIVESTOCK, WLE, FTA, and MAIZE – to determine areas of mutual interest and specify points of complementarity that can be incorporated into the next CRP. With PIM, efforts should be made to develop the basis of a joint program for FPs 1 and 2.
7. ICRISAT should lead a comprehensive, critical assessment of past research accomplishments for key geographies and crops, identifying in which research areas greater or less success have been achieved, the underlying factors that have limited success, and concrete lessons to help guide research directions and approaches going forward.
8. Building on these inputs, a preliminary CRP proposal should be prepared by July for review and comment by key stakeholders.
9. A final proposal should be presented for final System Council decision in November.

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PROFESSIONAL EXPERIENCE

Since November, 2007: Retired from Rockefeller Foundation, Self-Employed. Adjunct International Professor of Applied Economics and Management. Cornell University. Member of the External Advisory Board of the Sorghum and Millet Innovation Lab, Kansas State University (2013-present). Chair of the Board of Trustees for The Africa Rice Center, Cotonou, Benin (2011-2016). Member of the Board of Trustees of the African Agricultural Technology Foundation (2010-2011). Member of the Advisory Board, Cornell International Institute for Food, Agriculture and Development (2009-2016). Chair of the Steering Committee (2008-2010) and Senior Advisor for AWARD (African Women in Agricultural Research and Development) (2010-2016). Board Chair of the Global Fund for AWARD (2009-present). Consultant for the Bill and Melinda Gates Foundation. Consultant for the African Economic Research Consortium. Member of the CGIAR Working Group on Structure and Governance (2007-2009).

September 2006 to November, 2007: Managing Director, Africa. The Rockefeller Foundation, Nairobi. Directed operational support and guided all Rockefeller Foundation strategic planning and programming in Africa. Contributed to the development of a new global strategic plan for The Rockefeller Foundation.

September 2006 to November 2007: Interim President, Programs for a Green Revolution in Africa, Nairobi. Coordinated program planning, recruitment and establishment of financial, administrative and logistical systems for the Alliance for a Green Revolution in Africa (AGRA). AGRA was established as an autonomous charitable organization with the purpose of strengthening African agriculture and reducing poverty and food insecurity. The Rockefeller and the Bill and Melinda Gates foundations provided initial funding of \$150 m.

January 2004 to September 2006: Director, Africa Regional Program, The Rockefeller Foundation, Nairobi. Oversaw Foundation grant making in health, food security, education, and information systems throughout Africa. Supervises the work of five Foundation program officers and 16 support staff.

August 2001 to December 2003: Deputy Director for Food Security, The Rockefeller Foundation, New York. Supported Foundation philanthropic activities through grant making in science and technology, market development, policies and capacity building. Management responsibilities include developing an integrated African strategy for Rockefeller's food security program and overseeing the activities of three Food Security Program Officers based in Africa. Team leader of The Rockefeller Foundation's cross-thematic Intellectual Property Policy Team.

January to August 2001: Group Leader a.i., Environmentally Sustainable Development Group, Bureau for Development Policy, United Nations Development Programme (UNDP), New York. **Managed professional and support staff of the ESDG. Led the formulation of UNDP corporate strategies for environmental and natural resource management, and preparation of a thematic trust fund proposal to mobilize resources in support of**

programming in these areas. Spokesperson for UNDP in global environmental meetings and conferences. Member of Bureau for Development Policy Results Management Team that is charged with developing Bureau policies and operational procedures. Identified, negotiated and managed resource mobilization and strategic partnerships in environment and natural resources management on behalf of UNDP. Served as the UNDP Co-Sponsor to the CGIAR.

June 1997 to December 2000: Chief, Global Programme for Food Security and Agriculture, Sustainable Energy and Environment Division, UNDP, New York. **Provided strategic guidance and technical assistance to the formulation of UNDP food security and agriculture programs, and managed a portfolio of global projects. Principal author of the UNDP Global Cooperation Framework that sets out the strategy for UNDP global programming across all development themes for the period 2001-2003. Supported Country Office programs. Served as the Executive Secretary of the Impact Assessment and Evaluation Group for the CGIAR. Also served as the UNDP Co-Sponsor of the CGIAR during 2000.**

September 1988 to April 1997: Director of Research, West Africa Rice Development Association (WARDA), Bouake, Cote d'Ivoire. Joined WARDA at the beginning of a transition period during which fundamental reforms were introduced into the Association's mission, structure and operations. Helped draft the WARDA Strategic Plan (1990-2000); prepared First Medium-Term Plan (1990-1994); coordinated formulation of Second Medium-Term Plan (1994-1998); prepared and successfully negotiated funding proposals to mobilize resources from bilateral and multilateral donors; directed global recruitment of new scientific staff; participated in developing institutional policies for operations, administrative, contributed to the design of research office and laboratories in new Main Research Center (MRC); led the development of a long-term land use plan; coordinated the selection and purchasing of laboratory and farm equipment; conceptualized and directed innovative mechanisms for collaboration with national agricultural research systems in West and Central Africa; negotiated collaborative agreements with advanced research centers; directed and supervised the work of 25 PhD level research scientists located in four countries; drafted and/or coordinated the preparation of funding proposals and periodic reports for submission to donors; directed annual review of research programs; directed and edited the annual research report; negotiated and monitored all collaborative initiatives with national research institutes and advanced centers; represented WARDA in regional and international meetings.

