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CGIAR Kenya Country Evaluation: Case Study Report on Biofortified Beans

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October 2026



Citation: Haussmann, B. I.G., Theuri, G., Agwara, H., Culver, K. 2026. CGIAR Kenya Country Evaluation: Case Study Report on Biofortified Beans. Rome: CGIAR Independent Advisory and Evaluation Service (IAES)

<https://iaes.cgiar.org/evaluation/publications>

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Contents

Executive Summary	iv
1. Introduction	1
1.1 Background	1
1.2 Purpose	2
1.3 Evaluation Questions	2
2. Methodology	2
3. Limitations	3
4. Key Findings	4
4.1 Background	4
4.2 Relevance: Alignment with National Priorities	5
4.3 Coherence and Efficiency: Partnerships	5
4.4 Effectiveness: Adoption and Emerging Outcomes	7
4.5 Sustainability: Conditions for Continued Scaling	8
4.6 Explaining the Findings	9
5. Conclusions and Lessons Learned	10
6. Way Forward	11
Annex 1. Bibliography	12
Annex 2. Additional Figures	15
Annex 3. Stakeholders Consulted	17
Annex 4. Data Collection Guides	18

List of Figures

Figure 1. PABRA bean commodity corridor approach: interventions across production, distribution and consumption hubs	6
Figure 2. Innovation Pathway	16
Figure 3. Multi-Stakeholder Platform model linking bean seed supply and grain demand	17
Figure 4. Stakeholder categories included in the case study data collection	18

List of Tables

Table 1. Biofortified common bean varieties released in Kenya since 2017	4
Table 2. CMO patterns shaping the development and scaling of biofortified beans in Kenya	9
Table 3. Guide A. Technical and Pathway Actors	18
Table 4. Guide B. Scaling and Dissemination Actors	19
Table 5. Guide C1. Government and Policy Actors	20
Table 6. Guide C2. Donors and Strategic Funding Partners	20
Table 7. Guide D. End Users and Market Actors	21
Table 8. Guide E. Alternative Focus Group Discussion Guide with End Users	21

List of Acronyms

CGIAR in the past stood for Consultative Group of International Agricultural Research, but now is a name in its own right, and not an acronym. Today, CGIAR is a global research partnership for a food-secure future, dedicated to transforming food, land, and water systems in a climate crisis, operating as a global network of 13 research centers, often referred to as the CGIAR Consortium of International Agricultural Research Centers.

ABC	Alliance of Bioversity International and CIAT	KEPHIS	Kenya Plant Health Inspectorate Service
ACIAR	Australian Centre for International Agricultural Research	KNAP	Kenya Nutrition Action Plan
AGRA	Alliance for a Green Revolution in Africa	KNBS	Kenya National Bureau of Statistics
ASTGS	Agriculture Sector Transformation and Growth Strategy	Masl	Meters Above Sea Level
CABI	Centre for Agriculture and Biosciences International	MELIAF	Monitoring, Evaluation, Learning, Impact Assessment and Foresight
CGA	Cereal Growers Association	MSP	Multi-Stakeholder Platform
CIAT	International Center for Tropical Agriculture (now part of the Alliance of Bioversity International and CIAT)	NARES	National Agricultural Research and Extension Systems
CMO	Context–Mechanism–Outcome	NARS	National Agricultural Research Systems
Fe	Iron	NGO	Non-Governmental Organization
GAC	Global Affairs Canada	PABRA	Pan-Africa Bean Research Alliance
GAIN	Global Alliance for Improved Nutrition	SDC	Swiss Agency for Development and Cooperation
IAES	Independent Advisory and Evaluation Service	SPIA	Standing Panel on Impact Assessment
KALRO	Kenya Agricultural and Livestock Research Organization	TAAT	Technologies for African Agricultural Transformation
		USAID	United States Agency for International Development
		Zn	Zinc

Acknowledgements

This report was prepared by independent consultants under the guidance of the Independent Advisory and Evaluation Service (IAES) Senior Evaluation Manager Ibtissem Jouini. Overall direction was provided by IAES Director Allison Grove Smith. Peer review was provided by Dr. Ravindar Kumar, a member of the [Evaluation Reference Group](#).

The evaluation team gratefully acknowledges the generous support of all those who contributed to this case study. Special thanks to Dr. Jean Claude Rubyogo, Global Bean Program Leader and Director of the Pan-Africa Bean Research Alliance (PABRA), for facilitating the evaluation team's visit to Kenya, mobilizing colleagues from the Alliance of Bioversity International and CIAT (ABC)/PABRA, and partners from the Kenya Agricultural and Livestock Research Organization (KALRO) and other national research partners, establishing contacts with seed companies and food processors, and providing continuous support throughout the case study. This assistance was invaluable and highly appreciated.

Another special thanks also go to Dr. David Karanja, National Coordinator for Grain Legumes at KALRO, for dedicating several days to accompanying and engaging with the evaluation team and for generously sharing knowledge and experience.

We sincerely thank all colleagues and stakeholders who participated in interviews, shared publications and other information, responded to follow-up questions and emails, and otherwise contributed their time and insight. Your support was highly valued.

Finally, we would like to acknowledge and thank all partners for the important work they are doing to strengthen bean research, seed systems, markets and nutrition in Kenya.

IAES staff provided essential support throughout the process, ensuring the smooth coordination of the field visit and administrative activities. Copy-editing was provided by Kelly Blank, and layout and design by Federica Bottamedi.

Executive Summary

This case study examines the development, scaling and emerging outcomes of the Kenya biofortified bean innovation system, co-developed by the Kenya Agricultural and Livestock Research Organization (KALRO) and other Kenyan partners with support from the Alliance of Bioversity International and CIAT (ABC) through the Pan-Africa Bean Research Alliance (PABRA), HarvestPlus and other partners. This study was undertaken as part of the CGIAR [Kenya Country Evaluation](#), which assesses the extent to which CGIAR's de facto country work is aligned with national priorities, and whether coordination mechanisms among CGIAR centers and programs function coherently and effectively to deliver outcomes.

The innovation system reflects a long-term collaborative research and development effort predating the 2022–25 evaluation period, with key variety releases between 2017 and 2023. The case assesses CGIAR's contribution within this wider partnership to Kenya's agricultural, nutrition and development priorities through the lenses of relevance, coherence and efficiency, effectiveness, and sustainability. Using a qualitative, realist evaluation approach, it draws on literature and document review, available quantitative evidence and consultations with 52 stakeholders across research, government, private sector, development partners and farmers.

