



**ACCELERATING THE DELIVERY OF QUALITY  
SEED FROM BREEDING INVESTMENTS MADE  
BY THE CROPS TO END HUNGER INITIATIVE  
THROUGH ECONOMICALLY SUSTAINABLE  
SEED SYSTEMS**

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# LIST OF ABBREVIATIONS

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<b>AGRA</b>	Alliance for a Green Revolution in Africa
<b>API</b>	Application Programming Interface
<b>CtEH</b>	Crops to End Hunger
<b>DUS</b>	Distinctness, Uniformity, and Stability
<b>EGS</b>	Early Generation Seed
<b>EiB</b>	Excellence in Breeding
<b>KPI</b>	Key Performance Indicator
<b>NBP</b>	National Breeding Program
<b>PLC</b>	Product Life Cycle
<b>QA</b>	Quality Assurance
<b>QDS</b>	Quality Declared Seed
<b>SEMIS</b>	Seed Enterprise Management Institute
<b>VCU</b>	Value for Cultivation and Use

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## ACCELERATING THE DELIVERY OF QUALITY SEED FROM BREEDING INVESTMENTS MADE BY THE CROPS TO END HUNGER (CTEH) INITIATIVE THROUGH ECONOMICALLY SUSTAINABLE SEED SYSTEMS

Commercial seed delivery for smallholder farmers in many parts of sub-Saharan Africa has been limited to few crops and varietal turnover has been slow. Publicly funded breeding needs to engage with seed systems in order to deliver greater genetic gain in farmers' fields via varietal replacement. This White Paper was commissioned by funders of the Crops to End Hunger (CtEH) initiative in the context of the ongoing One CGIAR reform to identify approaches and make recommendations that will both diversify the range of public-bred crop varieties available to smallholder farmers and increase varietal turnover through commercial channels.

An expert consultation identified 14 bottlenecks to commercial seed delivery. These can be broadly classified into policy and regulatory barriers hindering variety release, insufficient understanding of target markets, lack of technical and business capacity of small and medium seed enterprises (SMEs), and the need to better define roles and responsibilities between One CGIAR, National Breeding Programs (NBP) and commercial seed companies in a changing landscape. A product life cycle (PLC) approach was used to categorize the bottlenecks and then to identify solutions. The PLC is useful to: (i) describe when bottlenecks in the deployment of publicly bred varieties occur; (ii) identify possible interventions; (iii) more clearly define the roles of partners, and (iv) monitor progress through the stages.

# 1 - EXECUTIVE SUMMARY

While economic reforms have seen a liberalisation of the seed sector in many countries, incomplete seed policy and regulatory reform and implementation are holding back seed delivery and more rapid variety turnover. Public sector entities need to put structures in place to effectively link with the commercial seed delivery sector. SMEs need both technical and business support to professionalize their approaches, reduce risks and access finance. National breeding programs (NBPs) likewise require fundamental changes to enable innovative public-private partnerships.

The White Paper expands on recommendations for how One CGIAR may want to adjust its approaches and collaboration with NBPs and private sector entities to (i) be more successful in developing and deploying newly developed varieties, and (ii) support the evolution towards a more effective, sustainable local seed sector, with appropriate public and regulatory capacities and a vibrant entrepreneurial sector.

It is recommended that a One CGIAR-wide seed delivery unit or platform streamlines handover to commercialization by: (i) establishing a transparent and simple legal framework and system for germplasm licensing, including realistic approaches to revenue management between CGIAR centers and NBPs; (ii) better communicating what varieties are available for commercialization, their seed production characteristics, protocols and risks, and how to access germplasm for commercialization; and (iii) implementing transparent and speedy product allocation and licensing processes that consider the capability of suppliers, speed to farmer, diversity of suppliers, and wide availability. This unit would also develop expertise to ensure that variety deployment pursues and aids the development of sustainable business models aligned with seed demand. It would assist in evolving the capabilities of local entities for early generation seed production, and the marketing of new varieties, i.e. two significant bottlenecks in the deployment of public varieties. By establishing pragmatic Key Performance Indicators (KPIs) that capture the scale and reach of variety deployment as well as the strength and capabilities of local breeding, early generation seed production and deployment partners, the unit would enable aligned and longer-term investments by funders and ensure that future investment strategies are informed by capability gap analyses and the viability of the investment.

The expert consultation also provided insights into how One CGIAR may want to optimize its breeding networks to foster seed delivery, by: (i) choosing network leaders that have both technical and partnership skills to lead through the variety development and deployment process with motivated and actively participating public and private sector partners; (ii) enabling local partners to assume greater responsibility within the breeding networks; (iii) reorienting resources so they deliver fewer but relatively better varieties, at a rate aligned with the absorption capacity of the available seed production channels; (iv) scaling up on-farm testing under farmers' own management conditions to ensure new varieties perform as expected, provide substantially greater value to farmers and are in demand by the market; (v) early engagement of downstream partners, in particular seed companies, in both evaluating results and participating in testing so as to eliminate varieties that may not prevail in the marketplace; (iv) focusing product profile definition so they deliver varieties with characteristics that are informed by what farmers and the market are willing to pay for.



## 2 - INTRODUCTION AIM & SCOPE

In the last 30 years there have been significant and largely beneficial changes in seed delivery that have resulted in increased varietal choice of selected crops from a broader range of seed suppliers, most notably commercial seed companies. However, crop and varietal choice has been limited to relatively few crops and varietal turnover has been slow. While there have been critical improvements in breeding crops for resource-poor smallholder farmers, adoption of recent varieties at scale, especially by resource-poor farmers, has only happened for a few crops. Many parts in sub-Saharan Africa and Asia remain undersupplied with seed and planting materials of recent varieties.

This White Paper was commissioned by funders of the Crops to End Hunger (CtEH) initiative in the context of the ongoing One CGIAR reform. Whilst considerable effort and progress has been made in modernizing plant breeding of CtEH supported crops, comparatively little attention has been given to ensuring that all breeding projects establish partnerships leading to sustainable downstream delivery of recent varieties. The objectives of the White Paper are, therefore, to identify approaches and make recommendations to the CGIAR and CtEH funders that will both diversify the range of publicly bred crop varieties available to smallholder farmers and increase varietal turnover through commercial channels, and for more farmers to benefit from greater genetic gains. Although the study limited itself to the commercialization of public-bred varieties, we recognize that the promotion of private breeding in emerging markets or public-private partnership breeding approaches engaging companies with significant research and development capability (and looking to enter emerging markets) may also generate benefits for smallholders.



The White Paper draws on academic and action research that has been instrumental in describing bottlenecks and informing many of the seed delivery interventions that have increased varietal choice of selected crops from a broader range of seed suppliers. Through consultation with experts from the public, private and regulatory sector both in sub-Saharan Africa and Asia, it provides an updated list of bottlenecks and interventions that currently hinder or would enhance the commercial seed delivery of publicly bred varieties. While recommendations are given to CtEH funders and the CGIAR leadership, with focus on sub-Saharan Africa, the analysis of bottlenecks, possible interventions and key implications may also be useful to National Breeding Programs (NBPs) and the wider range of organizations involved in, or supporting, seed systems development.

In designing the scope of this study, the CtEH committee and authors consciously decided to explore the barriers and opportunities inherent in following a business-led approach to improving access to seed and a wider range of choices. In doing so we recognize that seed remains a much-debated topic and that other approaches are equally valid and worthy of study but we believe not mutually incompatible. There also remains the valid argument that for many countries, continuing food insecurity and the threat of future biotic and abiotic “shocks” (Covid-19 being a prime example) means that the issue of national seed security remains an important trade-off to consider whilst promoting further market liberalization.

