Market Intelligence and Product Profiling

September 28, 2021

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Initiative name	Market Intelligence and Product Profiling
Primary Action Area	Genetic Innovation
Geographic scope	Global and regional
Budget	US$ 39,000,000

1. General information

- Initiative name: **Market Intelligence and Product Profiling**
- Primary CGIAR Action Area: **Genetic Innovation**
- Proposal Lead and Deputy: **Matty Demont and Vivian Polar**
- IDT members and affiliations: **Berber Kramer (CGIAR), Jason Donovan (CGIAR), Peter Coaldrake (CGIAR), Carolina Gonzalez (CGIAR), Pepijn Schreinemachers (World Vegetable Center), Vishnuvardhan Reddy Banda (CGIAR), Lateef Sanni (CGIAR), Julius Okello (CGIAR), Erick Boy (HarvestPlus), Nimo Wiredu (CGIAR), Pheneas Ntawuruhunga (CGIAR), Tran Bruno (CGIAR), Godwin Atser (CGIAR), Guy Hareau (CGIAR), Hale Anne Tufan (Cornell University), Dominique Dufour (CIRAD, France), Rose Fiamohé (University of Abomey-Calavi, Benin), Gary Atlin (BMGF), James Gaffney (USAID), Hervé Thieblemont (Syngenta Foundation)**

2. Context

2.1 Challenge statement

Decisions on how to invest scarce resources in CGIAR genetic innovation systems are predominantly supply-driven, and therefore potentially out-of-sync with the demands of smallholders, consumers and agro-industry. While returns on investment in genetic innovation have been high (Alston *et al.*, 2020), they tend to fall below potential. Mismatched investments reduce options to channel support towards activities with higher potential to contribute to Impact Areas such as gender equality, climate change adaptation, and nutrition. The turnover of improved crop varieties developed by CGIAR and its partners has been slow as indicated by a high average age of varieties in the field (Atlin *et al.*, 2017; McEwan *et al.*, 2021; Thiele *et al.*, 2021; Walker *et al.*, 2014). Moreover, farmers may not be well informed about varietal options available to them, and reluctant to experiment with new varieties (Rutsaert and Donovan, 2020). Small-scale seed businesses lack incentives to actively promote new varieties given weak demand, preferring instead to target marketing resources towards more established varieties. Indeed, little is known about the institutional and behavioral drivers of varietal replacement and product substitution, and the role of downstream market actors such as traders, processors, and consumers in this process.

There is clear recognition of the need for demand- and data-driven processes to guide genetic innovation systems (EiB, 2020), but efforts to advance this remain incomplete and fragmented within CGIAR. Current product profile design is strongly biased towards agronomic and stress tolerance traits (Cobb *et al.*, 2019), with little systematic identification and integration of traits that contribute to wider social impact such as, for example, gender equality, opportunities for youth, social inclusion, and nutrition. Greater data-driven processes require that social scientists (e.g., gender and marketing specialists, and economists), geospatial scientists, nutritionists, and representatives from national breeding programs, among others, engage with breeding and seed system programs providing timely and useful "market intelligence."

We define "market intelligence" as *strategic information on future crops, market segments and trait priorities aligned to the needs and preferences of farmers, agri-business and consumers*

that can be incorporated into product profiles, pipeline investment cases and seed system strategies, enabling genetic innovation systems to contribute to the five Impact Areas. Since plant breeding takes time, product profiles must capture the future needs and preferences of customers (women and men farmers, value chain actors, consumers) and society by anticipating "*future trends in international and domestic markets for the commodity and its by-products, dietary patterns, urbanization, labour and land markets, structural transformation of economies, domestic, regional and international policies, abiotic and biotic stress incidence and severity, environmental conditions and climate*" ([Custodio *et al*., 2016](#); [Lenaerts *et al*., 2019](#)). Genetic innovation systems, however, lack institutional standards and processes to systematically involve and empower transdisciplinary teams of social and biophysical scientists in product profiling. This is also important as CGIAR breeding programs are expected to focus more on upstream research (e.g., trait discovery and development) while leaving more of the downstream research on variety adaptation to in-country public and private sector partners ([EiB, 2020](#)).

2.2 Measurable 3-year (end-of-Initiative) outcomes

The Market Intelligence and Product Profiling Initiative's vision is:

> *CGIAR and its partners maximize investment returns in breeding, seed systems and other Initiatives across the five Impact Areas based on reliable and timely market intelligence. Stronger demand orientation generated by market intelligence strengthens co-ownership and co-implementation by CGIAR, NARES, private sector, and NGOs, leading to more strategic efforts to getting high quality products into the fields of women and men smallholder farmers, enhancing livelihoods and diets of populations at large.*

This vision will guide actions towards four end-of-Initiative (EoI) outcomes:

1. **At least three transdisciplinary teams** across CGIAR and partners in prioritized CGIAR regions (WCA, ESA, SA; one team per region) are empowered in co-implementation of market and behavioral intelligence and co-design of product profiles, measured through quantitative and qualitative indicators of transdisciplinary practice and empowerment ([Steelman *et al*., 2021](#)).
2. **At least 10 CGIAR partners** in the prioritized CGIAR regions (WCA, ESA, SA) adopt institutional standards and processes for market segmentation and product profile design, sharing of market and behavioral intelligence, and monitoring of outcomes, increasing the impact of investment in genetic innovation whilst ensuring inclusion and gender equity.
3. **At least five seed suppliers, food companies, and NGOs** in the prioritized CGIAR regions (WCA, ESA, SA) use market and behavioral intelligence from this Initiative in strategic decision making.
4. **At least three research leaders and investors** make investment decisions using pipeline investment cases and the Investor Dashboard. Increased availability of information and transparent, holistic analyses on high-impact opportunities attract increased investments in under-invested and new-opportunity market segments.

2.3 Learning from prior evaluations and impact assessments (IA)

Insufficient priority given to consumer-preferred traits by breeding programs in sub-Saharan Africa likely contributes to limited uptake of modern varieties and low varietal turnover ([Thiele *et al*., 2021](#)). The recent evaluation of CGIAR Research Programs (CRPs) stresses the need to increase inclusiveness in defining product profiles to better contextualize variety development and tailor research to diverse agricultural communities ([CAS Secretariat, 2021](#)). Clearly, market intelligence is a crucial input for genetic innovation to efficiently increase its contribution to the five Impact Areas.

Assessing the impact of better market intelligence requires novel impact assessment methods and metrics. Traditionally, impact assessment of CGIAR genetic innovation research and

development (R&D) has focused on changes in smallholder productivity and income (e.g., Alston *et al.*, 2020). There is a need for impact assessment to expand its methods and metrics to estimate a broader range of impacts across the five Impact Areas. Wiebe *et al.* (2021) uncovered strong heterogeneity in impacts across crops, regions and outcome indicators, suggesting that decision makers may have diverse objectives with possible trade-offs. The CRPs' evaluation recommends to incentivize the use of monitoring, evaluation, learning and impact assessment (MELIA) metrics and to increase the use of mixed-method designs in evaluations (CAS Secretariat, 2021). Using disability adjusted life years (DALYs) as a metric for chronic and hidden hunger, for example, Lenaerts and Demont (2021) found that supply of cereals, vegetables and fruit significantly reduces the global burden of hunger, and Sulser *et al.* (2021) found that investments in agriculture had the potential to offset the adverse effects of climate change on the global burden of hunger.

2.4 Priority-setting

This Initiative is designed to become the priority setting unit of the Genetic Innovation (GI) Action Area (AA). Foresight on future global impact potentials (*why*) that can be tapped into by GI Initiatives will inform prioritization of market segments (*where*), which will drive development of product profiles (*what*) and pipeline investment cases (*how*) to capture these global impact potentials. This prioritization mechanism will progressively steer the GI Initiatives as more data and evidence become available. As a result, the geographical focus of the Initiative will be both global and regional; it will continuously monitor global impact potentials, while investing regionally in the collection of robust and high-resolution data for market segment identification and prioritization, and product profile design.

GI breeding efforts cover 24 food and fodder crops (Banana [Matoke], Barley, Beans [common], Brachiaria grass [sp. *Humidicola*], Cassava, Chickpea, Cowpea, Faba bean, Grass pea, Groundnut, Guinea grass, Lentil, Maize, Millet [Finger, Pearl], Plantain, Potato, Rice, Sorghum, Soybean, Sweet Potato, Wheat [Bread wheat, Durum wheat], Yam). Across GI, resources will be utilized in alignment with the level of projected impact. Investments will target impacts that breeding can make a unique contribution to, also considering the role of Resilient Agrifood Systems to solving the targeted problem, and will be aligned with the presence of realistic impact pathways reaching the intended beneficiaries, farmers or consumers, i.e., (i) viable seed systems or dissemination approaches are in place or being put in place (SeEdQUAL); (ii) varieties are in-demand and will be used by the intended beneficiaries; and (iii) in the case of nutrition, the harvested produce will be bioavailable and likely be consumed by at-risk populations, drawing on evolving insights from HarvestPlus.

Current crop-specific breeding objectives and associated product profiles were informed by: national priorities; stakeholder feedback from national agricultural research and extension systems (NARES), seed companies and farmers; structured household surveys on requirements of men and women farmers; pest and disease surveys; climate change models; and/or impact estimates of welfare/health improvements such as done for biofortified crops (HarvestPlus, 2021). The strongest emphasis will be on staple crops and legumes with multi-country importance in sub-Saharan Africa and South Asia. These regions are clearly differentiated from the rest of the world in that they feature the highest (i) numbers of undernourished people; (ii) proportion of young people (15–24 years old); (iii) population share under the global poverty line (<1.9 US$/day); (iv) prevalence of climatic hazards in areas with more than 10% of population under the global poverty line; and (v) predicted global burden of hunger in 2030 under climate change. These regions are also characterized by high (i) gender gaps; (ii) crop biodiversity; and (iii) soil erosion. Finally, greenhouse gas emissions from agriculture are highest in SA and SEA, due to the dominance of rice growing (see maps).

Going forward, the Initiative will further assess the contribution of each breeding effort to the five Impact Areas in a much more targeted way than has ever occurred in CGIAR, including for crops and traits most important for women, young adults and indigenous populations.

Understanding projected impacts and therefore prioritization will also be informed by Plant Health Initiative, for most devastating pests and diseases, and latest climate models (from ClimBeR) that allow focused breeding investments where the largest production shortfalls can be restored or averted. SHiFT will provide valuable insights into strategies that would support a food system transformation to more sustainable, healthier diets. All these insights together, combined with input from funders, countries and civil society as aggregated by GI and Regional Integrated Initiatives (RII), will influence the relative emphasis on breeding pipelines, systematically increasing the total impact across the portfolio.

2.5 Comparative advantage

CGIAR has a comparative advantage in developing global public goods in the form of improved varieties and elite germplasm that contain key traits thanks to its long-term investment vision and access to genetic resources. National breeding programs and private seed companies, on the other hand, have a comparative advantage in adaptive research, variety release and promotion, and seed production. Information sharing is critical for this system to work well as CGIAR crop breeders do not have direct connections to end-users in many environments.

In private sector crop breeding, product profiles are typically designed by an internal marketing team together with business development units and sales departments (Cobb *et al*., 2019). Variety sales and market shares serve as key performance indicators. Lacking such data and marketing departments, public breeding programs need to collect market intelligence through networks with downstream partners. As demonstrated by HarvestPlus, this requires a systematic approach that not only considers the sales potential of a variety, but also its potential to generate social impact (Foley *et al*., 2021).

CGIAR is best-placed to coordinate this intelligence gathering at a global level and to form the necessary partnerships (Gaffney *et al*., 2019), as it can build on the CGIAR Gender and Breeding Initiative, which has successfully developed strategies for gender-responsive breeding through close collaboration among breeders and social scientists. Moreover, the CGIAR is a trusted partner for managing large R&D investments typically required for genetic innovation and allocating R&D resources among CGIAR, NARES and other partners.

2.6 Participatory design process

Private foundation support for CGIAR, particularly investment in genetic innovation from the Bill & Melinda Gates Foundation (BMGF), has increased in recent years (Alston *et al*., 2020). From 1978 to 2018, USAID has invested over US$3 billion in agricultural development through Innovation Labs (Dalton and Fuglie, submitted). The majority of this investment has gone into plant genetic and agronomic improvement of cereals, legumes and horticultural crops. In the past eight years, the investment has increased dramatically through the USAID Feed the Future program, in reaction to the severe price spikes and food price shocks starting in 2008 which have continued to present. These investments clearly demonstrate the demand for genetic innovation R&D with a specific focus on delivering genetic gains to smallholder farmers on a broad scale.

In 2020, the five donors (ACIAR, BMGF, GIZ, UKAID, USAID) of the "Crops to End Hunger" initiative expressed six requests in their support to modernize CGIAR breeding programs and networks to ensure that they deliver the highest possible rate of genetic gains in farmers' fields, in the form of nutritious, climate-resilient, market-demanded cultivars (EiB, 2020):

1. Develop pipeline investment cases.
2. Incentivize management and staff to deliver higher genetic gain.
3. Develop strategic plans for delivery to farmers and varietal turnover.
4. Quantitatively optimize pipelines to increase genetic gain.
5. Implement shared services.
6. Build NARES breeding networks and capacity.

Our Initiative directly contributes to five of these requests (1, 3, 4, 5 and 6) and indirectly to the second request by enhancing the accountability and assessing the impacts of GI, which can be used to incentivize management and staff. It was co-designed with the major demand partners (Accelerated Breeding and SeEdQUAL Initiatives within GI) and the NARES (a representative was included in the design team), the donors (USAID and BMGF representatives were included in the design team), non-CGIAR innovation partners (World Vegetable Center — WorldVeg, Cornell University and CIRAD). Regular review meetings were held with the Investment Advisory Group led by Maya Rajasekharan and Kevin Pixley. Finally, on September 15, our Initiative organized two CGIAR stakeholder consultation meetings during the GI Science Group Update Meeting.

2.7 Projection of benefits

The projections below transparently estimate reasonable orders of magnitude for impacts which could arise as a result of the impact pathways set out in the Initiative's theories of change. Initiatives contribute to these impact pathways, along with other partners and stakeholders.

For each Impact Area, projections consider breadth (numbers reached), depth (expected intensity of effect per unit) and probability (a qualitative judgement reflecting the overall degree of certainty or uncertainty that the impact pathway will lead to the projected order of magnitude of impact).

Projections will be updated during delivery to help inform iterative, evidence-driven, dynamic management by Initiatives as they maximize their potential contribution to impact. Projected benefits are not delivery targets, as impact lies beyond CGIAR's sphere of control or influence.

Impacts of genetic innovations materialize when improved varieties are adopted by smallholder farmers, including women. All Initiatives in the GI AA jointly contribute to more efficient and faster development, release, dissemination, and adoption of improved, in-demand varieties through common impact pathways. Besides producing and delivering better quality seed to target beneficiaries in priority market segments, the proposed work aims at modernizing and transforming the GI system (Figure 1). Selected examples across all five Impact Areas show the aggregated projected benefits of all GI Initiatives working in collaboration and contributing at different stages along the impact pathways.
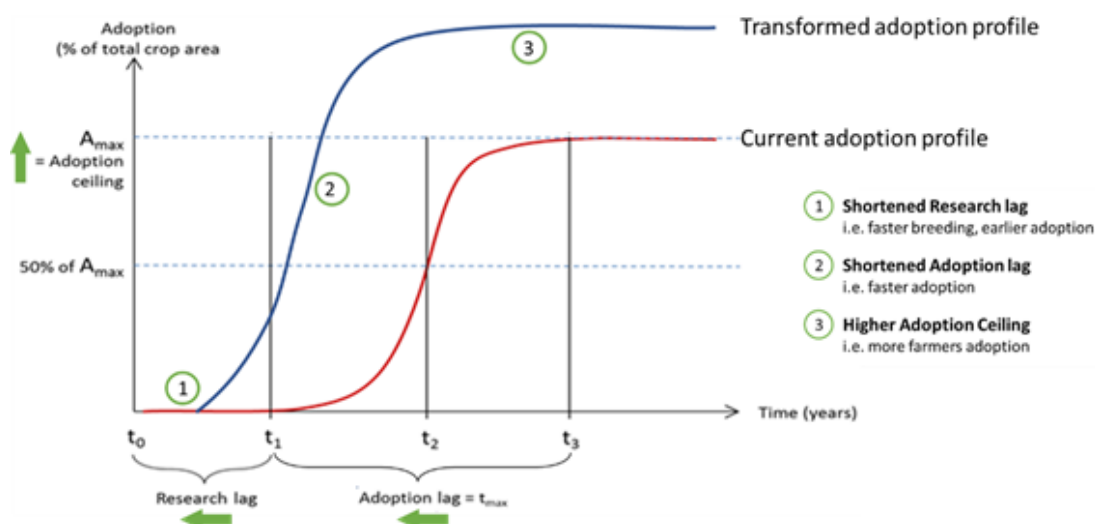

Figure 1. Impact of GI Initiatives on the adoption profile of genetic innovations

Market intelligence shortens the adoption lag and increases adoption levels as new varieties are targeted to specific market segments. This leads to faster and more complete replacement of existing varieties and accelerated varietal turnover. Investment in **genebanks** reduces the research lag by making germplasm available to breeding programs, reducing the search time and cost for traits. In addition, potentially game-changing traits are preserved and made accessible, thus elevating future impact levels. Development of improved varieties with producer/consumer-demanded traits improves livelihoods and food security. Modernized strategies and approaches **accelerate breeding**, thus reducing the research lag, and generating multiplier effects on the benefits from breeding and seed systems. Improved tools and services enable breeders to create more complex, multi-trait products that match desired product profiles. Modernizing **enabling tools and services** increases the speed of breeding, thus shortening the research lag and accelerating variety release. Efficient **seed delivery** accelerates and increases adoption as targeted products reach — even disadvantaged — farmers faster. Moreover, enabling access to high-quality, clean seed and planting material ensures the potential of genetic innovations are realized in farmers' fields.