Relevance. The innovation is well aligned with Kenya's agricultural, food and nutrition security and climate-resilience priorities. KALRO and other Kenyan partners developed and adapted biofortified beans through demand-led breeding, drawing on germplasm, breeding expertise and regional collaboration made available through the PABRA network, of which KALRO is a member, with support of ABC. This work linked nutritional objectives with agronomic, culinary and market traits valued by farmers and consumers. Six biofortified varieties have been released since 2017: four by KALRO (Nyota, Angaza, Metameta and Faida), one by Egerton University (EUB 502/Tatton) and one by Pure Seeds EA Ltd. (NUA45/Pure Seed 1). This diversified portfolio is an important achievement. However, dissemination remains concentrated around Nyota. Some stakeholders reported disease susceptibility and weaker performance of Nyota in higher rainfall areas; these observations require further agronomic verification and should not be generalized nationally. The other released varieties continued breeding, and the emerging pipeline of improved biofortified varieties provide opportunities for deploying the wider portfolio in a way that better matches local contexts.

Coherence and efficiency. A particular strength is the long-term partnership model combining strong national leadership with regional collaboration. KALRO led adaptive breeding, testing and deployment in Kenya,

drawing on germplasm, expertise, capacity development and regional learning available through the PABRA network. The Kenya Plant Health Inspectorate Service (KEPHIS), seed companies, county governments, development partners, processors and institutional buyers played complementary roles across seed systems and markets. Working through national institutions and sharing germplasm and expertise reduced duplication and generated process efficiencies. As scaling progresses, opportunities increasingly lie in strengthening downstream coordination between seed supply, farmer demand and viable grain markets.

Effectiveness. Biofortified beans have progressed from research and variety release into farmer production and commercial and institutional markets. HarvestPlus Solutions (2024) reported that biofortified beans accounted for about 5% of national bean production, while Nyota covered approximately 13% of bean area within intervention zones. More than 200 schools in four counties reportedly introduced Nyota by 2024, demonstrating emerging institutional demand. Evidence on sustained adoption and livelihood and resilience outcomes remains limited. International trials demonstrate that iron from biofortified beans is bioavailable and can improve women's iron status (Haas et al., 2016; Glahn et al., 2020), but Kenya-specific evidence of nutrition outcomes is not yet available.

Sustainability. The partnerships described in this case established important foundations for continued scaling, including national breeding and regulatory capacities, private seed-sector participation, decentralized delivery approaches and emerging grain and institutional markets. Sustaining these achievements will require balancing competing interests and incentives across the innovation system—for example, affordable quality seed for farmers with viable markets for seed producers, and institutional demand for nutritious beans with procurement costs. Complementary commercial, decentralized and institutional-market scaling models, stronger seed quality and varietal identity, reliable grain markets, contextual varietal deployment, and sustainable financing can help navigate these trade-offs. Continued breeding will remain important as climate, disease pressures and preferences evolve.

Overall, the case illustrates the value of CGIAR's scientific comparative advantage when embedded in nationally owned, long-term innovation partnerships. It points to three opportunities to build on these achievements: using the PABRA experience as a learning case across CGIAR; extending portfolio breeding into contextual portfolio scaling across crops and environments; and generating stronger Kenya-specific evidence on the nutrition, livelihood and resilience outcomes of biofortified beans.

1. Introduction

1.1 Background

This case study was undertaken as part of the CGIAR Kenya Country Evaluation Pilot, which assesses the extent to which CGIAR's de facto country work is aligned with national priorities and across centers, and whether coordination mechanisms among centers and programs function coherently and effectively to deliver outcomes. Following the System Council's approval of the 2026–27 Workplan and Budget for the Independent Advisory and Evaluation Service (IAES), the Evaluation Function is proceeding with a process and performance country evaluation pilot (see evaluation Concept Note and [Terms of Reference](#)). The innovation was identified from a stocktaking inventory compiled by the Centre for Agriculture and Bioscience International (CABI), contracted by the Standing Panel on Impact Assessment (SPIA). The development and scaling of biofortified bean varieties (hereafter referred to as the innovation) was selected as the case study because it met predefined selection criteria:

1. The innovation must demonstrate direct collaboration between at least two CGIAR centers operating in Kenya and at least one external partner, including cases that also show linkages with bilateral funding.
2. Innovations that span the full co-design to scaling pathway, involving identifiable demand and scaling partners.
3. The selected innovation lifecycle should overlap with the 2022–24 Portfolio and/or into the current Portfolio.
4. The case should have clear potential to inform CGIAR Portfolio management and align with at least one national priority in the coming years.
5. The case study must not duplicate ongoing or planned Monitoring, Evaluation, Learning, Impact Assessment and Foresight (MELIAF) studies; innovations already under assessment will be excluded to ensure complementarity and efficient use of resources.
6. The case must be feasible to assess within the evaluation timeframe, key stakeholders' availability, and sufficient data availability.

Among these, biofortified high-iron beans were identified as a mature technological innovation with strong potential for adoption and scaling (see Kenya Evaluation ToR Appendix 12. Case Study Selection Process).

Beans are among Kenya's most important food crops and constitute a major source of dietary protein and micronutrients for millions of households. They are predominantly cultivated by smallholder farmers, particularly women, and play an important role in food security, nutrition and household income. According to Ritho et al. (2023) beans supply approximately 9% of national calorie intake and 11–14% of daily protein intake, with annual per-capita consumption of around 12–15 kg nationally and substantially higher levels in parts of western Kenya. Most farming households retain about 60% of production for home consumption.

Beans are also an important dietary source of iron, zinc and other essential micronutrients, making them a suitable target for biofortification. The main policy impetus for biofortification in Kenya came from the 2011 Kenya National Micronutrient Survey, which documented widespread iron and zinc deficiencies across the population. Iron deficiency affected 22% of preschool children, 36% of pregnant women and 21% of women of reproductive age, while zinc deficiency exceeded two-thirds of all major population groups and was particularly severe in rural areas (Kenya National Micronutrient Survey, 2011). These findings provided a strong rationale for promoting biofortified beans alongside other food fortification strategies to address hidden hunger.

INNOVATION SYSTEM.

