MAIZE CRP:
Extension Proposal
2015 – 2016

CGIAR

Research Program on MAIZE

1. THEORIES OF CHANGE, IMPACT PATHWAYS AND INTERMEDIATE DEVELOPMENT OUTCOMES (IDOS)

Together with rice and wheat, maize provides at least 30% of the food calories of more than 4.5 billion people in 94 developing countries. They include 900 million consumers whose income is less than US$ 2 per day and for whom maize is the preferred staple, including 120 -140 million poor farm families. Between now and 2050, the demand for maize in the developing world will double. Without appropriate interventions, harvests at current levels of productivity growth continue to fall short of demand, millions of farm families will remain in poverty, and inadequate productivity growth continues to trigger deforestation. These challenges are the main reason that the CGIAR centers engaged in maize research, together with a community of over 350 public- and private-sector partners worldwide, are implementing MAIZE. Its strategy is to ensure that publicly-funded international agricultural research helps most effectively to **stabilize maize prices and double the productivity of maize-based farming systems, making them more resilient and sustainable and significantly increasing farmers' income and livelihood opportunities, without using more land and as climates change and fertilizer, water, and labor costs rise.**

Theory of Change and impact pathway analysis define three Research Strategies (RSs) in MAIZE: **1) Sustainable intensification of maize-based cropping systems; 2) Stress resilient and nutritious maize and 3) Inclusive and profitable maize futures.** Based on the current standardization of CRP structures, the three RSs are further broken down into 5 Flagship Projects (FPs), encompassing the nine Strategic Initiatives of the original MAIZE proposal. Currently, RS 1 and 3 contain one FP each; RS 2 contains three FPs (discovery, validation and delivery). In turn, each FP is comprised of between three and five Cluster of Activities (CoA); these are the aggregations of projects and work packages within a research thrust. Current investments are very much aligned with the original MAIZE proposal. New areas of research were taken up to combat Maize Lethal Necrotic Virus, a highly virulent disease that emerged in Africa in 2011. As MAIZE moves towards the extension phase, partners request higher investments in value addition and the capacity building of a new generation of researchers and professionals. The high proportion of bilateral and Window 3 funding in MAIZE determines how and where funds can be used. In spite of a healthy overall budget, several strategic research areas remain hence underfunded.

Research Strategy 1: Sustainable intensification of maize-based farming systems

Research Strategy 1 delivers integrated and scalable innovations that increase the productivity, sustainability, and resilience of farming systems where maize is the mainstay for resource-poor farmers' food security and income ("maize-based farming systems") and links farmers using these innovations to markets. It recognizes that maize productivity cannot be addressed in isolation but needs to be integrated in approaches that sustainably increase the overall livelihood and income of farm families and the quality of the environment. Research Strategy 1 focuses on generating development outcomes in **six maize-based farming systems** in Central America, sub Saharan-Africa (SSA) and Asia (MAIZE CRP Proposal 2011, p.11) where it links and collaborates with other relevant CRPs. The six maize-based farming systems were selected for including the greatest number of poor, 300 million living on less than US $2 per day (Hyman et al 2008; Wood et al 2010). The Research Strategy's ambition is to **empower 20 million smallholder farmers** (MAIZE Proposal 2011, p.32) to successfully manage their crops and farms in a more profitable and environmentally friendly manner, and moving from subsistence to more market connected, poverty abandoning approaches. Wherever possible, it combines on-farm or community based innovations with cutting edge remote sensing and communication tools.

Maize-based systems are dynamic and evolve with important drivers of change - feminization of agriculture, demography, climate change, resource depletion and socio-cultural factors. To make progress, it is essential for MAIZE, as a global program, to embrace the heterogeneity between geographies and at nested spatial scales, and to prioritize investments and thematic areas accordingly following a clearly defined Theory of Change. Entry and end points for sustainably intensifying maize-based systems hence differ between countries and regions due to varying livelihood / food security / environmental quality objectives. Also to reach 20 million farmers, innovations and technologies must be sufficiently adapted and widely known that local extension systems and market dynamics ensure their wider uptake.

To date, work has been established at **87 innovation platforms** and approximately **13,500 study and survey sites** in five of the six targeted farming systems, many of them in collaboration with other CRPs including WHEAT, GRiSP, CCAFS, Grain Legumes, Livestock, Aquatic Systems and Humid Tropics. These platforms are operational in Mexico; Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Rwanda, Zambia, Zimbabwe; Bangladesh, India and Nepal, and largely funded through bilateral regionally focused projects that capitalize on cross-country learning. The innovation platforms are both the primary research platform and starting points for the impact pathway, and bring together the efforts of CGIAR, NARS, private sector and farmer innovation with the scale-out capacities of NGOs, extension and the private sector. Across all the projects in this research strategy, **50,000 individuals** are currently exposed each year to over 120 decentrally-conceived MAIZE innovations and know-how through training events and field days. Researchers therefore receive systematic feedback from the very farmers they serve. This feedback guides the innovations developed and tested at a particular platform and associated on-farm sites. They include conservation agriculture and precision agriculture approaches, mechanization, improved nutrient and water management, alternative crop rotations and mixes, all adapted to farmers and market realities. W1&W2 funding supports the development and elaboration of new cutting-edge approaches with high adoption potential and supports analyses to strategically improve the efficiency and effectiveness of the innovation platforms and study sites.

Research Strategy 2: Stress Resilient and Nutritious Maize

Research Strategy 2 delivers high-yielding, stress-resilient and nutrient-enhanced maize varieties to target areas in Latin America, SSA and Asia (MAIZE Proposal 2011, p.23). The target areas encompass over 600 million maize dependent people who live on US $2 per day or less, including about 120 million malnourished children. The Research Strategy has two distinct target groups (MAIZE Proposal 2011, p.11). The first target group includes smallholder farmers who live in stress-prone environments and who have poor market access, both for inputs and grain. The second target group comprises smallholders in more favorable production areas with some potential to supply grain markets but who lack access to appropriate seed from private sector breeding programs due to a wide range of reasons (unattractive seed market sizes, specific variety needs, presence of abiotic stresses, new pests and diseases, wide-spread poverty). Experts estimate that over 50% of the maize area in the tropics is currently not or inadequately targeted by private sector maize breeding programs. A somewhat larger area is supplied by the maize seed sector yet using outdated maize varieties or varieties that are not adapted to the prevalent conditions (e.g. maize bred for irrigated conditions is offered to farmers with no irrigation). The Research Strategy ambition is to increase maize food security, income and reduce production shortfalls with at least **36 million smallholder farmers**, working with and through NARS and local private sector programs that are being strengthened with new maize germplasm, technologies and know-how. They are thus empowered to address the diverse needs of farmers that could not be

addressed through CGIAR breeding programs and are outside the target areas of multinational private sector breeding programs.

In addition to supporting and strengthening breeding programs in Africa, Asia and Latin America, it is essential for MAIZE to align with and strengthen local maize seed systems in the target areas following a clearly defined Theory of Change. Delivering low-cost hybrids and open-pollinated varieties to difficult-to-reach smallholders requires that local, small- and medium-scale seed enterprises (SMEs) be comprehensively supported with information on products, adequate and reliable supplies of foundation seed, training in seed production and seed business methods, and low-cost production systems. CIMMYT and IITA are pioneering innovative models for the integration of SMEs into consortia that can achieve economies of scale in testing and germplasm development, thereby helping them to establish viable seed businesses in areas currently undersupplied with appropriate maize varieties.

