

ISPC Commentary on the MAIZE Phase-II – Preproposal (2017-2022)

Summary

The MAIZE preproposal is very well written and makes the case convincingly for further investment in maize research, to tackle major challenges for increasing maize productivity in developing countries. The pre-proposal argues for going beyond being a commodity program and reorganizing its research towards a “farm livelihood approach” to be further strengthened by integrating several sites from the Humidtropics CRP. However, there was not enough evidence in the text, that lessons have been learnt from the systems CRPs or that the current CRP preproposal embraces effectively an agri-food-system integrated approach, different from its previous research, particularly when its flagships are still defined by disciplinary boundaries. MAIZE as a CRP could offer more value to the CGIAR portfolio if it followed fully an agri-food systems approach,

The MAIZE comparative advantage was validated in general by the recent IEA evaluation (2015); the CRP was also asked to review its priorities in areas where it has less comparative advantage and to consider reducing efforts in areas where the private sector is stronger. The overall Theory of Change is plausible and aligned with the SRF; there is overall good prioritization in MAIZE flagships, although not systematically based on strategic foresight.

MAIZE provides a detailed plan as to how it will operationalise gender and youth in the maize research agenda. However, it does not have a research strategy or clear concept for what and how to tackle youth-related issues in the CRP. Similarly the preproposal seems to be lacking an overall strategy for capacity development. It will be desirable to articulate clearly the MAIZE vision for strengthening NARS institutional capacity. Further work on the partnership strategy is also needed in the full proposal.

Recommendation: The ISPC considers this preproposal **Satisfactory with adjustment**, and recommends inviting the proponents to submit a full proposal which takes account of the following substantive issues (elaborated upon in the subsequent commentary) or provides a justification for lack of change:

- As MAIZE intends to use an agri-food systems approach and integrate research hubs of the Humidtropics CRP, it has to clearly spell out the lessons learnt from system CRPs and demonstrate how it plans to implement a MAIZE agri-food system strategy, and indicate what parts and components of Humidtropics will be incorporated in MAIZE.
- MAIZE should fully justify the rationale for its comparative advantage, and give more strategic consideration to the dynamics in demand and use of maize products (food, feed, fuel) and research supply (private sector, ARIs, NARS) in the CRP target areas.
- Much more attention is needed by MAIZE to strengthen its gender strategy, and how it will address the problems facing youth in the maize agri-food system and target regions.
- A comprehensive MAIZE partnership strategy will be needed.
- Four MAIZE flagships (FP1, FP4, FP5 and FP6) need some adjustment as per the detailed commentaries included below for each specific flagship.

[Overall pre-proposal Score: B]

1. Overall analysis as an integral part of the CRP Portfolio [Score: B]

Maize is a multi-purpose crop, cultivated on 184 million ha globally, with an annual production of 1016 million t, and 64% of the total maize production comes from low- and middle-income countries. The global importance of maize for food security and other uses for the benefits of the poor is convincingly described in the pre-proposal. MAIZE's expected contributions to the SRF-SLO targets for 2030, based on the estimates of relative importance of maize for poor producers and consumers (Table 3 and annexes) are significant, although some of these estimates (e.g. number of people lifted out of poverty or with improved food and nutrition security) seem to be aspirational targets that need to be refined and validated by objective ex-ante analysis rooted in a solid impact assessment strategy. MAIZE has a large area of influence, and the case for further research on maize through the support of the CGIAR is compelling.

MAIZE comparative advantage was generally validated by the recent IEA evaluation (2015); however the report also recommended that MAIZE should review its priorities in areas where it has less comparative advantage and where smallholders already have access to appropriate technology (Recommendation #2); e.g., consider reducing efforts in final product (hybrid) delivery where the private sector is strong. The CRP Management Response and Action Plan (2015) has promised that MAIZE '*will undertake analyses of maize seed sector evolution in the contrasting target environments of Africa, Asia and Latin America for the next 10 to 15 years and the role and comparative advantage of suppliers of international public goods with relevant traits (like CIMMYT and IITA) vis-à-vis private sector; such analyses must include relevant assumptions, for proper forecasting*'. Therefore the full proposal should provide clear evidence for the justification of MAIZE comparative advantage, and give more strategic consideration to the dynamics in demand and use of maize products (food, feed, fuel) and research supply (private sector, ARIs, NARS), to establish priorities in the CRP target areas.