Building on CGIAR's systems perspective, this case study understands the innovation system as the wider set of actors, partnerships, complementary innovations and enabling conditions through which an innovation is developed, adapted, delivered, used and scaled. For biofortified beans, this includes research and breeding, seed systems, markets, end users and policy actors and the interactions among them.

1.2 Purpose

The case study examines the development and scaling of the Kenya biofortified bean innovation system, co-developed by Kenyan and international partners with CGIAR support. Rather than assessing the performance of individual technologies or organizations, it analyses how interactions among research, breeding, seed systems, public institutions, private-sector actors, and farmers contributed to observed outcomes.

The study seeks to identify the contextual factors and mechanisms that facilitated or constrained the development, dissemination and adoption of biofortified bean varieties, providing lessons for future CGIAR investments in integrated innovation systems.

1.3 Evaluation Questions

The case study addresses four overarching evaluation questions that align with the Kenya Country Evaluation objectives and scope:

- **Relevance:** To what extent did the biofortified bean innovation respond to Kenya's agricultural, nutrition and climate resilience priorities? What does the available evidence suggest about its responsiveness to farmer and consumer needs and preferences?
- **Coherence and efficiency:** How effectively did CGIAR collaborate with national institutions, private-sector actors and development partners to develop, release and scale the innovation?
- **Effectiveness:** What evidence exists that the innovation contributed to improved seed availability, adoption, livelihoods, nutrition and resilience, and what contextual factors influenced these outcomes?
- **Sustainability:** Which institutional, technical and market conditions are most likely to support or constrain the continued scaling and long-term sustainability of biofortified bean varieties in Kenya?

2. Methodology

This purposively selected case study adopted a qualitative approach within the broader CGIAR Kenya Country Evaluation. Drawing on principles of realist evaluation, it examined not only what outcomes were associated with the biofortified bean innovation, but also how these outcomes emerged, for whom they occurred, and under which contextual conditions. This analysis looks at the substantive content of CGIAR's contributions within a broader innovation system as defined in the Technical Note on evaluating scaling efforts in CGIAR involving national research organizations, government agencies, private-sector actors and development partners. The approach is designed to draw out any good practices, promising ways of working, concrete steps, and relational mechanisms as well as pitfalls or challenges to avoid, in other innovation pathways pursued by CGIAR.

The analysis combined four complementary sources of evidence: (1) a review of project documents, scientific literature and policy documents to reconstruct the innovation pathway and synthesize existing evidence on breeding, seed systems, adoption, gender and nutrition; (2) semi-structured interviews or group discussions with representatives of CGIAR, Pan African Bean Research Alliance (PABRA), Kenya Agricultural and Livestock Research Organization (KALRO), Kenya Plant Health Inspectorate Service (KEPHIS), seed companies, county governments, development partners, and processors; (3) a focus group discussion with farmers to explore varietal preferences, adoption decisions and local experiences; and (4) secondary quantitative evidence on variety release, seed production, adoption and nutrition outcomes. The literature review focused primarily on publications and reports produced between 2020 and 2026, complemented by key earlier publications documenting the origins and evolution of the innovation.

Primary data collection was conducted in June and July 2026, with a field visit from 6-10 July 2026. A total of 52 stakeholders were consulted, with five Key Informant Interviews and eight focus group discussions. The demographics of the interviewees were 25 females and 27 males. CGIAR center representatives were the majority (29%) of the interviewees followed by county government representatives (25%) and farmers (19%). National Agricultural Research and Extension Systems (NARES) representatives were 15%, distantly followed by the private sector (6%). Other partners (4%) and non-governmental organization (NGO) representatives (2%) were among the least represented groups. See stakeholder list in Annex 3.

Evidence from all sources was analyzed thematically against the evaluation questions and criteria and triangulated to identify consistent findings, explain divergent perspectives, and examine the contextual factors, institutional arrangements and partnership mechanisms influencing the development, dissemination and adoption of biofortified bean varieties. Interview transcripts were coded and analyzed using the software

MaxQDA, while documentary and quantitative evidence was synthesized through systematic review and expert interpretation. ChatGPT (OpenAI GPT-5.5) was used as a supporting tool for evidence synthesis, consistency checks and language editing. All interpretations, evaluative judgements and conclusions remained the responsibility of the evaluation team. Findings are presented using a Context–Mechanism–Outcome (CMO) perspective (Pawson & Tilley, 1997) to explain how different elements of the innovation system contributed to the observed results.

3. Limitations

The limitations for the case study include the risks of key biases, which are present in much qualitative research. These include social desirability bias, in which respondents seek to please the interviewers, and sponsor bias in which responses are conditioned by interviewees' independent perceptions of donors. The evaluation team attempted to build rapport to gain genuine and thoughtful responses and reminded respondents of the confidentiality of interviews and of evaluation team's independence. These biases may affect the case study because the pool of potential respondents is somewhat limited and most of those who can respond to the interview questions have, in one way or another, worked on the innovation. This does not mean that all interviewees will always be positive; rather, that having worked on the bean project makes it more likely their responses will reflect well on the effort. To mitigate this, the team sought external viewpoints from farmers, private sector actors and county government officials to balance any bias, worked to set interview responses in context, questioned respondents about alternative interpretations, and used focus group discussions to bring out contrasting ideas.

Another challenge emerges with the duration of the innovation. The biofortified bean innovation represents a long-term research and development effort that began well before the Kenya Country Evaluation period (2022–25), with key breeding activities beginning well before the evaluation period and biofortified varieties released between 2017 and 2023. Although evidence was collected in 2026, many of the observed outcomes reflect cumulative investments in research, partnerships, capacity development and seed systems over more than a decade. Consequently, the findings should be interpreted as an assessment of the innovation system's cumulative work rather than of activities implemented exclusively during the evaluation period. There may also be recall bias and recall difficulties, challenges from turnover of relevant personnel, and changes in climate, political economy, or other conditions that are, in a sense, unobserved variables that may have affected the case. As such, this study is not to be read as definitive across the long history of the innovation. Instead, it is better read as a review of state of play in 2026 and the immediately preceding five years, with particular attention to systems and gaps.

The availability of quantitative evidence varied across the innovation pathway. Information on varietal development, release and seed production was generally robust. However, evidence on adoption, nutrition and livelihood outcomes is limited and based on studies using different methodologies and geographic scopes. Quantitative evidence therefore served primarily to complement and triangulate some qualitative findings, particularly about CGIAR's areas of manageable interest.

