Impact Pathway Narrative for MAIZE Research Strategies and Intermediate Development Outcomes (IDOs)

The MAIZE CRP has three key Research Strategies: 1) Sustainable Intensification and Income Opportunities for the Poor; 2) New Maize Varieties for the Poor, and; 3) Integrated Post-Harvest Management. All three Research Strategies are supported by a cross-cutting Strategic Initiative “Socio-economics and Policies for maize futures”.

1. Sustainable Intensification and income opportunities for the poor

The goals for this Research Strategy are to: 1) reduce poverty and hunger through integrated and scalable innovations that improve market access and increase the productivity, sustainability, and resilience of maize-based farming systems, reaching 25 million people by 2020 and 75 million people by 2030, and lifting at least 10 million out of extreme poverty within the first 10 years. The foundation for this change is based on the premise that; 2) a network of change agents and modern communication tools, empower 20 million smallholders to manage their crops in a more profitable and environmentally friendly manner, thereby providing food for 150 million poor maize consumers while reducing the environmental footprint.

Phase (1) Research Outputs

The principal outputs for Research Strategy 1 - Sustainable Intensification and income opportunities for the poor are crop and resource management practices and knowledge. New maize varieties, and other high performing adapted crop varieties, are developed with national public and private sector partners to meet the specific needs of farmers in the MAIZE CRP target areas (see target geographies for SI 2, SI 3, SI 4 and SI 5). Crop and resource management practices are developed with national public and private sector partners to address specific resource constraints and agronomic opportunities present in the MAIZE CRP target areas (see target geographies for SI 2, SI 3, SI 4 and SI 5). These research outputs are supported by knowledge, tools, and methods for better targeting of interventions and policy and institutional innovations for enhancing maize technology adoption, inclusiveness, gender equity, market access, and reducing vulnerability.

Phase (2) Immediate Outcomes

Profitable, resource efficient maize-based farming systems and value-chain innovations are locally adapted and promoted using two modalities. The first modality centers on the direct intervention of the MAIZE CRP through its large bilaterally funded projects. In this modality, different approaches to sustainable intensification and value-chain integration are tested, adapted and the most successful approaches are scaled-up and scaled-out. The second modality centers on the actions of change agents (Policy and development actors, NARES, NGOs, farmers etc.,) independently adapting and scaling-up and scaling-out approaches to sustainable intensification and value-chain integration developed by the MAIZE CRP. This Research Strategy is supported by ex-ante and ex-post analysis, which assists MAIZE
CRP project managers and national policy and decision-makers in “better targeting and support of new technologies and institutional innovations”.

Ultimately, crop and resource management practices and value-chain integration approaches developed by the MAIZE CRP only lead to desirable outcomes if one or more of the following assumptions hold: 1) they truly address locally important challenges and opportunities. For example, poor farmers and women benefit from increased productivity, reduced risks, and improved food security, while reducing or reversing negative impacts on soils and the environment; 2) change agents in developing countries are better equipped to diagnose maize production problems and give reliable and simple messages to farmers on “best-bet” crop management practices. This includes enhanced capacity of smallholder farmers managing maize-based systems in developing countries to better understand factors that limit maize and system productivity, and the interactions between these factors; 3) development partners, policy makers, researchers, and change agents are able to identify viable options for rapid and sustainable poverty reduction in maize-based systems; 4) value-chain actors and service providers benefit from market innovations and take steps to link the poor into markets to access inputs and equipment and increase incomes; 5) researchers/change agents are better equipped to catalyze and lead multi-agent innovation systems, as well as to facilitate information/knowledge flows; 6) there is a willingness to change and new practices are not seen as potentially detrimental; 7) interventions results in reduced soil erosion, siltation, and flash-flooding downstream from agricultural areas. Reduced greenhouse gas emissions, especially as a result of reduced fuel use in agriculture, and increased carbon sequestration in agricultural soils, thereby mitigating climate change; 8) interventions increased biological control of pests accompanied by a reduction in pesticide use; 9) increased nutrient use efficiency in high productivity maize systems of Asia and Latin America; 10) by using decision guides, alone or with assistance from extension services, farmers are able to increase the productivity and profitability of their maize crops; 11) there are increased benefit to farmers from using fertilizer and improved varieties, and; 12) seed companies and other input suppliers are better able to target their products to particular agro-ecological niches, thereby making the maize value chain more efficient.