September 1979-September 1986: Principal Economist and West African Economics Program Leader, ICRISAT, Ouagadougou, Burkina Faso, and September 1986-September 1988: Principal Economist, ICRISAT Center, Hyderabad, India. Served as economist on a multidisciplinary team of scientists for which the goal was to develop improved sorghum and millet production technologies for the West African semi-arid tropics. Conducted field research and analyses aimed at: identifying farm-level constraints; analyzing farmers' objectives and resources; and defining technologies types that would fit into and perform well within resource-poor farming systems. To these ends, conducted panel survey of 150 farm households in three agroclimatic zones during five years (1981-1985). Also designed and conducted on-farm tests of sorghum and millet varieties, fertility management practices, intercropping systems, new tillage equipment and water harvesting/erosion control systems. Directed thesis research of four PhD students.

April 1977-August 1979: Assistant Professor, Department of Agricultural Economics, Michigan State University, East Lansing, Michigan. Taught two graduate level courses (Agricultural Project Analysis and Research Methods). Directed thesis research of four PhD and seven MSc students. Served as principal investigator for a USAID funded research project on technical change and income

distribution in Nigeria and Sierra Leone. Provided technical support (survey design and analysis) to integrated agricultural research project in Burkina Faso. Member of Faculty Executive Committee for the African Studies Center of Michigan State University. Published research results as journal articles, book chapters and in institutional publications.

EDUCATION

1971-77	Cornell University	Agricultural Economics PhD	
1967-71	Woodrow Wilson School, Princeton University	Development Economics	MPA
1963-67	School of Foreign Service, Georgetown University Magna cum laude, Phi Beta Kappa	International Affairs	BSFS

LANGUAGE PROFICIENCY

Speak and read French fluently.

OTHER PROFESSIONAL ACTIVITIES

Journal Related

Member of the Advisory Committee of the journal *Agricultural Economics*, since 2006.
Member of the Editorial Board of the journal *Nutrient Cycling in Agroecosystems*, since 1993.
Member of the *Conseil scientifique* of the journal *Agriculture et développement*, since 1993.

Referee for:

American Journal of Agricultural Economics
Food Policy
Journal of Developing Areas
Nutrient Cycling in Agroecosystems
Review of Agricultural Economics
World Development

Board Membership

Member of the External Advisory Board of the Sorghum and Millet Innovation Lab of Kansas State University since 2013.

Member of the Advisory Board of the Cornell International Institute for Food, Agriculture and Development, 2010-2016.

Chair of the Board of Trustees for The Africa Rice Center, Cotonou, Benin, 2011-2016. Member of the Board since 2010.

Chair of the Board of Trustees for the Global Fund for African Women in Agricultural Research and Development (AWARD), 2009 to present.

Member of the Board of Trustees for the African Agricultural Technology Foundation (AATF), Nairobi, Kenya, 2010-2011.

Member of the Board of Trustees of St. Thomas Academy, a Catholic preparatory school, Mendota Heights, Minnesota, 2008 to 2011.

Member of Board of Directors for the Agricultural Biotechnology Support Program, Michigan State University, 2000-2003.

Panels/Committees

Member of the Advisory Committee for the Cornell International Institute for Food, Agriculture and Development, 2009 to present.

Chair of the Steering Committee and representative of the Bill and Melinda Gates Foundation for the African Women in Agricultural Research and Development (AWARD) Program, January, 2008 – June, 2009.

Member of the Structure and Governance Working Group of the CGIAR Change Management Process, February - November, 2008.

Member of the advisory panel of the Development Gateway, Food Security Community, 2001 to present.

Member of the United Nations Millennium Project Hunger Task Force during 2002-2005.

Member of the Executive Council for the Consultative Group on International Agricultural Research (CGIAR). Representing foundation members of the CGIAR. 2002-2004.

Member of the Study Panel on African Agricultural Productivity coordinated by the Inter-Academy Council of National Academies of Science during 2002-2003. The panel presented its report to the UN Secretary General in 2003.

Chair of the United Nations Inter-Agency Working Group for the Food Insecurity and Vulnerability Information and Mapping Systems program during 2000-2002; member 1997-2002.

Member of the Program Steering Committee of the United Nations ACC Sub-Committee on Nutrition, 1998-2000.

Member of the Scientific Advisory Committee for the West and Central African Council for Agricultural Research and Development (WECARD/CORAF), 1999 to present.

Advisor to the Committee for Agricultural Sustainability, Consultative Group on International Agricultural Research (CGIAR), 1994-1997.

Member of the Planning Task Force for the Ecoregional Program for the Humid Tropics of Africa, coordinated by the International Institute for Tropical Africa 1994-1996.

Member of the Advisory Committee for Humid and Sub-Humid Zone Framework for Action, Special Project for African Agricultural Research (SPAAR), The World Bank, 1992-1994.

Member of the SPAAR Network Working Group, 1993-1996.

Member of the Center Directors' Working Group on Ecoregional Approaches to Agricultural Research of the CGIAR, 1992-1993.

Chairman, Committee of Deputy Directors General for CGIAR Centers, 1991-1992.

Member of the External Advisory Committee for the Small NARS Research Project of ISNAR, 1990-1992.

Member of the Scientific Advisory Committee for the International Foundation for Science, Stockholm, Sweden, 1989-2001.

Resource Person for the Summer Institute for African Agricultural Research, International Agricultural Programs, University of Wisconsin, Madison, Wisconsin, annually 1989-1999.