Finally, the case study focuses on a single innovation within CGIAR's broader portfolio in Kenya. Its findings are not intended to be statistically representative, but rather to provide an in-depth understanding of the mechanisms and contextual factors that shaped the development and scaling of biofortified bean varieties. As such, they constitute one line of evidence within the overall Kenya Country Evaluation.

4. Key Findings

4.1 Background

The Kenya biofortified bean innovation system builds on more than two decades of collaborative bean research and development. In Kenya, [KALRO](#) led the demand-led breeding, adaptation and testing of biofortified beans, drawing on genetic resources, breeding materials, expertise and regional collaboration available through [PABRA](#), the regional membership network to which KALRO belongs. [KEPHIS](#), [HarvestPlus](#), [HarvestPlus Solutions](#), seed companies, county governments, development partners, processors and other market actors contributed complementary expertise and scaling functions.

Successive CGIAR portfolios added complementary layers to this longer-term innovation pathway. Legacy investments through CIAT/PABRA and IFPRI/HarvestPlus established key foundations in germplasm, biofortification research, nutrition evidence and regional partnerships. HarvestPlus, established in 2003 as a joint initiative of IFPRI and CIAT, combined policy, economic and nutrition research with crop breeding and biofortification (Douthwaite, Johnson & Wyatt, 2022). Building on the longer-term PABRA model, the 2022–24 Portfolio further strengthened market intelligence, breeding approaches, gender-responsive product design, demand-led seed systems and nutrition-oriented scaling. The current 2025–30 Portfolio further emphasizes contextual varietal deployment, inclusive seed delivery, market alignment and links between scaling, diets and nutrition outcomes. These portfolio contributions complement the sustained bilateral and partner funding underpinning PABRA and the wider bean innovation system.

The innovation combined enhanced iron and zinc content with agronomic, culinary and market traits. Six biofortified common bean varieties were released in Kenya since 2017, offering complementary adaptation, maturity, nutritional, culinary and disease-resistance characteristics (Table 1). These include four KALRO varieties released in 2017: Nyota, Angaza, Metameta and Faida, EUB 502 (Tatton Bean), released by Egerton University in 2021, and NUA45 (Pure Seed 1), released by Pure Seeds EA Ltd. in 2023. Nyota remained the most widely promoted and commercialized variety.

Table 1. Biofortified common bean varieties released in Kenya since 2017

Variety	Year/ owner	Adaptation and maturity	Selected attributes
Nyota (DAB299/KAD 02)	2017, KALRO.	900–1,800 meters above sea level (masl); 2–3 months.	High Fe (iron) and Zn (zinc); low phytic acid; fast cooking; early maturing and drought tolerant.
Angaza (NUA671/KMR 11)	2017, KALRO.	1,200–1,900 masl; 2– 3 months.	High Fe and Zn; low phytic acid; fast cooking and high-water absorption.
Metameta (NUA689/KMR 12)	2017, KALRO.	1,200–1,900 masl; 2– 3 months.	Moderate Fe and high Zn; low phytic acid; fast cooking and high-water absorption; tolerant to angular leaf spot and common bacterial blight; resistant to bean common mosaic virus and other bean diseases.
Faida (NUA711/KMR 13)	2017, KALRO.	1,300–2,000 masl; 2– 3 months.	High Zn; low phytic acid; tolerant to angular leaf spot and common bacterial blight; resistant to bean common mosaic virus.
EUB 502 (Tatton Bean)	2021, Egerton University.	1,500–1,800 masl; 3– 4 months.	High Fe and Zn; low flatulence and acid; suitable for bean flour and soup; tolerant to halo blight and rust.
NUA45 (Pure Seed 1)	2023, Pure Seeds EA Ltd.	1,000–1,600 masl; 2– 3 months.	High Fe and Zn; resistant to angular leaf spot, rust and anthracnose; tolerant to common bacterial blight.

Source: National Crop Variety List–Kenya, Version 5 February 2025.

The innovation extended beyond breeding and varietal release to include seed multiplication and certification, licensing, dissemination, nutrition awareness, processing and market development. It therefore provides a case

for examining how successive CGIAR contributions interacted with national institutions and wider seed and market systems to support development and scaling. The following sections assess this experience against the evaluation criteria of relevance, coherence and efficiency, effectiveness, and sustainability.

4.2 Relevance: Alignment with National Priorities

The available evidence indicates that the biofortified bean innovation was well aligned with Kenya's agricultural, food and nutrition security, and climate resilience priorities. Relevance, however, extends beyond government policy: for an agricultural innovation to be relevant and ultimately adopted, it must also respond to the needs and preferences of farmers, consumers and value-chain actors. The evidence therefore points to relevance at multiple, interconnected levels, although direct evidence from farmers and consumers is more limited than evidence on policy and institutional alignment.

At national level, the innovation addressed micronutrient deficiencies while seeking to improve the productivity and resilience of an important staple crop. The innovation aligned with Kenya's long-standing policy commitment to food and nutrition security, reflected in the [Constitution of Kenya \(2010\)](#), [Kenya Vision 2030](#), the [National Food and Nutrition Security Policy \(2012\)](#), the [Agricultural Sector Transformation and Growth Strategy \(ASTGS\) 2019–29](#), the [Agriculture and Food Policy \(2021\)](#), the [Kenya National Nutrition Action Plan \(2018–22\)](#), and the [National School Meals and Nutrition Strategy \(2017–22\)](#). It also aligned with county priorities for food and nutrition security, productivity, climate resilience, rural incomes and markets, and remains relevant for the [Bottom-Up Economic Transformation Agenda \(BETA\) 2022–27](#).

The innovation design also sought to respond to farmer needs. Participatory variety selection, farmer consultations and target product profile development combined enhanced iron and zinc content with traits valued by farmers, including high yield, early maturity, drought tolerance, and resistance to pests and diseases. Gender-responsive research incorporated women's preferences, particularly for affordable and locally accessible seed (Nchanji et al., 2021a; Nchanji et al., 2021b). These approaches were consistent with and drew on the wider demand-led and gender-responsive approaches shared through the PABRA network.