Breadth	Depth	Probability
Impact Area: Nutrition, health & food security Impact Indicator: # of people benefiting from relevant CGIAR innovations		
Higher yielding Vit A rich cassava: 19.5 million people (3.9 million households) *Orange-flesh sweetpotato*: 14.8 million people (3.1 million households) **TOTAL: > 23.1 million people (> 4.7 million households)**	**Significant**: 10% permanent impact on income; some DALYs saved.	**High certainty**: 50–80% expectation of achieving these impacts by 2030, at this point
Impact Area: Poverty reduction, livelihoods & jobs **Impact Indicator:** # of poor people benefiting from relevant CGIAR innovations		
Higher yielding rice: 12.3 million poor people (2.8 million poor households) *Stress tolerant maize*: 24.5 million poor people (5.2 million poor households) *Higher yielding wheat*: 10.0 million poor people (1.9 million poor households) **TOTAL: > 42.6 million poor people (> 9.0 million poor households)**	**Significant** 10% permanent impact on income	**High certainty**: 50–80% expectation of achieving these impacts by 2030, at this point
Impact Area: Gender equality, youth & social inclusion Impact Indicator: # of women benefiting from relevant CGIAR innovations		
High yielding fast cooking Beans: 1.8 million women producers > 3.4 million women in adopting households *Orange-flesh sweetpotato*: 1.5 million women producers **TOTAL: > 2.5 million women producers** **> 3.4 million women/girls in all adopting households**	**Significant**: 10% permanent impact on income	**High certainty**: 50–80% expectation of achieving these impacts by 2030, at this point
Impact Area: Climate adaptation & mitigation Impact Indicator: # of people benefiting from climate-adapted innovations		
Stress tolerant maize: 69.9 million people (14.7 million households)	**Significant**: 10% permanent impact on income	**High certainty**: 50–80% expectation of achieving these impacts by 2030, at this point
Impact Area: Environmental health & biodiversity Impact Indicator: # of plant genetic accessions available and safely duplicated		
Aggregate increase to 2030: 15% (70,000 additional accessions become available)	Not required for this indicator	**Very high certainty**: >80% expectation of achieving these impacts by 2030, at this point in the design process

1. Nutrition, health, and food security

# of People benefiting from relevant CGIAR innovations: Vitamin A deficiency is a major disease affecting 48% of children aged 6–59 months in sub-Saharan Africa (Stevens *et al.*, 2015). We project that the nutrition, health and food security status of about 23.1 million people (i.e., 4.7 million households) in 16 sub-Saharan Africa countries will improve significantly through the adoption of yellow cassava varieties with high β-carotene (precursor of Vitamin A) content and high dry matter, and orange-flesh sweetpotatoes (OFSP) with high β-carotene and improved productivity (details in Annex). Benefits for adopting households arise through increased production, consumption, and sale of crops with higher nutritional value that increase diet quality. The number of beneficiaries is projected using crop/country specific adoption profiles based on past evidence and expert estimates, secondary data on national crop production area (narrowed down to target domains), average household size, and crop area per household. We did not include benefits arising for end-consumers when they buy biofortified crops. The combined total number of beneficiaries accounts for an estimated 80% overlap (households growing both cassava and sweetpotatoes) in eight countries included in both projections. Projected impact is in the lower bound of high certainty, since dissemination and adoption of the varieties may be challenged by available seed systems and face market constraints in some countries.

2. Poverty reduction, livelihoods, and jobs

# of Poor people benefiting from relevant CGIAR innovations: By enabling poor smallholder households to achieve higher yields and hence "living income", adoption of improved varieties of rice, wheat and maize is expected to significantly benefit 42.6 million poor people (9 million poor households) by 2030 (details in Annex). While the GI Initiatives have identified 12 priority crops for breeding, only three innovations (higher yielding rice in South and Southeast Asia (Kumar *et al.*, 2021); high yielding wheat in South Asia (Juliana *et al.*, 2020; Crespo-Herrera *et al.*, 2017); and stress-tolerant maize in sub-Saharan Africa (Cairns and Prasanna, 2018; Prasanna *et al.*, 2021)) are included in the projection. These varieties are at an advanced stage, almost ready to be released and benefits are expected to materialize soon and with high certainty. The number of poor people benefiting is estimated by multiplying the projected number of adopters by 2030 in each country with the poverty headcount ratio at national poverty lines (World Development Indicators, most recent year available). To avoid double-counting in the projected total number of beneficiaries, we accounted for the overlap, especially in the Indo-Gangetic Plain, where households frequently grow both rice and wheat (Bhatt *et al.*, 2016), by reducing numbers accordingly (based on Ladha *et al.*, 2003; Timsina and Connor 2001).

3. Gender equality, youth, and social inclusion

# of Women benefiting from relevant CGIAR innovations: While approximately half of all beneficiaries of improved varieties are women, the GI Initiatives focus on crops/traits explicitly aiming at improving women's livelihoods. Two examples are bean varieties with increased yield and reduced cooking time (Katungi *et al.*, 2018; Letaa *et al.*, 2020), and OFSP (Mudege *et al.*, 2017). Women are benefiting from these varieties through three different impact pathways: (i) increase of income if grown as women's cash crops; (ii) fast cooking (targeted 30% reduction) benefits for women by freeing up time, since collection of firewood and meal preparation are mostly conducted by women; and (iii) health benefits for women and youth consumers. For our benefit projection, we focus on (i) and (ii) and follow the general steps outlined for indicators above, and then compute the share of women producers among all adopters (details in Annex). For the "time saving" benefit, we assume one woman/girl benefits per adopting household. Since most households in sub-Saharan Africa cultivate several crops, we use an 80% overlap for countries included in both crop projections. We project that at least 2.5 million women producers and 3.4 million women/girls in adopting households will benefit significantly and with high certainty from these two crops in the included 17 countries alone.

4. Climate adaptation and mitigation

# of People benefiting from climate-adapted innovations: The projection of beneficiaries from climate-adapted innovations is derived from the number of farmers in sub-Saharan Africa adopting maize varieties tolerant to abiotic stress (details in Annex). Droughts have become an almost regular occurrence in sub-Saharan Africa, severely reducing yields of many crops (Ray *et al*., 2015). Maize is an important staple crop in the region and the new drought and heat resistant varieties (Cairns and Prasanna, 2018; Prasanna *et al*., 2021) achieve 20% higher yields under drought conditions (Setimela *et al*., 2017). This effect is on the upper end of the "significant" depth criteria in terms of percentage permanent increase in income. We assume an s-shaped logistic adoption function and use country-level rates of current adoption of improved varieties as adoption ceilings (Krishna *et al*., 2021), in some cased adjusted upward thanks to significant recent donor investment in the seed sector in target countries. With first adoption by farmers expected in 2022 and an estimated 10-year period to maximum adoption, we project that by 2030 about 14.7 million households across the target domain will be adopting these improved varieties. This translates to at least 69.9 million people benefiting from this climate-adapted innovation over the next nine years.

5. Environmental health and biodiversity

# of Plant genetic accessions available and safely duplicated: CGIAR have an obligation to conserve and make available crop collections under their management, according to the provisions of the Plant Treaty. Making accessions available for international distribution requires germplasm to have acceptable viability, be free of quarantinable diseases, with adequate stock, and legally available. In 2020, CGIAR genebanks were managing a total collection of 592,257 crop and forage accessions* (with 79% available for international distribution). By 2030 CGIAR genebanks will achieve (and maintain) 90% availability (i.e., an additional 70,000 accessions becoming available -se details in Annex).** The genebanks will process backlogs (e.g., health testing and cleaning, seed regeneration, verifying trueness-to-type, etc.) to reach this performance target.*** Achieving and maintaining 90% availability enables genebanks to operate at a steady, efficient state, making them eligible for endowment funding, as well as ensuring users have access to germplasm. The effects of the pandemic and examples such as CGIAR's evacuation from Syria illustrate the importance of sustaining performance targets (Westengen et al., 2020).
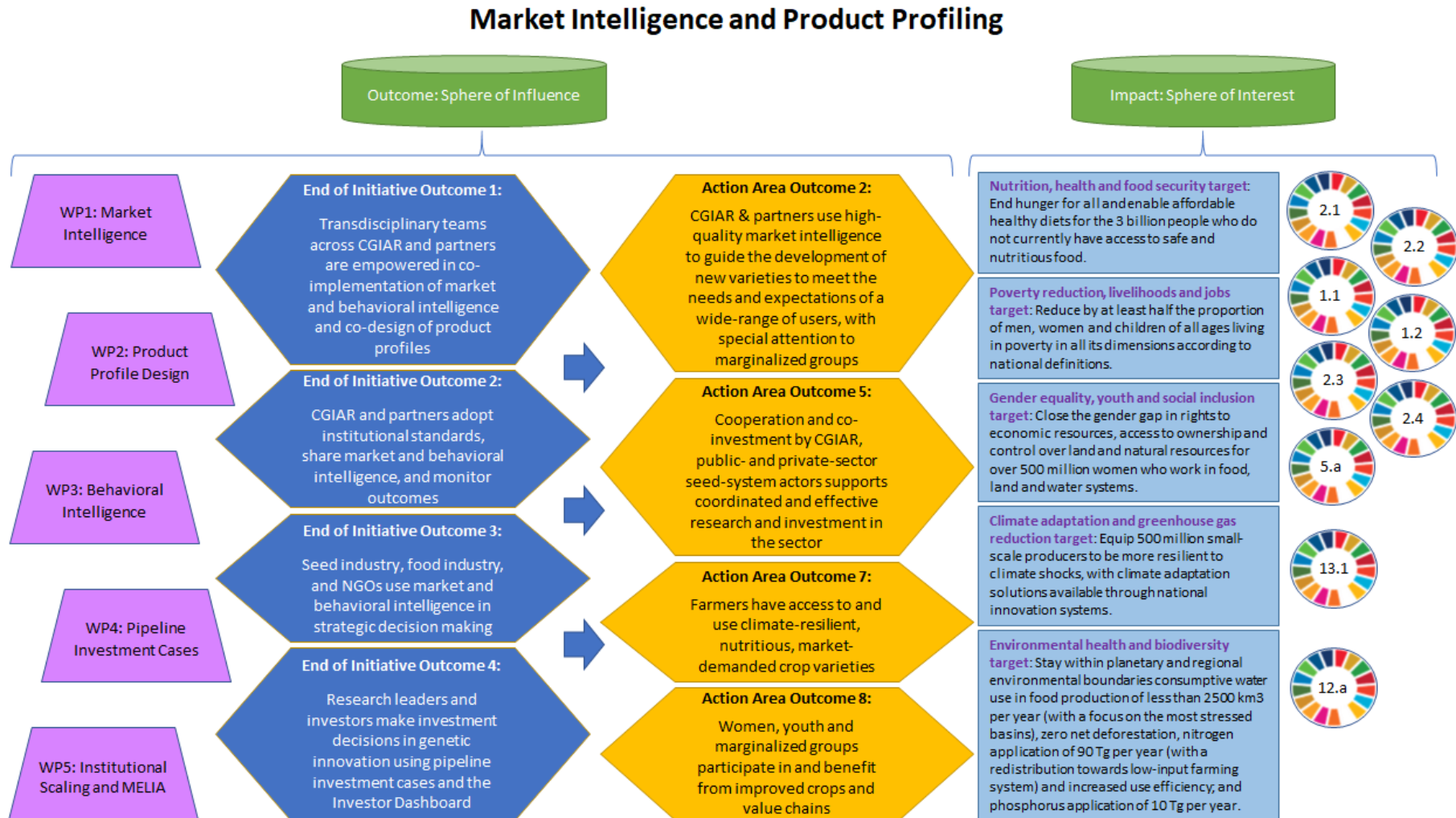
* Not including ICRISAT and CIFOR-ICRAF.
** Progress is monitored through an online reporting tool (managed by the Global Crop Diversity Trust), and reported in the annual Genebank Platform reports.
*** 2020 Genebank Platform Annual Report, pp20–21. https://www.genebanks.org/wp-content/uploads/2021/06/2020-Genebank-Platform-Annual-Report.pdf

3. Research plans and associated theories of change (TOC)

3.1 Full Initiative TOC

3.1.1 Full Initiative TOC diagram

Market Intelligence and Product Profiling

Outcome: Sphere of Influence

Impact: Sphere of Interest

WP1: Market Intelligence

WP2: Product Profile Design

WP3: Behavioral Intelligence

WP4: Pipeline Investment Cases

WP5: Institutional Scaling and MELIA

End of Initiative Outcome 1: Transdisciplinary teams across CGIAR and partners are empowered in co-implementation of market and behavioral intelligence and co-design of product profiles

End of Initiative Outcome 2: CGIAR and partners adopt institutional standards, share market and behavioral intelligence, and monitor outcomes

End of Initiative Outcome 3: Seed industry, food industry, and NGOs use market and behavioral intelligence in strategic decision making

End of Initiative Outcome 4: Research leaders and investors make investment decisions in genetic innovation using pipeline investment cases and the Investor Dashboard

Action Area Outcome 2: CGIAR & partners use high-quality market intelligence to guide the development of new varieties to meet the needs and expectations of a wide-range of users, with special attention to marginalized groups

Action Area Outcome 5: Cooperation and co-investment by CGIAR, public- and private-sector seed-system actors supports coordinated and effective research and investment in the sector

Action Area Outcome 7: Farmers have access to and use climate-resilient, nutritious, market-demanded crop varieties

Action Area Outcome 8: Women, youth and marginalized groups participate in and benefit from improved crops and value chains

Nutrition, health and food security target: End hunger for all and enable affordable healthy diets for the 3 billion people who do not currently have access to safe and nutritious food.

Poverty reduction, livelihoods and jobs target: Reduce by at least half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.

Gender equality, youth and social inclusion target: Close the gender gap in rights to economic resources, access to ownership and control over land and natural resources for over 500 million women who work in food, land and water systems.

Climate adaptation and greenhouse gas reduction target: Equip 500 million small-scale producers to be more resilient to climate shocks, with climate adaptation solutions available through national innovation systems.

Environmental health and biodiversity target: Stay within planetary and regional environmental boundaries consumptive water use in food production of less than 2500 km3 per year (with a focus on the most stressed basins), zero net deforestation, nitrogen application of 90 Tg per year (with a redistribution towards low-input farming system) and increased use efficiency; and phosphorus application of 10 Tg per year.

2.1 2.2 1.1 1.2 2.3 2.4 5.a 13.1 12.a
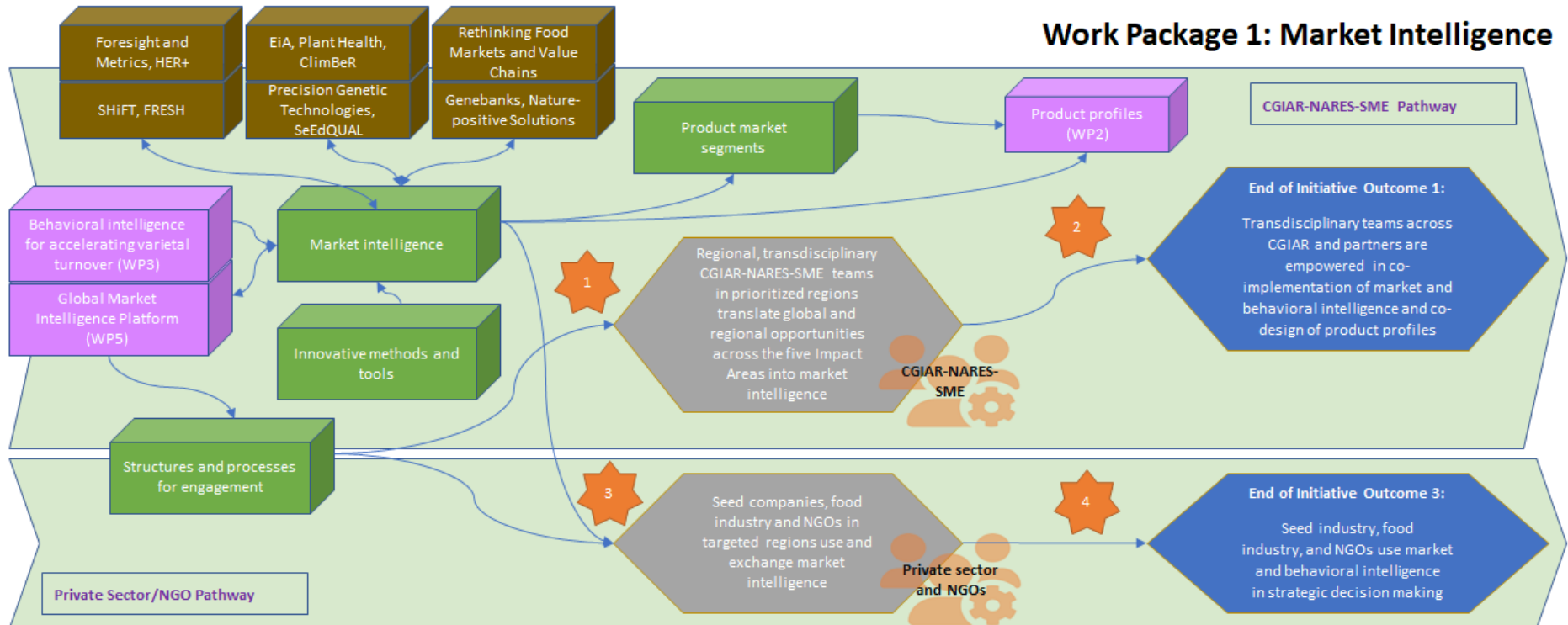
3.1.2 Full Initiative TOC narrative

Plant breeding has the potential to inclusively benefit the livelihoods of farmers and the nutrition and health of populations at large while supporting healthy ecosystems and minimizing greenhouse gas emissions. However, varietal turnover has been slow partly because products have not adequately met client requirements as investment decisions were mainly informed by supply-side considerations. Recently, donors and other organizations have recognized the need for market intelligence-driven product profiling, but efforts remain fragmented with limited involvement of social scientists and NARES and little attention to behavioral drivers of varietal replacement. Consequently, returns on investment in genetic innovation, although generally high, still tend to fall short of their potential.