**The White Paper is structured in the following manner:**

- **Chapter 3 describes the process to develop the paper;**
- **Chapter 4 introduces the product life cycle for developing and deploying new crop varieties;**
- **Chapter 5 describes bottlenecks and interventions, and the underlying challenges;**
- **Chapter 6 summarizes where the CGIAR should become involved;**
- **Chapter 7 summarizes capacity development and advocacy needs beyond the CGIAR.**



## PROCESS

The “CtEH Delivery Group” was constituted in May 2020 by the “CtEH Funders’ Group”, with the endorsement of the CGIAR System Management Board, to guide future investment in seed delivery and ensure that investment in public breeding does translate into genetic gain and varietal turnover in farmers’ fields. A three-person panel was subsequently contracted to research and write a White Paper on options for better seed delivery for consideration by the CtEH Delivery Group.

In consultation with CtEH funders, 13 Technical Experts were selected for their practical experience in different aspects of seed delivery both in sub-Saharan Africa and Asia. They included experts from the public, private and regulatory sector. Using a structured questionnaire, each person was jointly interviewed by the authors, and their collective responses collated into a table which was then circulated to each member for clarification and further comment. The Technical Experts were selected for their individual experience and not their institutional affiliation, and all responses were kept anonymous. The authors of this White Paper are grateful to these experts for freely volunteering their time and their subsequent feedback.

The document uses the term “seed” to refer to both seed and/or, in the case of vegetatively propagated crops, planting materials.

## 3 - PROCESS

The development and deployment of a new crop variety can be described as a Product Life Cycle (PLC) (Fig. 1). Getting a common understanding of the different PLC stages is useful to: describe when bottlenecks in the deployment of publicly bred varieties occur; identify possible interventions; more clearly define the roles of partners, and; and monitor progress through the stages. Stages one to five encompass the breeding of a new variety. Stages seven to ten encompass the production, marketing and distribution of seed of a new variety. In between, stage six is a critical stage when decisions on which variety should actually be produced, registered, promoted and commercialized, are being taken. Increase in varietal turnover is determined both by progress in breeding and the capacity to effectively implement and manage the different stages.

In vertically integrated seed companies, the PLC from research through to delivery is managed internally. In systems that draw upon publicly funded plant breeding, the public and private sector may assume different roles depending on the commercial viability of the seed-value chain, and agreements negotiated and reached between public and private entities on the handover process between the different stages. Also, breeding investments happen through multiple public entities, most prominently NBPs, CGIAR centers, and universities. As commercial opportunities increase, it is likely that we will see increased public-private partnerships and private breeding targeted to the needs of smallholder farmers as already seen in many upper middle-income countries and also in India.

<b>Stage 1. Variety design: Market research, product profile creation, investment case definition</b>
<b>Stage 2. Discovery: Identification, characterization and selection of specific traits required and germplasm to be used</b>
<b>Stage 3. Development and screening of product components or pre-products</b>
<b>Stage 4. Small plot screening of products</b>
<b>Stage 5. Characterization and selection of candidate varieties, establishing seed production characteristics and costs</b>
<b>Stage 6. Large-scale on-farm testing, submitting varieties for registration, Early Generation Seed (EGS) production</b>
<b>Stage 7. Promotion and launch of new variety, first seed sales</b>
<b>Stage 8. Rapid growth of seed sales</b>
<b>Stage 9. Peak seed sales</b>
<b>Stage 10. Product withdrawal and replacement with newer, better varieties</b>

**Fig 1. Product Life Cycle for developing and deploying new crop varieties**



# 4 - THE PRODUCT LIFE CYCLE FOR NEW CROP VARIETIES

## BOTTLENECKS AND INTERVENTIONS

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The expert consultation identified a total of 14 bottlenecks and a range of interventions that could possibly address these bottlenecks. They are listed in Table 1 and aligned with PLC stages so as to describe at what point in the development or deployment of a new crop variety they occur. They are further discussed in this section, together with the underlying challenges.

**The table (Table 1) following is the list of bottlenecks hindering, and possible interventions accelerating, the deployment of varieties bred by CGIAR centers and NBPs. Some of these interventions are already implemented in selected initiatives or countries. However, their use needs to be more systematically scaled up.**

Product Life Cycle (PLC) Stage	Bottlenecks hindering greater use of recent public varieties	Interventions
<b>PLC Stages 5 and 6 - Late development and pre-commercial testing</b>	1. The public sector develops and releases large numbers of varieties. In some instances, their value propositions are insufficiently verified or communicated to seed companies and farmers.	1.1. CGIAR and NARS breeding programs need to deliver fewer but relatively better varieties, with characteristics that are informed by what farmers and the produce market are willing to pay for, and at a rate aligned with the absorption capacity of the available seed channels. 1.2. On-farm testing under farmers’ own management conditions needs to be scaled up to ensure new varieties perform as expected and provide substantially greater value to farmers. 1.3. Seed companies need to be engaged early in participating in testing of new varieties, including their seed production characteristics. 1.4. Policy advocacy is required to align the requirements of national variety release committees to reflect legitimate public-good traits (e.g. addressing plant health concerns or nutrition) and not to “second guess” the market.
	2. Seed companies lack simple information about germplasm available from CGIAR centers, and how to access germplasm for commercialization. Such information may be difficult to find on centers’ websites, be inconsistent across centers, or difficult to understand.	CGIAR needs to provide simple and validated information on: 2.1. The value proposition(s), of the best germplasm available for research, breeding and commercialization, including targeted agro-ecology/adaptation and market segment, and their Variety Identification Number (VIN). 2.2. Information on seed production characteristics, including ease of multiplication and risks. 2.3. How to access germplasm for commercialization.
	3. Seed companies encounter slow, cumbersome, contradictory, and sometimes non-existent licensing approaches from various CGIAR centers and NBPs.	3.1. CGIAR and NBPs need a simple legal framework and systems in place for germplasm-sharing, licensing and IP management from the public to the private sector, including realistic approaches to revenue management, to promote greater access and investment. One CGIAR is an opportunity to develop a framework that can be routinely implemented across all centers, building on best practice inside and outside the CGIAR.
<b>PLC Stage 7 - commercial introduction</b>	4. Many seed companies and decentralized seed multipliers cannot access adequate quantities of Early Generation Seed (EGS) at the right time, and of consistent quality. Specialized commercial approaches will work for the most valuable crops, others will need to be partially subsidized.	4.1. Develop crop specific strategies that produce EGS of adequate quality and quantity of diverse crops in a cost-effective manner, involving additional and capable public and private sector capacity and noting that exclusivity in licensing may complicate EGS production through losing economies of scale (not having multiple customers for the same EGS) 4.2. Consider enlarging the mandate of the emerging commercial EGS producers, to include support for conducting seed production research as well as providing a mentoring and capacity-building role, through donor funding. 4.3. Consider pre-financing or “first” loss seed buy-back schemes to reduce risk of entry into producing EGS of new crops. 4.4. Link funder investments in NBPs to their ability to produce, or partner to produce, EGS of adequate quality and quantity at competitive prices and successfully manage revolving funds. 4.5. Link funder investments in EGS producers’ dependent on their having adequate plans, capacity and QMS procedures in place or in development, and practicality to produce EGS of diverse crops and serve adequately sized geographic regions.
	5. Seed companies are faced with risks relating to variable seed demand, seed production failures, government and distributors defaulting or delaying payment, regulatory hurdles, and regulatory failures.	5.1. Strengthen the capacity of the regulatory system both at the regional and national level, to collect, report and publicize generic seed production and trade data, and to publicly communicate the information in a timely manner. 5.2. Support the move from paper-based to digital systems for some elements of seed inspection and certification to improve efficiency, quality and timeliness in data acquisition and communication. 5.3. Enhance both the technical and management capacity of companies to mitigate production and business risks, and in meeting regulatory requirements. 5.4. Facilitate access to irrigation for good companies and/or their out-growers. 5.5. Stimulate collective action among companies and seed multipliers to reduce risk, increase efficiencies, leverage skills and physical infrastructure (storage, processing, and irrigation) or implement quality assurance (QA).