However, the evidence also points to limitations in the fit and deployment of the varietal portfolio. The four KALRO varieties released in 2017 were initially targeted particularly to Eastern Kenya, drier areas of the Rift Valley and Nyanza, but market demand subsequently encouraged their production in a wider range of environments. Some stakeholders reported concerns about Nyota's disease susceptibility and relatively weak performance in higher-rainfall production areas. These observations were location-specific and were not independently verified through agronomic performance data in this case study; they should therefore not be interpreted as evidence of a general performance limitation across Kenya. At the same time, released varieties (Table 1) offer complementary traits and adaptation, including the later-maturing Tatton for medium- and higher-altitude environments and NUA45 with resistance or tolerance to several important bean diseases. Continued breeding and the emerging pipeline of improved biofortified varieties may further expand these options. One stakeholder also noted demand for high-iron yellow beans, indicating that some market preferences remain insufficiently addressed. Overall, maintaining relevance across diverse production environments and market segments therefore depends both on continued varietal improvement and on effective deployment of the existing portfolio.

Consumer, household and market preferences were also incorporated through traits such as taste, shorter cooking time, low flatulence, cooking expansion, gravy formation and desirable grain characteristics. Shorter cooking time can reduce fuel requirements and preparation time, which are traits particularly relevant for women, while engagement with processors, traders and other market actors sought to align varieties with market demand. Available evidence suggests acceptance of Nyota based on its combination of nutritional, culinary and market characteristics. However, the case study's limited direct evidence from consumers warrants caution in generalizing these findings.

Overall, the innovation's relevance derived from aligning nutritional objectives and national priorities with the agronomic, culinary and market characteristics valued by farmers, consumers and value-chain actors. While the evidence suggests substantial responsiveness across these levels, remaining gaps highlight the importance of continued feedback and adaptation to changing production conditions, climate risks and user preferences. Attention to gender-differentiated preferences strengthened the relevance of the innovation, although the case study provides limited direct evidence on whether women's and men's needs were addressed equally in practice.

4.3 Coherence and Efficiency: Partnerships

The biofortified bean innovation was developed through long-term collaboration among CGIAR, Kenyan institutions and a broad network of public, private and development partners. Rather than following a linear

pathway, the innovation evolved through an integrated system in which different partners contribute complementary expertise from breeding through seed systems to market development.

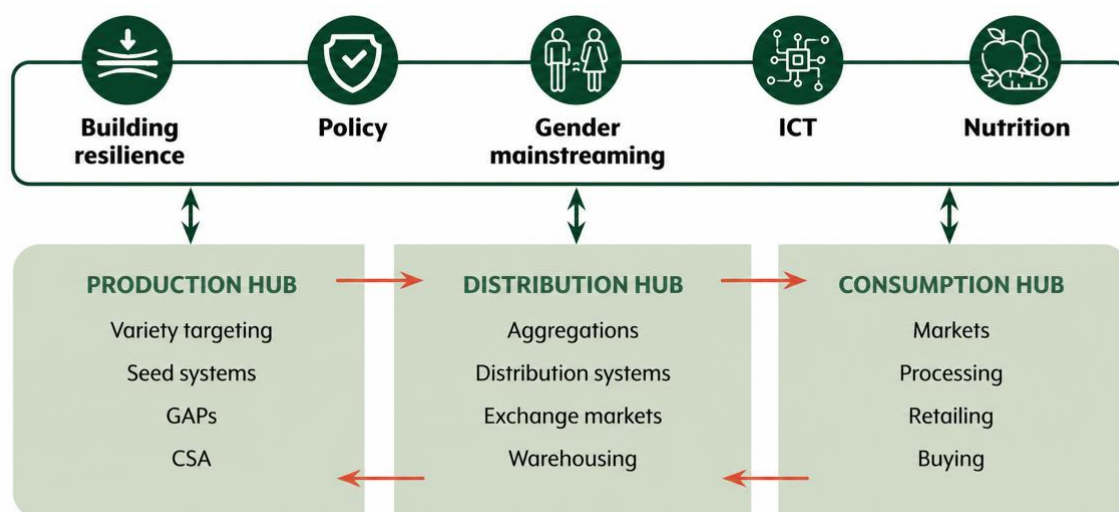
At regional level, ABC/PABRA provides a membership platform through which national bean programs, including KALRO, collaborate and access genetic resources, breeding expertise, methodologies and learning from across the network. PABRA's network of some 30 member countries, organized through three regional research networks, was built around principles of national ownership, participatory decision-making, transparent resource allocation and mutual accountability (PABRA, 2020). This architecture enabled Kenya to draw on regional scientific capacities and breeding materials while maintaining national leadership in their adaptation and deployment. Stakeholders emphasized that PABRA's continuity depended on sustained core funding, particularly from [Global Affairs Canada \(GAC\)](#) and the [Swiss Agency for Development and Cooperation \(SDC\)](#), complemented by project-specific support from the now defunct [United States Agency for International Development \(USAID\)](#), the [Australian Centre for International Agricultural Research \(ACIAR\)](#), the [Gates Foundation](#), and the [African Development Bank](#) through the [Technologies for African Agricultural Transformation \(TAAT\)](#) program.

Within Kenya, institutional roles were largely complementary. KALRO led adaptive breeding, participatory variety selection and national performance trials, while KEPHIS was responsible for variety release, seed certification and quality assurance. ABC/PABRA supported these nationally led processes through germplasm and breeding expertise, regional collaboration, capacity development, demand-led approaches and links across seed systems and markets. Joint planning, training and technical exchange strengthened national capacities and ownership. Working through existing national institutions rather than parallel project structures also supported coherence and continuity and reduced duplication. PABRA's contribution therefore extended beyond breeding and regional exchange into approaches for seed delivery, multi-stakeholder coordination and market-oriented scaling.

Following variety release, collaboration broadened to scaling and commercialization. Licensed seed companies multiplied certified seed, while county governments, NGOs and development partners supported extension, awareness and distribution. Partnerships involving [Global Alliance for Improved Nutrition \(GAIN\)](#), HarvestPlus Solutions, the [Cereal Growers Association](#), processors, traders, retailers and institutional buyers connected seed supply with grain markets and consumer demand. This pluralistic approach built on earlier PABRA experience showing that decentralized seed production and delivery through research institutes, NGOs, farmer organizations, seed companies and traders substantially expanded access to new bean varieties across several African countries (Buruchara et al., 2011).

Evidence from interviews with seed companies, processors, school representatives, and other stakeholders indicates that Kenyan partners applied key elements of PABRA's bean commodity corridor approach¹, linking seed production and farmer access with grain aggregation, processing and institutional markets. Women reportedly also participated in the scaling system as farmers, seed producers, traders, and processors. However, quantitative data about their participation and equal access to commercial opportunities remains scarce.