Member of the Sustainability Committee of the CGIAR, 1989-1990.

Co-founder and Member of the Steering Committee for the West African Farming Systems Research Network, 1981-1986.

Member of the Management Committee for the Organization of African Unity/SAFGRAD Regional Farming Systems Program (IFAD funded), 1984-1986.

Member of Planning Committee for the National Adaptive Research Program *Institut Burkinabe de la Recherche Agronomique et Zootechnique*, Government of Burkina Faso, 1984-1985.

Member of Faculty Executive Committee for the African Studies Center, Michigan State University, 1977-1978.

Consultancies

The Bill and Melinda Gates Foundation, Seattle, Washington State, 2009. Review research proposals and provide other advice as requested.

The African Economic Research Consortium, Nairobi, Kenya. 2008. Review research proposals and papers.

The World Bank, Washington, DC, 1987-1990. Prepared technical report examining the effects of land tenure on soil fertility management practices in Burkina Faso.

Office of Technology Assessment, U.S. Congress, Washington, D.C. August 1987. Evaluated technical interventions employed in projects initiated by the African Development Foundation.

Institut Sénégalais de la Recherche Agronomique, Dakar, Senegal, May 1985. Lectured to scientists and technicians in national farming systems program on methods of on-farm research.

IFDC, Bamako, Mali, October 1984. Lectured on methods for the economic evaluation of results from fertilizer experiments. Students included scientists and technicians from several francophone West African countries.

IFAD, Rome, Italy, 1982. Prepared President's Report for OAU/SAFGRAD West Africa Farming Systems Project.

USAID Rural Development Project in Fada N'Gourma Upper Volta, 1978. Prepared survey methodology for multidisciplinary field studies.

PRINCIPAL PUBLICATIONS

Professional Journals

- Chavas, J-P., P.M. Kristjanson, and **P.J. Matlon**. 1991. "On the Role of Information in Decision-Making. The Case of Sorghum Yield in Burkina Faso." *Journal of Development Economics*. 35 pp 261-280.
- Matlon, P.J.** 1990. "Improving Productivity in Sorghum and Pearl Millet in Semi-Arid Africa." *Food Research Institute Studies*, Vol. XXII, No. 1, Food Research Institute, Stanford University.
- Jaeger, W.K. and **P.J. Matlon**. 1990. "Utilization, Profitability, and the Adoption of Animal Draft Power in West Africa." *American Journal of Agricultural Economics*. Vol. 72, No. 1.
- Hulugalle, N.R., J. de Koning and **P.J. Matlon**. 1990. "Effect of rock bunds and tied ridges on soil water content and soil properties in the Sudan savannah of Burkina Faso." *Tropical Agriculture (Trinidad)*, Vol. 67, No. 2.
- Reardon, T., **P.J. Matlon**, and C. Delgado. 1988. "Coping with Household-level Food Insecurity in Drought-affected Areas of Burkina Faso." *World Development*, Vol. 16, No. 9.
- Monteith, J.L., **Matlon, P.J.**, Sachan, R.C., Virmani, S.M., and Walker, T.S. 1988. "The Evolution of On-Farm Research at ICRISAT". *Entwicklung + Landlicher Raum* 3:7-9.
- Matlon, P.J.**, and D.S.C. Spencer. 1984. "Increasing Food Production in Sub-Saharan Africa: Environmental Problems and Inadequate Technological Solutions." *American Journal of Agricultural Economics*, Vol. 66, No. 5.
- Matlon, P.J.** 1978. "Aspects of Rural Labor Market Operation: A Javanese Case Study: Discussion." *American Journal of Agricultural Economics*. Vol. 60, No. 5.

Edited Books

Coming Full Circle - Farmers' Participation in the Development of Technology, **Peter Matlon**, Ronald Cantrell, David King, and Michel Benoit-Cattin (eds.). 1984. IDRC, Ottawa, Canada.

Book Chapters, Contributions

- Matlon, P. J.** 2012, "The African Resurgence – an updated narrative for African agriculture." Pages 117-123 in *What is the Matter with African Agriculture*. H. J. W. Mutsaers and P.W. M. Kleene (eds.). KIT Publishers. Amsterdam.
- Matlon, P. J.** 2008. Forward to *Innovation Africa: Enriching Farmers' Livelihoods*. Selected and edited from papers presented at an International Conference on Innovation in African Agriculture Held in Kampala, Uganda, November, 2006. Earthscan. London.
- Norman, D.W. and **P.J. Matlon**, Agricultural Systems Research and Technical Change. 2000. Pages 17-47 in *Research on Agricultural Systems: Accomplishments, Perspectives and Issues*. J-P Colin and Eric Crawford (eds.) Nova Science Publishers, Inc. New York.
- Matlon, P.J.**, T. Randolph, R. Guei. 1998. "Impact of Rice Research in West Africa." Pages 383-401 in *Impact of Rice Research*. P.L. Pingali and M. Hossain (eds.). International Rice Research Institute, Los Banos, Philippines.
- Matlon, P.J.** and A. Adesina. 1997. "Agricultural Growth and Sustainability: Prospects for Semi-Arid West Africa." Pages 229-245 in *Sustainability, Growth and poverty Alleviation – A Policy and*

Agroecological Perspective. S.A. Vosti and T. Reardon (eds.). Johns Hopkins University Press, Baltimore and London.