<p><b>PLC Stage 8 - commercial growth</b></p>	<p>6. Small and medium-sized seed companies lack access to finance.</p>	<p>6.1. Intervention #5.3, 5.4 and 5.5 help small and medium-sized seed companies to de-risk and get more likely access to finance.</p> <p>6.2. Grant and loan programs supporting seed companies need to develop and monitor commercially oriented Key Performance Indicators (KPIs) that will incentivize companies to adopt a trajectory towards commercial investment. Mentor small and medium-sized companies on how to meet those KPIs.</p> <p>6.3. Financing schemes (including, critically, access to working capital) designed to bridge the gap and to make small and medium-sized companies eligible for more conventional types of available finance (financial instruments/products) need to be expanded; support, including contracted commercial investor expertise to mentor companies to be more investment-ready and to build confidence with lenders, is also required.</p> <p>6.4. Facilitate strategic partnerships (including joint ventures, aggregations, and cooperatives) across countries, providing a surrogate for the way that international companies hedge against local problems and fluctuations in demand.</p>
	<p>7. Seed companies do not invest enough in marketing of new varieties, or to new regions.</p>	<p>7.1. Capacity development of companies in: Portfolio management and life-cycle strategies, market development and promotion; pricing on value, establishing and demonstrating a value.</p> <p>7.2. Stimulate variety replacement through more consistent public-private supported awareness about the value proposition of new varieties (linked to # 1.2), using proven tools such as radio, TV, social media, small-pack promotions, etc.</p>
<p><b>PLC stage 8 - commercial growth</b></p>	<p>8. Seed companies do not invest in breeding of self-pollinated and clonal crops, or marketing in geographic regions with low market value, but there is unmet seed demand for these crops.</p>	<p>8.1. Reduce regulatory barriers for registering commercially less attractive crops and allow the marketing of truthfully labelled/quality declared seed or planting materials multiplied from certified EGS.</p> <p>8.2. Develop and promote business cases built on successful past experience and better understand limitations of seed companies to diversify their portfolio or enter these markets.</p> <p>8.3. Negotiate with financial institutions and strengthen existing and design and/or establish new financing facilities to support loans for accredited seed producer organizations, aligned with their sales achievements, and with CtEH objectives linked to #6.3.</p> <p>8.4. Consider subsidizing EGS or, alternatively, financing “first loss” seed buy-back schemes of EGS and certified seed and “sale or return” schemes (selling on consignment) for agro-dealers to reduce risk of entry into new crops and varieties.</p> <p>8.5. In the case of commercially less attractive crops, including clonal crops, commercial models for seed multiplication appear viable where growers are linked to aggregators or other off-takers, or in agro-ecologies where planting material becomes seasonally limiting or seed degeneration is evident.</p> <p>8.6. In situations where clonal crops are largely grown for subsistence and farmers can regrow their own seed, the case can be made for subsidizing introduction and initial dissemination of new varieties, through capable seed companies and decentralized multipliers, and relying on informal systems for further dissemination.</p>

<p><b>PLC stage 8 - commercial growth</b></p>	<p>9. Seed regulations are overly complicated and not fit for purpose. They impose unnecessary costs, increase seed prices, slow down variety turn-over, disincentivize the diversification of the seed industry, and reduce their investment in a wider range of crops and geographies.</p>	<p>9.1. Provide both technical and legal support to review and revise seed policies, laws, and regulations both at national and regional level that are fit for purpose and can be adjusted as the seed sector evolves.                  9.2. Strengthen regional coordination capacity to facilitate seed trade.                  9.3. Alternatives should be assessed for regulatory agencies meeting their goals with a more “hands-off” approach where:                      9.3.1. Inspection is executed through accredited private inspectors,                      9.3.2. Value chain actors take responsibility for their products with emphasis on empowering consumers over punishing wrong-doers.                  9.4. Where primary legislation permits interpretation through regulations, countries may want to consider monitoring of seed quality on a sample basis at the point of sale or before large-scale distribution (DNA fingerprint as compared to a reference variety, viability) instead of checking every step in the seed multiplication process.</p>
	<p>10. Farmers are unaware about the characteristics of new varieties and their benefits. They purchase what they know and from whom they trust.</p>	<p>10.1. Invest in focused campaigns that make down-stream partners and farmers aware of new varieties and their benefits (same as #7.2) engaging extension services and other farmer service providers.                  10.2. Assess how branding could be used to convey the value proposition of, and build trust for, new varieties.</p>
	<p>11. Farmers lose trust in seed from the formal sector, following issues with viability, adulteration, and non-performance.</p>	<p>11.1. Consumers should be empowered to raise complaints to the regulator so that evidence for poor quality seed can be collected in a systematic way and addressed.                  11.2. Promote innovation in, and the use of, tamper-proof packaging, labels and e-verification systems among seed companies that have established a consistent track record.</p>
<p><b>General cross-cutting issues</b></p>	<p>12. Farmers lack income opportunities and cannot pay for farm inputs, including seed, from the formal sector.</p>	<p>12.1. Public breeding programs need to deliver varieties with characteristics that are informed by what farmers and the market (processors, aggregators, and consumers) are willing to pay for, not simply farmers’ preferences. “What farmers like” is not equal to “what farmers will purchase”.                  12.2. Educate and encourage lending to farmers backed by proof of purchasing quality seed to promote seed demand and reduce risk to the lender.                  12.3. Instead of distributing seed and bypassing retail systems, seed relief and government seed subsidy schemes should invest in e-vouchers that can be redeemed for officially recognized seed (or any other farm input) to empower consumers and discourage “pop-up” seed companies. Avoid breaking the link between farmers and authorized seed suppliers and consider aligning subsidies with crop diversification, resilience, and nutrition goals.</p>
	<p>13. Atomized and fragmented donor interventions fail to support the development of sustainable seed supply systems and can create perverse incentives and inappropriate competition. Interventions often only extend to variety release, not considering the need to introduce and promote varieties with new benefits.</p>	<p>13.1. More aligned and longer-term investments by funders, linked to agree KPIs.                  13.2. Technical assistance to seed companies must draw on experts with actual seed business expertise.                  13.3. Discussions on future investment strategies and alignment should be informed by capability gap analyses and the viability of the investment.</p>



The history of seed delivery in many countries of sub-Saharan Africa and Asia is one of publicly dominated systems where the Ministry of Agriculture had a monopoly on research, delivery by parastatal seed companies, and the regulatory agencies. Economic reforms have seen a liberalisation of the seed sector in many countries with privatization of parastatals and increased participation of commercial seed companies.

The expert consultation identified many areas where this transition has not fully happened and are holding back seed delivery and more rapid variety turnover in a significant number of countries. These include: outdated policies, laws and regulations; only a few public sector entities having structures in place to effectively link with the commercial seed delivery sector; inconsistencies in the application of rules; and use of subsidies creating unfair competition. This last point is, for example, seen in the cases of relief seed, where seed produced by the public sector or (ex-) parastatals is in some instances given preferential treatment. If multiple seed channels are to co-exist, the same rules and levels of subsidy need to be applied evenly and without bias.