The impact pathway is working: MAIZE annually exchanges new germplasm with over **100 collaborators** in Africa, Asia and Latin America, and now systematically augments the capacity of over **40 NARS**, **180 small- and medium-sized seed companies** and **226 community-based seed producers** that reach out to disadvantaged farmers. Currently, MAIZE has close to 30,000 lines under first stage testing, 1,500 product type varieties and hybrids undergoing more advanced stage testing and **releases around 50-70 hybrid and open-pollinated varieties annually** through public and private sector institutions and companies. W1&W2 funding supports the development and rapid delivery to NARS and small companies of tools hitherto available only to multinationals, including doubled haploids and marker-driven breeding systems, tools under development in FP2. W1&W2 funding is also used for maintaining a strong early trait pipeline; informatics approaches and database management supporting new breeding approaches, several of which are now mainstreamed to other crops through collaboration with the Integrated Breeding Platform of the Generation Challenge Program; novel phenotyping tools for abiotic and biotic stresses and quality traits; and incorporating quality traits into elite genetic backgrounds. Wherever possible farm level exposure and feedback to new varieties takes place in conjunction with RS 1. Once new varieties are released and seed becomes available, the reach of seed companies and impact also goes beyond the six farming systems targeted by RS 1 (MAIZE CRP Proposal 2011, p.23).

Research Strategy 3: Inclusive and profitable maize futures

Research Strategy 3 delivers data and information for improved targeting of MAIZE interventions, and generates insights to enhance maize technology adoption, inclusiveness, gender equity, market access, and reduce vulnerability. The Research Strategy works at local, national, regional and global scales and produces four types of results. Firstly, foresight and targeting develops scenarios and predictions in support of developing and targeting MAIZE technologies and interventions on areas (thematically or geographically) with greatest development impact. Secondly, adoption pathway and impact analysis provides decision-makers at all levels with evidence-based information towards successes and lessons to be learnt in the development of more profitable, productive and sustainable maize-based systems. Thirdly, a strong focus on gender in ex-ante, ex-post and adoption pathway analysis is to ensure that both men and women, as well as socially disadvantaged groups, equally contribute to, and benefit from, innovations and their impacts. Forth, post-harvest value-chain analyses and exploration of value-addition opportunities for maize provides farmers and communities with options for more profitable, risk averting, healthier or alternative uses of maize. These options, such as improved grain storage and aflatoxin bio-control, are then tested through innovation platforms established as part of RS 1 or

through networks of value chain participants. To ascertain impact of this RS, it is essential for MAIZE to ensure that the results of ex-ante and ex-post analysis are utilized by policy and decision-makers and that, in turn, these results encourage better targeting and support of new technologies and institutional innovations; see Theory of Change.

W1&W2 funding supports the development and elaboration of foresight and targeting information, impact pathway analysis and learning, strategic gender research and gender mainstreaming, and improved understanding of smallholder market opportunities. The development of novel products and opportunities for value addition is largely funded through bilateral regionally-focused projects. To date, work has been established in five countries (Kenya, Malawi, Mexico, Zambia, Zimbabwe) for improved grain storage and eight countries (Nigeria, Senegal, Burkina Faso, Kenya, Zambia, Mozambique, Tanzania and Ghana) for the development of aflatoxin bio-control (AflaSafe).

Table 1 list top level outputs from each FP. The outputs contribute to several IDOs but most prominently to IDO1: Productivity, IDO2: Food security, IDO4: Income, IDO5: Gender. RS1 and 2 have beneficial impacts on the environment and climate change adaptation, including through land savings. RS1 enables communities to innovate and adapt. The achievement of IDOs is not independent of each other. Table 1 proposes key performance indicators relevant for MAIZE that will need to be aligned with performance indicators agreed at the system level.

Table 1: Alignment of Research Strategies and Flagship Projects with IDOs and Performance Indicators

RS	FP	Measureable Outputs	IDOs	Key Performance Indicators
1	1	- Analytical frameworks - Innovative crop and farm management systems - Decision guides	IDO1: Productivity IDO2: Food security IDO4: Income IDO5: Gender IDO6&7: Capacity to innovate and adapt IDO9: Environment IDO11: Climate	– Productivity increase per land, water, nutrient, labour under farmer relevant conditions – Number of farmers, communities, countries participating/using MAIZE technologies – Percentage female participation in program execution and as informants – HH food sufficiency & security (includes marketable surplus) – HH income and assets – Soil organic matter, nutrient balance and fossil fuel use – Land saved/deforestation reduced – Greenhouse gas emissions
2	2	- Geno/phenotypic data - New donor germplasm - Software and molecular tools - DH breeding system - Open source breeding models - High throughput/low cost phenotyping systems	IDO1: Productivity IDO2: Food security IDO3: Nutrition IDO4: Income IDO5: Gender IDO9: Environment IDO11: Climate	– Genetic gains in MAIZE breeding products under farmer relevant conditions – Maize varieties released by seed enterprises and national programs – Seed production – Number of institutions, countries participating/using MAIZE technologies – Percentage female participation in program execution and as informants – HH food sufficiency & security (includes marketable surplus) – HH income and assets – Consumption of bio-fortified maize – Land saved/deforestation reduced – Maize price
	3	- Improved maize varieties		
	4	- Commercialised maize varieties - Stronger seed business capacities		
3	5	- Maize specific data and information at global, regional, national and local scale and their link to IDOs - Ex ante and ex-post impact and adoption pathway studies - Gender mainstreaming - Novel maize products and processing innovations, such as grain storage or Aflasafe	IDO2: Food security IDO4: Income IDO5: Gender	– Value addition of MAIZE innovations under farmer relevant conditions (eg through reduced losses, alternative use, healthier grain, delayed sale) – Number of farmers, communities, institutions, countries participating/using MAIZE technologies – HH food sufficiency & security (includes marketable surplus) – HH income and assets – Percentage female participation in program execution and as informants – Number of publications aligned with research strategy

2. FLAGSHIP PROJECTS (FPS)

The five FPs contribute to the outcome oriented Research Strategies that allow prioritizing among potential MAIZE Work plan deliverables and budget allocation. Flagship Projects are each subdivided into Cluster of Activities (CoA) jointly identified with partners in the conception of the original MAIZE proposal and, more recently, through a MAIZE Partner Priorities Survey which received responses from 67 R&D partners in 29 countries.

FP1 Sustainable intensification of maize-based farming systems is comprised of three CoAs. Target countries are Mexico; Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Rwanda, South Sudan, Zambia, Zimbabwe; Bangladesh, India, Pakistan and Nepal:

CoA 1.1 "***Development partners adopt strategic, scalable approaches based on farming systems analytical frameworks at multiple spatial and temporal scales***" supports development partners ('last mile providers'), with knowledge products, decision-support and information systems; enabling them to take to scale targeted options that increase system performance and sustainability.

CoA 1.2 "***Participatory R4D to integrate technical and institutional components at multi-hub/landscape level to increase system productivity and sustainability***" enhances system productivity and sustainability through the integration and evaluation of technical and institutional options at farm (household) and village scale, using innovation platform based approaches aligned with other CRPs.

CoA 1.3 "***Adapted agronomic technologies with the potential for increased production and productivity (resource use efficiency) move on-farm***" develops farmer co-generated and adapted agronomic technologies that have the potential to increase crop production and resource use efficiency.