Reardon, T., V. Kelly, C. Delgado, **P. Matlon**, O. Badiane. 1994. "Is Income Diversification Agriculture-Led in the West African Semi-Arid Tropics (WASAT)? Nature, Causes, Effects, Distribution, and Production-Linkages of Off-Farm Activities." Pages 207-229 in *Economic Policy Experience in Africa - What Have We Learned?* A. Atsain, S. Wangwe, and A.G. Drabek (eds.). African Economic Consortium, Nairobi.

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Matlon, P. J. 1999. "Hunger and Free Trade – Remarks". Pages 127-130 in *Proceedings of the 93rd Annual Meeting*, The American Society of International Law. 24-27 March 1999. Washington D.C.

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Matlon, P. J. and Adesina. 1994. "Potential IARC Contributions to Building Social Science Capacity in NARS". Pages 24-27 in *Social Science in the CGIAR*. Proceedings of a Meeting of CGIAR Social Scientists Held at the International Service for Agricultural Research (ISNAR), The Hague, The Netherlands, August 1992. Collinson M. P. and Platais K. W. (eds.) CGIAR Study Paper No. 28. The World Bank, Washington, D.C.

Matlon, P.J. 1994. "Research Needs for Sustainable Rice Production in West Africa: WARDA's Assessment and Response." Pages 231-239 in *Proceedings of the 17th Session of the International Rice Commission*, 4-9 February 1990, Goiânia, Goiás, Brazil, International Rice Commission Newsletter, 1990, Vol. 39, FAO, Rome.

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Matlon, P.J., and Kristjanson, P.M. 1989. "Farmers' Strategies to Manage Crop Risk in the West African Semi-Arid Tropics." Pages 604-606 in *Challenges in Dryland Agriculture - A Global Perspective*. Proceedings of the International Conference on Dryland Farming, 15-19 Aug. 1988, Amarillo/Bushland, TX, USA. College Station, TX, USA: Texas A & M University (CP 475).

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Institutional Publications

Gilbert, E., **Matlon, P.**, and Eyzaguirre. 1994. "New Perspectives for Vulnerable Institutions: Agricultural Research Systems in the Small Countries of West Africa". *ISNAR Briefing Paper No. 14*. International Service for National Agricultural Research (ISNAR). The Hague, The Netherlands.

Tenkouana, A., Traore, T., de Koning J., **Matlon, P.J.**, and Stoop, W.A. 1992. "Research on cropping systems at ICRISAT, Burkina Faso". Pages 272-296 in *Improving Farming Systems in the Interior Savannah Zone of Ghana*. Nyankpala Agricultural Research Report.

Matlon, P.J., and Fafchamps, M. 1988. "Crop Budgets for Three Agroclimatic Zones of the West African Semi-Arid Tropics". *Progress Report No. 85*, Resource Management Program, Economics Group, ICRISAT, India.

Lichte, J., **Matlon, P.**, Bloom, R. 1981. "An Assessment of Animal Traction in Francophone West Africa". *African Rural Economy Working Paper No. 34*. Dept. of Agricultural Economics, Michigan State University, East Lansing.

Matlon, P., Eponou, T., Franzel, S. Byerlee, D. and Baker D. 1979. "Poor Rural Households, Technical Change, and Income Distribution in Developing Countries: Two Case Studies from West Africa". *African Rural Economy Working Paper No. 29*, Dept. of Agricultural Economics, Michigan State University, East Lansing.

Matlon, P. 1979. "Income Distribution Among Farmers in Northern Nigeria: Empirical Results and Policy Implications". *African Rural Economy Working Paper No. 18*, Dept. of Agricultural Economics, Michigan State University, East Lansing.

Matlon, P. 1978. "Income Distribution and Patterns of Expenditure, Savings, and Credit Among Farmers in the North of Nigeria - A Cash Flow Analysis". *Occasional Paper No. 96*, Dept. of Agricultural Economics, Cornell University, Ithaca.

Matlon, P. 1975. "A Note on the Production and Marketing of Groundnut in Three Villages of Kano State". *Samaru Newsletter*, Vol. 17, No. 3. Inst. for Agric. Res., Zaria, Nigeria.

Matlon, P. 1972. "The Definition and Measurement of Rural Disguised Unemployment in Low Income Countries - A Review of the Literature and Speculations on the Use of Energy". *Staff Paper No. 72-11*, Dept. of Agricultural Economics, Cornell University, Ithaca.

Annex 1 BIOS OF ADDITIONAL EXPERT PANEL MEMBERS

Listed alphabetical by family name

TIMOTHY J. DALTON

Dr Timothy J. Dalton serves as the Director of the Sorghum and Millet Innovation Lab. Professor Dalton received A.B from Columbia University in 1988, an M.S in Agricultural Economics from the University of Illinois in 1992 and a Ph.D. in Agricultural Economics in 1996 from Purdue University. Dr Dalton's research and development experience in sorghum and millet stretches back 20 years back to a M.S thesis on dryland sorghum and millet farming systems in the Peanut Basin of Senegal followed by an award-winning doctoral dissertation on the ex-ante economic impact of improved sorghum varieties on soil degradations in Southern Mali (partially funded by INTSORMIL) He is well versed in interdisciplinary research and specialized in understanding the relationship between agricultural production, technological changed and the environment. He has extensive professional experience in more than 20 African nations. He has considerable experience with CGIAR research institutes, the Standing Panel on Impact Assessment of the CGIAR, the Food and Agriculture Organization of the United Nations, foundations, USAID and USDA. He is a member of the multistate research project "NC&1034 Impact Assessment and Decision Strategies for Agricultural Research" and a member of the Council of Food, Agriculture and Resource Economics Blue Ribbon Panel on Development. In 2012 he led the USAID-commissioned external evaluation of the Peanut CRSP and the Aquafish CRSP. Dr DALTON is fluent in French