MAIZE plans to collaborate with several other phase II CRPs, including DCLAS, RAFS, WHEAT, RTB and Livestock among the agri-food system CRPs and with A4NH, CCAFS and PIM among the integrative CRPs. The clarification of linkages with other CRPs addresses one of the recommendations made by the ISPC in its review of the MAIZE Phase I extension (2014). However, the linkages are still not defined in impact pathway schematics. This must be addressed by the full proposal when it will be clearer which linkages can be supported by W1/2 funding.

The MAIZE pre-proposal claims to go beyond being a commodity program and its research takes a "farm livelihood approach" and will further benefit by integrating several sites from the on-going Humidtropics CRP. However, there was not a compelling argument or enough evidence in the text, that this CRP embraces an agri-food-system integrated approach¹, different from its previous research, particularly when its flagships are still defined through a disciplinary boundary: socio-economics, genetics, breeding, agronomy/farming systems, processing/marketing, and delivery. If following a systems approach, rather than being the sum of its flagships, MAIZE as a CRP can offer more value to the CGIAR portfolio.

The pre-proposal shows scientific rigor and credibility and when appropriate, literature is cited to support its arguments. Specific scientific arguments included in FPs are discussed below under each flagship. Some of the lessons learned (e.g. on double haploids) are well

¹ According to FAO (2009; <ftp://ftp.fao.org/docrep/fao/011/i0499e/i0499e01.pdf>), an agri-food system considers both agricultural and agro-industrial sectors and how both interact closely with other production and service sectors, thus broadening the vision of agriculture by acknowledging the importance of economic and production activities taking place beyond the primary production process and highlighting the impact of the political, environmental and social environment on these activities.

stated, and major lessons learned are also noted when developing the FPs. The pre-proposal considers partially some recommendations given by external reviews (ISPC, IEA), but it is not clear what lessons are being learnt from the previous phase and particularly from interaction with national programs in the main target areas.

Maize plan for site integration builds from the on-going MAIZE CRP (*Annex 9*) and the existing cross-center collaborations through multi-center W3/bilateral projects, particularly in Africa and Asia. MAIZE intends to take into account the experiences from the system CRPs, especially Humidtropics, to develop a more detailed and relevant site selection and integration plan, but the CRP has to clearly spell out the lessons learnt from system CRPs and Humidtropics in particular.

2. Theory of Change and Impact pathway [Score: A]

The MAIZE preproposal has seriously considered the recommendations by the ISPC to develop a coherent program-level product delivery strategy better aligned to the SLOs; complete the definition of impacts through the identification of IDO targets and indicators; and explain the incorporation of the assumptions about the impact pathway. Appendix 1 consolidates diagrammatically the MAIZE impact pathway and ToC, showing how MAIZE contributes to seven of the SDGs, which are closely aligned with CGIAR SLOs. Appendix 1 also shows how the MAIZE's impact pathway is composed of several nested theories of change at the FP level that together contribute to various sub-IDOs and associated IDOs. The overall ToC is plausible and consistent with the SRF. The impact pathways are feasible and aligned with SRF IDOs and sub-IDOs. The impact pathway structure will help MAIZE to develop a strategy for impact assessment that sets clear priorities for focusing such assessments, provides an analytical framework and elaborates on the use of impact pathways in planning and documenting scaling up of results and impact.

There is overall good prioritization in MAIZE FPs, although not systematically based on strategic foresight. For instance, it is not clear how the CRP will focus its future work on improving the traits necessary for climate change adaptation, carbon sequestration, or aflatoxin. Table 2 describes the main MAIZE target product profiles for the various sub-regions. Although it is commendable that MLN is given high importance, there is limited focus and prioritization given to Striga management, given its threat to food security. The performance indicator matrix is presented (*Annex 6*), but the pre-proposal text does not elaborate further on, or reveal if, prioritization at the CRP level was taken into account.