FP2, Novel tools, technologies and traits for improving genetic gains and breeding efficiency is comprised of five CoAs that target NARS and local seed companies in SSA, Latin America and the Caribbean; the products are accessible to the entire global community:

CoA 2.1 "***Unlocking and incorporating important native trait variation through the Seeds of Discovery project (SeeD)***" unlocks so far untapped genebank accessions for important traits, such as heat and drought tolerance, and ensures that new genetic variation (favorable genes/haplotypes and trait donors) can be utilized by the global maize breeding community.

CoA 2.2 "***Trait pipeline development and capacity building***" accelerates maize variety development through the development of markers and the integration of marker assisted breeding and genome wide selection (GS) in NARS and private sector the breeding programs.

CoA 2.3 "***Informatics, database management & decision support tools***" develops web-accessible genotypic and phenotypic open access databases and breeding informatics tools and ensures that they can be utilized by global MAIZE partners for their own breeding programs.

CoA 2.4 "***Novel haploid inducers and improved protocols for efficient DH production in the tropics***", develops, adapts and mainstreams tropicalized haploid inducers in the breeding programs of NARS and local seed companies for enhanced genetic gains.

CoA 2.5 "***Novel phenotyping tools for abiotic and biotic stresses and quality traits***" develops novel phenotypic approaches, aligned with genomics tools, and supports their mainstreaming in local breeding programs for enhanced genetic gains.

FP3, Stress resilient and nutritious maize, is comprised of three CoAs:

CoA 3.1 "***Developing elite abiotic stress tolerant maize germplasm for SSA, Latin America and Asia***" uses novel approaches to achieve genetic yield gains in abiotic stress-prone environments to allow farmers to escape the poverty trap of recurrent failed harvests and enable them to obtain reliable returns on investments in seed, fertilizer, land and labour.

CoA 3.2 "***Incorporating biotic stress resistance into elite abiotic stress tolerant maize germplasm***" responds to newly emerging and highly virulent diseases, such as Maize Lethal Necrosis, tar spot or banded leaf and sheath blight, to ensure the overall resilience and productivity of maize-based production systems of resource-poor farmers in SSA, Latin America & Asia.

CoA 3.3 "***Incorporating quality traits in elite genetic backgrounds for the tropics***" enhances selected maize varieties through fortification of nutritional and other end-user quality traits to improve the nutritional well-being and enhance market opportunities of resource-poor female and male farmers in defined farming systems in SSA, Latin America & Asia.

FP4, Aligning with and strengthening maize seed systems for effective product delivery, is comprised of five CoAs that strengthen emerging small and medium sized seed enterprises in SSA, Latin America and Asia to become increasingly market-oriented, diverse and dynamic so to provide female and male smallholders with greater access to affordable maize seed:

CoA 4.1 "***Evaluation and publication of the per se performance and seed producibility of elite maize hybrid varieties***" supports the emerging small scale maize seed sector in SSA, Latin America and Asia to test and commercially release elite farmer-demanded MAIZE varieties.

CoA 4.2 "***Production of stimulatory quantities of breeder, pre-basic and pre-commercial hybrid seed, and quality assurance services provided to SMEs***" supports the small-scale maize seed sector to scale up seed production of new varieties more rapidly and successfully.

CoA 4.3 "***Facilitation of pilot hybrid seed productions and on-farm demonstration of pre- and newly commercialized maize varieties with emerging local seed enterprises***" ensures that smallholder farmers, especially women, are getting exposed to new MAIZE varieties and hybrids, thereby improving their knowledge of new options that increase household food security and income.

CoA 4.4 "***Capacity building of SMEs and NSAs (National Seed Authorities***)" supports seed regulators to take measures that increase the number of elite maize varieties in the market, and provide efficient and accredited seed regulatory services for the assurance of seed quality from the emerging seed sector.

CoA 4.5 "***Socio-economic and policy-related research and publication***" assesses bottlenecks to variety adoption by male and female farmers and provides MAIZE partners, NARS and the emerging seed sector with guidance for greatest impact of new seed varieties.

FP5, Inclusive and profitable maize futures is comprised of four CoAs:

CoA 5.1 "***Prioritizing through foresight and targeting***" promotes evidence based MAIZE decision making and priorities and enhances improved practices by R&D participants and decision makers in SSA, Latin America and Asia through strategic ex-ante impact analyses, foresight analysis and geographic targeting.

CoA 5.2 "***Enhancing pathways to impact***" develops a better understanding of the adoption/adaptation/ dis-adoption processes associated with MAIZE technologies along the impact pathway and among men and female farmers.

CoA 5.3 "***Enhancing gender/social inclusiveness***" mainstreams gender research in MAIZE and ensures greater social inclusion in all MAIZE interventions.

CoA 5.4 "***Harnessing smallholder market opportunities***" improves maize market opportunities for smallholder farmers through the development of novel products and value-addition opportunities that stabilize and increase incomes.

WHAT IS NEW FOR THE PHASE 2015-2016?

FP1: seeks greater investments in one critical area: Farming Systems Analytical Frameworks. Under-investment in analytical frameworks for scenario and trajectory of change analysis and priority-setting at landscape and household level limits our capacity to target and monitor adoption of appropriate farmer-demanded technologies and innovations and to take these technologies and innovations to scale.

FP2: seeks greater investments in three areas: Trait pipeline development and capacity building; Informatics, database management & decision support tools, and; Novel phenotyping tools for abiotic and biotic stresses and quality traits. These are crucial investments for accelerating productivity increases in farmers' fields and be responsive to new and steep challenges such as climate change adaptation and highly virulent diseases with rapid spread (such as Maize Lethal Necrosis).

FP3: seeks greater investments in two areas: Breeding for biotic resistance, especially for resistance to Maize Lethal Necrosis, and; Breeding for quality traits. The current underinvestment in breeding for resistance to biotic stresses reduces the capacity of NARS and SME seed companies to stack abiotic and biotic resistance traits in commercially viable maize varieties. The current under investment in breeding for quality traits restricts access to existing, emerging and future speciality maize markets; thereby reducing the scope for value-addition for small holder farmers.

FP5: seeks greater investments in two areas: Enhancing gender/social inclusiveness, and; Harnessing smallholder market opportunities, especially in the areas of value-chain analysis (VCA) and novel product development. Whilst significant investments have been made in gender and social inclusiveness during the past two years, we need more capacities to address the needs in diverse regions and systems. Researchers want support by gender experts to understand constraints and opportunities of various FPs and CoAs, yet capacities and investments are limited and current expertise stretched. In the case of VCA, partners advise that the current under investment in maize VCA and the development of novel maize products to exploit evolving market opportunities reduces market access, income generation and nutrition of small holder farmers and their communities. MAIZE needs a stronger analytical framework and insights to effectively position MAIZE value chain related interventions in Phase 2.

3. GENDER

Gender inequalities are an important factor in low production levels, inefficient marketing, and in poor uptake of innovations. Empowering all - women, men, young women and men and marginalized rural groups - is key to sustainable productivity and food security gains. This requires research on context-specific gender and other inequalities affecting a particular system and to ensure interventions are gender-responsive and socially equitable – also to prevent apparently technically superior innovations from exacerbating gender inequalities.

MAIZE will meet CGIAR performance requirements for gender mainstreaming in 2016, by bundling W1&2 with bilateral funding, to increase its gender research and its capacity to for gender analysis and mainstreaming gender research in the regions. Greater capacity is critical to collaborating with new and existing partners - including women farmers and their representatives, men's groups working for gender equality, and higher-level R4D partners. For 2015-16, the focus is on:

Mainstreaming into Research Management Framework (incl. project cycle and M&E): Key partners adopt the protocol for gender and social inclusion in participatory research; Screening procedure for gender mainstreaming in project development.