Most of these issues are cross-sectorial and cross-disciplinary, and therefore complex. Assuming the political will exists, they need to be resolved collaboratively, with a strong and pragmatic focus on the overarching goal – to generate a vibrant seed sector that strengthens farmers' access to high-quality seed of the full range of crop varieties while desirably drawing on approaches that have strengthened seed delivery elsewhere.





# CHALLENGE 2

## COMMERCIAL DELIVERY OF INTERNATIONAL PUBLIC GOODS

The CGIAR was established when seed systems were publicly dominated, and collaborations were almost exclusively with NBPs of the Ministry of Agriculture. Although seed-sector liberalization has broadened the range of seed actors at national level over the past three decades, some CGIAR centers struggle to serve the broader range of seed actors for multiple reasons. First, materials developed by the CGIAR are intended as international public goods. This is sometimes misunderstood as that these materials have to be “delivered” by the public sector or with no commercial benefit. Secondly, a focus on an international public good may imply that some breeders inadequately consider seed and product market requirements when defining breeding goals. Third, there is ambiguity and/or misunderstanding over ownership and use of CGIAR-developed varieties. While some NBPs generate royalties by releasing CGIAR-developed varieties, a process which in many countries confers de facto commercialization rights, commercial companies can also directly access and submit CGIAR materials for registration, without paying royalties to NBPs.

For the CGIAR and NBPs to be more impactful, they need a more systematic framework to engage the private sector in the development and delivery of international public goods, as has been implemented by a few pioneering centers and NBPs. Furthermore, between these actors, there is need for a commonly agreed or more widely accepted framework for managing intellectual property, handing over new varieties from the public to the commercial sector for scale-up, doing this in a way that allows for multiple seed delivery channels to co-exist, and for equitable sharing of revenues to further support research and seed-system development. Best practice examples exist but they need to be discussed openly, consolidated, and implemented in a more systematic and streamlined manner.



# CHALLENGE 3

## PRODUCT PROFILES THAT DRIVE MARKET DEVELOPMENT

Whether public sector varieties will successfully be taken up by commercial channels relies on seed companies, farmers, and processors recognizing and investing into the value proposition of new varieties. A new variety must be “in demand” and the volume of the demand must be adequate to justify investment by a seed producer.

While plant breeders have gained a better understanding of farmers’ needs, the expert consultation revealed that breeding objectives and, more specifically, the actual product profiles are often insufficiently informed by the end-product requirements of agro-traders and processors. Regular demand for fresh seed is largely derived from crop varieties that are being marketed i.e., marketable crops are at the core of developing entrepreneurial seed delivery. Public breeding efforts that set out to understand market demand and have incorporate key traits into the product profiles turn out to be more successful in establishing downstream delivery pathways.

While there is an impressive range of examples for publicly bred crops that have improved smallholder livelihoods, the expert consultation also revealed that crop varieties that are being proposed for commercialization are in some instances insufficiently tested. As a result, they may not provide a sufficiently large advantage for a new variety to replace existing varieties. Breeding programs need to ascertain that differences to current varieties and the associated value proposition will trigger farmers to purchase seed of these new crop varieties and replace their current ones, and the varieties need to show these differences when grown under farmers’ own management practices. Also, seed of new varieties needs to be easy to produce including across a range of production environments for a seed company to be able to produce them at a price that is acceptable to farmers. At this stage, some public breeding efforts waste resources on proposing to commercialize varieties with inadequate benefit to farmers, seed companies or processors. These resources should instead be invested in more thorough collaborative testing with farmers and seed companies, and to raise awareness for fewer but substantially better varieties.

While breeders are very knowledgeable about their new varieties, this knowledge may not be transmitted. There is a great asymmetry of information between those offering and those seeking new varieties. Once the superior performance and value of new varieties has been confirmed, the public sector needs to place greater emphasis on awareness-creation among seed companies, processors, traders, extension services and farmers. They need to know the value proposition, how to access and produce the new varieties, and associated risks. Such awareness creation is crucial for new varieties to enter the marketplace. Some breeding networks have managed to develop close interactions to downstream entrepreneurs with the result that varieties get deployed faster and at larger scale. These approaches need to be more widely known and mainstreamed.

A photograph showing a person's hands and arms in a field of green plants. The person is holding a white notebook in their left hand and is reaching out with their right hand to touch or examine a plant. The plants are lush and green, with some small white flowers visible. The person is wearing dark clothing and black shoes.

# CHALLENGE 4

## STRENGTHENING SEED COMPANIES

Commercial seed companies have largely avoided production and marketing of a wider range of publicly bred crops targeted at smallholder farmers. Just as with publicly funded breeders, there is limited understanding of the market opportunities for these crops, and how to align seed production and marketing to take advantage of these opportunities. Furthermore, there are limited technical skills in quality seed production and in successful seed business management among emerging seed enterprises.

Competitive grants awarded to entrepreneurs for scaling seed have facilitated the establishment and expansion of multiple seed companies, particularly in sub-Saharan Africa. Competitive grants targeted to scaling of CtEH crops have encouraged commercial seed companies to take up the challenge of diversifying their product portfolio and to continue marketing of these crops without further grant support. There are examples of seed producer groups, often established with NGO support, wholesaling seed to commercial seed companies as seed producer groups lack access to markets beyond their immediate local area. Also, funders have supported emerging seed companies by investing in targeted capacity-building and provision of technical and seed business expertise, including on a one-to-one basis. These investments have been highly rated by beneficiaries, but there is a lack of quantifiable data on the effectiveness of these investments. Clear indicators are needed that guide the trajectory towards a commercially healthy and resilient seed enterprise, as otherwise there will be a proliferation of companies and seed producer organizations that continue to be dependent on public funds.

Managing a commercial seed business is both risky and complicated because of the long production cycles and product perishability. Commercial seed companies incur costs in procuring/producing early generation seed (EGS) and commercial seed, maintaining seed inventories between cropping seasons, and sharing the risk from unsold seed inventories at the retailer, given fluctuations in demand, and also when introducing new varieties or moving into new geographies. Greater attention needs to be paid to enable seed companies to build know-how and hedge against risks so as to make them eligible to access credits and other types of commercial investments.

A photograph showing a person's hands holding a white notebook and examining a green plant in a field. The person is wearing dark clothing and shoes. The background is filled with lush green foliage.

# CHALLENGE 4 STRENGTHENING SEED COMPANIES

In sub-Saharan Africa, the Alliance for a Green Revolution in Africa (AGRA) has supported technical capacity building for emerging seed companies through the Seed Enterprise Management Institute (SEMIS) at the University of Nairobi. Short-term residential training modules at the dedicated training facility, which is equipped with seed-processing equipment, is given by staff contracted from a range of selected agencies. This system has worked well to provide the basic know-how; however, Francophone and Lusophone speakers have not always benefited due to language barriers. This training has been supplemented with mentoring support provided by a cohort of seed experts contracted by AGRA and, in some instances, other organizations, to visit individual seed companies. Recently, go-to-market tools and strategies that are so far only available within the multinational private seed sector are being made available by the Seeds2B program. They are used to facilitate the commercialization of varieties of a wide range of crops, originating from a number of CGIAR centers and NBPs across Africa and Asia, through local commercial channels. Also, more recently, additional financing, backed by technical assistance, to meet the needs of a wider range of small and medium-sized seed companies in Africa has been made available through the “Seeds for Impact” program of the Africa Enterprise Challenge Fund (AECF).

Academic and applied seed business expertise both offer value but differ in their experiences and rationales and can require bridging. Further capacity-building in emerging seed companies will more likely be successful if they are being supported by a business-led platform where practical business know-how, tried and tested in successful companies, can support seed-sector evolution, integrate local experiences, further identify, evolve, and promote successful business strategies, and assist in managing and lowering risks.