Maximizing and diversifying genetic innovation systems' impacts across the five Impact Areas and ultimately across SDGs 1, 2, 5, 12 and 13 requires institutional innovation that (i) spurs CGIAR and partners to use high-quality market intelligence to guide the development of new varieties (AA Outcome 2); (ii) stimulates cooperation and co-investment by CGIAR, public- and private-sector seed-system actors (AA Outcome 5); and ultimately results in (iii) farmers having access to and using climate-resilient, nutritious, market-demanded crop varieties (AA Outcome 7); and (iv) women, youth and marginalized groups participating in and benefiting from improved crops and value chains (AA Outcome 8). To catalyze this institutional innovation, an Initiative is urgently needed that (i) empowers transdisciplinary teams across CGIAR and partners in the co-implementation of market and behavioral intelligence; (ii) encourages CGIAR and partners to adopt institutional standards in the co-design of product profiles, the sharing of market and behavioral intelligence, and monitoring of outcomes; (iii) supports strategic decision making by seed industry, food industry, and NGOs; and (iv) supports research leaders and investors in investment decision making. The Initiative proposes to achieve these outcomes through five Work Packages (WPs), four core innovations that are jointly developed with Accelerated Breeding, SeEdQUAL, N4ETTSS, Foresight and Metrics, Plant Health, and Digital Transformation Initiatives, and two toolkits.

Funding, a clear engagement process and a shared commitment towards increasing impacts of genetic innovation will enable the formation of regional, transdisciplinary CGIAR-NARES-SME teams that systematically convert global and regional challenges into regional impact opportunities for genetic innovation (WP1). Co-ownership generated through novel institutional standards and processes for co-design of product profiles among CGIAR and partners and social and biophysical scientists (WP2) and the demonstrative value of behavioral intelligence (WP3) will empower the teams in guiding breeders to refocus and restructure their pipelines and align them to the five Impact Areas (WP4). Clear visualization of returns on investment on the Investor Dashboard will empower research leaders and investors in resource allocation decision making and attract investment in genetic innovation (WP4). Active exchange of market intelligence through the Global Market Intelligence Platform, institutional capacity building through the Genetic Innovation for Impact (G×I) Learning Alliance, and active monitoring and demonstration of impacts will persuade CGIAR and partners to scale the adoption of institutional standards (WP5).

Achieving this institutional innovation will require strong financial support from donors seeking to increase returns on their investments, as well as strong engagement from CGIAR and public and private sector partners to jointly increase co-ownership and accountability of genetic innovation systems in their shared ambition of maximizing impacts across the five Impact Areas.

3.2 Work Package TOCs

Causal linkage #	Actor Type	Assumption
1	Research (CGIAR and partners)	Funding, a clear engagement process and a shared commitment towards increasing impacts of genetic innovation supports the formation of regional, transdisciplinary CGIAR-NARES-SME teams and collection of robust market intelligence.
2	Research (CGIAR and partners)	Demonstrated success of collaboration and a strong, shared vision empower transdisciplinary teams in co-implementation of market intelligence.
3	Private sector and NGOs	Through strong engagement and demonstration of the value of market intelligence, seed companies, food industry and NGOs are interested in exchanging market intelligence developed by the Initiative, as it can advance their business or development goals.
4	Private sector and NGOs	Through strong engagement and exchange of market intelligence, seed industry, food industry, and NGOs are convinced of its value in strategic decision making, as it can advance their business or development goals.

3.2.2 Work Package research plans and TOCs

Work Package title	**WP1: Market Intelligence**
Work Package main focus and prioritization	WP1 collects data to map global and regional challenges across the five Impact Areas and translates them into priorities and opportunities for GI by identifying stakeholders' current and future drivers of demand for crops, seed and traits, and variation of demand according to gender, age, and social groups: farmers (production systems, priorities, risks), agro-industry (production requirements, supplier engagement, by-products) and consumers (tastes, nutrition, costs, convenience). Collaborative engagement on methods and tool design will ensure comparability of results across crops and regions. WP1's outputs will provide critical inputs to WP2, WP3 and WP4, as well as various GI Initiatives.
Work Package geographic scope (Global/Region/Country)	Global and regional (see Section 2.4).

The science

Research questions	Scientific methods	Key outputs
1. Building common framework: What concepts, methods, and tools are most suitable for the collection of market intelligence?	Transdisciplinary tool design working group Literature review of published work by CGIAR, NARES, universities, NGOs, and others, covering existing concepts, methods and tools.	**Innovative methods and tools** for (i) identification and description of product market segments; (ii) gender disaggregated assessment of needs and preferences for traits (and the underlying factors that shape these*) for gender-intentional product profile design; and (iii) prioritization of product market segments across regions and crops according to potential to advance the five impact goals. New **structures and processes for engagement** on co-implementation of market intelligence: regional, transdisciplinary (see Section 9.1) CGIAR-NARES-SME teams formed that include experts from WorldVeg, Cornell University, Innovative Genomics Institute (UC, Berkeley), Flinders University and CIRAD. Systematic incorporation of market intelligence in **Global Market Intelligence Platform**.
2. Mapping future impact potentials to inform prioritization: What are the current and future global and regional challenges that can be converted into opportunities where CGIAR breeding programs are best placed (e.g., where are viable seed systems in place facilitating delivery of breeding products) to contribute to the five Impact Areas? Where are other Initiatives best placed?	Joint strategic foresight analysis with Foresight and Metrics to anticipate a range of possible future scenarios and impact potentials (Glover *et al*, 2021; Miller and Poli, 2010), in collaboration with other Initiatives: Plant Health, HER+, SHiFT, FRESH, ClimBeR, and EiA. This will include analysis of trade-offs and synergies across future impact potentials. Crop modeling featuring IPCC AR6 climate projections in target population environments. Review of secondary data, expert consultations, key informant interviews, spatial analysis.	Foresight **market intelligence to inform market segmentation and prioritization**: Global and regional reports to inform priorities for product market segmentation, based on potential impact across the five Impact Areas.
3. Describing prioritized product market segments: Within	Farmer/consumer surveys, GIS and spatial analysis tools, key	**Product market segments**: set of maps, articles, and reports that

prioritized product market segments, what are current and future trait preferences (trait type and threshold of improvement) of farmers, agro-industry and consumers (by gender, social groups, income groups)?	informant interviews, participatory techniques, choice experiments, gender analysis and secondary information. Evaluation of psychological drivers of key stakeholders: perceptions, attitudes and beliefs, motivation, and learning. Joint research with SHiFT, Excellence in Agronomy, and Plant Health Initiatives, to inform crop/trait priorities.	describe prioritized product market segments. **Market intelligence for design of gender-intentional product profiles**: robust and comparable analysis on current and future trait needs and preferences in regional reports, articles, and discussion briefs.
4. Characterizing varietal demand: What are smallholders' and consumers' preferred varieties (by gender and social group) and how accessible are these in terms of price and availability?	Rapid survey techniques, field experiments, experimental auctions, participatory tools/games to assess gender disaggregated trait preferences, trade-offs among them, and demand for improved varieties, supported by genotype-based varietal monitoring data from SeEdQUAL and IMAGE. Participatory workshops with breeders, seed companies, NARES, CGIAR breeding teams, and food industry representatives. Demand analysis for Precision Genetic Technologies to anticipate acceptability in sub-national markets, export, organic and traditional markets, as well as impact on gender.	**Market intelligence for design of seed system strategies**: regional and crop specific bulletins, reports and articles on demand and supply for seed.

* These could include livelihood strategies, risk preferences, farming practices (and access to inputs), time preferences, and constructs that may relate to gender (e.g., bargaining power) which might strongly differ between men and women.

The theory of change

Market intelligence used by CGIAR-NARES breeding programs is limited, fragmented and commodity-specific. Moreover, needs of women, indigenous people and minority groups are typically not properly captured. The RICE and RTB CRPs and related bilateral projects (e.g., AGGRi Alliance, AGG, RTBfoods, HarvestPlus) have collected market intelligence, but this has not yet been incorporated in EiB's current set of product market segments, which reflect current crop environments and need to be prioritized and refined through alignment with value chains and end-markets.
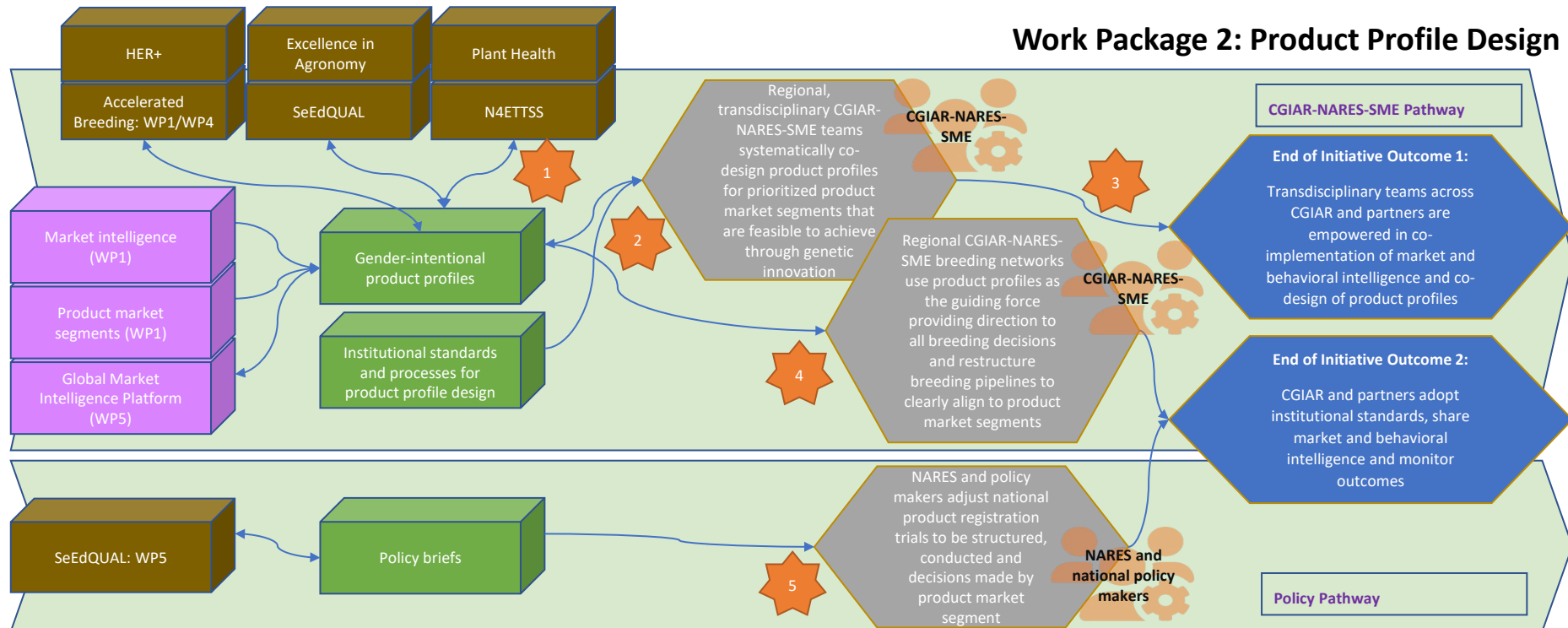
In order to contribute to EoI Outcomes 1 and 3, and eventually to AA Outcomes 2, 5, 7 and 8, WP1 needs to initiate an institutional change process by building regional, transdisciplinary CGIAR-NARES-SME teams. Strong engagement through a shared vision of increasing the impact of GI through the co-implementation of market intelligence, combined with funding for addressing intelligence gaps, will align CGIAR and partners' interests and persuade them to build transdisciplinary teams that (i) map current and future global and regional challenges; (ii) translate them into regional opportunities; and (iii) generate the fundamental building blocks of market intelligence that need to be incorporated in gender-intentional product profiles (WP2) and pipeline investment cases (WP4) to capture these opportunities and generate a well-balanced portfolio of impacts across the five Impact Areas. A shared ambition to consolidate and exchange forward-looking information through a novel platform will encourage WP1, WP5, Foresight and Metrics, and Digital Transformation to jointly develop the Global Market Intelligence Platform and monitor its scaling through an Innovation Packages and Scaling Readiness Plan (Section 4). Scaling will be triggered by active demand for market intelligence by demand partners such as GI and other Initiatives (e.g., Accelerated Breeding, SeEdQUAL, Genebanks, Plant Health, Rethinking Food Markets and Value Chains, Excellence in Agronomy, Nature-Positive Solutions, etc.), NARES and public and private sector partners

seeking to improve their strategies and advance their business or development goals through better market intelligence.

For each region where activity will take place, a regional team comprised of specialists from CGIAR and partners will be formed that is able to engage across crops. Experts from a range of disciplines will be brought together, including social science (gender specialists, economists, consumer and marketing specialists), GIS specialists and climate change experts, agronomists, breeders, among others (e.g., plant pathologists, entomologists, human nutrition scientists) to design shared methods for implementation across regions and crops. Attention will be given to variations in context across crops and regions (e.g., perishability of seed, informal/formal nature of marketing systems, different drivers of product and seed demand, to include consumers, millers, governments and seed companies). The team will engage extensively across all WPs. The regional team building approach is critical to ensure comparability across crops and allow for efficient use of the scarce human resources available for this type of work, which is a first in CGIAR.

At the end of the Initiative, WP1 will achieve the following two outcomes: (i) Regional, transdisciplinary CGIAR-NARES-SME teams in prioritized regions translate global and regional opportunities across the five Impact Areas into market intelligence; (ii) seed companies, food industry and NGOs in targeted regions use and exchange market intelligence. Achieving these outcomes will require strong engagement from partners and a common vision of increasing the impact of genetic innovation systems across the five Impact Areas.

Boxes (top): HER+, Excellence in Agronomy, Plant Health, Accelerated Breeding: WP1/WP4, SeEdQUAL, N4ETTSS

Boxes (left, purple): Market intelligence (WP1), Product market segments (WP1), Global Market Intelligence Platform (WP5)

Green boxes: Gender-intentional product profiles; Institutional standards and processes for product profile design

Box (lower left): SeEdQUAL: WP5 → Policy briefs

Hexagon (grey): Regional, transdisciplinary CGIAR-NARES-SME teams systematically co-design product profiles for prioritized product market segments that are feasible to achieve through genetic innovation — CGIAR-NARES-SME

Hexagon (grey): Regional CGIAR-NARES-SME breeding networks use product profiles as the guiding force providing direction to all breeding decisions and restructure breeding pipelines to clearly align to product market segments — CGIAR-NARES-SME

Hexagon (grey): NARES and policy makers adjust national product registration trials to be structured, conducted and decisions made by product market segment — NARES and national policy makers

CGIAR-NARES-SME Pathway

End of Initiative Outcome 1: Transdisciplinary teams across CGIAR and partners are empowered in co-implementation of market and behavioral intelligence and co-design of product profiles

End of Initiative Outcome 2: CGIAR and partners adopt institutional standards, share market and behavioral intelligence and monitor outcomes

Policy Pathway

Causal linkage #	Actor Type	Assumption
1	Research (CGIAR and partners)	Strong engagement and demonstration of the value of product profiles persuades N4ETTSS Initiative to guide efforts to build phenotyping capacity for the key traits identified in the product profiles and to develop assays to translate characteristics to traits.
2	Research (CGIAR and partners)	Funding, a clear engagement process, institutional standards and processes, and a shared commitment towards increasing impacts of genetic innovation encourages the formation of regional, transdisciplinary CGIAR-NARES-SME teams in the co-design of product profiles.
3	Research (CGIAR and partners)	Demonstrated success of collaboration empowers transdisciplinary teams in in co-implementation of market intelligence co-design of product profiles.
4	Research (CGIAR and partners)	Through strong engagement between social and biophysical scientists, regional CGIAR-NARES-SME breeding networks co-own and see the value of product profiles, which persuades them to use product profiles in breeding decisions.
5	NARES and national policy makers	Through strong engagement in collaboration with SeEdQUAL (WP5) and demonstration of the benefits of product market segmentation, NARES and policy makers are persuaded to adjust national product registration trials following product market segments.