Gender disaggregated data collection: CIMMYT, IITA and key partners adopt and apply a protocol.

Diagnosing gender-related constraints: Strategic research, including inter-CRP collaborative research to better understand how gender disparities affect R4D outcomes, the interactions between gender norms, women's agency, and the development and dissemination of key MAIZE technologies in selected regions - to identify sensible 'entry-points' to improve equity and equality for all; implementing guidelines for gender-responsive development of maize-based systems for 1 key target area.

Table 2: Strategic gender research and gender mainstreaming per Flagship Project

FP1: Sustainable intensification and income opportunities for the poor	• Women farmers and entrepreneurs are understood as a core clientele with distinct needs and social capital by knowledge, input, and service providers. • Undertake gender sensitive technology generation and testing, including of mechanization and diversification options, and understand and mitigate the trade-offs for women and men. • Capacity building events to increase participation by women and young scientists. • Ensure that partners for innovation and scale-out systematically embed gender relevant insights into their business models and training programs, to help women gain more access, more control and enable their use of technology, knowledge etc. • Existing social networks for collective action or self-help leveraged for understanding and reaching women farmers. • Equity at landscape scale ('terroir'; the social arena of interdependency of actors).
FP2 Novel tools, technologies and traits for improving genetic gains and breeding efficiency	• Capacity building events to increase participation by women and young scientists. • Continuous emphasis on traits that are emphasized by women farmers (eg drought tolerance, post-harvest and processing characteristics) • Initiate trait pipelines that reduce drudgery (e.g., herbicide tolerance) and that address nutritional quality and specialty traits (e.g., blue maize, antioxidants, etc.) for R4D on novel trait variation and molecular pipelines.
FP3 Stress resilient and nutritious maize	• On-farm trials and demonstrations systematically capture trait and varietal preferences of women and men farmers, and incorporate the feedback in breeding programs/product advancement. • Capacity building events to increase participation by women and young scientists. • Inclusion of specialty traits of particular importance to certain social groups (e.g. in Mexico, blue maize is important for many indigenous groups, as well as for informal niche/specialty product markets).
FP4 Aligning with and strengthening maize seed systems for effective product	• Women and men smallholder farmers included in participatory variety evaluation and on-farm variety testing/demonstration activities; Also, ensuring participation and feedback from men and women of different age groups or social groups (e.g. farmers for whom both grain and feed is important etc.). • Increased proportion of demo-plots & on-farm trials hosted by female farmers & disadvantaged groups. • Increasing recruitment and use of female field assistants (for on-farm trials, demos, field days and related data-collection) – not just related to the field day event, but for all farmer level interactions.

delivery	• Systematic sex-disaggregation in collection & analysis of farmer-level data from on-farm demos & PVS. • Women and men employees of emerging local seed enterprises participating in seed production and seed business management courses. • Gender-sensitive variety promotion and decision support information.
FP5 Inclusive and profitable maize futures	• Strategic gender research to inform research priority setting & targeting & increasing capacity for gender analysis. • Systematic integration of gender perspective in ex-ante and ex-post impact assessments • Systematic sex-disaggregation in all people-level data collection and analysis • Recruitment of female enumerators for people level data collection • Capacity building events to increase participation by women and young scientists.

4. PARTNERSHIPS

MAIZE is able to draw on a very strong partnership network that includes diverse contributions of partners in innovation, technology development and scale-out and in defining R4D priorities. It is only through this partnership network that the scope of activities described in Section 1 can be achieved. In terms of governance, MAIZE is guided by a Stakeholder Advisory Committee composed of reputable experts from all target regions representing a balanced set of disciplines and stakeholders (NARS, private sector, donor, ARI, farmer organizations). In the Management Committee, program leaders from CGIAR centers are joined by three non-CGIAR partners. In both committees, decisions are made by consensus or two-third majority vote so no institution alone can dominate a decision. A distinct amount of research funding is assigned to non-CGIAR partners and dispatched through competitive mechanisms following gap analyses done on an annual basis by the Management Committee.

Table 3 lists the key partners by Flagship Project. The actual list of partners is much longer but cannot be represented due to space constraints. In the case of RS 1, partners from Advanced Research Institutions, the private sector, NARES and farming communities work together with CIMMYT and IITA to generate a range of resource-efficient maize-based farming systems and value-chain innovations, test, adapt, scale-up and scale-out the most successful approaches. Such collaboration has resulted in several NARS aligning and investing in corresponding national activities. For example, the Ministry of Agriculture in Mexico (SAGARPA) aligned its extension services (PROMAF) to the MasAgro Project of MAIZE. In Nigeria, the government included MAIZE (via IITA) as a key partner in the country's Agricultural Transformation agenda. There are also private sector partners (such as equipment manufacturers, GrainPro, seed companies) and NGO actors (such as Total Land Care or the One Acre Fund) that have taken the initiative to up- and out-scale MAIZE-championed approaches to sustainable intensification and value-chain integration in a manner that is both profitable and adapted to the local context. Based on such experiences, greater attention will be focused during the extension phase on working with partners that make own commitments. MAIZE on the other hand will focus its investment on building national capacities in the leadership of multi-agent innovation systems approaches (overcoming traditional intra-institutional approaches), the use and adaptation of new cutting edge tools (precision agriculture, remote sensing, cell phone mediated decision making tools, small scale mechanization), and accelerate learning between regions, countries and partners.

In the case of RS 2, MAIZE links with several advanced research institutes and the private sector to expose and ultimately mainstream among NARS and SMEs breeding approaches that are otherwise only used by the multinational private sector, including the doubled haploid technology, molecular markers, genome wide selection approaches, supporting bioinformatics tools and transgenics. NARS and SMEs are engaged in applying new approaches in variety development and scale-out. Regional networks of NARS and seed companies jointly assess new varieties at managed phenotyping sites and through on-farm testing. The power of such networks is that best and most suitable varieties are recognized much more rapidly and simultaneously for different agro-ecologies or needs. Technical backstopping and, in

some cases financial support, are provided to assist SME seed companies in the process of variety registration and to produce breeders and basic seed. By and large however, the scale up of most seed production happens through seed companies' own means and using competitive approaches for companies getting rights to commercialize different MAIZE varieties meanwhile everybody is free to use the varieties in their own breeding programs. Varieties that are released and where seed becomes available are also included in activities of RS1 partners to stimulate faster uptake.

In the case of Research Strategy 3, partners from the CRP on Policy, Institutions and Markets, ARIs, the private sector and NARES, work together with CIMMYT and IITA to develop information and knowledge, gender mainstreaming options and tools, improved options for storage, food safety, processing and novel products for market access. Expected Immediate Outcomes are that these technologies, approaches and knowledge are promoted using two modalities. The first modality centers on their inclusion in the formulation and execution of bilaterally funded projects. The second centers on independent uptake by NARS, NGOs, and private entrepreneurs. In the Extension Phase, greater emphasis will be placed on working with partners who express a will to co-invest and have a proven track record of delivery and trust. In all postharvest approaches, a strong emphasis is being placed on expanding partnerships with the private seed sector. To support this, MAIZE has brought on board new skills (MBA – agri-business etc.) that balance R4D with investments that support linkages with the private sector and "go-to-market".