3. Cross-cutting themes

The pre-proposal dedicates a section to dealing mostly with gender issues, but also referring to youth. Progress made and lessons learned in CRP Phase I assist in developing further the agenda and setting priorities for gender research and mainstreaming in Phase-II. Key elements from Phase I shaping Phase II are summarized in this section, which provides MAIZE outputs based on gender analysis and research. Annex 8 lists key research questions which set the overall stage for gender analysis and gender research in MAIZE Phase II. These initiatives respond to one of the recommendations of the IEA evaluation to strengthen work on gender. MAIZE also provides a plan on how it will operationalise gender and youth in the maize research agenda including gender research and analysis and mainstreaming gender in the research management framework and how it will monitor and evaluate progress. Most of the research questions and plans refer to gender; the proposal mentions youth in various sections, but it does not have any specific strategy for youth. Youth is dealt with in slightly more detail in the separate flagship sections; however guidelines on how MAIZE will address youth issues are needed.

Recognition of the importance of an enabling environment is not addressed at the CRP level but is referred to in most of the FPs under risks and assumptions of impact pathways.

Capacity development is also addressed at individual FP level rather than at CRP level and ISPC comments will be summarised below under the relevant flagships. The adoption of the *CapDev* Framework is mentioned under some FPs, but the pre-proposal lacks an overall MAIZE strategy on this subject. It will be desirable to demonstrate what effort is being planned to take NARS to the next level, and what the MAIZE vision is for NARS institutional strengthening in the next 10-15 years.

4. Budget

MAIZE aspires to mobilize resources that will bring its annual budget to an average of US\$ 130 (of which about $\frac{1}{3}$ is expected from W1 and W2) in its second year, totaling nearly a billion dollar investment during the entire phase II. The annual budget is more than 30% up from the stated 2016 budget of the on-going Phase I and the integration of work from Humidtropics that will fall in its Phase II. This significant increase may not to be feasible, though the proposal justifies the need for such extra-funding in each flagship, and to address various areas highlighted by the IEA evaluation. MAIZE budget gives “priority” (as determined by the allocation amount) to breeding (FP3), agronomy (FP4) germplasm and genetic gains (FP2) and the scaling up and out (FP6). Genetic enhancement per se (FPs 2 and 3 together that include 15 out of 50 expected MAIZE outcomes) accounts for about 45% of the total proposed budget while scaling (9 expected outputs) takes another 25% of it (mostly from bilateral sources), which may be regarded as unbalanced unless the proposers provide detailed costing towards delivering each flagship’s outcome. At least 30% of the overall budget may be allocated to non-CGIAR partners, as indicated in the pre-proposal.

MAIZE Value for Money is being justified in the proposal based on the importance of maize for poor producers and consumers in the developing world, and the estimated potential contributions to the SRF 2030 targets. As stated in the pre-proposal, it is important that methodologies for forecasting such impacts are aligned across CRPs.

5. Governance and management [Score: A]

The proposers claim that MAIZE follows management principles defined in the CGIAR SRF and the standard performance contract of the CGIAR Consortium. The MAIZE Management Committee (MMC) proposed includes 2 CIMMYT staff (including the CRP Director) and 1 IITA staff plus 4 tier-1 partners: 3 OECD (SAGARPA, SFSA and WUR) and 1 non-OECD (KALRO). The MC should keep a balance both among CGIAR Centers (i.e., 1 from each) and at least 50% from non-OECD partners. The non-CGIAR members should serve for a fixed non-renewable term to allow other tier-1 partners to participate. Gender representation should be also enforced in the MMC.

The technical competences of the leadership team and of selected partners are described per flagship, showing their relevant track record (Annex 13). MAIZE includes a broad range of 350 public and private partners to ensure impacts on the livelihoods of producers and consumers depending on maize agri-food systems. Their competitive advantage and indicative purpose of collaboration are given in Annex 12.

MAIZE partnership seems to be largely focused on institutions in the North. While some potentially key partners (e.g. AGRA) are hardly mentioned, some ARIs (e.g. Wageningen University) are disproportionately featured in almost all FPs and certainly more significantly than in the previous phase. Several governments in sub-Saharan Africa have established priorities and strategies for boosting productivity of staples like maize for food security/nutrition and yet no priority alignment or consultations with governments were done.