**Phase (3) Intermediate Development Outcomes**

If one or more of the above assumptions hold, the Sustainable Intensification and income opportunities for the poor Research Strategy will lead to two important Intermediate Development Outcomes: **IDO1** Increased productivity and stability of farming systems and **IDO2** Increased income of small holder farmers.

Performance Indicators for **IDO1** Increased productivity and stability of farming systems include:
- Increased yields
- Increased farm level production
- Diversification of production
- Diversification of diets and nutrition (crop rotations/intercrops)
- Reduced farm level demand (per area unit) for water
- Lower per ha level input use (labor, fossil fuels, fertilizer, pesticides, irrigation water, etc)
- Improved soil health (SOM, reduced erosion, nutrient depletion)
- Change in farmer attitudes and gain in sustainability

Performance Indicators for **IDO2** Increased income of small holder farmers include:
- Reduced production costs
- Higher profitability of maize production
- Diversification of income sources
2. New maize varieties for the poor

The Goals for this Research Strategy is to: 1) provide maize food security and reduce production shortfalls for at least 36 million and ideally over 100 million of the poor in Africa, Asia, and Latin America whose crops suffer the effects of an array of abiotic (especially, drought) and biotic stresses, accentuated further by global climate change; 2) Through public–private partnerships, increase maize productivity among smallholders in high-potential areas of Asia, Africa, and Latin America, thereby providing food for 50–170 million poor maize consumers, reducing demands on land and irrigation, increasing the diversity of improved maize varieties grown by farmers and fostering a more competitive maize seed sector; 3) Using native maize genetic diversity and novel tools, develop and disseminate maize varieties that are biofortified for pro-vitamin A (pro-V A), zinc, or essential amino acids (quality protein maize—QPM), thereby reducing 10–20% of the life-years that are lost annually to Vitamin A deficiency in five sub-Saharan African countries alone, and benefiting malnourished children who grow up on maize-based diets.

Phase (1) Research Outputs

The principal outputs for Research Strategy 2 - New maize varieties for the poor are high yielding, stress tolerant and nutrient enhanced maize varieties. New elite maize varieties are developed with national public and private sector partners to meet the specific needs of farmers in the MAIZE CRP target areas (see target geographies for SI 2, SI 3, SI 4 and SI 5). These research outputs are supported by knowledge, tools, and methods for better targeting of interventions and policy and institutional innovations for enhancing maize technology adoption, inclusiveness, gender equity, market access, and reducing vulnerability.

Phase (2) Immediate Outcomes

New elite maize varieties are promoted using three modalities. The first modality centers on the provision of technical backstopping to NARS and private seed companies (SMEs). In this modality, the MAIZE CRP provides new elite maize varieties and lines, and technical backstopping, for regional on-station testing. Next, for maize varieties that show significant promise, technical backstopping is provided to NARS and private seed companies for regional on-farm testing; including entry into National Performance Trials (NPT) and for Distinctness, Uniformity and Stability (DUS) trials. In some cases, technical backstopping and financial support are provided to assist SME seed companies in the process of variety registration and to produce breeders and basic seed. The second modality centers on the inclusion of new elite maize varieties in large bilaterally funded sustainable intensification interventions outlined above. The third modality centers on the independent uptake of new elite varieties by NARS and private seed companies. This Research Strategy is supported by socio-economic ex-ante and ex-post analysis, which assists MAIZE CRP project managers and national policy and decision-makers in “better targeting and support of new technologies and institutional innovations”.

Ultimately, new elite maize varieties developed by the MAIZE CRP only lead to desirable outcomes if one or more of the following assumptions hold: 1) Public (NARS) and Private (SME seed companies) are willing and able to test new germplasm; 2) Germplasm originating from MAIZE CRP is better than commercial checks; 3) Seed companies & NARS are willing & able to put new maize varieties through NPT testing &/or DUS; 4) Seed companies & NARS have capacity (technical/financial) to produce breeders & basic seed; 5) Farmers’ are convinced of the value of new maize varieties and are willing and able to purchase; 6) Seed companies deliver quality seed, at a competitive price, in a timely manner; 7) New maize varieties are more profitable than existing commercial varieties or confer greater fitness for
the farmers’ environment; 8) There is sufficient production increases in 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 labor; 9) There is increased diffusion of improved technologies in stress-prone environments, to the benefit of farmers and local entrepreneurs; 10) There is reduced variation in maize production and more stable grain prices, and; 11) National research systems and seed companies participate in research consortia that empower them to establish and implement an effective collaborative research agenda, including use of new research tools and information.