Table 3: Strategic Partnerships of Flagships Projects

Flagship Project	Partner and Topic
1	Public sector – NARES in Mexico; Ethiopia, Ghana, Kenya, Malawi, Mali, Mozambique, Nigeria, Rwanda, Zambia, Zimbabwe; Bangladesh, India and Nepal for adaptive research and scaling out of innovations. • Private sector (machinery manufacturers, GrainPro, Syngenta) for co-invention and scaling out innovations. • NGOs - Total Land Care, One Acre Fund etc., national extension systems and agrodealers for scaling out of innovations. • ARIs (KIT, WOCAN, Univ. Illinois, Univ. Sheffield) for household and farm systems analyses. • WUR, CIAT, CIRAD, SAIL (Sustainable Agriculture Innovation Laboratory), Earth Institute-Colombia University, & ITC for systems frameworks and quantitative analysis at landscape scale, and institutions. • Humid Tropics for cropping systems research and systems modelling. • Water Land & Ecosystems for efficient water and nutrient management and reducing the environmental footprint of MAIZE - to be strengthened during the Extension Phase.
2	• Cornell University for high-density genotyping (GBS) and genomic selection. • US and UK-based Universities (e.g., Minnesota, Alabama, Wisconsin) on genomic selection. • University of Hohenheim on R4D on haploid inducers and DH technology. • IBP, DArT and JHI on database management and breeding informatics. • DArT for medium density genotyping (GBS). • University of Barcelona and private sector on field-based phenotyping. • Multinational companies (Monsanto, Pioneer) and partners in SSA (e.g., KARI, ARC and NARO) on maize transgenic testing under CFTs and stewardship implementation. • KARI on maize lethal necrosis (MLN) trait pipeline. • Several ARIs and regional partners (e.g., WACCI) for capacity building.
3	• An array of NARS, seed companies and NGOs are partners in multi-location testing in SSA, LA and Asia. • Introgression of other institutional germplasm and technologies (e.g., Monsanto under WEMA; Pioneer under IMAS) in developing international public goods. • Some of the NARS partners (e.g., KARI and ARC) contribute elite germplasm for product development. • USDA-ARS and OSU provided maize germplasm for developing MLN resistant products. • USDA-ARS (Mississippi) provided aflatoxin resistant germplasm for introgression to develop mycotoxin resistant products for SSA.
4	• Large numbers of smallholder farmers for on-farm variety evaluation, demonstration and stimulating adoption. • Emerging seed enterprises in SSA as well as in Latin America and Asia, under IMIC-LA and IMIC-Asia, respectively, as key partners for client-oriented product development, collaborative testing network, on-farm demonstrations, seed production and marketing.

	• NARS and SME seed company partners that are provided resources under Maize Working Groups in SSA as well as the MAIZE Competitive Grants Initiative for varietal registration. • National seed authorities in SSA, LA and Asia, who oversee variety release and quality assurance. • National maize programs for variety evaluation, variety registration/release and extension. • Public and private extension services, for facilitating on-farm variety demonstrations, farmer-participatory evaluation and stimulating variety adoption. • NGOs (e.g., CARE, World Vision) for stimulating variety adoption and variety dissemination. • AGRA-PASS for seed enterprise capacity building. • ASARECA, SADC, COMESA and FANRPAN for facilitating seed policy review and publication. • USAID (FtF), IFDC, CDI, engaged in seed business development. • FAO for seed sector support and NGO coordination.
5	• Consortium Office gender specialist, KIT etc., for strategic gender research and gender mainstreaming • Universities and ARIs for ex-ante and ex-post impact assessment • PIM for foresight and targeting • GrainPro for co-invention and scale-out of storage technologies • USDA, AATF and Doreo Partners for AflaSafe

5. REGIONAL COLLABORATIONS

MAIZE has regional collaborations in SSA, Asia and Latin America. They are led by project leaders affiliated with the different Research Strategies or Flagships. Currently, MAIZE is partnering with more than 20 NARS and a network of over 100 small seed companies in SSA. It actively engages with FARA, NEPAD and Africa sub-regional agricultural research institutions, ASARECA, CORAF and SADC as part of the CAADP agenda. During the Extension Phase, MAIZE will seek increasing alignment with CAADP and its supporting institutions. The evolving alignment/integration can already be seen with ASARECA in Eastern Africa. ASARECA, CIMMYT and IITA have developed a highly productive and synergistic relationship in their common response to the Maize Lethal Necrosis disease. ASARECA also partners in one of MAIZE's sustainable intensification projects in Eastern and Southern Africa. In addition, collaboration will intensify between MAIZE and the Humid Tropics CRP across all Action Areas of the Humid Tropics CRP. Already now, collaboration between the CRPs jointly addresses the scourge of the parasitic weed Striga in the eastern Africa. In Central Africa, MAIZE, the Humid Tropics and RTB CRPs will work closely together to optimize productivity and profitability of maize, cassava, and legume systems. In Asia, MAIZE works hand-in-hand with NARS, ARIs and the private sector in Bangladesh, Bhutan, China, India, Indonesia, Nepal, Pakistan, Philippines and Thailand. It has strong collaboration with several CRPs (GRiSP, WHEAT, PIM, Aquatic Systems, and Livestock & Fish) through its work on sustainable intensification of cereal systems in South Asia. Given the challenges posed by increasing demands and climate change, there is the strong desire by several Asian governments and the private sector to further strengthen MAIZE collaboration. In Latin America and the Caribbean, the MAIZE research agenda is most strongly focused on Mexico given available, geographically bound resources. There are significant spill overs from this work to Latin America. Active interchange of technologies and know-how takes place with NARS and the private sector in most maize growing countries, even though at low levels of investments. MAIZE works with the Humid Tropics CRP to sustainably intensify maize-based production systems.

Globally, MAIZE envisions to further strengthen linkages with the CRP on Policy Institution and Markets (for foresight and targeting), and Agriculture for Nutrition and Health CRPs (for nutritionally enhanced maize and AflaSafe). MAIZE fosters collaboration in areas where multiple CRPs are operational.