While the pre-proposal clearly names the institutions in the North, no such attempt was done when it comes to the national programs, beyond a blanket mention of ‘NARS’. There are now some strong national programs and universities that deserve to be taken as partners in actual research and discovery. While it is clear that the involvement of regional partners has been strengthened as recommended by the ISPC, all of this does not amount to a partnership strategy or an understanding of the engagement and commitment of partners to MAIZE. Further work on the partnership strategy is needed in the full proposal.

Flagship 1- Enhancing MAIZE’s R4D Strategy for Impact [Score: B]

The ToC of this flagship describes 10 outcomes which contribute to 4 sub-IDOs: a) increased value capture by producers, b) increased capacity of partner organizations, c) improved capacity of women and young people to participate in decision-making and d) increased capacity of beneficiaries to adopt research outputs. By providing horizontal guidance to MAIZE and its outcomes-to-impact, it also contributes to the full range of sub-IDOs generated by the other FPs. The ToC is plausible and is aligned with the SRF sub-IDOs and IDOs and the impact pathways are feasible. However, it is confusing that the impact pathway diagrams include reference to WHEAT and to ICARDA (p. 64), which does not participate in this CRP. Are both CRPs following the same generic flagship impact pathway?

This FP was reorganized by considering organizational learning and bringing more strategic focus. Its multi-disciplinary research strengthens foresight and targeting, with the aim of having greatest impact. Its activity clusters will be providing knowledge on the supply-demand nexus of agricultural innovations in maize-food systems within its temporal, spatial and social dimensions. The track records of the leadership team involved in this FP are described but without specifying what they achieved in the previous CRP portfolio.

The partners and their key contributions will assist in enhancing the probability of impact. But the pre-proposal does not elaborate on whether it aligns the question or problem being addressed by this FP and expected outputs with national and regional priorities and initiatives. For instance, many governments in Africa see that as the middle class grows, consumers will switch to rice consumption and demand for rice will continuously grow as opposed to maize, cassava or other staples. Some of these governments also have good capacity for strategic foresight. Identifying those governments and closely working with them in addition to the partners identified will further improve this FP.

Gender and youth issues were considered when developing this FP, which includes a CoA dealing with enhancing gender and social inclusiveness to ensure that disadvantaged groups benefit in maize agri-food systems. Capacity development is included in each of the four CoAs of this FP that acknowledges the importance of an enabling environment.

About 9.5% of the proposed budget goes to this FP whose priority (if matching the resource allocation) is to increase the capacity of beneficiaries to adopt research outputs. The budget seems to be appropriate.

Flagship 2- Novel Diversity and Tools for Increasing Genetic Gains [Score: A]

The ToC underlying this flagship shows how outputs contribute to 3 sub-IDOs, namely: enhanced genetic gains, increased conservation and use of genetic resources, and enhanced capacity to deal with climatic risks and extremes (through FP 3, which will be the first user of FP 2 outputs). The ToC is plausible and is aligned with the SRF sub-IDOs and IDOs and the impact pathways are feasible. But the text does not acknowledge the need for research to account for potential unintended consequences on SLOs that are not the primary focus of the research; neither does it show evidence for the alignment of expected outputs with national and regional priorities and initiatives. It is also not clear why the companion text to the linear

impact pathway diagram refers to including metadata development for IWIN –the International Wheat Improvement Network (p. 70).

Research in this FP includes cutting-edge science such as informatics tools to integrate complex and large data sets into decision support tools in the frame of the integrated breeding platform (with other AFS CRPs), novel biometric analysis methods –particularly for genomic estimated breeding values, developing a tropical maize reference genome, a peer-reviewed haplotype advancement strategy that leads to a rigorous and unbiased scrutiny of scientific results supporting deployment decisions, use of molecular effectors to accelerate host plant resistance breeding, and genome editing to generate de novo variation for the breeding pipeline, among others. The FP text notes lessons learned in Phase I that refer mostly to the shortcomings found in the use of some tools and methods, which should be overcome by relevant CoAs in Phase II. This is supported by recommendations from the IEA evaluation.