GREG EDMEADES

Independent Consultant, Cambridge, New Zealand

Greg Edmeades was raised on a dairy farm near Cambridge in the North Island of New Zealand, and obtained his first two degrees in agriculture and crop science from Massey University in that country. He completed his PhD in maize physiology from the University of Guelph, Canada, and joined CIMMYT in Mexico in 1976 as a Postdoctoral Fellow. From 1979 to 1984 he led a Canadian-funded project in Ghana, western Africa, aimed at increasing maize and cowpea production at the farm level. Greg then returned to CIMMYT, where he led a research program focused on developing stress-tolerant maize varieties—especially tolerance to drought and low soil fertility. This work has served as the precursor of three projects in Sub-Saharan Africa sponsored by the Bill and Melinda Gates Foundation.

In 1999 Greg joined Pioneer Hi-Bred international and, although based in Hawaii, he continued to work on field aspects of maize drought tolerance. In 2004 he retired from Pioneer and returned to New Zealand where he consults as a project reviewer in Africa and South-East Asia, and in maize agronomy in New Zealand. Greg is a Fellow of the Crop Science Society of America.

Dr. Brhane GEBREKIDAN

Dr. Brhane Gebrekidan currently lives in Alexandria, VA, USA with frequent visits and extended stay in Addis Ababa, Ethiopia. He was the Africa Region Manager of the Integrated Pest Management Innovation Lab (IPM IL) and is Member of the External Advisory Board of the Sorghum/Millet Innovation Lab (SM IL), both of USAID's Feed –the-Future program. In the most recent past, he has served and/or currently serves as a member and/or leader of various professional groups including V/President, Founding Fellow and Board Member of the Ethiopian Academy of Sciences (EAS), Chair of the Agriculture Working Group (AWG), V/Chair of the Professional Advisory Group (PAG) to Colleges of Agriculture of Ethiopian Public Universities, and V/Chair of the Ethiopian Association of Agricultural Professionals (EAAP). Additionally, he has served as External Board Member of ICRISAT's Sorghum and Millet Project supported by the Gates Foundation.

Starting from 2002, for almost six years, he was the Chief of Party / Senior Research Advisor of the USAID funded, Virginia Tech implemented Amhara Micro-enterprise development, Agricultural Research, Extension and Watershed management (AMAREW) Project based in Bahir Dar, Ethiopia. Prior to that, at Virginia Tech's Office of International Research Education and Development (OIRE), he was the Program Director of the Integrated Pest Management Collaborative Research Support Program (IPM CRSP) for eight years, a USAID Global Bureau-funded program covering Africa, Asia, Latin America, the Caribbean, and Eastern Europe. Overall he has over 40 years of Ethiopian, African, and global experience in agricultural research, education, technology transfer and project management. Dr. Brhane Gebrekidan is a plant breeder by profession, having developed several new varieties of sorghum and maize for different ecological zones of Ethiopia. In the late seventies he served as the founding editor of the Ethiopian Journal of Agricultural Sciences.

In the nineteen sixties and seventies, for nine years, he taught courses in plant breeding, genetics, biometry, and cropping systems at the former Alemaya College of Agriculture, Addis Ababa University (now Haramaya University). In addition to the above, his leadership skills have been tapped for numerous agricultural development and related projects in Ethiopia, elsewhere in Africa, and internationally. He has served as Associate Program Director of the International Sorghum and Millet (INTSORMIL) CRSP, national (Ethiopian) sorghum research team leader and coordinator, regional (Eastern and Southern Africa) team leader and coordinator for sorghum and millet under the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), maize breeder and team leader for Eastern and Southern Africa under the International Maize and Wheat Improvement Center (CIMMYT), and Head of the Plant Sciences Department of Alemaya College of Agriculture, Addis Ababa University. As leader of both the national Ethiopian and the eastern/southern Africa regional sorghum/maize programs, he has worked closely with the former Institute of Agricultural Research (now EIAR) for over two decades. During the 50th Anniversary of the Ethiopian Institute of Agricultural Research (EIAR) he was awarded a certificate for exceptional contributions in agricultural research in Ethiopia. In general, for over two decades he has worked with national researchers and administrators of most eastern and southern African countries to facilitate and promote good practices and policies in maize, sorghum, and millet improvement, and agricultural development in general.

EDWARD MABAYA

Dr. Edward Mabaya is an academic and a development practitioner in the field of Agricultural Economics. As a development practitioner, Mabaya is involved in several programs that seek to improve the lives of African farmers through private enterprises and public policy. In various capacities, he has more than a decade of experience with seed sector development across Sub-Saharan Africa. Mabaya is the lead investigator of The African Seed Access Index, a research and outreach program that promotes the creation and maintenance of enabling environments for competitive seed systems serving smallholder farmers in Africa. He has served as advisor on several seed sector development initiatives including: External Advisory Committee Member for Alliance for a Green Revolution in Africa's Program for Africa's Seed Systems (AGRA-PASS), Investment Committee member for the 11 million dollar African Seed Investment Fund (ASIF) and Principal Investigator for a multi-year research project investigating the potential of genetically modified crops in Africa.