6. MAIZE CRP WORK PLAN: EXTENSION PHASE – 2015 TO 2016

Cluster of Activity	Deliverables 2015	Deliverables 2016
Research Strategy 1: Sustainable intensification of maize-based cropping systems.		
Flagship Project 1: Sustainable intensification of maize-based cropping systems.		
1.1. Multi-scale farming system framework for enhanced integration and adoption of sustainable intensification options (linkage with FP5, which works at wider scale)	1. Robust analytical frameworks for scenario analysis and trajectories of change developed 2. Geospatial and remote sensing platform established in Bangladesh 3. Policy briefs & other advocacy materials on institutional constraints for CA-based intensification developed 4. SMS based tools for site-specific DSS established in 3 countries 5. Multi-Stakeholder Interaction mechanisms to enhance technology adoption functioning in x countries (**125k**) 6. Innovation framework processes and methodologies developed and documented 7. Training of trainers strategy developed (**125k**) 8. Supporting tools for innovation & last mile delivery developed (**250k**)	1. Ex post evaluations of alternative systems designs evaluated at the farm scale and, through model applications, extended to landscape scales 2. Innovation framework processes and methodologies developed and documented 3. Inter-institutional working groups established 4. New PPP platforms established 5. Extension strategy developed (**125k**) 6. Gender strategy developed (**125k**) 7. Supporting tools for innovation and last mile delivery developed and fine-tuned=> Conservation Earth, Dynamic M&E field books (BEM), first version of e-platform (**250k**)
1.2. Participatory approaches for adaptation and integration of technological components	1. Integrated Striga management options tested and validated and widely disseminated 2. Performance of maize in legume rotation and intercropping systems in heterogeneous farming landscapes documented. 3. Drivers of adoption of technology in maize-based systems in ESA analyzed and published (**150k**) 4. Nutrient management (farm level)? 5. Strategic utilization of in situ water resources in rain fed production systems determined for/where? 6. Knowledge sharing platform on 2WT-based technologies developed.	1. Management options for maize in legume rotation and intercropping systems in heterogeneous farming landscapes developed 2. Nutrient management (farm level)? 3. Strategic utilization of in situ water resources in rain fed production systems 4. Double maize yields & reduce goat mortality by 15% in crop-livestock systems in Zimbabwe 5. Maize varieties adapted to tree-crop systems identified (ESA) 6. Business models for small-scale mechanization developed in 4 countries in ESA and x countries in SA
1.3. Development and field testing of agronomic technologies for increased production, and risk reduction (resource use efficiency)	1. Interventions (e.g. rotation, intercropping, weed management, residue management, inoculants, minimum tillage; fodder legumes) tested on-station and on-farm 2. Integrated soil fertility management for maize genotypes on-farm across heterogeneous landscapes evaluated 3. Needs-based irrigation scheduling developed. 4. Insights in GxSxE C-N cycling, WUE–NUE documented. 5. ICT-based decision support systems for site-specific nutrient management developed 6. Precision ag. (greenseeker), Remote Sensing of weeds (ESA, S-Asia) 7. Aflatoxin management; new strain identification and validation	1. Widely test liquid formulation of herbicide-resistant maize for Striga and broader weed control in maize 2. Interventions (e.g. rotation, intercropping, weed management, residue management, inoculants, minimum tillage) promoted and tested by farmers 3. Performance of maize genotypes across several environments under various soil fertility management options documented. 4. Mechanization (implements) developed. 5. Needs-based irrigation scheduling and decision tool development 6. G x E x M; variety evaluation for CA developed 7. ICT-based decision support systems for site-specific nutrient management developed 8. Aflatoxin management; new strain identification and validation
Research Strategy 2: Stress Resilient and Nutritious Maize		
Flagship Project 2: Novel tools, technologies and traits for improving genetic gains and breeding efficiency		
2.1. Unlocking & incorporating native trait variation for important traits through SeeD	1. Source germplasm identified for tar spot resistance. 2. Journal publication describing methods for mining GWAS data using at least one trait as a model. 3. At least 20 scientists and students trained in GBS methods, data analysis and/or interpretation.	1. Source germplasm identified for two additional high-priority traits. 2. More than 100 pre-breeding crosses made, incorporating novel diversity to elite genetic backgrounds. 3. At least 50 scientists and students trained in GBS methods, data analysis and/or interpretation.

2.2. Trait pipeline development and capacity building	1. QC/QA assay refined and protocol disseminated to MAIZE partners 2. Journal publications on breeder-ready markers for msv1, qHIR1, C1-I, DT, NUE and MLN. 3. At least 3 training courses/workshops for MAIZE partners on marker-assisted breeding	1. Tropical reference genome sequenced and published 2. Breeder-ready markers for Tar Spot and NUE validated 3. At least 4 maize breeders using GS for complex trait improvement 4. At least 4 seminars/workshops for MAIZE partners on GS and marker-based breeding
2.3. Informatics, database management & decision support tools	1. Web-accessible database populated with a sample of MAIZE phenotypic and genotypic data (**500k**) 2. At least 15 MAIZE partner institutions trained in standard metadata and implementation of web-accessible data sharing (**100k**)	1. Web-accessible database populated with a sample of MAIZE phenotypic and genotypic data (**500k**) 2. Prototype breeding decision support tool for application of genomic selection available for testing by advanced MAIZE users 3. Breeding project management tool(s) deployed to at least 5 MAIZE partner institutions 4. At least 10 MAIZE partner institutions trained in use of breeding project management tools
2.4. Novel haploid inducers and improved protocols for efficient DH production in the tropics	1. Second-generation haploid inducers (based on *R-nj* marker system) with high HIR developed and tested in SSA, Latin America and Asia 2. A DH platform established and functional in Asia 3. DH development protocol further refined for enhanced success in the tropics (**100k**) 4. At least 2 regional/international training workshops organized (**100k**)	1. DH development service availed by at least 30 institutions (public and private) across SSA, Latin America and Asia 2. New tropicalized haploid inducers accessed and utilized by at least 15 institutions (public/private) in the developing world (**100k**) 3. At least 3 regional/international training workshops organized (**150k**)
2.5. Novel phenotyping tools for abiotic and biotic stresses and quality traits	1. Standardized phenotyping protocols for major biotic (GLS, tar spot, MLN, MSV, *Striga*) and abiotic (drought, heat, NUE, water logging) stresses and quality traits (micronutrients, industry preferred) developed and disseminated to MAIZE partners. 2. Multiplex diagnostic tools (lab and field) for major viruses (MSV, MCMV and SCMV) developed & disseminated to partners 3. At least 3 regional training workshops for NARS organized across SSA, LA and Asia on new traits and tools (**500k**)	1. High-throughput phenotyping system using spectral image analysis for drought and nutrient responses integrated in the breeding platforms. 2. At least 5 managed drought stress screening sites in SSA with robust soil moisture monitoring and weather data collection established. 3. Biophysical mapping of target environments for pathogen diversity and environmental variables and knowledge incorporated in site selection and breeding strategies 4. NIRS calibrated for relevant quality traits and incorporated in breeding strategies. 5. Digital tools for real-time phenotyping data capture validated for use in breeding decision support systems (**200k**) 6. At least 3 regional training workshops for NARS organized across SSA, LA and Asia on new traits and tools (**650k**)
Flagship Project 3: Stress resilient and nutritious maize		
3.1. Developing elite abiotic stress tolerant maize germplasm for SSA, Latin America and Asia	1. Regional trial hybrid advancement cohort having a 25% yield advantage under severe drought stress, as compared to 2008 benchmark hybrids 2. At least 4 new lines with high combining ability for yield potential, DT and WLT shared with MAIZE partners, especially in Asia. 3. At least 5 HT donors identified and shared with partners in Asia and SSA. 4. Gender sensitive communication (e.g. diverse information needs/human capital/ language/literacy)	1. Africa Regional trial hybrid advancement cohort having a 25% yield advantage under low nitrogen stress compared to 2009 benchmark hybrids. 2. Africa and Asia Regional trial hybrid advancement cohort having a 25% yield advantage under combined drought + heat stress compared to 2013 benchmark hybrids. 3. Hybrids meeting Bt efficacy trial requirements identified for RSA, Kenya and Uganda. 4. Study on gender as a customer attribute
3.2. Incorporating biotic stress resistance in elite maize germplasm	1. At least 3 new hybrids with MLN tolerance (and other adaptive traits) released by partners in eastern Africa 2. At least 10 lines with resistance to MLN, and at least 5 lines with MLN + MSV resistance identified and seed disseminated to partners in SSA 3. MSV resistance incorporated in at least 10 important inbred lines in SSA through marker-assisted breeding (based on *msv1* resistance haplotype).	1. At least 5 new hybrids with MLN tolerance (coupled with other adaptive traits) released and in commercial production in ESA 2. At least 40 donors with high levels of resistance to multiple diseases, including MLN, MSV, GLS, TLB, mycotoxins, PFSR, downy mildew and other high priority regionally important diseases documented and disseminated to partners in SSA, Latin America and Asia 3. Mechanisms underlying MSV and MLN resistance characterised, and knowledge incorporated into breeding strategies 4. At least 20 elite donors with high tolerance to stem borers and post-harvest insect pests identified and used in breeding programs.