# CHALLENGE 5

## GREATER CAPACITY FOR EARLY GENERATION SEED PRODUCTION

Within the area of seed production, EGS production remains a key bottleneck in the scale-up of new crop varieties. Particularly in sub-Saharan Africa, few entities are able to reliably execute the multiplication and implement strict quality control in the progression from breeder seed to pre-basic and basic seed, and do so for the wider range of crops. Likewise, few regulatory agencies have the necessary know-how to reliably monitor EGS production.

A proliferation of projects has attempted to build capacity in EGS production; some are successful, others were not. At this stage, an accreditation system is required that identifies qualified agencies – public, private, or regulatory – that have the necessary protocols and approaches in place to reliably scale up or certify EGS production at reasonable cost. Such accreditation systems exist in other sectors where there is a void in quality management. As for EGS production, the system could draw on protocols already used in the private seed industry, and which use updated technology such as fingerprinting for quality assurance (QA), and make them more widely available. Capacity development would need to be focused so as to increase the number of competent agencies that are strategically required for a particular crop. Seed companies that intend to deploy public varieties would then preferentially contract accredited EGS producers, whether public or private, and assume some of the risks by pre-paying for part or all of the contracted EGS. This is not a new approach. In many US research systems at the state level, EGS production is contracted out to pre-certified companies. These companies must compete for the opportunity to be a pre-certified EGS producer and they compete again for specific production contracts. The effect is to exercise quality and cost control.

Detailed studies of EGS production systems of a wide range of crops and in different countries have been developed. They are publicly available to help in guiding innovative institutional arrangements to address this bottleneck.



# CHALLENGE 6

## RIGHT-SIZING SEED REGULATORY APPROACHES

The ability to reliably implement each stage of the PLC is dependent on capacity and resources, which are both limiting in less developed markets. While emerging seed companies need access to technical and business know-how to develop a sound business and be able to access finance, there is also need to more effectively utilize or align what capacities exist in both the public and private sectors so to broaden crop and varietal choice and increase varietal turnover.

One area where this is needed is in seed regulation where the expert consultation highlighted several impediments between stages six and ten. In many countries, seed regulatory capacity has not kept pace with the expansion in commercial seed delivery. Seed regulatory functions are still predominantly carried out by under-resourced public agencies with the result that many countries have QA regulations that far exceed their ability to implement them. In many instances, fees charged by public agencies are not fully re-invested into expanding regulatory capacity, which leads to inconsistent and often delayed QA. Where there is some autonomy in the use of generated revenues, excessive fees may be charged. Excessive fees are a disincentive to seed-sector evolution, variety turn-over and particularly for crops that are less commercially attractive.

Policies and laws governing seed regulations are complex. In the past these were largely determined at national level but increasingly efforts are being made to change the regulatory regime to a regional approach to facilitate seed trade. In this transition, countries need to decide whether their current schemes are overregulated and indeed impede the availability of good quality seed. The move towards regional seed trade harmonization with harmonized regulations is a welcome development. It is important to ensure that unnecessary regulations at national level do not get incorporated into regional agreements. Also, attention needs to be given to the practical implementation of seed trade agreements and their integration into streamlined document-handling systems that are well developed for other commodities traded across borders.



# CHALLENGE 6

## RIGHT-SIZING SEED REGULATORY APPROACHES

One significant bottleneck to varietal turnover is the variety release process. National governments and regional institutions of most countries in sub-Saharan Africa require data both on distinctness, uniformity, and stability (DUS) and value for cultivation and use (VCU). Although DUS has been widely adopted for varietal identification, the development of newer techniques based on genetic fingerprinting are more accurate, quicker, and potentially cheaper to implement. VCU testing remains a significant challenge for many regulatory agencies, including for the variety release committees charged with deciding which varieties should be approved for release. VCU testing standards should be revised to encompass minimum (not maximum) standards that need to be met before a variety can be commercialized. They should be limited to pest and disease resistance that can be objectively assessed rather than testing of other traits, which is greatly dependent on the testing environments, time-consuming and often fails to account for the wider range of product profiles that farmers value.

The trading of sub-standard seed is an issue in sub-Saharan Africa— i.e. seed that is not true to the variety indicated, has poor germination, or contributes to transmitting disease. Quality assurance needs to be improved, drawing upon best practices both from within and outside of the continent. In India, South Africa, and the United States – very contrasting markets – the concept of “truthfully labelled seed” puts the onus on the seed producer to comply with rules that are backed up by strong sanctions for those caught selling sub-standard seed. In other countries, the concept of Quality Declared Seed (QDS) has been adopted. The QDS system provides an alternative for seed QA, particularly designed for crops or situations where resources are limited. It is less demanding than full seed quality control systems yet guarantees a satisfactory level of seed quality. Another third approach is for the regulatory authority or seed producers to contract trained and accredited seed inspectors. Finally, many advanced economies have progressed to providing accreditation to seed companies provided they have adequate internal quality control systems in place. In this instance, the seed regulator’s monitoring is done through audits and by following up on farmers’ feedback, recognizing that the ultimate judge of seed quality is the farmer investing in seed.



## IMPLICATIONS FOR THE CGIAR

Several CGIAR breeding centers are involved in the development of CtEH crops. While breeding approaches are professionalized in collaboration with the Excellence in Breeding platform (EiB), go-to-market strategies greatly vary. There are some excellent examples of variety deployment at scale. Yet in a significant number of cases, go-to-market strategies do not exist. In those instances, deployment is left to NBPs with no verification that seed of new varieties indeed gets to smallholder farmers within reasonable time and at large scale. Also, many CGIAR efforts inadequately consider, understand, and utilize the emerging entrepreneurial seed sector. As a result, varieties may not be deployed even though opportunities exist or, alternatively, public funds may be ineffectively invested in non-viable business and deployment solutions.

Based on the expert consultation and analysis of bottlenecks, the following sections recommend how the CGIAR and NBPs may want to adjust their approaches to be more successful in developing and deploying newly developed varieties. An important issue is that the development and deployment of new crop varieties should not be seen in isolation – as standalone, externally funded projects that will be repeated endlessly – but as steps in the evolution towards a more effective, sustainable local seed sector, with appropriate public and regulatory capacities and a vibrant entrepreneurial sector. How to support such an evolution for CtEH crops is first discussed by establishing a framework for collaboration between the public (CGIAR, NBPs) and private seed sector. As a second step, it also looks at desirable changes in variety development and the role of CGIAR and local breeding programs.





# FRAMEWORK FOR THE COLLABORATION WITH THE PRIVATE SECTOR

The public and the private seed sector assume different roles in the development and deployment of new crop varieties depending on the commercial attractiveness of selling seed in a particular region or market (Fig. 2). In the commercially most attractive markets, with high marginal economic value of quality seed, a competitive private sector will execute all parts of the life cycle (Fig. 2, Case D: private sector archetype). This situation is often not the case in lower value markets of emerging economies where private sector investments in fully fledged breeding programs are commercially unviable, such as where CtEH-funded crop-breeding projects are implemented by the CGIAR and NBPs.

Commercially unattractive crop varieties are initially developed and distributed by the public sector (including possibly parastatals) and the informal sector (Fig. 2, Case A). As markets evolve, and crops and seed-value chains become commercially more viable, the seed sector for a particular crop and region will evolve for entrepreneurial entities (seed companies, farmer producer organizations) to first assume a greater role in seed production and commercialization (Stages 7-10, Fig. 2, Case B), before partnering in testing (Stage 5) and possibly earlier upstream breeding stages (Stage 3-4), submitting varieties for registration, and executing or contracting EGS production (Stage 6, Fig.2, Case C). Hence, the more commercially attractive a crop-market combination, the greater the involvement of the private sector.