This FP depends on ARI partnerships and with leading service providers, some of which are noted in the pre-proposal. Important to note the engagement of this FP with the Genomics and Open source Breeding and Informatics Initiative (GOBII) that involves other agri-food system CRPs such as DCLAS, GRiSP and WHEAT.

Gender preferences and implications of target traits are considered in conjunction to focus research upon them. Capacity development is very important for this FP, which will engage in both group and degree training, and host postdocs and visiting scientists in various relevant topics.

Most (60%) of the proposed budget in this FP goes to increasing genetic gain rates in maize breeding, while 30% was given to conservation of maize genetic resources and the remaining 10% to enhance institutional capacity of partner research organizations. The budget seems to be on the high side, for the undertakings described in this flagship.

Flagship 3 - Stress Tolerant and Nutritious Maize [Score: A]

This flagship aligns with CGIAR SRF and its expected outcomes contribute to various sub-DOs, namely a) more efficient use of inputs, b) reduced pre- and post-harvest losses, c) increased availability of diverse nutrient rich foods, d) enhanced capacity to deal with climatic risks and extremes, e) technologies that reduce women' labour and energy expenditure, and f) enhanced institutional capacity of partner research organizations. The pre-proposal, however, does not elaborate on how the problem or question to be addressed by this FP and its expected outputs align with national and regional priorities and initiatives. Its impact pathway diagram includes at the bottom the box “MAIZE and WHEAT FP3 Theories of Change”; are both CRPs sharing the same structure and theory of change?

Improved data management, crop modelling, precision phenotyping, mechanization/automation of breeding operations, and multidisciplinary synergies will be pursued in this FP to ensure high standards. Lessons learned were taken into account by this FP to design and implement innovative approaches for achieving impact. CIMMYT and IITA have established successful partnerships with the public and private sectors, thus adding to, inter alia, discovery research, validation/proof of concept, and deployment/scaling-up. One particular concern in S.S. Africa is the question of how genetically diverse are the CIMMYT parental lines, and the potential risks this might have for sensitivity to new diseases and pests. The research on biotic constraints in Africa has focused much more on MLN, but less on *Striga* and other constraints, which are devastating to maize production. MAIZE partners, through their decentralized tropical maize breeding and testing networks in the target population of environments, address specific adaptation and enable a strong product pipeline. Partnerships

are also sought to capture the complementarity of germplasm, broaden the genetic diversity and access intellectual property for public use.

This FP will engage women farmers, youth and the socially disadvantaged in participatory evaluation of improved stress resilient and nutritious maize cultivars in target populations of environment, and to gain more insight into their distinct needs to breed gender-responsive products. It also acknowledges that an enabling environment facilitates the uptake of bred-germplasm. Capacity development is an integral component of this FP.

This flagship has the largest ($\approx 28\%$) proposed budget allocation of MAIZE, which should be appropriate for delivering key outcomes related to bred-germplasm and pathogen/pest surveillance –particularly in S.S. Africa.

Flagship 4 - Sustainable Intensification of Maize-based Systems for Better Livelihoods of Smallholders [Score: B]

FP4's primary outcomes are aligned with three CGIAR SRF sub-IDs: a) more efficient use of inputs; b) yield gaps closed through improved agronomic and animal husbandry practices; and c) agricultural systems diversified and intensified in ways that protect soils and water. Sustainable intensification of maize-based systems may also simultaneously address a number of development objectives, thus addressing national and regional priorities and initiatives. The diagram illustrating the ToC for this FP and its companion notes along with the target and beneficiary table indicate the feasibility of its impact pathways as well as its expected impact in 2022. Importantly, this FP also proposes indicators and metrics for a sustainable intensification monitoring framework.