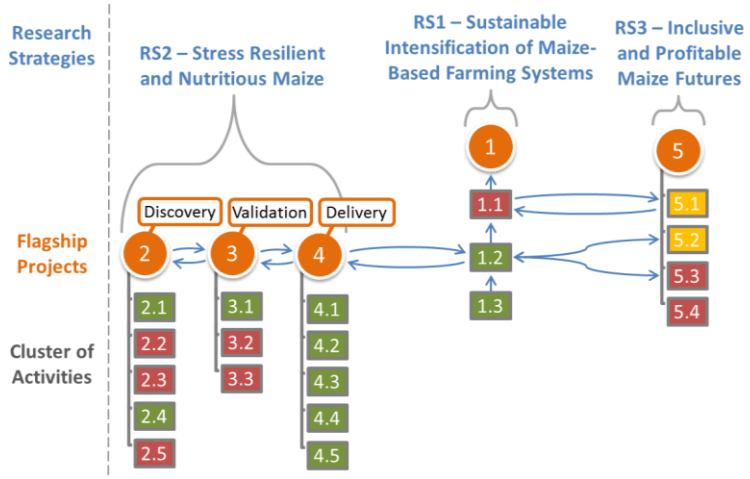
		5. At least 20 new donors with high levels of *Striga* resistance developed and disseminated.
3.3. Incorporating quality traits in elite genetic backgrounds for tropics	Elite QPM lines developed and experimental hybrids ready for multi-location testing in SSA.	1. Web-based database of genotypic and phenotypic attributes for food, feed, industrial, and end-use quality of elite and diverse maize genetic materials. 2. Maize lines, hybrids, and source materials with desirable characteristics for stover production identified or developed. 3. Training of at least 100 health extension specialists on the concept and impact of biofortified maize.
Flagship Project 4: Aligning with and strengthening maize seed systems for effective product delivery		
4.1. Evaluation and publication of the *per se* performance and seed producibility of elite maize hybrid varieties	1. Variety, parental and producibility information for at least 100 elite hybrids over 15 environments generated and published. 2. At least 40 hybrid maize varieties tested for VCU and DUS in SSA by CIMMYT/IITA, SMEs and NARES 3. At least 25 maize hybrid varieties released by at least 15 local seed enterprises and 8 NARS.	1. Variety, parental and producibility information for at least 100 elite hybrids over 15 environments generated and published. 2. At least 50 hybrid maize varieties tested for VCU and DUS inSSA by CIMMYT/IITA, SMEs and NARES 3. At least 25 maize hybrid varieties released by at least 15 local seed enterprises and 5 NARS.
4.2. Production of breeder, pre-basic and pre-commercial hybrid seed	1. Initial breeders/pre-basic and hybrid demonstration seed, totaling at least 1000 kg of 30 pre- or newly released varieties produced and provided to partners. 2. Molecular-based QA/QC services provided to at least 10 SMEs in SSA.	1. Initial breeders/pre-basic and hybrid demonstration seed, totaling at least 1500 kg for 30 pre- or newly released varieties produced and provided to partners. 2. Molecular-based QA/QC services provided to at least 20 SMEs in SSA.
4.3. Facilitate pilot hybrid seed productions and on-farm demonstration…..	1. Pilot seed productions on 0.5 to 5 ha of at least 30 hybrid varieties supported 2. At least 100 on-farm demonstrations of at least 30 pre- or newly commercialized varieties conducted, of which at least 30% are managed by women farmers.	1. Pilot seed productions on 0.5 to 5 ha of at least 30 hybrid varieties supported 2. At least 100 on-farm demonstrations of at least 30 pre- or newly commercialized varieties conducted, of which at least 40% are managed by women farmers.
4.4. Capacity building of SMEs and NSAs (National Seed Authorities)	1. Backstopping and consultative services provided to at least 80 SMEs on aspects of variety selection, seed production, seed marketing and business management provided by seed systems specialists 2. Short term capacity building events on hybrid seed production and seed business management provided to at least 40 technical staff from SMEs, at which at least 15% of participants are women 3. Short term capacity building events for at least 40 SME and NSA staff on variety release systems and seed quality assurance conducted, at which at least 15% of participants are women 4. Support provided for at least 2 MSc and 2 PhD students on seed-related studies, with gender equity of awardees.	1. Back-stopping and consultative services provided to at least 100 SMEs on aspects of variety selection, seed production, seed marketing and business management provided by seed systems specialists 2. Short term capacity building events on hybrid seed production and seed business management provided to at least 60 technical staff from SMEs, at which at least 20% of participants are women 3. Short term capacity building events for at least 60 SME and NSA staff on variety release systems and seed quality assurance conducted, at which at least 20% of participants are women 4. Support provided for at least 2 MSc and 2 PhD students on seed-related studies, with gender equity of awardees.
4.5. Socio-economic and policy-related research and publication	1. Seed sector study including maize trait preferences and market segmentation conducted in a target country in LAC. 2. Policy review and brief produced on variety release	1. Seed sector study including maize trait preferences and market segmentation conducted in several target countries in SSA. 2. Policy review and brief produced on accredited seed quality assurance
Research Strategy 3: Inclusive and profitable maize futures		
Flagship Project 5: Inclusive and profitable maize futures		
5.1. Prioritizing through foresight and	1. Global analysis of maize sector (WA, ESA, Asia, LAC) conducted. 2. Maize atlas developed. 3. Ex-ante assessment of maize in SSA updated	1. Global maize demand dynamics study (food, feed, industrial) 2. Ex ante analysis of one strategic technology

targeting	4. Ex-ante analysis of MLN (ESA) conducted. 5. Heat tolerant maize (S Asia) assessment conducted. 6. Ex-ante analysis of small-scale mechanization (ESA) conducted	
5.2. Enhancing pathways to impact	1. Maize adoption studies (S Asia; Mexico) 2. DT maize adoption studies cases (Nigeria, Uganda, Malawi) 3. MAIZE impact assessment cases (Ethiopia, Kenya, Nepal, Malawi) - Asia maize IA [validation, SIAC]	1. DT maize impact case studies (SSA) 2. Hermetic grain storage maize impact studies (ESA) 3. Striga resistant maize adoption/impact case studies (WA) 4. Maize adoption and impact improved varieties in SSA
5.3. Enhancing gender/social inclusiveness	1. Gender-in-maize knowledge base consolidated 2. Qualitative assessment of gender norms and agency related to agricultural innovation in key target regions conducted 3. Comparative analysis of gender aspects hermetic grain storage technologies (ESA) conducted. 4. Gender policy developed and adopted by the CRP. 5. Protocol for sex-disaggregated data collection institutionalized by lead institutions and adopted by key partners. 6. Gender project screening procedure developed & piloted. 7. Protocol for gender and social inclusion in participatory research developed and piloted (**150k**) 8. Gender capacity strengthening plan developed and under implementation	1. Guidelines for gender-responsive development of maize-based systems drafted for at least one key target area 2. Strategic gender research portfolio emerging. 3. Screening procedure for gender mainstreaming in project development elaborated, piloted & institutionalized in CRP MAIZE 4. Protocol for gender and social inclusion in participatory research developed, piloted & institutionalized by lead institutions and adopted by key partners 5. Senior Mgt and >50% of project leaders have passed basic gender awareness test 6. Procedure for integration of gender in sub-grant agreements established 7. Gender focal points identified and trained
5.4. Harnessing smallholder market opportunities	1. Maize market segmentation studies (Mexico) 2. Maize value chain analysis for Eastern, Western, Central and Southern Africa (**500k**) 3. Novel product consumer acceptance study conducted (**150k**) 4. Study on comparative assessment of novel products with existing ones in the market conducted (**150k**)	1. Country/region specific non-toxigenic strains utilized in 'aflasafe' production for marketing of quality maize by smallholders (SSA). 2. Validated models for access to maize market opportunities (storage; inputs; small-scale mechanization) 3. Identified maize processing methods for enhanced efficiency and new products (**250k**) 4. Modified products developed for market validation (**200k**) 5. Identified preferred traits for industrial use 6. Maize value chain analysis for South and South-East Asia (**100k**)