Figure 1. PABRA bean commodity corridor approach: interventions across production, distribution and consumption hubs



Source: Birachi et al. (2023)

¹ A market-driven agricultural framework developed by [PABRA](#) that maps and connects major production, distribution, and consumption zones to transform informal, fragmented bean trading into efficient, a structured regional value chain.

Multi-stakeholder platforms and other coordination mechanisms helped connect the diverse actors involved in scaling. PABRA experience shows that such platforms can bring research organizations, seed producers, farmers, traders, processors and other value-chain actors together around shared objectives, supporting joint planning, resource mobilization and market linkages (Birachi & Rubyogo, 2022). In Kenya, arrangements such as the GAIN–HarvestPlus commercialization partnership and the Cereal Growers Association's decentralized [Farmer Service Centre model](#)² performed elements of this coordinating function. Their importance increased as scaling moved beyond breeding and seed release to require alignment between seed supply, farmer demand and grain markets.

Coordination became more challenging as the innovation moved downstream. While roles in breeding, variety release and regulation were relatively well established, scaling required sustained alignment among actors with different interests and incentives, including seed companies, farmers, processors, traders and institutional buyers. Weak effective demand for certified seed, uneven grain-market development, limited market differentiation and traceability, and mismatches between seed supply and demand continued to constrain commercialization. Seed producers reported difficulties selling available stocks despite a large estimated unmet national requirement for quality seed. This suggests that the constraint is not simply seed production capacity, but the alignment of seed supply, farmer demand and viable grain markets.

Comparative evidence from other PABRA member countries similarly shows that multi-stakeholder partnerships linking breeders, certified seed producers, agro-dealers and grain buyers accelerated breeding progress and improved farmers' access to quality seed, while informal seed systems remained important where formal supply was limited (Aseete & Katungi, 2023; Sperling et al., 2021).

Overall, CGIAR's contribution was coherent with national research and regulatory systems and benefited from complementary institutional roles, regional collaboration and sustained partnerships. The model generated process efficiencies through shared germplasm and expertise, reduced duplication and use of existing national structures. However, the available evidence does not permit a broader assessment of cost-efficiency. The main coordination challenges now lie downstream, where effective scaling depends on stronger alignment between seed systems, markets and commercial incentives.

4.4 Effectiveness: Adoption and Emerging Outcomes

The available evidence indicates that biofortified beans have moved beyond research and initial dissemination into farmer production and commercial and institutional markets, although the scale and depth of adoption remain difficult to establish. Available adoption evidence relates largely to Nyota, while dissemination and uptake of other released biofortified varieties are less well documented. Biofortified beans are estimated to account for about 5% of Kenya's bean production (HarvestPlus Solutions, 2024). An AGRA survey of 862 households in five counties found that the number cultivating biofortified beans increased from 417 in 2023 to 537 in 2024, with most of the increase attributable to Nyota. HarvestPlus Solutions separately estimated that Nyota covered approximately 13% of bean area within its intervention zones. These figures are not directly comparable because they refer to different geographic areas and measures, and no verified national adoption estimate is available. They nevertheless indicate meaningful uptake in areas where biofortified beans have been promoted, while highlighting important gaps in adoption data.

Evidence on production and livelihood outcomes is more mixed. Interviewees associated the varieties with improved production, household food security and market opportunities, and 93.4% of respondents in the AGRA survey considered biofortified beans important or very important for household food security. However, average harvested quantities reported in the survey declined between 2023 and 2024 for both Nyota and Angaza. Stakeholders also reported that varietal performance varied across production environments, potentially affecting continued adoption or dis-adoption. Further evidence is needed to understand these dynamics and their implications for sustained adoption.

Market development, building partly on the wider PABRA approach of linking seed delivery with downstream demand, contributed to uptake. Partnerships with seed companies, processors, retailers and institutional buyers, including school feeding programs, created outlets for biofortified grain and processed products, while the Cereal Growers Association's decentralized Farmer Service Centers expanded farmer awareness, seed access and market linkages across more than 18 counties. HarvestPlus reports that more than 200 schools in Bomet, Narok, Embu and Elgeyo Marakwet introduced Nyota beans, illustrating emerging institutional demand and links between school feeding and local production (HarvestPlus, 2024). School-level evidence indicates that Nyota was valued for its nutritional value, taste, low flatulence and short cooking time, which can reduce fuel use and

² Farmer Service Centers are rural entrepreneurs, farmer groups, or aggregators serving as a crucial link between private and public sector partners and smallholder farmers.

preparation time. At the same time, higher prices can put pressure on constrained school-feeding budgets, while broader commercial market penetration remains limited.

Evidence on nutritional outcomes remains an important gap. Kenyan biofortified bean varieties are developed for enhanced iron and zinc content, while international controlled trials provide evidence that iron from biofortified beans is bioavailable and that regular consumption can improve women's iron status (Glahn et al., 2020; Haas et al., 2016). However, nutritional impact also depends on regular consumption and sufficient dietary intake. Stakeholders from ABC and KALRO confirmed that Kenya-specific studies have yet to demonstrate the effects of biofortified bean consumption on iron status, anemia or other nutrition outcomes. The evidence therefore supports the nutritional potential and efficacy of biofortified beans but does not yet demonstrate population-level nutrition outcomes attributable to the innovation in Kenya.

Women were important agents in the development and scaling of the innovation, participating in variety selection, bean production, seed multiplication and marketing. Examples include women participating as seed outgrowers, such as through [Agripack's](#) collaboration with women and youth producers organized through a cooperative in the Marigat irrigation scheme. These roles positioned women as actors contributing to the innovation's testing, production and diffusion.

Evidence that women benefited from the innovation is less conclusive. Productivity, shorter cooking time and locally accessible seed may offer benefits, while seed production and marketing can create economic opportunities. However, available adoption, livelihood and nutrition data are insufficiently sex-disaggregated to determine whether benefits accrued differently to women and men. Women also continue to face constraints in accessing quality seed, extension, market information and commercial opportunities (Nchanji et al., 2020; Nchanji & Lutomia, 2021).