Work Package title	**WP2: Product Profile Design**
Work Package main focus and prioritization	WP2 creates new generation gender-intentional product profiles using market intelligence from WP1. Representatives from WP1, WP3, Accelerated Breeding Initiative WP1, and regional CGIAR-NARES-SME teams of breeders, social scientists, food scientists, nutritionists, gender specialists, agronomists, climate specialists, and crop modelers are mobilized to (i) design a unique product profile for each product market segment which captures key traits, characteristics and minimum threshold trait improvements required by the farmer, processor and consumer, and descriptions of the market-leading varieties to replace; and (ii) provide data to enable priority setting for product market segments, breeding pipelines, trait discovery and phenotyping tool development.
Work Package geographic scope (Global/Region/Country)	The geographical scope of WP2 will be global for the crops in the One CGIAR portfolio. The current EiB approach has been at the One CGIAR region level and this effort has identified 350 unique product market segments. Initially it will be necessary to establish a basic product profile for each product market segment and then prioritize efforts to develop a complete product profile based on the regional and crop priorities established for One CGIAR.

The science

Research questions	Scientific methods	Key outputs
1. Building the collaborative basis for product profile design: What processes, structures and frameworks are needed to facilitate productive engagement between stakeholders to develop gender-intentional product profiles, especially the process of identifying and prioritizing the key traits to include in the product profile?	Regional transdisciplinary* CGIAR-NARES-SME team building and consensus building workshops to balance heterogeneous interests and opinions. Development of quantitative and qualitative indicators to assess transdisciplinary practice and empowerment through social network analysis: diversity of participants, whether and how integration and collaboration are occurring, the relative degrees of network stability and fragility and how the network is structured to achieve its goals (Steelman *et al.*, 2021). Review of the scales currently used to score traits across crops and to develop a recommendation to harmonize scales for traits across crops (e.g., Custodio et al., 2019). Formation of expert panels of individuals with experience and understanding in key areas to determine translation of key characteristics (e.g., nutritional, sensory and biophysical characteristics such as taste, mouthfeel, texture) to measurable traits (e.g., Aznan *et al.*, 2021).	Novel **institutional standards and processes for product profile design:** <u>1. Institutional standards</u>: A blueprint based on test case learnings for a process to develop gender-intentional product profiles that respects, captures, and equitably integrates the different backgrounds and viewpoints of experts and various stakeholders (e.g., NARES, farmers, value chain actors) while addressing trade-offs and costs. <u>2. Protocols and SOPs</u>: Determination of the traits responsible for the desired characteristic, description and cost estimation of the assays needed to measure them and recommendations for low-cost high throughput screening methods for these traits. <u>3. Technical standards</u>: Harmonized trait metrics for scoring traits. Reports documenting patterns of interactions to inform progress towards transdisciplinary practice and empowerment.
2. Designing gender-intentional product profiles and aligning them to product market segments and breeding pipelines: What are the ideal products** for each product market segment prioritized by WP1, and what changes are needed in	Expert elicitation, collective induction, group consensus building. Transdisciplinary regional teams translate market intelligence from WP1 into gender-intentional product profiles. WP2 coordinates with Accelerated Breeding WP1 to	**Gender-intentional product profiles**: Ideal product profile for each prioritized product market segment and alignment of prioritized product market segments to pipelines that consistently deliver products that meet variety registration

breeding pipelines to ensure the ideal products are developed?	determine the size and structure of breeding pipelines, the number of product market segments a breeding pipeline focuses on, assigning a tier of breeding effort to each product market segment and using a stage gate advancement process based on the gender-intentional product profile for each product market segment. Product profiles for Precision Genetic Technologies will also be aligned with gender-intentional breeding product profiles. Analysis of trade-offs and synergies across traits that target different Impact Areas.	requirements and meet/exceed women and men farmer and consumer expectations.
3. Identifying needed changes in the enabling environment: What changes are needed in national variety registration trials to recognize that each product market segment will require a different "product" with a unique set of key traits?	Review national seed variety registration trial protocols to verify whether product market segments are categories in the testing program; if not, transdisciplinary team develops proposal to run variety registration trial for each product market segment.	<u>Policy briefs</u>: Proposals to adjust national variety registration trials to be structured by product market segment.

* "*Transdisciplinarity integrates the natural, social and health sciences in a humanities context, and transcends their traditional boundaries*" ([Choi and Pak, 2006](#)). Transdisciplinary teams include experts from breeding, seed systems, plant health, social science, gender, agronomy, nutrition and food science, geospatial science, climate change, environmental science, etc. (see Section 9.1).
** Based on the detailed descriptions of prioritized product market segments (output from WP1).
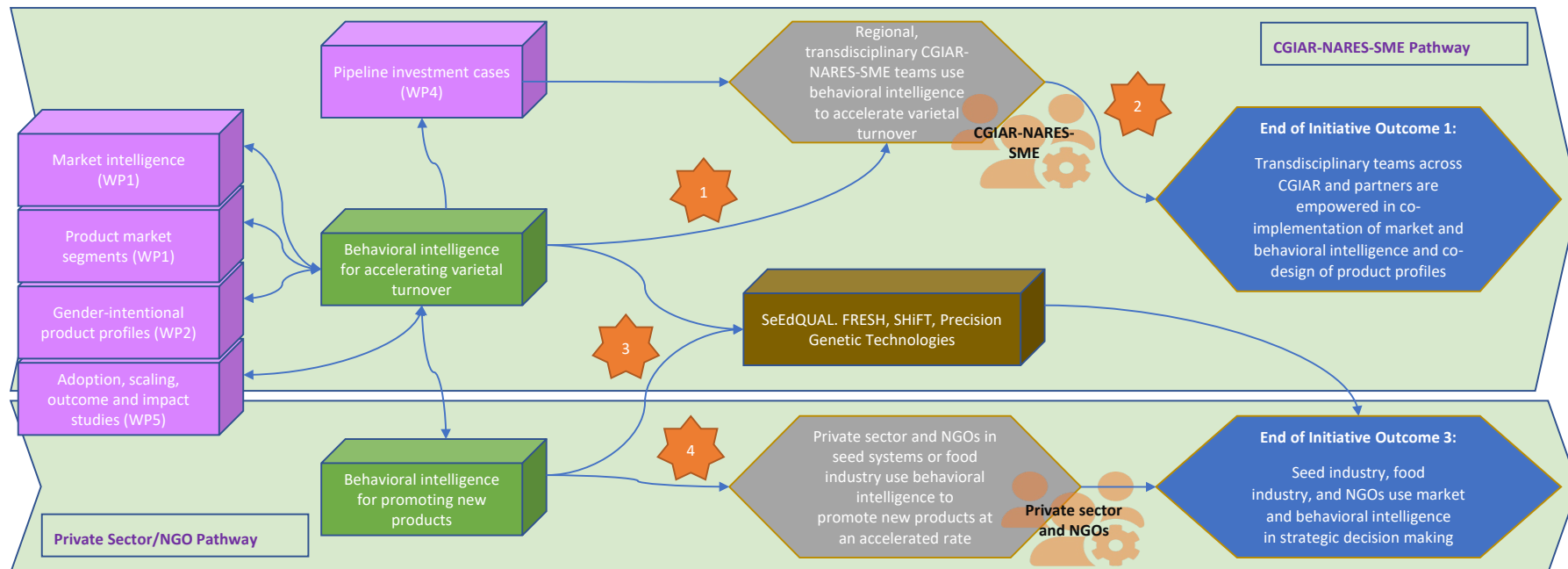
The theory of change

The use of product profiles to define breeding targets in CGIAR-NARES breeding programs is limited. Existing product profiles focus on replacing existing crop varieties with higher-yielding varieties with little consideration of other aspects that could contribute to social impact such as gender equality, opportunities for youth, social inclusion, climate adaptation and mitigation, and reduction of environmental footprint.

To achieve the institutional change reflected in EoI Outcomes 1 and 2, WP2 will co-develop institutional standards and processes with Accelerated Breeding and Plant Health to establish co-ownership of data collection and market segmentation starting in WP1, and initiate co-design of gender-intentional product profiles among CGIAR and NARES and social and biophysical scientists. The scaling strategy for this institutional innovation will be developed and monitored through an Innovation Package and Scaling Readiness Plan (Section 4). Aligned by a shared interest in increasing the impact of genetic innovation and supported by funding, regional CGIAR-NARES-SME teams of social scientists, economists, gender specialists, plant breeders, food scientists, nutritionists, etc. will incorporate the building blocks of market intelligence from WP1 into a gender-intentional product profile for each product market segment by identifying and prioritizing key traits in each product profile in an inclusive, transparent, and equitable way. With the aim of maximizing future impacts, SeEdQUAL will provide information on traits relevant to seed production and multiplication and traits required for the variety registration process. To align demand with supply, Accelerated Breeding Initiative's WP1 will assess the feasibility of creating the product defined by the product profile and will update each product profile as needed. If genetic variability in elite germplasm is not adequate, Accelerated Breeding's WP4 will determine if the needed traits are present in genebanks, and the investment and timeline required to get the traits into elite germplasm. Technical support will be required from the Network 4 Enabling Tools, Technologies, and Shared Services (N4ETTSS) Initiative to convert required "characteristics" into measurable

traits. WP4 will use gender-intentional product profiles to cross check the alignment of pipelines to product market segments and to generate pipeline investment cases.

Research conducted by WP2 will focus on three areas: (i) institutional standards; (ii) gender-intentional product profile design; and (iii) enabling environment (see table). Through a clear engagement process backed by funding, a shared commitment towards increasing impacts of genetic innovation, and jointly developed institutional standards and processes for increasing co-ownership, regional, transdisciplinary CGIAR-NARES-SME teams will be formed and empowered in co-design of gender-intentional product profiles (EoI Outcome 1). Through direct involvement of breeders and other biophysical scientists (e.g., plant health) in the design of product profiles, a sense of co-ownership of the potential impacts of future varieties is generated, which encourages breeding networks to use product profiles as the guiding force for breeding decisions and align breeding pipelines to product market segments. Through strong engagement with SeEdQUAL (WP5) and demonstration of the benefits of product market segmentation, NARES and policy makers become aware of the value of adjusting national product registration trials following product market segments and implement these changes in the policies. These outcomes will contribute to AA Outcomes 2, 5, 7 and 8 and achieving them will crucially hinge on a strong willingness from partners to make product profile design more inclusive, motivated by their ambition to increase and diversify impacts of genetic innovation across the five Impact Areas.

Work Package 3: Behavioral Intelligence

Pipeline investment cases (WP4)

Market intelligence (WP1)

Product market segments (WP1)

Gender-intentional product profiles (WP2)

Adoption, scaling, outcome and impact studies (WP5)

Behavioral intelligence for accelerating varietal turnover

Behavioral intelligence for promoting new products

Private Sector/NGO Pathway

CGIAR-NARES-SME Pathway

Regional, transdisciplinary CGIAR-NARES-SME teams use behavioral intelligence to accelerate varietal turnover

CGIAR-NARES-SME

SeEdQUAL. FRESH, SHiFT, Precision Genetic Technologies

Private sector and NGOs in seed systems or food industry use behavioral intelligence to promote new products at an accelerated rate

Private sector and NGOs

End of Initiative Outcome 1: Transdisciplinary teams across CGIAR and partners are empowered in co-implementation of market and behavioral intelligence and co-design of product profiles

End of Initiative Outcome 3: Seed industry, food industry, and NGOs use market and behavioral intelligence in strategic decision making

Causal linkage #	Actor Type	Assumption
1	Research (CGIAR and partners)	Through strong engagement in the design of behavioral research, regional, transdisciplinary CGIAR-NARES-SME teams co-own behavioral intelligence and the value of the latter persuades them to use it in their strategies to accelerate varietal turnover.
2	Research (CGIAR and partners)	The use of behavioral intelligence has such demonstrative value that it empowers transdisciplinary teams across CGIAR and partners in co-implementation of market and behavioral intelligence and co-design of product profiles.
3	Research (CGIAR and partners)	Behavioral intelligence for accelerating varietal turnover and promoting new products has such demonstrative value that it persuades other CGIAR Initiatives to use it in scaling of new varieties and products.
4	Private sector and NGOs	Behavioral intelligence for promoting new products helps private sector and NGOs demonstrate value-for-money and increase investments in accelerating varietal turnover.

Work Package title	**WP3: Behavioral Intelligence**
Work Package main focus and prioritization	WP3 generates intelligence on what drives farmers, consumers and private-sector decisions to adopt new varieties and related products, and will support other Initiatives in identifying cost-effective and inclusive strategies for accelerating varietal up-take and turnover. Through behavioral experiments, WP3 will generate actionable evidence on how to (i) influence consumers' and farmers' variety replacement and product substitution decisions, and (ii) encourage the private sector to invest in marketing new varieties and products that contribute to gender equality, healthier diets, and social inclusion. Behavioral intelligence will also inform WP4 of costs required to achieve these desired levels of varietal turnover in targeted market segments.
Work Package geographic scope (Global/Region/Country)	Regional (see Section 2.4).

The science

Research questions	Scientific methods	Key outputs
1. Providing behavioral intelligence for accelerating varietal turnover: What triggers women and men farmers and consumers to switch to a new variety or related product? What are the implications for strategies aimed at steering women and men farmers and consumers towards newer products? How cost-effective and equitable are these approaches? What are the trade-offs and synergies between Impact Areas?	Field experiments, randomized trials and A/B testing of various strategies. Experimental methods will be used to estimate causal effects of alternative approaches, such as vouchers, other types of incentives, information, delivery methods, trial packs/products, and behavioral nudges. Qualitative work (e.g., in-depth interviews, ethnographic observations, focus group discussions, key informant interviews, semi-structured interviews) will help understand how the strategies employed in the experiments do (not) influence behavior. Close collaboration with SeEdQUAL and IMAGE to identify factors of adoption and disadoption of improved varieties.	**Behavioral Intelligence Briefs**, published regularly, which provide actionable multi-country, multi-commodity and gendered evidence on how to influence variety replacement and product substitution for different market segments in a cost-effective and inclusive manner. Segments and commodities will be aligned with the primary market segments and gender-intentional product profiles developed in WP1 and WP2, and leverage existing partnerships, e.g., NL-CGIAR research program for seed systems development, ISSD Africa, RICE, STMA, HarvestPlus.
2. Providing behavioral intelligence for promoting new products: What approaches and tools are most effective for private sector actors (e.g., seed businesses, processors, supermarkets) and NGOs to steer farmers and consumers towards newer products? What barriers and constraints prevent private sector actors and NGOs from implementing these approaches and tools? To what extent do these approaches and tools bring gender equality and inclusion and what are the trade-offs and synergies between Impact Areas?	Qualitative interviews with private sector actors and NGOs aimed at understanding their business models and the risks and barriers that prevent them from promoting new varieties and products, and insights on how to overcome these barriers. Field experiments with alternative approaches to encourage private sector actors to start marketing new gender responsive varieties and related products at an accelerated rate.	**Case study briefs, blogs and workshops** to communicate evidence on prudent private business models and cost-effective and inclusive approaches for engaging private sector actors and NGOs to increase the rate at which they start promoting new varieties and products.
3. Synthesis and external validity: How do the findings from the experiments on accelerating varietal turnover and promoting new products vary across countries, product market segments and contexts? What drives this heterogeneity in cost-effectiveness and inclusivity (e.g.,	Meta-analysis or synthesis research linking differences in cost-effectiveness and inclusivity from experiments under research questions 1 and 2 to characteristics of farmers, consumers and the decision-making environment that differ across experiments,	**Peer-reviewed research articles and associated outreach products (blogs, podcast)** providing a synthesis of key findings, and insights on external validity. This will include an overview of how different factors interact with contextual features to shape cost-effectiveness and

market structure, competition, policy environment, access to services)?	complemented by rigorous qualitative research.	inclusivity of alternative approaches to accelerate varietal turnover and promote new products.

The theory of change

Better market intelligence (WP1) and product profiling (WP2) will not automatically result in improved turnover. Successful varietal replacement and product substitution will also require behavioral intelligence on how to influence farmers and consumers to start purchasing new products, and how to steer government, private sector and NGOs towards promoting new products and varieties through approaches such as awareness creation, choice engineering, nudging, and relaxing other demand-side constraints to adoption. WP3 therefore aims to unravel constraints to varietal uptake by generating behavioral intelligence on gender-equitable and socially inclusive approaches to accelerate turnover and promote new products.