Unfortunately, no specific examples of science contribution were described under this flagship. The FP lists the main lessons from previous research, including that smallholder farming systems and communities are diverse and 'one-size-fits-all' or silver bullet solutions do not exist; and guidelines are needed for complex knowledge sharing and dissemination. CoA 1 describes an overarching methodological and farming systems analysis framework that will guide the targeting of technical interventions. The agro-ecological spatial framework from the Global Yield Gap Atlas underpins this farming systems framework to effectively delineate extrapolation domains and for impact assessment. "Big data" and meta-analysis are also included. This FP builds on knowledge generated by IITA, CIMMYT and their partners in relevant fields –particularly agronomy and farming systems. It leverages further by partnering with ARIs to tackle challenging methodological and research issues related to sustainable intensification. However the FP still needs to articulate the specific scientific hypotheses to be tested in relation to the ToC and impact pathway.

Gender, youth and social inclusion issues were considered for developing this FP, which also acknowledges the importance of the enabling environment. Its commitment to capacity development is clearly stated by fostering joint work and facilitation of linkages with ARIs, for degree and course training, distance learning, and sharing of science infrastructures.

About 18% of the proposed budget is allocated to this FP, which targets 9 expected outcomes important for the enhanced capacity for an increased adoption of combinations of sustainable intensification strategies and products.

Flagship 5 - Adding Value for Maize Producers, Processors and Consumers [Score: B]

Maize is a multi-purpose crop used as food, feed and fuel, which add further value in agri-food systems. This FP aligns with SRF sub-IDs and IDs, and shows feasible impact pathways. Target countries using a 2-tier system are noted with a rationale for prioritization in the pre-proposal for this FP.

FP5 will use several innovative multidisciplinary and inter-institutional approaches and tools, whose partial list was included in the pre-proposal. Lessons learned are not explicitly identified and indicated only for building one activity in respective cluster. The track record of the FP5 leadership team is presented in their CVs, but often lack information on what they achieved in the previous CRP portfolio. The comparative advantage of the proponents in processing or “developing innovative and affordable animal feed formulations” needs further justification. The CRP will work together with Wageningen University due to its experience in developing and adapting processing technologies, and seek partners in ARIs leading research on nutrition, food product development, postharvest storage, and consumer preferences. Perhaps there is also a need to further enhance partnership and linkages with other private sector and feed resources players, which may allow strengthening an agri-food systems focus for this CRP. FP5 gives priority to working with two other CRPs: DCLAS and Livestock because maize, grain legumes and livestock are the backbone of many farming systems in MAIZE target areas.

FP5 has the smallest allocation (about 4%) of the proposed MAIZE budget, which seems to be the minimum to start working on developing diverse novel and nutritious maize-based products, improving technology and knowledge for small-to medium scale processors, pursuing livelihood opportunities through maize and maize by-products for animal feed, and reducing post-harvest losses through improved storage technologies. About 50% of this FP proposed budget will deliver outcomes related to the sub-IDO on diversified enterprise opportunities.

Flagship 6 - Scaling-up and Scaling-out [Score: B]

This FP includes 3 impact pathways: one for CoA1 on maize seeds systems, another on adoption of appropriate sustainable intensification and value chain options together with FP4 ToC, and the last on enhancing local, national and regional capacities. This FP links its outcomes to 8 target SRF sub-IDOs; the ToC is plausible and aligned with the SRF sub-IDOs and IDOs and the impact pathways are feasible. However this flagship leans mostly towards development rather than undertaking research per se. Seed quality issues are critical for implementing this FP; e.g., some seed companies especially in Africa are selling seeds with the wrong varietal names and causing substantial production losses. Methods for quick varietal identification need to be made available and incorporated in this FP. A stronger research emphasis on seed systems, availability and access will be needed.

Lessons learned will allow this FP to address critical issues such as seed value chains, access of women farmers and the disadvantaged to agricultural inputs, improved coordination to scale out technologies, and strengthen the capacity of innovation. This FP builds on MAIZE Phase I and benefits from established partnerships with seed SMEs. FP6 will also bring partners from the public sector, MNCs, private processing enterprises, agro-dealers, NGOs, trade associations, universities and philanthropy, and envisages partnering with financial service providers.

This FP has the second largest allocation of the proposed MAIZE budget (25%), which seems to be on the high side. The largest investments within FP6 are for delivering outcomes related to adoption by smallholder farmers on stress-resilient bred-germplasm, or gender-preferred nutritional/end-use quality.