Overall, the evidence demonstrates uptake of biofortified beans and their integration into farmer production and emerging commercial and institutional markets. Evidence of sustained adoption and broader livelihood, nutrition and resilience outcomes is less conclusive. Effectiveness was supported by the combination of nutritional, agronomic and culinary traits with seed dissemination and market development, but varies with production conditions, varietal performance, seed access and market linkages. The findings therefore distinguish successful variety release and uptake from sustained adoption and demonstrated development outcomes.

4.5 Sustainability: Conditions for Continued Scaling

The long-term sustainability of biofortified beans in Kenya will depend less on continued promotion of individual varieties than on whether seed systems, markets, breeding capacity, institutional partnerships and their financing can be sustained. Important foundations are in place, including national breeding and regulatory capacity, licensed private seed companies, decentralized delivery approaches, emerging grain markets and institutional demand. However, structural constraints remain.

Limited use of certified bean seed is a longstanding feature of Kenya's seed system, although supply has increased substantially. Rubyogo et al. (2010) estimated that certified seed supplied only 0.5% and 0.8% of theoretical national requirements in 2002 and 2006, respectively. By 2025, about 4,000 tons were reportedly commercialized—around 8% of theoretical requirements—including about 2,000 tons of Nyota. Assuming farmers renew bean seed approximately once every three seasons, effective demand may be closer to 17,000 tons, meaning current supply could meet roughly one quarter of effective demand (J.C. Rubyogo, personal communication, 2026). This indicates substantial growth in formal seed supply while highlighting the difference between theoretical requirements and effective commercial demand. Seed companies nevertheless reported difficulties selling Nyota stocks, while community seed producers reported limited local demand. Farmers' ability to recycle self-pollinating bean seed or obtain seed through informal channels further reduces repeat purchases and commercial incentives (Rubyogo et al., 2019). The challenge is therefore to balance farmers' need for affordable quality seed with sufficient demand and incentives for sustainable seed production.

Complementary scaling models can help address this challenge. Commercial seed companies can serve market segments where demand for certified seed is viable, while decentralized and community-based production can improve local access and affordability where commercial incentives are weaker. Institutional procurement, including school feeding, can link grain demand with local production, while processors and other buyers can stimulate demand through commercially oriented value chains. This pluralistic approach is consistent with evidence from sub-Saharan African legume seed systems emphasizing context-specific combinations of formal, intermediary and informal seed channels (Breen et al., 2024), as well as PABRA experience with decentralized seed delivery (Buruchara et al., 2011). Recent CGIAR work in Western Kenya also positions community seed banks as an interface between formal and farmer-managed seed systems (Niane et al., 2025), while experience from

Uganda demonstrates the potential of locally anchored models combining seed multiplication, capacity development and market linkages, including for women and youth (Nchanji et al., 2026). Seed quality remains important across these models: stakeholders reported counterfeit and mixed seed, uneven quality control and difficulties distinguishing Nyota from conventional, red-mottled beans, potentially undermining varietal identity and market confidence.

Sustainable scaling also requires corresponding grain markets. Existing KALRO/PABRA multi-stakeholder mechanisms already help generate demand and connect seed and grain-market actors. However, market development remains uneven: higher prices can constrain processors and school-feeding budgets, while lower-priced imports increase competition. Further progress depends on stronger market differentiation and traceability, more reliable producer–buyer linkages and sustained demand from processors and institutional buyers. These mechanisms can strengthen incentives for farmers to invest in quality seed and for seed companies to continue multiplication, while balancing affordability with viable incentives across the seed and grain value chains.

Sustainability also depends on the diversity, continued improvement and effective deployment of the varietal portfolio. The location-specific concerns reported about Nyota, while requiring further agronomic verification, illustrate the broader risks of relying heavily on a single widely promoted variety. Complementary varieties are available, including Tatton for medium- and higher-altitude environments and NUA45 with resistance or tolerance to several important bean diseases, although their dissemination appears more limited. This highlights the importance of contextual scaling; matching varieties to agroecological, market and user contexts alongside continued breeding and active pipelines for improved biofortified varieties, including climate-resilient, fast-cooking lines with high bioavailable iron, to respond to changing production environments, pest and disease pressures and user preferences.

Finally, sustainability also rests on the long-term institutional and financing model underpinning the PABRA network. Continued support from core funders, including Canada and Switzerland, for more than two decades has provided unusual funding continuity, complemented by contributions from other development partners. Member governments also contribute through NARS staff, infrastructure and logistics, while NARS catalyze additional investment in bean value-chain development from development partners, NGOs and the private sector. This combination provides an important foundation for continuity, but PABRA's operational funding remains substantially dependent on external donors, creating a longer-term financing risk if external support declines.

Overall, the innovation established important institutional, technical and market foundations for continued scaling, but sustainability cannot be assumed from successful variety release and initial uptake. Sustainability will depend on balancing competing interests and incentives across the innovation system, combining appropriate scaling models, strengthening grain markets and varietal identity, maintaining a responsive breeding and variety-introduction system, and sustaining institutional capacity and coordination.

4.6 Explaining the Findings

The Context–Mechanism–Outcome (CMO) analysis highlights how the mechanisms supporting the biofortified bean innovation operate differently across production, institutional and market contexts. Long-term collaborative breeding, national institutional capacity, seed-system partnerships and market engagement have supported variety development and scaling, but varietal fit, seed-system conditions and market incentives influence where and how these mechanisms translate into sustained adoption and development outcomes.

Table 2. CMO patterns shaping the development and scaling of biofortified beans in Kenya

Context	Mechanism	Outcomes/evidence gaps
Nutrition & user needs: High bean consumption; micronutrient deficiencies; diverse environments and preferences; women play central roles in bean production and seed systems.	Participatory breeding incorporates nutritional, agronomic, culinary and market traits and gender-differentiated preferences; women participate in variety selection, seed production and dissemination.	Documented: Six complementary biofortified varieties released; women contributed as agents of innovation and scaling. Gaps: Continued adaptation to changing environments and user preferences; limited sex-disaggregated evidence on adoption and development benefits.