N.B. **Red** = Additional budget requested beyond 2015 and 2016 Finance Plan growth

7. PROPOSED BUDGET 2015-2016

Figure 1 provides a color-coded view of current sources of funding for MAIZE. The colour green denotes a high proportion of Window 3 and bilateral funding. Currently, MAIZE receives strong Window 3 and bilateral funding for breeding for abiotic stresses (namely drought and heat – CoA 3.1), maize variety development and delivery (FP4), and the development-focused dimensions of FP1. The colour yellow denotes mixed funding (Window 1, 2, 3 and bilateral). Currently, MAIZE allocates moderate amounts of Windows 1&2 funding to supplement Windows 3 and bilateral funding for Prioritizing through foresight and targeting (5.1) and Enhancing pathways to impact (5.2). The colour red denotes proportionally high investments by Windows 1&2. Currently, MAIZE



allocates significant Windows 1&2 funding to: (1.1) Development partners adopt strategic, scalable approaches based on farming systems analytical frameworks at multiple spatial and temporal scales; (2.2) Trait pipeline development and capacity building; (2.3) Informatics, database management and decision support tools; (2.5) Novel phenotyping tools for abiotic and biotic stresses and quality traits; (3.2) Incorporating biotic stress resistance in elite maize germplasm, especially breeding for resistance to Maize Lethal Necrosis, and; (5.3) Enhancing gender/social inclusiveness.

New and additional research areas described in this workplan are listed below, related to the 2015-2016 budget. Many of the new and additional research areas are accommodated within the CGIAR Finance Plan projected budget increases (listed in **black**). MAIZE requests additional budget as detailed in **red**, either from W1&W2, W3 or through bilateral projects. There is no allowance for inflation in the budget. The MAIZE Management Committee expects to accommodate inflation-related annual reductions in available R4D funds through increased efficiencies, and by systematically reducing investments in R4D activities with lower IDO related impact, based on insights developed in FP5 and expert assessments.

MAIZE Budget (US$ '000)		**W1&W2 As per POWB 2014**	**W1&W2 As per FP 2015**	**W1&W2 Beyond FP 2015**	**W1&W2 As per FP 2016**	**W1&W2 Beyond FP 2016**	**Bilateral 2015**	**Bilateral 2016**	**Of which Gender**	**Of which Partner**	
FP1		2,329	2,729	650	3,204	125	10,147	10,642	17%	25%	
FP2		3,582	3,957	1,000	4,232	1,150	11,838	12,416	5%	9%	
FP3		2,714	3,028	0	3,400	0	15,077	15,813	16%	22%	
FP4		1,356	1,356	0	1,356	0	8,903	9,337	15%	14%	
FP5		3,192	3,540	1,100	3,951	550	4,308	4,518	32%	33%	
CRP Management		2,248	2,360	500	2,524	336	0	0	10%	0%	
Total CRP Strategic		**15,420**	**16,970**	**3,250**	**18,667**	**2,161**	**50,273**	**52,726**	**15%**	**19%**	Aligned with strategic CRP agenda
Total W1&W2 Budget Application for 2015 & 2016			**20,220**		**20,828**						
CRP Supplementary		0	0	0	0	0	28,000	29,366	22%	36%	Additional extension/development type funding leveraged by CRP.
Additional/new activities explaining 2014 > 2016 budget increase within (black) and (red) in addition to the Consortium Finance Plan											
FP1	CoA 1.1: Robust analytical frameworks for scenario a		250	0	0	0					
FP1	CoA 1.1: Multi-Stakeholder Interaction mechanisms t		0	125	0	0					
FP1	CoA 1.1: Innovation framework processes and methc		150	0	150	0					
FP1	CoA 1.1: Training of trainers strategy developed		0	125	0	0					
FP1	CoA 1.1: Supporting tools for innovation & last mile c		0	250	250	0					
FP1	CoA 1.1: Ex-post evaluations of alternative systems c		0	0	350	0					
FP1	CoA 1.1: Extension strategy developed		0	0	0	125					
FP1	CoA 1.1: Gender strategy developed		0	0	125	0					
FP1	CoA 1.2: Drivers of adoption of technology in maize-		0	150	0	0					
FP2	CoA 2.2: QC/QA assay refined and protocol dissemin		125	0	0	0					
FP2	CoA 2.3: Web-accessible database populated with a		0	700	0	700		As per joint B&MGF (200k p.a.) and Consortium Initiative (500k p.a.)			
FP2	CoA 2.3: Prototype breeding decision support tool fo		0	0	250	0					
FP2	CoA 2.3: Breeding project management tool(s) deplo		0	0	100	0					
FP2	CoA 2.4: DH development protocol further refined fc		100	0	0	0					
FP2	CoA 2.4: New tropicalized haploid inducers accessed		0	0	100	0					
FP2	CoA 2.5: Multiplex diagnostic tools (lab and field) for		150	0	0	0					
FP2	CoA 2.2-2.5: Regional training workshops for NARS o		0	500	0	650					
FP2	CoA 2.5: Digital tools for real-time phenotyping data		0	0	200	0					
FP3	CoA 3.2: At least 3 new hybrids with MLN tolerance (		150	0	0	0					
FP3	CoA 3.2: At least 10 lines with resistance to MLN, and		164	0	86	0					
FP3	CoA 3.2: At least 5 new hybrids with MLN tolerance (		0	0	150	0					
FP3	CoA 3.2: At least 40 donors with high levels of resista		0	0	200	0					
FP3	CoA 3.2: Mechanisms underlying MSV and MLN resist		0	0	250	0					
FP5	CoA 5.3: Gender-in-maize knowledge base consolida		148	0	0	0					
FP5	CoA 5.3: Qualitative assessment of gender norms an		200	0	0	0					
FP5	CoA 5.3: Protocol for gender and social inclusion in p		0	150	0	0					
FP5	CoA 5.3: Gender capacity strengthening plan develop		0	150	0	0					
FP5	CoA 5.3: Guidelines for gender-responsive developm		0	0	150	0					
FP5	CoA 5.3: Gender focal points identified and trained		0	0	59	0					
FP5	CoA 5.4: Maize value chain analysis for Africa & S Asi		0	500	400	100					
FP5	CoA 5.4: Novel product consumer acceptance study (		0	150	0	0					
FP5	CoA 5.4: Study on comparative assessment of novel		0	150	0	0					
FP5	CoA 5.4: Identified maize processing methods for enl		0	0	0	250					
FP5	CoA 5.4: Modified products developed for market va		0	0	0	200					
FP5	CoA 5.4: Identified preferred traits for industrial use		0	0	150	0					
Management	M&E strengthened		112	0	112	0					
Management	Open Access		0	500	164	336					
Additional budget required			**1,550**	**3,450**	**3,247**	**2,361**					