# FRAMEWORK FOR THE COLLABORATION WITH THE PRIVATE SECTOR

The private sector will not engage in crop-region combinations with inadequate marginal economic value which implies that for some crop-region combinations, distribution would need to be subsidized/publicly supported for new crop varieties to reach farmers (Case A). Provided a substantive amount of quality seed is made available initially through the formal sector or parastatals – experts estimate this amount to have to cover at least 15 percent of the area – further distribution through the informal sector can be quite successful in the case of self-pollinated or vegetatively propagated crops.

The evolution from Case A to Case B to Case C to Case D can be helped along through capacity building and by lowering or absorbing part of the risk that companies take as they enter into new crops or markets, and some of these interventions are listed in Table 1.

LC stage	Crop-by-region or crop-by-market combinations			
	Commercially less attractive << --- >> Commercially highly attractive			
	<b>Case A: Public sector archetype</b>	<b>Case B: Public-private archetype</b>	<b>Case C: Public-private archetype</b>	<b>Case D: Private sector archetype</b>
<b>Stage 1-4</b>	Public sector	Public sector	Public sector	Private sector
<b>Stage 5</b>	Public sector	Public sector	Public sector, desirably with private sector participation	Private sector
<b>Stage 6</b>	Public sector	Public sector	Private sector	Private sector
<b>Stage 7-10</b>	Subsidized formal introduction, further informal dissemination	Private sector	Private sector	Private sector

**Fig. 2. Public and private sector engagement in the life cycle of crop varieties depending on the marginal economic value of quality seed**

To be more successful in the deployment of newly developed public varieties, and to more deliberately support seed sector evolution, it is recommended that the CGIAR and NBPs address the following issues:

**1. For any particular crop-region combination, the CGIAR or NBPs should only execute activities within a certain life cycle stage if:**

- The private sector is unable to capably lead and execute those activities, or
- The market is dominated by one private sector entity and there is no competitive market created by different private sector entities, or
- The market environment does not address the particular needs of smallholders (e.g. crops suited for low input conditions), or other public goals (e.g. improved nutrition).

**2. Interventions by the CGIAR and NBPs should be designed so they foster the evolution towards a competitive private sector environment (Case A to B to C to D), i.e. establishing, as much as possible, economically sustainable systems that lead to continuous delivery, thereby reducing the need for public funds. This implies that:**

- CGIAR and NBPs acknowledge that most countries have liberalized seed laws and regulations in place which give equal rights and obligations to public and private breeding programs. Countries put these laws and regulations in place to allow diverse entities to develop, test, register, and produce seed of new varieties in a competitive manner to the benefit of the farming community.
- CGIAR and NBPs (and their funders) recognize that emerging seed companies are often in a similar position to the NBPs. Initially they may not have the capacity or resources to participate in testing but are able to scale up a variety licensed from the CGIAR or the NBP (Fig. 2, Case B). With the seed business growing, a company begins to invest in “research”, which implies that the seed business participates in testing, and possibly in EGS production (Fig. 2, Case C).
- CGIAR and NBPs (and their funders) recognize that a seed company needs to be substantially more sophisticated, resourced and have capable personnel on board to be able to fully support the development of top-notch varieties (Case A).
- CGIAR breeding networks therefore include both NBPs and private sector entities, all of them with variable strength, contributing according to their availability of resources, facilities and capabilities and aligned with their mandates.
- CGIAR offers capacity development to both public and private breeding programs. In the case of the private sector this may be on a self-paying basis.
- Also, in the Case A where the introduction of new crop varieties may need to be partially supported by public funds, the CGIAR and NBPs aggregate experiences and develop approaches on how to effectively involve the private and informal sectors for true-to-type seed to reach smallholders at large scale and within a reasonable time period.

**3. In the hand-off to commercialization, the CGIAR and NBPs actively broker and guide linkages with private seed companies for the deployment of new public varieties. This implies that:**

- Drawing on outside expertise and current experiences, the CGIAR establishes a transparent and simple legal framework and system for germplasm sharing, registration, licensing, and IP management from the public to the private sector, including realistic approaches to revenue management between CGIAR centers and NARS, to promote greater access and investment. **The resulting approaches should:**
  1. Fully recognize seed sector liberalization and find approaches for the fair and appropriate treatment of public and private sector partners.
  2. Enable NBPs to generate income proportionate to their participation in CGIAR breeding networks, while not monopolizing the role of NBPs.
  3. Be designed that they do not hinder the deployment of new varieties by small and emerging companies, e.g. by phasing in revenues aligned with sales volumes and not charging unrealistic royalties.
  4. Manage the registration and commercialization of CGIAR varieties contractually and only exceptionally through PVP registration.
  5. Ensure compliance with the International Treaty on Plant Genetic Resources for Food and Agriculture and the Standard Material Transfer Agreement (SMTA).
- CGIAR and NBPs communicate to the private sector what varieties are available for commercialization, seed production characteristics and protocols, information about ease of multiplication and risks, and how to access germplasm for commercialization. This needs to happen in a streamlined manner and systematically across crops.
- Publicly bred varieties are offered for deployment using transparent product allocation criteria that consider the capability of suppliers, speed to farmer, diversity of suppliers, and wide availability.
- There is a plan and support for reliable EGS production through a competent local entity, either the NBP, parastatal or a private sector entity.
- CGIAR advocates that accreditation principles are developed to identify capable EGS producers which then qualify for inclusion in public funded projects.
- Actual demand for seed of new varieties is estimated or assessed, and variety deployment pursues and aids the development of sustainable business models aligned with that demand.
- Capabilities are being built for NBPs and the private sector to be more proficient in the marketing of new varieties.
- Drawing on outside expertise and current experiences, the CGIAR establishes a framework for how rigor during variety development in its breeding networks and a unified approach to branding may be utilized to build trust for new varieties.

4. While we do not promote the idea that the CGIAR gets involved in seed production or commercialization, streamlining deployment of public varieties implies that the CGIAR and NBPs need professionals – a unit or a platform or a contracted agency – that intrinsically understands and can effectively link with entrepreneurial entities involved in deployment and design realistic approaches to variety deployment that support viable commercial seed market evolution. This is the more important as emerging seed businesses in the developing world cannot afford to embark on non-viable business solutions and themselves lack seed production and marketing know-how for new crops or varieties. This unit would establish best, albeit pragmatic practices, and develop systems to streamline the implementation of recommendations made in Point 3. The planning and management of the steps from late stage breeding through to hand-over to commercial partners needs managing through a stage-gated advancement process to facilitate efficient “portfolio management” of new products linked to a responsive breeding pipeline. The use of the kinds of tools being made available by the Seeds2B program (product advancement “handbook”) would greatly enhance the efficiency of these processes and permit the monitoring of progress against CtEH targets. However, these approaches, widely adopted in the commercial seed sector, need adapting to be relevant to the different objectives of public breeding and to permit a wider range of voices to be heard, including social scientists, gender specialists, etc.



# FRAMEWORK FOR CGIAR COLLABORATION WITH NATIONAL AND OTHER LOCAL BREEDING PROGRAMS

With access to a vast amount of genetic diversity and working at the international level with a substantive target environment, CGIAR centers have a comparative advantage in executing breeding programs for important food crops and for public goods purposes, such as climate change adaptation, nutrition, emerging pests and diseases or to address smallholder farmers requirements if they differ from those of large-scale farmers. However, in the same manner as the role of the private seed sector will evolve and assume a greater role, CGIAR collaboration with NBPs and other local breeding programs should be seen as an evolution towards a situation where local resources and breeding program capacities will become adequate to develop top-notch varieties for distinct crops and markets (Fig 3, Case D), as is the case in high- and many upper middle-income countries.