Generating such behavioral intelligence will be informed by existing evidence on agricultural technology adoption, ongoing adoption studies within CGIAR and partners, and private sector market intelligence. Field experiments resulting in behavioral Intelligence Briefs and peer-reviewed research articles will generate insights on how to accelerate variety replacement by farmers and product substitution by consumers, whilst ensuring inclusion and gender equity. These insights will inform Regional, transdisciplinary CGIAR-NARES-SME teams, and help resource-constrained NARES develop capacity and attract resources to accelerate varietal turnover in a more cost-effective and inclusive manner (EoI Outcome 1).

Case studies and experiments co-implemented with governments, private sector and NGOs will provide insights on cost-effectiveness, inclusivity, profitability and barriers that prevent these actors from promoting new products. The behavioral intelligence generated through WP3 on how to accelerate turnover and promote new products, along with tools allowing stakeholders to generate such intelligence for their own settings, will be shared with other Initiatives (SeEdQUAL, SHiFT and FRESH) to scale demonstrated approaches (EoI Outcome 3) and ultimately enhance impacts of investments in genetic innovation.

Whereas WP1 and WP2 provide WP4 with the market intelligence and product profiles required for impactful breeding, WP3 will generate behavioral intelligence on what else — beyond traits — drives varietal turnover, and what strategies are needed for customers to adopt the proposed product profiles. This will inform pipeline investment (WP4) on how much it will cost to reach the desired level of varietal/product replacement/substitution in each product market segment for a targeted product profile, which is important in cost-benefit analyses of investment scenarios. Behavioral insights on varietal turnover in WP3 also inform impact assessment and capacity building in WP5; and WP3 experiments provide a structure for (quasi)-experimental ex-post impact evaluation (WP5).

At the end of the Initiative, behavioral intelligence generated through WP3 will inform the Regional, transdisciplinary CGIAR-NARES-SME teams and at least two other Initiatives on how to accelerate varietal turnover in a more cost-effective and inclusive manner, and at least three government, private sector or NGO actors will use behavioral intelligence from WP3 in their decision to change their approaches for promoting new varieties and products. Beyond the timeframe of the Initiative, this will result in increased variety replacement and product substitution by women and men farmers and consumers, increased profitability of private sector actors, improvements in the five CGIAR Impact Areas, and strengthened impacts of CGIAR breeding activities.

Work Package 4: Pipeline Investment Cases

Causal linkage #	Actor Type	Assumption
1	Research (CGIAR and partners)	Strong engagement with Accelerated Breeding and clear demonstration of the value of pipeline investment cases convince breeders to refocus and restructure their pipelines and align them to the five Impact Areas, driven by a shared interest in maximizing the impact of breeding programs.
2	Research (CGIAR and partners)	Demonstrated cases of CGIAR breeding programs refocusing and restructuring pipelines convince partners to adopt institutional standards.
3	Research leaders and investors	Strong engagement with end-users and clear visualization of returns on investment encourages research leaders and investors to use the Investor Dashboard in investment and resource allocation decision making in genetic innovations.
4	Research leaders and investors	Positive user experience with the Investor Dashboard motivates research leaders and investors to adjust their investment and resource allocation decision making in genetic innovation, motivated by a strong drive to increase returns on their investments.

Work Package title	**WP4: Pipeline Investment Cases**
Work Package main focus and prioritization	WP4 develops pipeline investment cases based on (i) product market segments identified by WP1; (ii) gender-intentional product profiles developed (WP2) for each product market segment; (iii) information from ABI WP1 on the alignment of pipelines to product market segments and pipeline investment; and (iv) behavioral intelligence from WP3. WP4 will describe the opportunity or potential impact in each product market segment and across the segments served by a pipeline and calculate metrics to determine the return on investment for each pipeline, developing recommendations for the prioritization of and level of investment in each pipeline. WP4 will publish pipeline investment cases to the Investor Dashboard.
Work Package geographic scope (Global/Region/Country)	Global (see Section 2.4). Most pipelines will be aligned to two or more product market segments. Product market segments can be developed at various "levels" for example by region, country, providence or by TPE. If a NARES team is identifying product market segments, the "region" would be their country. So, the pipeline investment case would be for one or more product market segments within the country based on the alignment of pipelines to product market segments. If CG in partnership with WP1 is identifying the product market segments, the region could be One CGIAR region.

The science

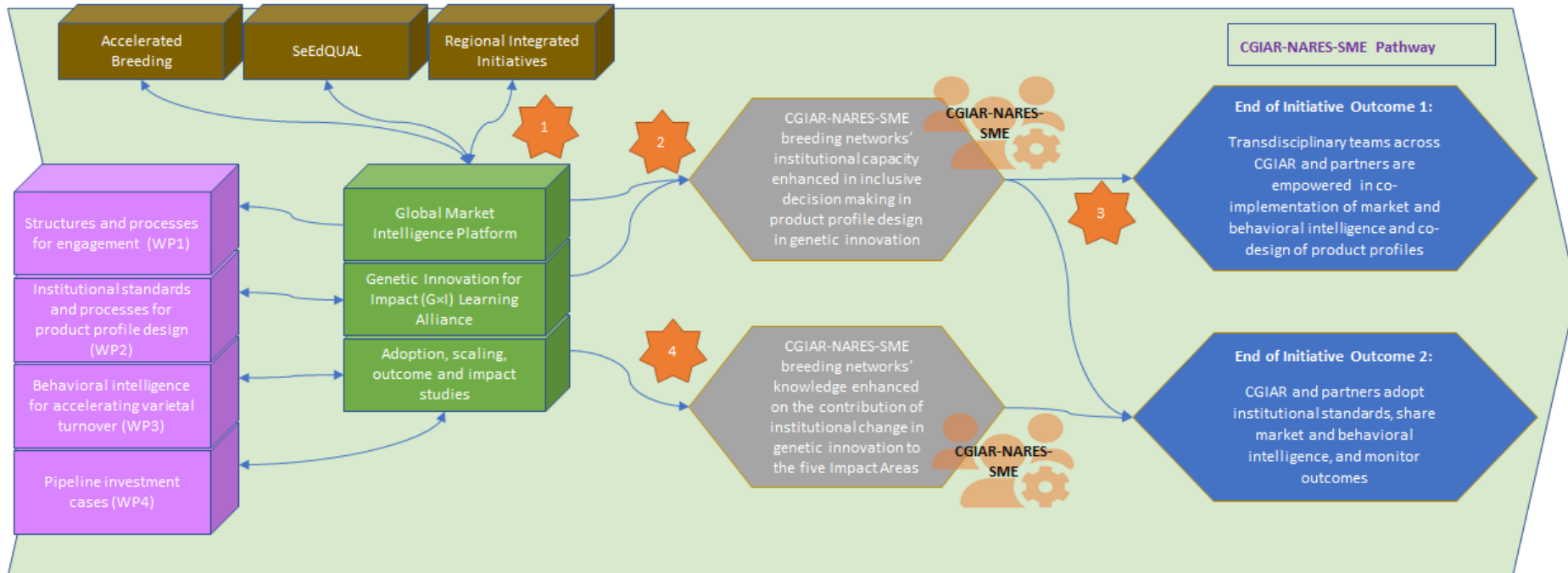| Research questions	Scientific methods	Key outputs
1. Advanced investment and cost analysis of breeding pipelines: What is the level of investment in each pipeline including all costs to run the pipeline but excluding trait discovery and development costs and seed system costs? What are the fixed and variable costs for each pipeline? What are the number of resources used by a pipeline and what is the regional cost of each resource using a workload ranking?	Investment and cost analysis, in collaboration with N4ETTSS Initiative	**Database** of breeding pipeline investments and costs in CGIAR and NARES: pipeline investment, fixed and variable costs, breakdown of resources used by pipeline and regional cost of each resource.
2. Supporting prioritization of breeding investments based on potential impact: Which pipelines have the greatest opportunity to contribute to the five Impact Areas in a given region, taking into account: market trends and marketing cost, farmer needs, gender gap elements, population growth, malnutrition epidemiology, and climate change? What are the trade-offs between Impact Areas and how do we compare and weigh them, e.g., between gender equality and productivity?	Benefit-cost analysis *Ex-ante* impact assessment Bio-economic modeling Explore options to align data provided by WP1 on product market segments from ABI WP1 on the alignment of pipelines to product market segments to estimate the contribution of each pipeline to the five CGIAR Impact Areas. Use outputs from WP3 to determine the potential varietal turnover and costs of marketing the varieties from a given pipeline. Return on Investment (ROI) analysis, disaggregated by crops, regions, gender, social groups, income groups, and Impact Areas. Close collaboration with SeEdQUAL and IMAGE to incorporate varietal adoption and turnover data into ROI analysis.	**Database** of impact by pipeline across the five CGIAR Impact Areas. **Pipeline investment cases** through regular (annual) pipeline prioritization and investment briefs. **Peer-reviewed research articles** showcasing evidence from case studies on prioritization of breeding pipelines. **Investor Dashboard:** Global online digital tool, co-developed with Digital Transformation and N4ETTSS Initiatives, to assist researcher leaders, and investors to visualize potential returns on investment across crops, product market segments, pipelines, and Impact Areas. **Case study briefs, blogs and workshops** to communicate evidence to researchers, research managers and investors
3. Supporting optimization of investments in breeding pipelines: What potential exists to increase the return on investment for some pipelines by investing	Portfolio analysis *Ex-ante* impact assessment Develop approaches to build scenarios of combinations of pipelines and levels of investment	**Database** that contains multiple scenarios and the impact of each scenario to use to develop pipeline investment recommendations. A second version of the database

more in fewer pipelines rather than investing in many pipelines at a less than ideal level of investment? How should end users' risk tolerance be applied to each pipeline?	and compare the impact of each scenario against the Impact Areas. Develop approaches to determine potential benefits and incorporate risk preferences within targeted product market segments.	that integrates risk preferences and recalculates the impact of each scenario to develop risk adjusted pipeline investment recommendations. **Pipeline investment cases** through regular (semi-annual) pipeline prioritization and investment briefs. **Peer-reviewed research articles** showcasing evidence from case studies on investment optimization of breeding pipelines.

The theory of change

Investment in CGIAR breeding pipelines has been supply-driven due to a lack of evidence on pipelines' returns on investment beyond productivity and food security. There is a need to demonstrate the impact of CGIAR pipeline investments on food security, poverty, gender equality, opportunities for youth, social inclusion, climate adaptation and mitigation and reduction of environmental footprint. EiB assembled the first round of pipeline investment cases covering 130 pipelines for 25 crops and 290 of 350 product market segments identified at the CGIAR region level. This effort identified the need to review the alignment of pipelines to product market segments, revise pipeline investment cases and understand the range of investment in pipelines. A tiered approach to explain and manage differences in the activity focused on each product market segment should be implemented. Standardizing increments of capacity and defining deliverables for each pipeline would be a huge step forward. The process to prioritize pipelines and to recommend investment in a pipeline must be inclusive, transparent, and equitable. Assessing the opportunity/impact of a pipeline requires expertise from social scientists, impact assessment economists, gender specialists, breeders, food scientists and nutritionists.

WP1 will identify product market segments and Accelerated Breeding Initiative's WP1 will provide information on the alignment of pipelines to product market segments and the investment in each pipeline. Using this information, combined with gender-intentional product profiles developed in WP2 and their marketability assessed in WP3, WP4 describes the opportunity/impact for each pipeline and calculates metrics on the ratio of investment to opportunity/impact for each pipeline. Using these metrics, WP4 will generate pipeline investment cases, develop recommendations for pipeline prioritization, recommend pipeline investment levels and publish this information to the Investor Dashboard, an innovation that will be co-developed with Digital Transformation and N4ETTSS and be monitored through an Innovation Package and Scaling Readiness Plan (Section 4). Strong engagement with end-users and clear visualization of returns on investment encourages research leaders and investors to use the Investor Dashboard in investment and resource allocation decision making and adjust their portfolios, motivated by a strong drive to increase returns on their investments. To achieve these outcomes, a research effort on pipeline investment will be initiated and focus on advanced investment and cost analysis of breeding pipelines and supporting investment prioritization and optimization (see table). This research will generate databases, investment briefs, peer-reviewed research articles, case study briefs, blogs and workshops.

The increased transparency on the impacts generated by genetic innovation and increased accountability and need to demonstrate impacts will encourage CGIAR-NARES-SME regional breeding networks to implement breeding pipelines for prioritized crops with a more focused structure and alignment to the five Impact Areas. These outcomes will contribute to AA Outcomes 2, 5, 7 and 8. Achieving these outcomes will require that the data collected in WP1, WP2 and WP3 are of sufficient quality and detail that they enable building credible pipeline investment cases that convince investors to maintain or increase their investments in genetic innovation.

Work Package 5: Institutional Scaling and MELIA

Causal linkage #	Actor Type	Assumption
1	Research (CGIAR and partners)	The user-friendliness and utility of the Global Market Intelligence Platform encourages scientists in Accelerated Breeding, SeEdQUAL and Regional Integrated Initiatives to actively seek and exchange market intelligence in decision making.
2	Research (CGIAR and partners)	Access to the Global Market Intelligence Platform and involvement in the Genetic Innovation for Impact (GxI) Learning Alliance provides CGIAR-NARES-SME breeding networks with the tools required for inclusive decision making in product profile design.
3	Research (CGIAR and partners)	Enhanced institutional capacity in inclusive decision making in product profile design empowers CGIAR-NARES-SME breeding networks in co-implementation of market and behavioral intelligence and co-design of product profiles, driven by a shared interest in maximizing the impact of breeding programs.
4	Research (CGIAR and partners)	Clear demonstration of impacts triggers the interest of CGIAR-NARES-SME breeding networks in enhancing their knowledge on the contribution of institutional change in genetic innovation to the five Impact Areas, driven by a shared interest in maximizing the impact of breeding programs.

Work Package title	**WP5: Institutional Scaling and MELIA**
Work Package main focus and prioritization	WP5 establishes a collaboration hub across GI Initiatives and partners to (i) develop scaling mechanisms for the adoption of institutional standards and processes in market segmentation and gender-intentional product profile design in genetic innovation systems in CGIAR-NARES-SME breeding networks; and (ii) conduct rigorous MELIA of the institutional genetic innovation systems' portfolio of impacts across the five Impact Areas (food security, nutrition, poverty, productivity/profitability, gender equity and climate/environmental footprint).
Work Package geographic scope (Global/Region/Country)	Global and regional (see Section 2.4).

The science

Research questions	Scientific methods	Key outputs
1. Institutional change: What are the key drivers and constraints (e.g., power relationships between social and biophysical scientists) and attitudes towards institutional change (adoption of institutional standards and processes developed in WP2) in product profile design in CGIAR-NARES-SME breeding networks?	Review of literature on institutional change and management. Role-playing games to facilitate social learning and collective action towards institutional change (e.g., Salvini *et al.*, 2016). Surveys including focus group discussions, and key informant interviews; data analyzed through multi-stage adoption models to identify key drivers and constraints of institutional adoption (e.g., Lenaerts *et al.*, 2021).	**Adoption studies** showcasing evidence from case studies on opportunities and constraints to institutional change in genetic innovation systems. **Case study briefs, blogs and workshops** showcasing innovative pathways to encourage the use of market intelligence information, taking into account the institutional context.
2. Scaling: Which scaling mechanisms can successfully promote institutional change? What is the comparative effectiveness of the new market intelligence-informed breeding and seed systems approach as compared to existing approaches?	Testing and validating scaling approaches (old/new) of institutional change in different contexts using both experimental and quasi-experimental approaches. Innovation Packages and Scaling Readiness approach to characterise the level of scaling readiness of the four Core Innovations: (i) Institutional Innovation; (ii) G×I Learning Alliance; (iii) Global Market Intelligence Platform; and (iv) Investor Dashboard (see Section 4).	**Genetic Innovation for Impact (G×I) Learning Alliance** of CGIAR GI Initiatives, NARES and other public and private sector partners that conducts research and builds capacity for scaling institutional change in genetic innovation systems. **Global Market Intelligence Platform** for standardizing, crowdsourcing, scaling and sharing market intelligence to assist CGIAR and partners in identifying intelligence gaps to set market research priorities, target product market segments, build pipeline investment cases, and develop product profiles. **Scaling Readiness Assessment Studies** (Section 4)
3. Outcomes: To what extent does the market intelligence generated through this Initiative change how breeding programs define product profiles, prioritize breeding targets, and allocate investments? And particularly, the rate at which new materials are developed?	Qualitative and quantitative approaches to understanding, tracking and documenting institutional change among system actors.	**Outcome studies** that showcase evidence of outcomes. **Case study briefs, blogs and workshops** showcasing evidence of outcomes at institutional level on decision making in and for gender-intentional product profile design in breeding programs.
4. Impacts: How does institutional change in genetic innovation systems affect the total impact of breeding and seed systems and its distribution across the five CGIAR Impact Areas?	Meta-analysis (e.g., Lenaerts *et al.*, 2018). *Ex-post* impact evaluation using (quasi-)experimental methods to identify impacts of varieties from past breeding efforts that have targeted socio-economic or gender-relevant crop variety traits relative to breeding efforts that have mainly focused on biophysical traits (e.g., yields,	**Impact studies** providing evidence of impacts of institutional change on adoption rates by farmers (male and female), consumers, seed companies (WP3) and the resulting contribution to the five Impact Areas, evidencing impact trade-offs and synergies among them under a wide range of conditions for different value chain actors.

| | nutrient density, or stress tolerance).
Analysis of impact trade-offs and synergies across Impact Areas and SDGs (e.g., Hegre *et al.*, 2020). | |

The theory of change

Crop varietal replacement has been slow partly due to uncoordinated efforts among breeding programs within and among CGIAR and partners. To achieve the EoI Outcomes 1 and 2, WP5 will develop scaling mechanisms for institutional change in CGIAR-NARES-SME breeding networks and monitor and assess impacts of the adoption of institutional standards across the five Impact Areas. Through the Genetic Innovation for Impact (G×I) learning alliance, WP5 will build partnerships and capacity both horizontally (via breeding networks) and vertically (through the transdisciplinary teams built in WP1, WP2 and WP3), which are scaled through the RIIs. WP5 will co-develop the Global Market Intelligence Platform with WP1 and Foresight and Metrics to support standardizing, crowdsourcing and sharing of market intelligence among Initiatives and partners, and within Regional, transdisciplinary CGIAR-NARES-SME teams. The G×I Learning Alliance will be co-developed with Accelerated Breeding and SeEdQUAL, and will provide a platform for CGIAR and partners (NARES, SMEs, WorldVeg, CIRAD, Cornell University, etc.) to share their experiences in implementing institutional innovations developed in WP2. Scaling of the platform through the RII will be monitored through an Innovation Packages and Scaling Readiness Plan (Section 4). Scaling will be supported by funding and partners' shared interest in market intelligence and the tools needed to enhance their institutional capacity to increase the impact of genetic innovation.