**Phase (3) Intermediate Development Outcomes**

If one or more of the above assumptions hold, the *New maize varieties for the poor* Research Strategy will lead to three important Intermediate Development Outcomes: **IDO2** Increased income of smallholder farmers; **IDO3**: Increased yields of maize for smallholder farmers, and; **IDO4**: Increased nutritional diet.

Performance Indicators for **IDO2** Increased income of smallholder farmers include:
- Reduced production costs
- Increased profitability of maize
- Increased marketable surplus.

Performance Indicators for **IDO3**: Increased yields of maize for smallholder farmers include:
- Increased maize yields (t/ha) in high potential areas
- Increased maize yields (t/ha) in low potential areas facing severe biotic and abiotic stresses
- Reduced vulnerability (risk) from disease and pest attack
- Area expansion of maize at farm-level

Performance Indicators for **IDO4**: Increased nutritional diet include:
- Increased iron and zinc content of maize
- Increased lysine and tryptophan content of maize
- Increased pro-vitamin A content of maize
- Increased stover quality of maize

**3. Integrated Post-Harvest Management**

The Goals for this Research Strategy is to: 1) Improve the food security and safety, health, and marketing options of some 6 million smallholders in 15 countries of Africa, Asia, and Latin America by reducing post-harvest losses and mycotoxin contamination in maize-derived foods.

**Phase (1) Research Outputs**

The principal outputs for Research Strategy 3 – Integrated Post-Harvest Management are integrated approaches for reducing post-harvest losses and mycotoxin contamination. Integrated Post-Harvest Management approaches are developed with national public and private sector partners to meet the specific needs of farmers in the MAIZE CRP target areas. These research outputs are supported by knowledge, tools, and methods for better targeting of interventions and policy and institutional innovations for enhancing maize technology adoption, inclusiveness, gender equity, market access, and reducing vulnerability.
Phase (2) Immediate Outcomes

Integrated Post-Harvest Management approaches are promoted using two modalities. The first modality centers on the inclusion of post-harvest management approaches in small, medium and large budget bilaterally funded projects. The second modality centers on the independent uptake of post-harvest management approaches by NARS, NGOs and private entrepreneurs. This Research Strategy is supported by socio-economic ex-ante and ex-post analysis, which assists MAIZE CRP project managers and national policy and decision-makers in “better targeting and support of new technologies and institutional innovations”.

Ultimately, post-harvest management approaches developed by the MAIZE CRP only lead to desirable outcomes if one or more of the following assumptions hold: 1) Farmers and development partners are convinced of the value-added of maize storage technologies and Aflasafe; 2) Private entrepreneurs make profits from the production and distribution/sale of maize storage technologies and/or Aflasafe; 3) Farmers are convinced that they will increase profits through use of maize storage technologies and/or Aflasafe; 4) Farmers are convinced that they will retain a significantly higher proportion of the crop compared to traditional storage methods; 5) Farmers are convinced that they will or improve the quality and health benefits of the stored crop; 6) A premium develops for higher quality/lower aflatoxin maize; 7) Maize storage technologies increase food security and health benefits (perceived and real), and; 8) National government, INGOs and private sector scale-out the post-harvest technologies and/or Aflasafe.

Phase (3) Intermediate Development Outcomes

If one or more of the above assumptions hold, the Integrated Post-Harvest Management Research Strategy will lead to two important Intermediate Development Outcomes: IDO5 Reduced post-harvest losses, and; IDO6: Reduced aflatoxin in maize value chain.

Performance Indicators for IDO5 Reduced post-harvest losses include:
- Number of maize silos and bags purchased by farmers
- Reduced post-harvest losses

Performance Indicators for IDO6: Reduced aflatoxin in maize value chain include:
- Quantity of Aflasafe purchased by farmers
- Reduced aflatoxin in maize value chain
- Premium attained for higher quality maize (food and feed).