In lesser resourced countries and in the case of CtEH crops, breeding networks that involve CGIAR centers, NBPs and other local public or private breeding programs provide an avenue for partners to combine resources, including staff, facilities, nursery and testing locations and information to develop crop varieties that provide greater value to farmers, market participants and consumers (Fig 3, Case A, B and C). Such breeding networks deliver greater gains from the resources available to each partner, and the resulting varieties can be utilized across multiple countries. The design of breeding strategies and network collaboration influence the success of resulting varieties and are also key in building local breeding capacities.

Based on local resources and capacities available for the development of a particular crop, collaboration in such breeding networks can be of a different nature. This is already demonstrated by the current design of different CGIAR breeding networks. However, what would a rationale evolution of partners' roles look like? First, NBPs and other local, public or private breeding programs should ensure that they are able to effectively test (Stage 5) and adequately resource and execute variety registration and EGS production (Stage 6), i.e. execute those activities where they have a unique comparative advantage (Fig 3, Case A), and do so before embarking on other stages of variety development. As capacities evolve at the local level, a breeding network will be able to divide responsibilities for germplasm development between CGIAR centers and local breeding programs (Fig 3, Case B) or develop varieties through the strongest local partner(s) within the network (Fig 3, Case C), for deployment across multiple countries. Such networks require competent leadership and clear rules on how all participating partners can access the germplasm for research, breeding and commercialization, commensurate with their role in the network.

NBPs and other local breeding programs should only seek to execute an independent, full-scale breeding pipeline (Fig 3, Case D) if they are able to fully support the development of varieties of similar or better performance than the collaborative network and where the market size justifies this effort, or for crops for which no such networking opportunities exist. Excellence in Breeding can help NBPs to optimize their breeding investments and approaches.

Several CGIAR centers have developed consortia-type approaches, in situations with diverse private-sector presence (typically in the case hybrid crops), to formalize private-sector in-kind and financial contributions proportionate to germplasm access and use. Provided clear and agreed rules exist on how all participating partners can access the germplasm for research, breeding and commercialization, such consortia can work in Case A, B, C, or D. They are one logical approach for how the private sector can contribute to public sector research. In other instances, fruitful collaboration has been established with distinct private sector breeding programs which may also lead to new routes to market.

LC stage	Local resources and capacities available to address a crop-by-region or crop-by-market combination through a crop breeding program			
	Inadequate <<< ----- >>> Adequate			
	Case A: Breeding network	Case B: Breeding network	Case C: Breeding network	Case D: stand-alone breeding program
<b>Stage 1: Variety design</b>	Network partners (CG centers, NBPs, private sector) agree on product profiles to be pursued and roles of partners			NBP and other local breeding programs
<b>Stage 2: Discovery</b>	CGIAR provides traits and germplasm	CGIAR centers provide specific traits and germplasm, others are sourced locally		
<b>Stage 3: Product development</b> <b>Stage 4: Initial testing</b>	CGIAR breeding program	Responsibilities are divided between CGIAR centers, NBPs and other local breeding programs	Responsibilities are delegated to the strongest NBPs or other local breeding programs	NBP and other local breeding programs
<b>Stage 5: Large-scale testing</b>	Collaborative testing across multiple countries, at representative sites; coordinated linkages with the private seed sector who will deploy varieties			NBP and other local breeding programs
<b>Stage 6:</b>	NBP and other local breeding programs	NBP and other local breeding programs	NBP and other local breeding programs	NBP and other local breeding programs

**Fig. 3. CGIAR and local public and private sector engagement in the development of crop varieties depending on locally available resources and capacities**

In the interest of fostering the development and deployment of increasingly better varieties and at a larger scale, including through stronger local breeding programs, it is recommended that the CGIAR reviews and possibly adjusts its breeding networks in terms of leadership, role of partners, strategy and financial support, particularly for the following aspects. These approaches are utilized by the more successful breeding networks. Their use needs to be mainstreamed across the CGIAR.

**1. Leaders of CGIAR breeding networks** need to be chosen that are able to effectively lead through the variety development and deployment process and with motivated and actively participating public and private sector partners. This requires both technical and leadership-cum-facilitation skills. For CGIAR-NARS networks to perform well – and the network leader assumes a crucial role in that – they need to pursue the following principles:

Principles for an effective network	Common mistakes and issues
✓ Common commitment: The network is composed of capable and committed partners such as CG centers, NBPs in countries with similar variety requirements, in some instances also the private seed sector or universities.	The network tries to involve all partners, whether they are committed or not to sharing goals, resources and capabilities.  Partners access resources yet pursue different objectives.
✓ Common goal: Variety design (Stage 1) is executed with input from all partners so to arrive at the agreed set of product profiles.	The product profile is poorly defined, or one person or institution decides without involvement of the other partners.
✓ Common understanding: Partners acquire a common understanding of how the breeding pipelines are being optimized, using quantitative genetics principles, so the development and testing approach produces the desired product profiles in the most cost-effective manner.	Decisions are made “over the head of some of the partners” because “they don’t understand”. Note: common understanding motivates and enables equitable participation.
✓ Agreed approach for variety allocation for registration and commercialization, whether royalties are being paid and how such income is utilized.	Unclear decision-making
✓ Agile and competent leadership that effectively leads through the variety development and deployment process, allocates resources, ensures progress in the most pragmatic manner, and is able to undertake necessary course correction.	Focus is on dividing resources instead of defining and pursuing a common objective in the most effective manner.
✓ Clear responsibilities: Partners take responsibility for distinct activities towards the common product profiles, aligned with their own capacity such as: know-how, access to land, facilities and services, ability to achieve the desirable results in the most cost-effective manner.	Poor definition of responsibilities. Non-transparent approaches for how responsibilities are being allocated. Network leader ignores opportunities for executing activities through alternative more cost-effective approaches. Mismatch between responsibility and how resources are being assigned to meet the common goal.
✓ Transparent accountability: Partners discuss progress and issues, and the contribution by each partner using robust technical KPIs. Advancement decisions during Stages 2-5 strictly follow the product profile defined in Stage 1.	Some partners “do not pull their weight” or are not held accountable. Non-specified progress indicators.



2. The CGIAR should not execute activities that can be executed more cost-effectively (i.e. same outcome with less need for external funding) by local partners. **Capacities should be built to enable local partners to assume increasingly greater responsibility** in network activities. In particular, CGIAR staff should not execute Stages 6 and 7 activities themselves but instead:

- Enable local capacities to execute large-scale on-farm testing.
- Submit CGIAR varieties for registration through NBPs and the private seed sector.
- Assist in building local capacities for Early Generation Seed (EGS) production.
- Support NBPs and the private sector in promoting and launching new varieties.
- Develop strategies that reduce the risk of first seed sales of new varieties and crops.

3. To enable local partners to assume greater responsibility, CGIAR breeding networks need to direct attention towards building capacities and resourcing activities that typically are to be conducted by local partners, considering the available resource base of partners and what resources may need to be provided by external fund. This includes financial support for:

- **On-farm testing at scale** under farmers' own conditions to ensure new varieties provide substantially greater value to farmers and their trading partners.
- In cases where EGS cannot be fully executed on a commercial basis, **EGS production** with a competent local partner through prefinancing or "first loss" seed buy back schemes to reduce risk of entry into producing EGS.
- **Focused campaigns** that make farmers, traders, and processors aware of the value proposition of new varieties, engaging extension services and other farmer service providers, and proven tools such as radio, TV, social media, small-pack promotions.
- **Germplasm development activities** that can be executed more cost-effectively by local breeding programs, benefit all network partners, and yet cannot be fully funded with local resources.