As a Senior Research Associate in the Charles H. Dyson School of Applied Economics and Management at Cornell University, he conducts research on food marketing and distribution, seed systems, and the role of efficient agricultural markets in Africa's economic development. He is currently the Associate Director at the Cornell International Institute for Food, Agriculture, and Development, a center that engages diverse disciplines, actors and institutions around the world to advance knowledge and practice for sustainable agriculture, rural development and global food security. Mabaya earned his MS and Ph.D. degrees in Agricultural Economics at Cornell University and his B.Sc. from the University of Zimbabwe. In 2007, Ed was an Archbishop Desmond Tutu Leadership Fellow, a training program offered by the African Leadership Institute at Oxford University. He was 2016 New Voices Fellow, a media engagement fellowship run by the Aspen Institute. Ed has published widely including five books, 21 book chapters, 17 journal articles and 11 OpEds. A great public speaker, Mabaya has shared his work at many public fora (including opening keynote at CIMMYT@50, a TEDx talk, The Moth storytelling, etc) as well numerous media outlets (including NPR, BBC, Kenya TV, and CCTV).

Mabaya's work has received many distinguished recognitions including for "42 African Innovators to Watch in 2016" by Ventures Africa magazine, Coca Cola Africa Diaspora Network 2013 recognition for "dedicated service and contribution towards sustainable development in Africa" and the 2006 and 2017 L.A. Potts Success Story award for "program with model resulting in high impact on poor communities". Ed is currently president of the African Association of Agricultural Economists (2016-2019).

MAUREEN MIRUKA

Maureen Miruka is Director of Agriculture and Market Systems CARE USA and is currently based in Nairobi, Kenya. She previously worked as Senior Technical Advisor and later Team Leader of CARE's Flagship Women in Agriculture Program-Pathways; and Principal Researcher (Socio-Economics) at the Kenya Agricultural and Livestock Research Organization. She has consulted on gender equality, women's empowerment youth and livelihoods for:

- The International Development Research Center-Governance and Justice Program;
- The Global Alliance for Livestock Veterinary Medicines (GALVmed);
- The Partnership for African Social & Governance Research (PASGR);
- The McKnight Foundation; Africa Conservation Tillage Network;
- International Centre for Research in Women and GTZ- among others.

Her research and development focal areas are on gender equality and women's empowerment in agriculture, livestock and natural resource based livelihoods.

She holds a PhD in Natural Resources from University of Greenwich, London UK.

Annex 2
GLDC Expert Panel 12 Framing Questions

1. Rationale

- a. Does the proposal present a sufficient evidence-based justification for major international public research investment on grain legumes and dryland cereals in the target areas? If not, what is lacking?
- b. Are there adequate data and analysis on the extent, depth and nature of food and nutritional insecurity and natural resource challenges facing these broad agro-food systems? If not, what is lacking?
- c. Is there convincing evidence that research can address these problems with a high likelihood of sufficient impact i.e. that returns to the investment are likely to be competitive? If not, explain your concerns and what additional work/evidence needs to be provided?
- d. Are the outcomes and impacts projected in the proposal credible and based on the best available data and analysis? Please identify those projections that may require additional work and suggest how this should be done.
- e. Although the CGIAR has made major investments in dryland areas over the past 40 years, results have been mixed with few if any major documented impacts. Does the proposal reflect adequate analysis and insightful understanding of what worked, what didn't and why? If not, what changes do you recommend?
- f. Does the program adequately build on lessons learned to give stakeholders assurance that much greater progress will be made through this new program orientation going forward? If not, what changes in the proposal do you recommend?
- g. Theories of Change have been presented for each FP. Are the TOCs coherent and convincing? If not, what specific changes in the TOCs do you recommend?
- h. Does the proposal identify the most significant assumptions underlying the TOCs, and are they adequately addressed? If not, what do you recommend?
- i. Do you have any other comments or recommendations regarding the GLDC Rationale?

2. Prioritization of Crops, Countries and Research Themes

- a. Are the methods used to set crop priorities sufficient? Would you recommend additional factors or analyses to guide these decisions? If so, what?
- b. The ISPC raised concerns regarding possible contradictions and inconsistencies of using quantitative congruence analyses within an innovation systems framework? Do you agree, and if so, how can this be resolved?
- c. ISPC commented that one of the main arguments contained in the proposal for focus on the target crops - based on the unique institutional constraints and policy challenges facing that set of crops - is weak, pointing out that many crops in the CGIAR portfolio face very similar constraints and challenges in many contexts. Do you agree, and if so should the next proposal revise that argument, and how?

- d. Are the methods used to set research theme priorities sufficient? Would you recommend additional factors or analyses to guide these decisions? What specifically?
- e. Are the methods used to select target countries and spillover countries sufficient? Would you recommend additional factors or analyses to guide these decisions? What specifically?
- f. Does the proposal reflect sufficient knowledge and understanding of strategic research priorities at national and regional levels, and are those adequately incorporated into shaping the GLDC strategy? If not, what changes would you recommend?
- g. Is there an appropriate balance between program activities focused on (1) markets, institutions and policies, (2) genetic improvement, and (3) natural resources management? If not, how would you recommend achieving a better balance?
- h. Is the broad budgetary allocation optimally aligned with priorities across crops, FPs and CoAs? If not, how would you recommend adjusting the allocation of resources for greater efficiency and impact?
- i. Do you have any other comments or recommendations regarding the GLDC Priorities?