WP5's MELIA team will contribute to WP1 to map global and regional challenges and impact potentials across the five Impact Areas, and to WP4 to conduct *ex-ante* impact assessment for pipeline investment cases. WP5 will use behavioral intelligence generated in WP3 to assess how this Initiative can scale variety adoption and accelerate varietal turnover, and leverage the experiments undertaken in WP3 for evaluating the *ex-post* impacts of improved varieties. WP5 will closely work with SeEdQUAL, SHiFT and FRESH Initiatives to evaluate impacts on farmers and consumers of varieties and related products from past breeding efforts that targeted socio-economic or gender-relevant traits. Clear demonstration of impacts will trigger the interest of CGIAR-NARES-SME breeding networks in enhancing their knowledge on the contribution of institutional change in genetic innovation to the five Impact Areas, driven by a shared interest in maximizing the impact of breeding programs.

Driven by shared interests in exchanging information and increasing the returns to investment in genetic innovation, partners such as USAID Feed the Future Innovation Labs, universities (Flinders University, Innovative Genomics Institute at University of California, Berkeley, National University of Ireland Galway Ryan Institute) and projects and programs such as Gender-responsive Researchers Equipped for Agricultural Transformation (GREAT), Demand-Led Breeding (DLB), and Institutionalizing Monitoring of Crop Variety Adoption using Genotyping program (IMAGE) will be encouraged to be involved in WP5 to help scale the institutional innovation more widely across NARES and SMEs in and beyond prioritized CGIAR regions. These outcomes will contribute to AA Outcomes 2, 5, 7 and 8 and achieving them will require strong support from donors and strong willingness from partners to engage in exchange of information and collaboration. In the long run, WP5 is expected to lead to institutionalization of inclusive decision making in gender-intentional product profile design in genetic innovation systems, resulting in greater impacts of breeding efforts with spillovers outside the genetic innovation sphere.

4. Innovation Packages and Scaling Readiness Plan

The Initiative will partner with five other Initiatives to jointly develop Innovation Packages around four Core Innovations: (i) Institutional Innovation (WP2, Accelerated Breeding, Plant Health); (ii) G×I Learning Alliance (WP5, Accelerated Breeding, SeEdQUAL); (iii) Global Market Intelligence Platform (WP1, WP5, Foresight and Metrics, Digital Transformation); (iv) Investor Dashboard (WP4, N4ETTSS, Digital Transformation). In addition, two Toolkits will be piloted for scaling beyond 2024: (a) Behavioral Research Toolkit (WP3, building on Digital Product Profiling, 1000minds Decision-Making and Conjoint Analysis, etc.); and (b) Impact Toolkit (WP1–5, building on G+ tools for gender-responsive breeding, poverty-weighted models and metrics, etc.). The Initiative will appoint a Leader who will oversee the implementation of the Innovation Packages and Scaling Readiness Plan, which covers 26–50% of the total Initiative innovation portfolio and aims at deriving the following added-value for the Initiative: (i) identifying bottlenecks for adoption and scaling of the Core Innovations; (ii) designing a Scaling Strategy to achieve outcomes and impacts; and (iii) monitoring changes in readiness and use of innovations as part of MELIA. The success of the Initiative crucially hinges on the four Core Innovations; therefore, it should be prioritized for scaling backstopping in the First Wave and seeks to start Light Track from Q1-2022 onwards and Standard Track from Q4-2022 onwards for all four Core Innovations. The Initiative will allocate US$280k to implement the Innovation Packages and Scaling Readiness plan (2022: US$100k; 2023: US$100k; 2024: US$80k). Dedicated activities, deliverables, indicators and line-items are included in the Management Plan, MELIA and Budget sections.

5. Impact statements

This Initiative will make strong contributions to all five Impact Areas through its four Core Innovations and two Toolkits (Section 4).

5.1 Nutrition, health and food security

Challenges and prioritization

The burden of chronic and hidden hunger, and chronic non-communicable diseases (Popkin et al., 2020) is highest in WCA, ESA and SA (Lenaerts and Demont, 2021), justifying prioritization of these regions (Section 2.4 and maps). The predominance of low zinc wheat cultivars illustrates one consequence of breeding for yield only (Murphy et al., 2008). Consumer-driven demand for whole grains and nutritious, drought-resistant crops (e.g., millets) will strengthen food security in areas of conflict, and health-conscious urban market segments. Enabling a coordinated network of laboratories to rapid and efficient assessment of nutrients, antinutrients and hazardous compounds, and streamlining rapid dietary assessment methods are essential to developing nutritious variety profiles and achieve measurable impact.

Theory of change: (Research questions and components of Work Packages)

Market and behavioral intelligence on the triple burden of malnutrition, dietary recommendations, and consumer preferences and demand elicitation (WP1, WP3) will be incorporated into gender-intentional product profiles (WP2) and pipeline investment cases (WP4) resulting in breeding programs and seed systems developing healthier crops and traits that improve nutrition and health and facilitate crop and dietary diversification. The Initiative will remove constraints that limit its contribution to food and nutrition security, namely, breeding for nutrient density and not just for calories, anticipating lower nutrient contents of major C3 staples due to climate change (Myers et al., 2014), increasing the bioavailability of minerals (Raboy, 2020), and addressing the double burden of malnutrition affecting the same populations that consume our crops (Pompano and Boy, 2021).

Measuring performance and results

- Proportion of product profiles and pipeline investment cases for varieties that explicitly include a micronutrient trait (iron, zinc, provitamin A carotenoids, calcium, essential amino acids) or trait(s) that facilitate(s) crop diversification.
- Number of NARES in targeted regions with functioning high throughput, accurate and low cost/sample equipment for measuring nutritional contents.
- Food industry demand (MT) and applications of biofortified crops developed by CGIAR and NARES as a result of market and behavioral intelligence.

Partners

- Demand partners: donors.
- Innovation partners: Flinders University, Australia: for quality assurance of high throughput tools for minerals, vitamins, phytate, etc. in potential breeding lines (Professor James Stangoulis); Wageningen University and Research Centre, The Netherlands: global AI/photography/diet tools development and validation (Professor Inge Brouwer); SHiFT Initiative; FRESH Initiative; Foresight and Metrics Initiative; Excellence in Agronomy Initiative.
- Scaling partners: NARES, seed industry.

Human resources and capacity development of Initiative team:

- Nutrition and Food Science and Technology team (HarvestPlus): one Senior Nutritionist, one Food Science and Technology Research Associate, one Nutrition Research Associate, two Research Assistants, one food industry marketing and demand creation specialist, one Senior Scientist
  - The Nutrition and Food Science and Technology team will build capacity of transdisciplinary teams in nutrition analysis through the G×I Learning Alliance.

5.2   Poverty reduction, livelihoods and jobs

Challenges and prioritization
Poverty density levels are highest in WCA, ESA and SA, justifying prioritization of these regions (Section 2.4 and [maps](#)). Impact assessments have shown the potential value for investments in breeding on productivity and income but impacts vary across crops and regions ([Alston *et al*., 2020;](#) [Wiebe *et al*., 2021)](#). Breeding has focused on enhancing productivity and yields, or improving stress tolerance, but those biophysical traits do not necessarily generate (i) greatest profitability at the farmer level (e.g., because costs might increase if fertilizers or more labor are required to achieve yield gains, or because output prices are lower compared to those for other potential crops or varieties with greater demand from consumers/food industry); (ii) greatest impacts on livelihoods (e.g., when there is by-produce that is important for households); and (iii) greatest job creation. Breeding for crops and varieties that increase potential for local processing and food industry could have larger impacts than those that just focus on productivity or stress tolerance. There is a need for market and behavioral intelligence combined with *ex-ante* cost-benefit analysis to identify where advances in breeding can have the greatest impacts on poverty reduction.

Theory of change: (Research questions and components of Work Packages)
Evidence on breadth and depth of poverty (WP1, WP3) will inform prioritization of (i) product market segments (WP1); (ii) crops and traits in product profile design (WP2); and (iii) pipeline investment cases (WP4) resulting in breeding programs and seed systems developing varieties featuring an optimal mix of productivity-enhancing, loss and risk-reducing and value-adding product and byproduct traits that are expected to increase farmers' and consumers' livelihoods and contribute to job and income generation in food systems.

Measuring performance and results
- Proportion of product profiles and pipeline investment cases for new varieties that (i) generate new local processing opportunities; (ii) support the adoption of labor-saving technologies (e.g., direct seeding in rice); (iii) support the development of new products or valorization of by-products (e.g., straw, bran, stover, feed) with the potential to contribute to rural employment.
- Increased sales by food and seed industry of products resulting from GI thanks to market and behavioral intelligence and impact on local employment.

Partners
- Demand partners: donors.
- Innovation partners: Cornell University; USAID Innovation Labs; Foresight and Metrics Initiative.
- Scaling partners: NARES, seed industry.

Human resources and capacity development of Initiative team
The Initiative will partner with Foresight and Metrics Initiative to attract expertise and build capacity on tools and metrics for measuring impacts on poverty reduction, livelihoods and jobs.

5.3   Gender equality, youth and social inclusion

Challenges and prioritization
The overall gender gap and more specifically gender inequality in access and benefits from agricultural technology is high in WCA, ESA and SA, justifying prioritization of these regions (Section 2.4 and maps), to advance gender equality in agricultural technology design and scaling. Breeding programs have traditionally focused on addressing productivity and commercialization potential, and when engaging with smallholder producers, have often interacted only with men, consequently overlooking traits preferred by women farmers (Ashby and Polar, 2020; Kramer and Galiè, 2020). Crops or varieties with low market value but important for smallholder farmers' household food security and nutrition have frequently been left out. Some new varieties may even have had traits that could disempower women (Polar et al., 2021), for instance, by increasing their labor burden, reducing women's control over income, products or by products, or requiring complementary inputs to which women had less access than men (Bergman Lodin et al., 2012; Teklewold et al., 2013). Behavioral intelligence on how to inclusively increase varietal turnover is scarce and focuses mostly on male- versus female-headed households, instead of other aspects of social inclusion or on the majority of women living in male-headed households (Brearley and Kramer, 2020).

Theory of change: (Research questions and components of Work Packages)
Global evidence on gender inequality will inform crop and market segment prioritization (WP1). Gender, youth and social group-disaggregated market and behavioral intelligence (WP1, WP3) will be incorporated to develop gender-intentional product profiles (WP2) and pipeline investment cases (WP4) resulting in breeding programs and seed systems developing varieties that respond to gender related challenges of stakeholders along the value chain from producers to consumers. The Impact Toolkit's (Section 4) "Gender-responsive tools and methods module" will guide transdisciplinary teams to work collaboratively to systematically include gender analysis information in market segmentation and address gender intentionality in all product profiling; ultimately concurring to support the G×I Learning Alliance. Existing tools will be adapted for an analysis of needs and preferences from youth and other intersectional groups. The G×I Learning Alliance (WP5) will be gender-intentional and inclusive to ensure diverse voices are not just included (i.e., through participation), but also empowered and amplified (e.g., through targeted trainings, communication/ICT/social media efforts, engaging private sector coalitions around gender/inclusion approaches). Inclusiveness of participation in the Global Market Intelligence Platform (WP5) will also be fostered (e.g., through targeted leadership trainings, quotas, innovative communication efforts to reach women). Research on adoption, scaling and impact of the institutional innovation will be conducted to assess its inclusiveness in terms of gender, but also "minority groups" (social scientists in this case).

Measuring performance and results
- Proportion of product profiles and pipeline investment cases for new varieties that directly address challenges and opportunities faced by women, youth and other intersectional groups.
- *Ex-ante* impacts on gender equality, youth and social inclusion for developed product profiles as reflected in pipeline investment cases.
- *Ex-post* impacts on gender equality, youth and social inclusion for varieties that were developed with deliberate gender, youth or social inclusion objectives.
- Gender balance and disciplinary inclusiveness in transdisciplinary teams (WP1, WP2), G×I Learning Alliance (WP5), and Global Market Intelligence Platform (WP1, WP5).

Partners
- Demand partners: donors
- Innovation partners: Cornell University, USAID Innovation Labs, seed industry (seed companies, ACRE Africa), NGOs (Precision Agriculture Development, One Acre Fund, CARE, Oxfam), HER+ Initiative GENDER Platform.

- Scaling partners: NARES, seed industry, HER+ Initiative will help scale out gender and social inclusion trainings, advocacy efforts, etc. in the areas of focus, GREAT program and Makerere University will help scale capacity building with NARES and local partners.

Human resources and capacity development of Initiative team
- Senior Gender Specialist in Initiative Leadership Team (Section 7.1).
- Gender Specialist in each transdisciplinary team.
- G+ tools for gender-responsive breeding capacity building through G×I Learning Alliance in collaboration with HER+ Initiative.

5.4   Climate adaptation and mitigation

Challenges and prioritization
For roughly two decades, breeding programs of CGIAR and partners have prioritized stress tolerance in the design of new varieties. However, the types of stressors that need to be prioritized will vary across market segments, and will require market intelligence. Moreover, challenges exist to achieve higher levels of smallholder uptake of varieties with traits that render crops more resilient to climate extremes and climate induced pests and diseases. These include (i) farmers' reluctance to switch to new varieties; (ii) limited information on performance of new varieties in farmers' fields, which is particularly an issue with stress-tolerant varieties since shocks and stressors will not occur during every growing season, and (iii) limited access to the new varieties. Overcoming these barriers will require behavioral intelligence on how to increase farmer and industry awareness of the value of these new varieties and increase varietal adoption.

Theory of change: (Research questions and components of Work Packages)
Forward-looking information on climate change (WP1) in target population environments, combined with crop modeling featuring IPCC AR6 climate projections will inform the design of product profiles (WP2), the behavioral drivers that are needed for adoption (WP3), and investment cases (WP4) for breeding and seed delivery of varieties that complement climate-smart management practices (e.g., no till ready varieties) or feature traits that render crops more resilient to climate extremes and climate-induced pest and diseases, reduce fertilizer use, improve feed quality (e.g., straw digestibility) and contribute to climate change mitigation (WP5).

Measuring performance and results
- Proportion of product profiles and pipeline investment cases for new varieties incorporating traits relevant for climate adaptation that were identified through crop modeling
- Proportion of product profiles and pipeline investment cases for new varieties that enable increased valorization of by-products (straw, stover, husk, bran, etc.), which can contribute to reduction of unsustainable practices (e.g., straw burning).

Partners
- Demand partners: donors
- Innovation partners: CIRAD; ClimBeR; Excellence in Agronomy Initiative; Foresight and Metrics Initiative
- Scaling partners: NARES, seed businesses, seed retailers

Human resources and capacity development of Initiative team
The Initiative will partner with CLiMBER Initiative to attract and fund expertise, and build capacity on climate science and economics.

5.5   Environmental health and biodiversity

Challenges and prioritization
Lack of market intelligence forces breeding programs to make tough decisions on where to focus scarce resources for varietal development. While farmers clearly express demand for biotic stress resistance that reduces visible damage (e.g., lodging, pests, diseases; Maligalig *et al.*, 2021), and, hence, for sustainable (non-chemical) solutions for crop protection, demand for other efficiency-enhancing traits may be less explicit, e.g., reduced fertilizer needs (in particular N fertilizer, which is a source N20 greenhouse gas), reduced pesticides for less visible pests, reduced energy for processing (diesel, biomass, electricity, etc.), etc. Moreover, relatively risky decisions for breeding programs on whether to invest in heritage crops with potential for food processing industry and value chain development (thereby contributing to *in situ* conservation of genetic resources; e.g., Bairagi *et al.*, 2021) or lesser-known cover crops with potential to enrich soils need to consider not only potential demand, but also potential delivery mechanisms.