4. EIB is working with breeding programs to professionalize breeding approaches across CtEH crops. Beyond these ongoing efforts, this expert consultation highlighted two aspects related to **variety development** that will influence the success of future varieties:

- **New varieties need to deliver an advantage that farmers are able to recognize in their own field. Therefore, CGIAR breeding networks, NBPs, and other local breeding programs should:**
  1. Reorient resources so they deliver fewer but relatively better varieties, at a rate aligned with the absorption capacity of the available seed production channels.
  2. Scale-up on-farm testing under farmers' own management conditions to ensure new varieties perform as expected and provide substantially greater value to farmers.
  3. Engage downstream partners, in particular seed companies, early in both evaluating results and participating in testing so as to eliminate varieties that may not prevail in the marketplace.
- **Instead of broadly assessing "farmers' preferences", which leads to a proliferation of desirable characteristics, product profiles need to be focused so they deliver varieties with characteristics that are informed by what farmers and the market (processors, aggregators, and consumers) are willing to pay for.**

Aligned with EIB developing KPIs to capture the effectiveness of variety development, the CGIAR, and NBPs need to develop pragmatic KPIs (including innovative approaches to data collection and use) that capture the scale and reach of variety deployment, and the strength and capabilities of local breeding, EGS production and deployment partners. This will enable aligned and longer-term investments by funders and inform future investment strategies to be aligned with capability gap analyses and the viability of the investment.

# 7 - CAPACITY DEVELOPMENT AND ADVOCACY NEEDS BEYOND THE CGIAR

## CAPACITY DEVELOPMENT AND ADVOCACY NEEDS BEYOND THE CGIAR

The analysis of bottlenecks and interventions identified several areas where funder alignment needs to happen, yet where the CGIAR, at this stage, has no comparative advantage for implementation.



Emerging seed companies need to be supported by business-led platforms where practical business know-how, tried and tested in successful companies, can support seed sector evolution in low- and middle-income countries. Various organizations contracted consultants from the multinational sector to support emerging seed companies. While this support is greatly appreciated, better coordinated, skill-based approaches would more systematically ensure “end-to-end” solutions are being implemented, facilitate the necessary public-private linkages, build such capacities, and integrate local feed-back.

The Seeds2B initiative, started by the Syngenta Foundation for Sustainable Agriculture, has successfully piloted the secondment of experienced seed business expertise to local seed companies, as have others, including AGRA. Seeds2B plans to further engage seed professionals from large corporates to act as mentors as part of their own company career development. Mention has already been made of the Seeds2B handbook to assist product advancement decisions by public breeding networks. Seeds2B may also take a wider role in facilitating relationships between public sector breeding programs and SME seed companies through capacity building. This initiative is envisaged as evolving into an Africa-led multi-stakeholder initiative, constituted as a social enterprise or other form of sector support institution, that has access to a broad pool of seed business and regulatory expertise and can conduct its work at much greater scale alongside AGRA and other key actors. It could initially be supported through cost-sharing but move towards fuller cost recovery for selected services. Seeds2B, and others like it, will be in a position to assist in the following two areas identified in this White Paper:



SEED COMPANY SUPPORT

**Build the technical and managerial capacity of emerging seed companies in:**

- Mitigating production and business risks and get more likely access to finance.
- EGS and certified seed production.
- Meeting regulatory requirements.
- Portfolio management and life-cycle strategies.
- Market development and promotion including pricing on value, establishing and demonstrating a value.
- Use of tamper-proof packaging, labels, and use of e-verification systems.

**Evolve and promote new business strategies, such as those that:**

- Are built on successful past experience, understand limitations and can guide seed companies on how to diversify their portfolio or enter new markets.
- Stimulate collective action among companies and seed multipliers to reduce risk, increase efficiencies, leverage skills and physical infrastructure (storage, processing, and irrigation) or implement QA.
- Facilitate strategic partnerships (including joint ventures, aggregations, and cooperatives) across countries, providing a surrogate for the way that international companies hedge against local problems and fluctuations in demand.
- Develop crop-specific strategies and protocols to produce EGS of adequate quality and quantity of diverse crops in a cost-effective manner, and establish an accreditation scheme that identifies capable EGS producers.
- Familiarize seed companies with commercially oriented KPIs to adopt a trajectory towards commercial investment.

**Continued advocacy and capacity building is required to support regulatory reform at national and regional level, through organizations such as AGRA, COMESA, ECOWAS and SADC to:**

**1. Assist countries in implementing more pragmatic and simpler approaches to variety registration, such as those that:**

- Align the regulations and guidelines of national variety release committees to only include legitimate public-good traits (e.g. those that address plant health concerns or nutrition) and exclude those traits that try to “second guess” the market.
- Reciprocate more liberalized yet successful approaches such as those used in India and South Africa, where seed companies are not required to formally register varieties or certify seed, but rather are bound by the claims they make on the label with consumers having recourse to redress and compensation for bad quality seed. In India, variety registration is required if the seed producer wishes to participate in government subsidy schemes.

**2. Assist countries in implementing more pragmatic and simpler approaches to seed certification, such as those where:**

- Seed inspection is executed through accredited private inspectors.
- Value chain actors take responsibility for their products, and the emphasis moves from one of “punishing wrong-doers” to “empowering consumers”.
- Centralized certification is limited to EGS production for commercially less attractive and clonal crops, to reduce the costs and additional business risks posed by mistakes of certification and enable the sale of “truthfully labelled”/quality declared seed.
- Seed quality is monitored on a sample basis at the point of sale or before large-scale distribution (DNA fingerprint as compared to a reference variety, viability) instead of checking every step in the seed multiplication process.
- Consumers are empowered to place a claim in case of poor-quality seed backed by accessible legal redress or industry-supported compensation schemes (including insurance).

**3. Strengthen coordination capacity for implementing regional seed laws and regulations.**

**4. Enable regulatory systems and national/regional seed trade associations to systematically collect and publicize seed production and seed trade data.**

**5. Help in digitizing some elements of seed inspection and certification to improve efficiency and quality, i.e. replace paper-based systems with fit-for-purpose software that will facilitate traceability from production through to point of sale.**

**6. Promote best practices for the use of seed relief and government seed subsidy schemes so as to avoid breaking the link between farmers and authorized seed suppliers** and using subsidies with crop diversification, resilience and nutrition goals. This means that instead of distributing seed and bypassing retail systems, seed relief and government seed subsidy schemes should use e-vouchers that can be redeemed for any type of officially recognized seed (or any other farm input) to empower consumers and discourage “pop-up” seed companies.

The strengthening of NBPs requires more fundamental changes to engage in effective partnership as proposed in this White Paper. AGRA is well positioned to advocate for and support such institutional reform drawing upon best business practices. Suggested areas include:

- 1. Staffing skills need to be diversified and supporting systems established to enable innovative public-private partnerships.**
- 2. Many NBPs have large inventories of land, offices, and laboratories. These resources could be more effectively shared with commercial companies and the revenue generated used to support research activities, particularly operational costs.**
- 3. Limited public resources need to be more deliberately focused on activities that are not commercially viable.**
- 4. KPIs need to be developed and promoted that support, monitor, and assess impact of NBPs.**

A reformed CGIAR that collaborates with efficient and resourced NBPs will profoundly change their relationship for the better. NBPs will become empowered partners where both will work towards a common goal and be able to draw upon the strong scientific base that exists within the CGIAR.