3. Structure

The ISPC expressed concern regarding coherence between the two overarching streams being addressed in this single CRP: (1) technology focused research aimed at improving the productivity, sustainability and resilience of dryland production systems (especially FP 4 and FP 5, and elements of FP 3); and (2) research on market, institutional and policy issues that together restrict the development of those systems (FP 2 and FP 3 which employ livelihoods, innovation systems and value chain framings).

An overriding question, then, is whether these two streams of research are addressed most efficiently and effectively when combined into a single CRP, or whether they be would be tackled better in alternative institutional and structural arrangements.

This in turn depends on answers to the following sub-questions:

- a. Are there in fact strong functional synergies between these two streams such that they should be retained as components of a single CRP? And does the proposal make a convincing case demonstrating these synergies? If not, what changes do you recommend?
- b. The proposal describes multiple interlinkages and cross flows of information between the FPs. Do you believe that these are sufficient to adequately achieve the potential synergies that may exist? If not, how can they be improved and strengthened to more fully realize those functional synergies?
- c. Does the proposal demonstrate that the lead Centers have sufficient capacity to conduct impactful cutting edge research on markets, institutions and policies? If necessary, how should their capacities be strengthened? Or would

these elements be better lead and executed by a specialized institution such as IFPRI? What specific changes do you recommend?

- d. If IFPRI should play a lead role in the research on markets, institutions and policies, do you believe this requires changing the structure and institutional arrangements within GLDC (e.g. an IFPRI researcher leading the relevant FPs)? Or alternatively, should the markets, institutions and policy research be conducted outside of GLDC, either as a separate CRP or as a significant research program within PIM? And if this were to be done, what arrangements would be needed to achieve close cooperation and synergy between the technology, and markets/institutions/policies research streams? The broad geographical area in which grain legumes and dryland cereals are grown is characterized with wide heterogeneity with respect to climate, soils, biotic stresses, markets, institutions, policies, political stability, etc.
- e. Is this context variability adequately recognized, described and accounted for in the proposal's research structure? If not, what changes do you recommend?
- f. Is the range of relatively homogeneous sub-zones adequately distinguished and characterized (e.g. through a typology) in order to define their unique combinations of constraints, opportunities and risks, and on which targeted program initiatives can be most efficiently prioritized, designed and implemented? If not, what changes do you recommend?
- g. Could research across the wide range of GLDC's contexts be conducted with greater focus and efficiency by changing the program structure or approach? If so, what changes do you recommend?
- h. Do you have any other comments or recommendations regarding the GLDC Structure?

4. **Research Approaches**

The major actions of the GLDC research program are set out in 5 Flagship Programs (FPs) and 17 Clusters of Activities (CoAs). And these must be optimally selected and designed to successfully address the major challenges in GLDC agrifood systems.

- a. Are there important gaps, research activities that are not included in the proposed program of work at the FP or more detailed CoA levels, that are necessary to achieve the program goals? If so, what changes do you recommend?
- b. Are there any duplications or overlaps that need to be restructured and/or streamlined for greater efficiencies, either at FP or more specific CoA levels? If so, what changes do you recommend?
- c. Is the proposed research content of the FPs and CoAs optimally designed? Are there any changes in focus, approach or methods that do you believe should be considered, either at FP or more detailed CoA levels? If so, what changes do you recommend?
- d. Are the innovation systems concepts that have been used to frame activities in FPs 2 and 3 the best way to organize, guide and conduct work on markets, institutions and policies? Is there sufficient consideration of the political challenges facing this work, i.e. how political economy factors shape and

- constrain policy change in the real world? If not, what changes do you recommend?
- e. Are the FPs and CoAs adequately operationalized? That is, does the proposal provide sufficient detail to make it clear what will be done, how and by whom? What specific changes do you recommend?
 - f. Are the most important potential synergies between FPs and CoAs adequately identified, and are the measures proposed to exploit those synergies sufficient? If not, what changes do you recommend?
 - g. Do you have any other comments or recommendations regarding GLDC Research Approaches and Methods?

5. Comparative Advantage and Partnerships

- a. Is there sufficient evidence of the comparative advantages of ICRISAT, and its principal CGIAR and non-CGIAR partners, to lead all elements of this work? That is, that the collective organizations are the best in class research organizations to deliver the highest quality and most cost-effective research on the selected research topics, at both FP and more specific CoA levels? If you have any concerns, please explain.
- b. Are the roles assigned to partners optimal across the research to development spectrum, either at FP or more specific CoA levels? If not, what changes do you recommend?
- c. Are there other more capable research organizations that should be considered for inclusion as GLDC partners? If so, which, and to play what roles in specific FPs or CoAs?
- d. Are there organizations that are currently included as partners that may not have the requisite capacities, and should be considered to be dropped from the team, or whose roles should be reconsidered in specific FP? If so which, and in what ways?
- e. Do the bios presented for FP leaders demonstrate sufficient expertise and experience to lead the proposed programs? Do you have any specific observations and recommendations?
- f. In addition to other program components, comment specifically on whether you believe the proposed institutional assignments provide optimum capacity to lead the markets, institutions and policies research themes. If not, please recommend specific changes.
- g. Are national programs in the target and spillover countries adequately engaged in the design and implementation of the GLDC? And is the engagement designed in ways that will empower national capacities going forward? If not, what changes do you recommend?
- h. In FP 2 and 3, in particular, is it clear how GLDC will work with private sector entities across the value chains? If not, what specific recommendations do you make?
- i. Do you have any other comments or recommendations regarding issues of Comparative Advantage and Partnership arrangements?