Theory of change: (Research questions and components of Work Packages)
Forward-looking information on trends related to biotic stresses (WP1) will set product profile targets (WP2) and build pipeline investment cases (WP4) for new varieties featuring biotic stress resistance traits that reduce reliance on chemicals, reduce environmental footprint and preserve in-field biodiversity, and traits that increase water and energy use efficiency. Market intelligence on value of cover crops and heritage crops can assist cropping systems scientists, genebanks and farmers in valuing and preserving biodiversity.

Measuring performance and results
- Proportion of product profiles and pipeline investment cases for new varieties that potentially reduce land use, fertilizers, pesticides, or energy for processing.
- Proportion of product profiles and pipeline investment cases for cover crops and heritage crops (e.g., pigmented rice, blue maize) based on market intelligence.
- Market intelligence on value of heritage crops, informing Genebanks and Rethinking Food Markets and Value Chains for Inclusion and Sustainability Initiatives.

Partners
- Demand partners: Donors, Genebanks Initiative, Precision Genetic Technologies Initiative
- Innovation partners: CIRAD, Plant Health Initiative, Excellence in Agronomy Initiative, MiTIGATE+ Initiative, Foresight and Metrics Initiative
- Scaling partners: NARES, seed businesses, seed retailers

Human resources and capacity development of Initiative team
The Initiative will partner with Plant Health Initiative to attract and fund expertise, and build capacity on environmental science and economics related to plant health and crop protection.

6. Monitoring, evaluation, learning and impact assessment (MELIA)

6.1 Result framework

CGIAR Impact Areas				
Nutrition, health and food security	**Poverty reduction, livelihoods and jobs**	**Gender equality, youth and social inclusion**	**Climate adaptation and mitigation**	**Environmental health and biodiversity**
Collective global 2030 targets				
The collective global 2030 targets are available centrally here to save space.				
Common impact indicators that your Initiative will contribute to and will be able to provide data towards				
# of people benefiting from relevant CGIAR innovations # of people meeting minimum dietary energy requirements # of people meeting minimum micronutrient requirements	# of people benefiting from relevant CGIAR innovations # of people assisted to exit poverty	# of women benefiting from relevant CGIAR innovations # of youth benefiting from relevant CGIAR innovations # of women assisted to exit poverty	# of tonnes CO_2 equivalent emissions # of people benefiting from climate-adapted innovations	# of km^3 consumptive water use in food production # of Tg nitrogen application
SDG targets				
2.1, 2.2	1.1, 1.2.2	2.3, 5.a	1.5, 2.4, 13.1	2.4, 12.a

Genetic Innovation Action Area outcomes	Genetic Innovation Action Area outcome indicators
2: CGIAR & partners use high-quality market intelligence to guide the development of new varieties to meet the needs and expectations of a wide-range of users, with special attention to marginalized groups.	GIi 2.1 Proportion of new released varieties developed in alignment with market intelligence-informed product profiles
5. Cooperation and co-investment by CGIAR, public- and private-sector seed-system actors supports coordinated and effective research and investment in the sector	Gii 5.1 Number of genetic innovations commercialized through public/private sector cooperation agreements
	Gii 5.2 Number of public/private sector cooperation agreements
7: Farmers have access to and use climate-resilient, nutritious, market-demanded crop varieties.	GII 7.1 Number of farmers who grow climate-smart crop varieties, disaggregated by gender.
	GII 7.2 Number of farmers who grow crop varieties with increased nutritional content, disaggregated by gender.
	GII 7.3 Area weighted average age of varieties in Farmers' fields
ST & RAFS & GI 1 Women and youth are empowered to be more active in decision making in food, land and water systems	STRAFSGIi 1.3 Number of farmers who grow market intelligence-informed new crop varieties, disaggregated by gender and age.
	STRAFSGIi 1.4 Percentage of female headed farm households that use an improved crop variety.

Initiative and Work Package outcomes, outputs and indicators											
Result type (outcome or output)	Result	Indicator	Unit of measurement	Geographic scope	Data source	Data collection method	Frequency of data collection	Baseline value (outcome only)	Baseline year (outcome only)	Target value	Target year

End-of-Initiative outcome 1	Transdisciplinary teams across CGIAR and partners are empowered in co-implementation of market and behavioral intelligence and co-design of product profiles	Number of teams Quantitative and qualitative indicators to assess transdisciplinary practice and empowerment	Regional teams	Regional (WCA, ESA, SA)	Primary data collected through Initiative	Administrative user data	Semi-annual	0	Start 2022	3 teams (1 team per prioritized CGIAR region)	2022
End-of-Initiative outcome 2	CGIAR and partners adopt institutional standards, share market and behavioral intelligence, and monitor outcomes	Number of partners adopting institutional innovation from Initiative	Partners	Regional (WCA, ESA, SA)	Institutional adoption study	Surveys with breeders and other CGIAR and partner decision-makers on actual adoption and willingness to adopt	Annual	0	Start 2022	10 partners across prioritized CGIAR regions	2023
End-of-Initiative outcome 3	Seed industry, food industry, and NGOs use market and behavioral intelligence in strategic decision making	Number of institutions using intelligence from Initiative	Institutions	Regional (WCA, ESA, SA)	Case studies with industry and NGOs	Qualitative and quantitative surveys on how intelligence from Initiative informs strategies	Annual	0	Start 2022	5 institutions across prioritized CGIAR regions	2024
End-of-Initiative outcome 4	Research leaders and investors make investment decisions in genetic innovation using pipeline investment cases and the Investor Dashboard	Intention to use outputs from Initiative in investment decisions, and actual amount invested in impactful breeding pipelines based on outputs from Initiative	US$	Regional (WCA, ESA, SA)	Investor Dashboard Primary data	Tracking/usage data collected by server/host of Dashboard Qualitative and quantitative interviews with next users on (intention to be) using outputs from Initiative to guide investments	Annual	0	Start 2022	3 investors (e.g., GI leadership, 2 donors investing in breeding) across prioritized CGIAR regions	2024
WP1 outcome 1	Regional, transdisciplinary CGIAR-NARES-SME teams in prioritized regions translate global and regional opportunities across the five Impact Areas into market intelligence	Number of teams	Regional teams	Regional (WCA, ESA, SA)	Primary data collected through Initiative	Administrative user data	Semi-annual	0	Start 2022	3 teams (1 team per prioritized CGIAR region)	2022

WP1 outcome 2	Seed companies, food industry and NGOs in targeted regions use and exchange market intelligence	Number of institutions using intelligence from Initiative	Institutions	Regional (WCA, ESA, SA)	Case studies with industry and NGOs	Administrative user data	Annual	0	Start 2022	5 institutions across prioritized CGIAR regions	2024
WP2 outcome 1	Regional, transdisciplinary CGIAR-NARES-SME teams systematically co-design gender intentional product profiles for prioritized product market segments that are feasible to achieve through genetic innovation	Number of teams Quantitative and qualitative indicators to assess transdisciplinary practice and empowerment	Regional teams	Regional (WCA, ESA, SA)	Primary data collected through Initiative	Administrative user data	Semi-annual	0	Start 2022	3 teams (1 team per prioritized CGIAR region)	2022
WP2 outcome 2	Regional CGIAR-NARES-SME breeding networks use gender-intentional product profiles as the guiding force providing direction to all breeding decisions and restructure breeding pipelines to clearly align to product market segments	Number of breeding partners using gender-intentional product profiles	Partners	Regional (WCA, ESA, SA)	Institutional adoption study	Surveys with breeders and other CGIAR and partner decision-makers on actual adoption and willingness to adopt	Annual	0	Start 2022	10 partners across prioritized CGIAR regions	2023
WP2 outcome 3	NARES and policy makers adjust national product registration trials to be structured, conducted and decisions made by product market segment	Number of policies modified in design or implementation, informed by CGIAR research.	Policies	Regional (WCA, ESA, SA)	Primary data collected through Initiative	Key informant interviews Review of policy documents	Annual	0	Start 2022	3 institutions across prioritized CGIAR regions	2024
WP3 outcome 1	Regional, transdisciplinary CGIAR-NARES-SME teams use behavioral intelligence to equitably accelerate varietal turnover	Number of partners using behavioral intelligence	Partners	Regional (WCA, ESA, SA)	Primary data collected through Initiative	Surveys with CGIAR and partner decision-makers	Annual	0	Start 2022	10 partners across prioritized CGIAR regions	2023
WP3 outcome 2	Private sector and NGOs in seed systems or food industry use behavioral intelligence to inclusively promote new products at an accelerated rate	Number of institutions using intelligence from Initiative	Institutions	Regional (WCA, ESA, SA)	Case studies with industry and NGOs	Qualitative and quantitative surveys on whether intelligence from Initiative is used	Annual	0	Start 2022	5 institutions across prioritized CGIAR regions	2024

WP4 outcome 1	CGIAR-NARES-SME breeding networks implement breeding pipelines for prioritized crops with a more focused structure and alignment to the five Impact Areas	Number of breeding partners implementing breeding pipelines	Partners	Regional (WCA, ESA, SA)	Institutional adoption study	Surveys with breeders and other CGIAR and partner decision-makers	Annual	0	Start 2022	10 partners across prioritized CGIAR regions	2023
WP4 outcome 2	Research leaders and investors use the Investor Dashboard in investment and resource allocation decision making in genetic innovation	Number of research leaders and investors using the Investor Dashboard	Investors	Regional (WCA, ESA, SA)	Primary data collected through Initiative	Surveys with research leaders and investors	Annual	0	Start 2022	3 investors	2024
WP5 outcome 1	CGIAR-NARES-SME breeding networks' institutional capacity enhanced in inclusive decision making in gender intentionalproduct profile design in genetic innovation	Number of NARES-SME partners with enhanced capacity for inclusive product profile design	Partners	Regional (WCA, ESA, SA)	Primary data collected through Initiative	Records of capacity building activities and participation	Annual	0	Start 2022	10 partners across prioritized CGIAR regions	2024
WP5 outcome 2	CGIAR-NARES-SME breeding networks' knowledge enhanced on the contribution of institutional change in genetic innovation to the five Impact Areas	Number of NARES-SME partners with knowledge on principles for inclusive institutional change	Partners	Regional (WCA, ESA, SA)	Primary data collected through Initiative	Records of knowledge sharing and institutional change activities and participation	Annual	0	Start 2022	10 partners across prioritized CGIAR regions	2024
WP1 output 1	Innovative methods and tools curated to collect and analyze market intelligence data	Review report	Report	Global	Secondary data revised and curated	Literature review	Annual	n.a.	n.a.	1 review document	2022
WP1 output 2	Structures and processes for engagement with CGIAR-NARES-SME breeding networks developed	Structural design and process description	Report	Global	Primary data collected through Initiative	Expert consultation	Once	n.a.	n.a.	1 structural design and process description document	2022
WP1 output 3	Market intelligence data collected and curated	Number of studies conducted and curated	Studies	Regional (WCA, ESA, SA)	Primary and secondary data collected through Initiative	Varies per study	Annual	n.a.	n.a.	3 studies (1 per region)	2022

WP1 output 4	Product market segments identified	Number of product market segments	Report	Regional (WCA, ESA, SA)	Primary and secondary data collected through Initiative	Systematic analysis	Annual	n.a.	n.a.	3 studies (1 per region)	2022
WP2 output 1	Institutional standards and processes for gender intentional product profile design developed	Standard operating procedures	Report	Global	Primary data collected through Initiative	Expert consultation	Once	n.a.	n.a.	1 Standard Operating Procedure (SOP)	2022
WP2 output 2	Gender intentional product profiles defined	Product profile reports	Report	Regional (WCA, ESA, SA)	Primary and secondary data collected through Initiative	Systematic analysis	Annual	n.a.	n.a.	3 reports (1 per region)	2022
WP2 output 3	Policy briefs elaborated	Number of briefs	Brief	Regional (WCA, ESA, SA)	Primary and secondary data collected through Initiative	Non-systematic analysis	Annual	n.a.	n.a.	3 reports (1 per region)	2024
WP3 output 1	Behavioral intelligence research implemented for accelerating varietal turnover	Research report	Report	Regional (WCA, ESA, SA)	Primary and secondary data collected through Initiative	Behavioral experiments	Annual	n.a.	n.a.	3 reports (1 per region)	2024
WP3 output 2	Behavioral intelligence research implemented for promoting new products	Research report	Report	Regional (WCA, ESA, SA)	Primary and secondary data collected through Initiative	Behavioral experiments	Annual	n.a.	n.a.	3 reports (1 per region)	2024
WP4 output 1	Breeding pipeline cost, prioritization and optimization databases developed	Report of breeding pipeline databases	Report	Regional (WCA, ESA, SA)	Primary and secondary data collected through Initiative	Systematic analysis	Annual	n.a.	n.a.	3 reports (1 per region)	2024
WP4 output 2	Pipeline investment cases developed	Summary of investment cases developed per region	Investment cases summary	Regional (WCA, ESA, SA)	Primary and secondary data collected through Initiative	Systematic analysis	Semi-annual	n.a.	n.a.	3 summaries of investment cases (1 per region)	2024

WP4 output 3	Investor Dashboard established	On-line data portal	Data portal	Global	Primary and secondary data collected through Initiative	Systematic curation and visualization	Once	n.a.	n.a.	1 data portal	2023
WP5 output 1	Global Market Intelligence Platform established	On-line platform	On-line platform	Global	Primary and secondary data collected through Initiative	Systematic curation and visualization	Once	n.a.	n.a.	1 on-line portal	2023
WP5 output 2	Genetic Innovation for Impact (G×I) learning alliance established	Number of participants, disaggregated by gender	Participants	Global	Primary data collected through Initiative	Records of participation	Semi-annual	n.a.	n.a.	20 participants	2022
WP5 output 3	Adoption, scaling, outcome and impact studies	Number of studies	Studies	Regional (WCA, ESA, SA)	Primary data collected through Initiative	Surveys and interviews with users	Annual	n.a.	n.a.	3 studies (1 per region)	2024
Innovation Packages and Scaling Readiness											
Output	Innovation Profile and Scaling Ambition Report (Light Track)	Number of selected Core Innovations for which scaling ambition, vision of success and roadmap have been co-created, agreed-upon and documented	Number	Regional (WCA, ESA, SA)	Secondary data revised and curated	Non-systematic review	Once	n.a.	n.a.	4	2023
Output	Evidence-based Scaling Strategies (Standard Track)	Number of Initiative Innovation Packages that have undergone evidence-based and quality controlled/ validated Scaling Readiness assessments informing innovation and scaling strategies	Number	Regional (WCA, ESA, SA)	Primary data collected through Initiative	Focus group discussions and expert consultation	Once	n.a.	n.a.	4	2024

6.2 MELIA plan

MELIA will inform stakeholders, including donors and innovation, scaling and research partners, on the costs, benefits, and comparative effectiveness of a transdisciplinary approach to market intelligence-driven breeding, seed systems and investment prioritization. In demonstrating impacts, the expectation is that the institutional innovation generated through this Initiative will ensure that improved varieties not only contribute to productivity gains but generate a well-balanced portfolio of impacts across all five Impact Areas (nutrition, poverty reduction, equity, climate adaptation, and environmental health).

Causal impact evaluation for the institutional innovations in this Initiative are at the core of the MELIA plan; along with three activities that aim to monitor outcomes towards the three EoI outcomes. Monitoring data will be collected throughout the Initiative period, with a baseline starting in 2022, and using a mix of administrative tracking data from the Investor Dashboard, organized meetings and participation, quantitative and qualitative surveys with partners on Scaling Readiness. These monitoring data will inform the Initiative on where assumptions in the theory of change and related activities need to be updated.

In designing the impact evaluation, we recognize that the time period from better market intelligence to behavioral change in breeding programs, followed by an accelerated supply of high-quality breeding products, and finally resulting in variety release and adoption, will take longer than the timeline of this Initiative. The development impact may therefore only become evident in the medium to long-term. The focus on the impact evaluation will therefore be on rigorous documentation of: (i) the process of change within breeding programs, using behavioral tools and institutional adoption studies (activity 2); (ii) *ex-ante* cost-benefit analyses to forecast how these changes and resulting gender-intentional product profiles will impact farmers and consumers across the five CGIAR Impact Areas in the future, once varieties are released; with a focus on moving beyond impacts in terms of yield gains or economy-wide income (activity 4); and (iii) adoption and impacts of varieties developed through breeding efforts that have included socio-economic or gender-relevant crop variety traits, relative to those released by programs that focused purely on biophysical traits (as a counterfactual); and product substitution and impacts of related consumer products.

The empirical adoption and impact evaluation of varieties at the farmer and consumer level will be implemented in partnership with SeEdQUAL and WP4, using randomized controlled trials and quasi-experimental evaluation methods, to quantify the multiplier effects that institutional innovations in breeding can have in the five CGIAR Impact Areas (activity 5). This will inform the parameters used in *ex-ante* cost-benefit analysis of product profiles developed through the Initiative and provide our partners with evidence on the prospective impacts of shifting breeding priorities to what the market wants and needs.