6. Management and Governance

The management and oversight of 5 FPs and 17 CoAs, with participation of dozens of research organizations located both within and outside the target regions is complex and challenging. Governance is assured by an Independent Advisory Committee of up to 16 members from including 11 non-CGIAR partners and 5 CGIAR ex officio members.

The IAC in turn reports to the Lead Center Governing Board which has fiduciary and legal responsibility. Each FP is led by an FP Director who chairs an 11 member Research Management Committee. The 5 FP Directors are drawn from and located within 4 different CGIAR Centers. The 17 CoAs are also managed by Leaders from different Centers.

- a. Are the management and governance structures and processes adequately described and are they likely to be efficient and effective? If not, do you have any specific recommendations for changes?
- b. Is there sufficient agency given to regional and national stakeholders? If not, do you have any specific recommendations for changes?
- c. Do you have any other comments or recommendations regarding issues of Management and Governance?

7. Linkages to Other CRPs

There are multiple areas of shared interests and activities between GLDC and other CGIAR Research Programs at both FP and CoA levels. These can reflect either potentially productive synergies or wasteful duplication.

- a. Does the proposal identify and include the most significant intersections where close collaboration will occur? Are there any gaps at FP or CoA levels, and how should these be addressed?
- b. Are the levels and types of collaboration sufficient? If not, what changes do you recommend?
- c. Does the proposal describe adequately how research collaboration with other CRPs will be designed, implemented (e.g. who will do what and how will results be shared?) and managed for optimal efficiency? If not, what changes do you recommend at FP or CoA levels?
- d. Do you have any other comments or recommendations regarding Linkages to Other CRPs?

8. Gender

A range of gender factors can be decisive in influencing the nature, scale and inclusiveness of dryland crops development.

- a. Are the most important Gender issues adequately identified in the discussion of each FP? If not, what is missing and what recommendations do you recommend?

- b. Do the proposed measures to ensure gender responsive research represent current best practice, and are they sufficient to ensure that research outputs are inclusive and impactful at scale? If not, what changes do you recommend?
- c. Do you have any other comments or recommendations regarding Gender issues?

9. Capacity Development

- a. Are the Capacity Development activities adequately designed to ensure that national and regional partners will be sufficiently strengthened during the program to take on an expanded set of responsibilities, either at FP or more specific CoA levels? If not, what changes do you recommend?
- b. Do you have any other comments or recommendations on the Capacity Development dimensions of the GLDC?

10. Monitoring and Evaluation

The proposal includes a major and complex Monitoring, Evaluation, Impact Assessment and Learning (MEIAL) effort.

- a. Is MEIAL implementation fully practical given its complexity and needed changes in both behavior and organizational culture? Can you recommend any modifications to make implementation more practical and less costly?
- b. If the MEIAL program is fully implemented, do you believe that it will provide timely and sufficient information to advise management and guide program adaptation on an on-going basis?
- c. Do you have any other comments or recommendations regarding MEIAL?

11. Nature and Structure of Revised Proposal(s)

The Team has been encouraged not to limit ourselves to the boundaries and content of the current proposal. We have been encouraged to be open to thinking out of the box; to asking what else, or instead, needs to be done to “meet the needs of the drylands”. If there is a consensus in the Team that fundamental changes are needed regarding strategies, or structures, or partnership and institutional arrangements to meet the needs of the drylands, we are encouraged to put these forward as options to guide the next proposal or proposals. This explicitly includes whether or not the drylands agenda can be best met by a single CRP.

Keep in mind that while we have been encouraged to think creatively, we must also be pragmatic, because whatever directions we ultimately recommend must be feasible and have a high likelihood of success in the near term given institutional realities. And we must of course provide a convincing set of arguments to support our suggestions.

Given this context, what do you consider to be the nature and structure of the proposal or set of proposals that we should recommend to meet the needs of the drylands?

- a. Retain CRP proposal's current structure but improve content. Do you recommend that revisions to the GLDC CRP can be most effectively presented through major or minor revisions to the current proposal; that is, based on the current commodity, natural resource management, and market, institutions and policy systems elements and FP structure? If yes, specify which changes are most important?
- b. Retain one CRP but make major changes in the structure and approaches of the proposal. Or do you recommend a fundamental restructuring of the CRP proposal, with major changes in program elements and structure, including major changes to the FPs and CoAs? What major changes would you recommend? Are there major new program components that you recommend should be included in the revised CRP proposal? If so, what new elements, and how should they be incorporated?
- c. Recast drylands agenda into two or more CRPs and proposals based on the program components in the existing proposal. Or do you recommend that some or all of the major program initiatives in the current proposal should be reorganized across two or more CRPs? Provide specific recommendations along those lines
- d. Recast drylands agenda into two or more CRPs and proposals, incorporating entirely new program components. Should the two or more new CRPs include major new program components that are not included in the existing proposal? Provide specific recommendations.

12. Additional Comments and Recommendations

Do you have any other comments on any other aspects of the proposal or recommendations to further strengthen it to improve efficiency, effectiveness and impact of the CGIAR's drylands research program?