Apart from the G×I Learning Alliance and the Global Market Intelligence Platform, the Initiative will generate rigorous documentation and impact assessment of collaborative approaches (adoption of institutional standards, pathways to scaling, behavior changes) on farmer adoption of varieties and implications in terms of nutrition, poverty reduction, equity, climate adaptation and environmental health.

6.3 Planned MELIA studies and activities

Type of MELIA study or activity	Result or indicator title that the MELIA study or activity will contribute to.	Anticipated year of completion (based on 2022-24 Initiative timeline)	Co-delivery of planned MELIA study with other Initiatives	How the MELIA study or activity will inform management decisions and contribute to internal learning
1. Monitoring participation in G×I Learning Alliance to enable and empower CGIAR and partners empowering in product market segmentation and gender-intentional product profile design	Number of participants in G×I Learning Alliance.	2022	n/a	In case of lagging indicator, Initiative will undertake a more concentrated effort to institute G×I Learning Alliance.
2. Institutional adoption study through annual surveys quantifying actual adoption and willingness to adopt Initiative outputs among breeders and other decision-makers (in sphere of influence), particularly outputs from WP1, WP2 and WP3	Number of participants adopting institutional innovation from Initiative.	2023	n/a	Multi-stage models to analyze what determines next users' willingness to adopt Initiative outputs, to identify and address bottlenecks to more impactful breeding within CGIAR and partners.
3. *Ex-post* impact study on how outputs from WP3, WP4 and WP5 are shaping decision making among research leaders and investors (sphere of interest)	Amount invested in impactful breeding pipelines based on outputs from Initiative.	2024	n/a	If users in sphere of interest are not using the outputs from Initiative as planned, seek to understand why, and course correct to facilitate use.
4. *Ex-ante* impact assessment to quantify potential effects of prioritized breeding pipelines on CGIAR Impact Areas relative to *status quo*	EoI Outcomes 1 and 2 — ascertaining that the induced institutional change can have future impacts at farm and consumer level.	2023	n/a	If prioritized pipelines are not as impactful as targeted, then adjust methods for prioritization and investment cases under WP4.
5. Causal empirical impact evaluation of varieties informed by better intelligence on farmer and consumer level outcomes (including baseline and endline surveys that address gender analysis)	EoI Outcomes 1 and 2 — empirically confirm that the institutional change induced by Initiative will have impacts at farm and consumer level.	2024	SeEdQUAL	Validation of critical TOC assumption that market intelligence-informed prioritization will impact farmers & consumers.
6. Causal empirical impact evaluation of revised strategies adopted by seed and food industry, and NGOs (including baseline and endline surveys)	EoI Outcome 3 —identifying the impacts of achieving this EoI outcome at farm/consumer level in the five CGIAR Impact Areas.	2024	SeEdQUAL	Validation of critical TOC assumption that market intelligence-informed prioritization will impact farmers & consumers.
7. Scaling Readiness Assessment Studies	Number of Initiative Innovations that have undergone evidence-based and quality controlled/ validated Scaling Readiness assessments informing innovation and scaling strategies	2023 (4) and 2024 (4)	Foresight and Metrics Accelerated Breeding Plant Health SeEdQUAL Digital Transformation N4ETTSS	The study will inform the design, implementation and monitoring of an innovation and scaling strategy, and scaling readiness metrics can feed an optional Initiative innovation portfolio management system.

7. Management plan and risk assessment

7.1 Management plan

An Initiative Leadership Team (ILT) will be established, composed of (i) the Initiative Leader and Deputy Leader, (ii) a Senior Gender Specialist, and (iii) the five Work Package Leaders. The ILT will report to GI leadership and feature the following four responsibilities: (i) clearly defining the roles of CGIAR and non-CGIAR partners (WorldVeg, Cornell University, CIRAD and NARES) in governance, management and research implementation, and where possible, assigning specific WP activities, innovations or outputs to non-CGIAR partners; (ii) monthly convening online for overseeing the implementation of the five WPs and the hand-over points between them; (iii) semi-annually convening online with the Innovation Packages and Scaling Readiness Leader, the MELIA Leader and representatives from non-CGIAR partners to review progress and adjusting the TOC, priorities, scaling strategies, risk assessments and work plans as needed; and (iv) annually preparing the plan of work and budget (POWB) and Annual Report (AR), and organizing an extended MELIA workshop (in-person once COVID-19 restrictions are eased) among the ILT and other leaders/representatives and stakeholders to review the Initiative's progress towards (i) outputs, outcomes and the five Impact Areas across WPs; (ii) Innovation Packages and Scaling Readiness; (iii) partnerships and linkages with other Initiatives; (iv) capacity development; (v) risk management; and (vi) opportunities for fundraising. The ILT will be responsible for implementing and communicating the overall vision of the Initiative, which puts the *why* (global challenges) upfront as a driver of the *where* (prioritized CGIAR regions), *how* (TOC), and *what* (deliverables), and not the other way around (Sinek, 2009).

Initiative Start Date		Timelines												Description of key deliverables
		2022				**2023**				**2024**				
Work Packages	**Lead organization**	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
WP1: Market Intelligence	CGIAR		1	2	3			2	3			2	3	*1. Structures and processes for engagement and review of innovative methods and tools. 2. Market intelligence (recurring output). 3. Product market segments (recurring output).*
WP2: Gender-intentional product Profile Design	CGIAR	1		2		2		3		2			3	*1. Institutional standards and processes for product profile design. 2. Gender-intentional product profiles (recurring output). 3. Policy briefs (recurring output).*
WP3: Behavioral Intelligence	CGIAR			1		1		2		1			2	*1. Behavioral intelligence for accelerating varietal turnover (recurring output). 2. Behavioral intelligence for promoting new products (recurring output).*
WP4: Pipeline Investment Cases	CGIAR		1		2		2		3		2		2	*1. Breeding pipeline cost, prioritization and optimization databases. 2. Pipeline investment cases (recurring output). 3. Investor Dashboard.*
WP5: Institutional Scaling	CGIAR	1		2				3		3			3	*1. Genetic Innovation for Impact (G×I) learning alliance. 2. Global Market Intelligence Platform. 3. Adoption, scaling, outcome and impact studies (recurring output).*
Innovation Packages & Scaling Readiness	CGIAR			1	1	1	1	1	2	2	2	2	2	*1. Four documented scaling ambition, vision of success and roadmap for use of Scaling Readiness for selected 4 priority Core Innovations. 2. Four evidence-based Scaling Readiness assessment reports and related scaling strategies for selected 4 priority Core Innovations.*
MELIA	CGIAR		1		1		1 2		1 3		1 3		1 3	*1. G×I participation monitoring (recurring output). 2. Institutional adoption study (hosted in WP5). 3. Ex-ante impact assessments (hosted in WP4), and ex-post impact study on investors, seed/food industry, and NGOs (hosted in WP5).*
Project Management	CGIAR	1			2	1			2	1			2	*1. Annual Plan of Work and Budget (POWB) (recurring output). 2. Annual report (recurring output).*

7.3 Risk assessment

The Initiative design team undertook a risk assessment exercise to identify and evaluate the main risks and mitigating actions for the Initiative. Risks considered included around science, cohesion (including intended and unintended consequences of technologies/innovations for natural resources, GHG emissions, and social and economic aspects), legacy work, partnerships, talent, operational, ethical and legal and other. At this phase the risk assessment is used to highlight areas of concern and improvement recommendations for the Initiative. It also provides visibility to different bodies that is needed from a good governance perspective in line with the Risk Management Framework of the CGIAR System. Following the Initiative's approval, the risk assessment will be integrated into the Initiatives workplan for continuous monitoring and management.

Main risks identified are set out as follows:

Top 5 risks to achieving impact (note relevant Work Package numbers in brackets)	Description of risk	Likelihood	Impact	Risk score Likelihood x Impact	Mitigating actions or mechanisms
		Rate from 1-5	Rate from 1-5		
1. Demand partners exhibit low willingness to engage and adopt institutional innovation	CGIAR and partners are not willing to institutionalize policies and SOPs due to lack of trust in gender-intentional developed product profiles. The pipeline investment cases do not convince them to refocus and restructure their pipelines and align them to the five Impact Areas.	4	5	20 (high)	Nurture collaboration and co-ownership through a strong, shared vision. Demonstrate value of institutional change and gender analyisis through rigorous *ex-ante* impact assessment and communicate results to partners through the G×I Learning Alliance. Provide funding to partners conditional on adoption of institutional innovation.
2. Funding constrained, unstable or uncertain	Key collaborators unable to dedicate sufficient staff time, due to limited budget and uncertainties over future One CGIAR funding. Insufficient budget for primary data collection and analysis to fill critical gaps in existing secondary data. Strong and unexpected variations in budget that limit capacity to timely implement activities.	3	5	15 (high)	Demonstrate value of the Initiative to donors through the Investor Dashboard. Demonstrate value of the Initiative to other GI partners and initiate and join efforts for attracting additional bilateral funds (which are difficult to secure for a stand-alone Initiative on market intelligence.
3. One CGIAR restructuring and COVID-19 restrictions delay operations and jeopardizes Initiative's success	Delays in starting the Initiative due to One CGIAR processes related to HR, finance, and other matters still being worked out (including COVID-19 restrictions) can affect the Accelerated Breeding Initiative,	4	3	12 (medium)	We have already started setting up teams under bilaterally funded projects such as AGGRi Alliance (CGIAR), AGG (CGIAR) and EiB to mitigate this risk.

	which is dependent on timely input of market intelligence.				Complete the One CGIAR affiliation process before 2022.
4. Demand partners' institutional capacity constrains adoption of institutional innovation	NARES do not have the capacity to institutionalize policies and SOPs due to lack of experts across the five Impact Areas (economists, gender specialists, nutritionists, climate and environment experts, etc.).	3	2	6 (medium)	Build capacity through the G×I Learning Alliance. Outsource expertise or share or invest in new expertise. Demonstrate value of investing in transdisciplinary expertise through the G×I Learning Alliance.
5. Data insufficient or too costly to obtain to develop credible gender-intentional product profiles and pipeline investment cases	Available data not sufficient and detailed enough in order to estimate impact opportunities in product market segments across the five Impact Areas, which form the basis of product profiles and pipeline investment cases.	2	3	6 (medium)	Prioritize data collection to market segments where impacts are highest. Exploit economies of scope among crops and economies of scale among regions to the maximum extent possible. Exploit economies of scale for gender analysis across Initiatives.

8. Policy compliance, and oversight

8.1 Research governance

Researchers involved in the implementation of this Initiative will comply with the procedures and policies determined by the System Board to be applicable to the delivery of research undertaken in furtherance of CGIAR's 2030 Research and Innovation Strategy, thereby ensuring that all research meets applicable legal, regulatory and institutional requirements; appropriate ethical and scientific standards; and standards of quality, safety, privacy, risk management and financial management. This includes CGIAR's CGIAR Research Ethics Code and to the values, norms and behaviors in CGIAR's Ethics Framework and in the Framework for Gender, Diversity and Inclusion in CGIAR's workplaces.

8.2 Open and FAIR data assets

Researchers involved in the implementation of this Initiative shall adhere to the terms of the Open and FAIR Data Assets Policy. The Market Intelligence and Product Profiling Initiative will align with the OFDA Policy's Open and FAIR requirements, ensuring:

- Rich metadata conforming to the CGIAR Core Schema to maximize Findability, including geolocation information where relevant.
- Accessibility by utilizing unrestrictive, standard licenses (e.g. Creative Commons for non-software assets; General Public License (GPL))/Massachusetts Institute of Technology (MIT) for software), and depositing assets in open repositories.
- Wider access through deposition in open repositories of translations and requiring minimal data download to assist with limited internet connectivity.
- Interoperability by annotating dataset variables with ontologies where possible (controlled vocabularies where not possible).
  Adherence to Research Ethics Code (Section 4) relating to responsible data (through human subject consent, avoiding personally identifiable information in data assets and other data-related risks to communities).

9. Human resources

9.1 Initiative team

Category	Area of Expertise	Short description of key accountabilities
Research	Agricultural economics	Prioritization of product market segments (WP1), product profile design (WP2), behavioral research (WP3), pipeline investment cases (WP4), capacity building and scaling (WP5)
Research	Gender	Prioritization of market segments (WP1), gender-intentional product profile design (WP2), behavioral research (WP3), capacity building and scaling (WP5)
Research	Other multidisciplinary social science (Sociology, Anthropology, Psychology)	Prioritization of product market segments (WP1), product profile design (WP2), behavioral research (WP3), capacity building and scaling (WP5)
Research	Seed marketing	Prioritization of product market segments (WP1), product profile design (WP2), behavioral research (WP3)
Research	Foresight and Impact Assessment	Identification of impact potentials (WP1), *ex ante* (WP4) and *ex post* impact assessment (WP5), and MELIA
Research	Climate and Environmental Science/Economics	Prioritization of product market segments (WP1), product profile design (WP2), pipeline investment cases (WP4), capacity building and scaling (WP5)
Research	Geospatial Science	Prioritization of product market segments (WP1), product profile design (WP2), behavioral research (WP3), capacity building and scaling (WP5)
Research	Nutrition Food Science and Technology	Global networking and coordination of technical input for product profile design (WP2); dietary assessment and input to WP5 for impact evaluation; technical assistance; capacity building; coordination with WPs 1, 2, 4 and 5.
Research	Breeding	Assessing feasibility of product profiles (WP2); investment and cost analysis, and alignment of breeding pipelines to product market segments (WP4)
Research	Plant Health	Identification of crop/trait priorities, assessment of pests and diseases and adaptation opportunities to climate change (WP1); expert input in product profiling (WP2)
Research support	Data Management	Management and curation of data in Global Market Intelligence Platform
Research support	Communication	Communication of vision, outputs and outcomes in media

9.2 Gender, diversity and inclusion in the workplace

The Initiative team will meet CGIAR's gender target of a minimum of 40% women in professional roles and is comprised of individuals from diverse backgrounds. "Professional roles" includes staff in the Director General, Leadership, Senior Management Research, Senior Management Non-Research, Scientists, Professionals (Research and Non-Research) and Post-Doctoral Fellows categories. Women, minorities, and other under-represented groups will hold leadership roles in the Initiative team. This will be seen in the composition of our senior team and will extend to the fair allocation of leadership activities and accountabilities. "Under-represented group" means a group defined by a common physical trait, belief or other distinctive characteristics that are few in number in CGIAR's workplaces and that have previously had minimal access to power and/or little or no influence on decisions that affect them.

9.3 Capacity development

Capacity development will be conducted through the G×I Learning Alliance, which will involve representatives from CGIAR GI Initiatives, NARES, WorldVeg, CIRAD, public and private sector, value chain stakeholders, NGOs, USAID Innovation Labs, and universities (e.g., Cornell University, Innovative Genomics Institute at University of California, Berkeley, West Africa Centre for Crop Improvement — WACCI, Makerere University Centre for Climate Research and Innovations — MUCCRI, Flinders University, National University of Ireland Galway Ryan Institute, etc.). The G×I Learning Alliance will build the human capacity

necessary for the institutional innovation; i.e., the adoption of institutional standards and processes for co-design of gender-intentional product profiles and the formation, empowerment and assessment of transdisciplinary teams (Steelman *et al.*, 2021), and will consolidate the lessons learned to enable universities to integrate transdisciplinary methods into formative education of the next generation of students. Specific training needs will be determined based on the interaction among the different partners, complemented with an in-depth assessment. At the individual level, the Initiative will ensure the inclusion of different types of participants (as junior staff or professionals from under-represented groups) looking for knowledge increasing, changing attitudes, and skills development. In addition to the collective training, workshops on specific topics, and conferences, capacity-building activities will also include individual strategies such as mentorship, internships, and scholarships. The Initiative inception workshop will include an awareness session on CGIAR's values, code of conduct and the range of learning opportunities available within CGIAR. In the first three months of launch, team leaders and managers will participate in an inclusive leadership training and during the first six months, Initiative team members will attend a gender, diversity, and inclusion training.

10. Financial resources

10.1 Budget
10.1.1 Activity breakdown (US$)

USD	2022	2023	2024	Total
Crosscutting across Work Packages	1,000,000	1,000,000	1,000,000	3,000,000
Work Package 1	3,000,000	4,000,000	5,000,000	12,000,000
Work Package 2	1,000,000	1,500,000	2,000,000	4,500,000
Work Package 3	2,000,000	2,000,000	2,000,000	6,000,000
Work Package 4	1,000,000	1,500,000	2,000,000	4,500,000
Work Package 5	1,900,000	2,900,000	3,920,000	8,720,000
				0
Innovation Packages & Scaling Readiness	100,000	100,000	80,000	280,000
Total	10,000,000	13,000,000	16,000,000	39,000,000

10.1.2 Geographic breakdown (US$)

USD	2022	2023	2024	Total
Global	4,000,000	5,000,000	6,000,000	15,000,000
ESA	3,000,000	3,000,000	4,000,000	10,000,000
SA	2,000,000	3,000,000	4,000,000	9,000,000
WCA	1,000,000	2,000,000	2,000,000	5,000,000
Total	10,000,000	13,000,000	16,000,000	39,000,000

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