Context	Mechanism	Outcomes/evidence gaps
Institutional collaboration: KALRO's long-term participation in the PABRA network; national research and regulatory institutions; sustained partner and donor engagement.	National leadership combined with regional access to germ-plasm, expertise and learning; complementary institutional roles; capacity development and links across breeding, seed systems and markets.	Documented: Varieties released; national breeding and regulatory capacities strengthened.
Varietal deployment: Diverse agroecology; dissemination concentrated around Nyota.	Variety testing, promotion and dissemination connect varieties with farmers and markets.	Documented: Biofortified varieties reached farmers and markets. Gap: Uptake beyond Nyota poorly documented; contextual scaling uneven.
Seed & market systems: Farm-saved seed predominates; weak demand for certified seed; quality concerns; uneven grain markets and price competition.	Licensing, decentralized seed delivery, institutional procurement and market linkages.	Documented: Seed and market channels expanded. Gap: Financial incentives and conditions for sustained commercial scaling remain uneven.
Nutrition outcomes: Benefits depend on sustained access, consumption and iron bioavailability.	Higher iron content, dissemination and nutrition awareness support increased intake of bioavailable iron.	Documented: International evidence demonstrates nutritional efficacy. Gap: Kenya-specific nutrition outcomes not established.

The CMO analysis shows that no single mechanism explains the observed results. Breeding, institutional collaboration, seed delivery and market development reinforced each other where contextual conditions were favorable, while varietal fit, seed-system constraints and market incentives influenced where and how scaling occurred. It also highlights the distinction between developing a diversified portfolio and ensuring its contextual deployment, and between achieving uptake and demonstrating sustained development outcomes.

5. Conclusions and Lessons Learned

5.1 Conclusions

The biofortified bean innovation demonstrates several important strengths of a nationally led, regionally connected innovation system. KALRO led demand-led breeding, adaptation and testing in Kenya, drawing on diverse germplasm, breeding expertise, methods and regional learning available through the PABRA network. This combined national capacities, institutions and knowledge with regional scientific collaboration to develop nutritionally enhanced beans incorporating agronomic, culinary and market traits. The resulting portfolio of biofortified varieties represents an important research and institutional achievement.

Equally significant is the way the innovation evolved beyond breeding. Multi-stakeholder partnerships created feedback loops among researchers, farmers, seed companies and market actors, while engagement with county governments and institutional buyers connected the innovation to delivery channels and demand. Together, these features illustrate a systems-oriented model in which national leadership was complemented by regional scientific collaboration and approaches shared through the PABRA network, linking breeding with seed systems, multi-stakeholder engagement and markets. Public-, private-sector and development partners played complementary roles in regulation, delivery and scaling. This experience provides a potentially valuable model for CGIAR-supported innovation in other crops and contexts.

At the same time, progress from a strong innovation system to broad and sustained outcomes remains uneven. Dissemination was concentrated around Nyota despite a more diverse varietal portfolio. Some stakeholders reported concerns about its disease susceptibility and performance in higher-rainfall areas, although these location-specific observations require further agronomic verification. Seed quality and accessibility constraints, reliance on farm-saved seed, price competition and uneven grain markets further constrain demand for certified seed, wider adoption and commercial viability. The case therefore highlights the importance of contextual

deployment of the existing portfolio and continued breeding as climate, pest and disease pressures, production environments and user preferences evolve. Finally, evidence becomes weaker further along the outcome pathway. Available data indicate uptake in promoted areas and entry into commercial and institutional markets, but the overall scale and distribution of adoption remain insufficiently documented. Most importantly, Kenya-specific evidence that adoption and consumption are associated with improved nutrition is not yet available, despite nutrition being a defining objective and value proposition of biofortification. Evidence on livelihood and resilience outcomes was similarly limited. The case therefore demonstrates substantial achievements in research, partnerships and innovation-system development, while evidence on broader development outcomes remains limited and does not permit attribution of such outcomes to CGIAR alone.

5.2 Lessons Learned

The biofortified bean experience provides four broader lessons for CGIAR-supported agricultural innovation:

- **CGIAR's scientific *comparative advantage* can add value when embedded in nationally owned innovation systems.** Access to diverse germplasm and breeding expertise was combined with national capacities, institutions and knowledge to develop innovations responsive to local conditions and needs.
- **Regional membership networks can reinforce national leadership and provide continuity beyond individual projects.** The PABRA experience illustrates how national programs such as KALRO can draw on shared germplasm, expertise, learning and approaches while retaining leadership for adaptation, breeding and deployment.
- **A diversified breeding portfolio does not automatically translate into diversified scaling.** The concentration of dissemination around Nyota, despite the availability of complementary varieties, highlights the distinction between portfolio development and contextual deployment—matching varieties to specific agroecological, market and user contexts.
- **As innovations mature, the evidence challenge shifts from outputs and reach towards sustained adoption and development outcomes.** Evidence on variety development, dissemination and market engagement is considerably stronger than evidence on longer-term adoption and ultimate nutrition, livelihood and resilience outcomes.

Taken together, these lessons identify broader principles that extend beyond the biofortified bean case. The following opportunities translate the case-study findings into three priority areas for action.

6. Way Forward

The findings and lessons from the biofortified bean case point to three opportunities to build on demonstrated strengths while addressing remaining gaps, with relevance both for Kenya and for CGIAR-supported innovation more broadly.

1. Use the PABRA experience as an institutional learning case for CGIAR.

Responsible: CGIAR leadership and relevant centers/programs, with ABC/PABRA.

Timeframe: 2027–28.

The PABRA experience provides an opportunity to examine how a regional membership network can combine shared scientific resources, learning and market-oriented approaches with strong national leadership and ownership, and how this model could inform innovation and scaling approaches in other CGIAR-supported crops and contexts.

2. Extend portfolio breeding into contextual portfolio scaling.

Responsible: CGIAR breeding and scaling programs, with NARES, seed companies and other scaling partners.

Timeframe: Immediate and ongoing.

The Kenya case shows that developing a diverse varietal portfolio does not automatically result in its differentiated deployment. CGIAR and partners have an opportunity to link breeding and scaling more explicitly by matching varieties to agroecological conditions, climate and disease pressures, user preferences and markets, and tracking which varieties are adopted where and why. Continued breeding remains important as these conditions evolve.

3. Close the evidence gap between adoption and development outcomes of biofortified beans in Kenya.

Responsible: CGIAR/ABC and HarvestPlus, with Kenyan research and nutrition institutions.

Timeframe: Initiate within one to two years.

A Kenya-specific study provides an opportunity to establish whether, for whom and under what conditions adoption and consumption of biofortified beans are associated with improved nutrition, livelihoods and resilience, with particular attention to consumption, iron bioavailability and nutritional outcomes. The MELIAF Kenya Activator can coordinate this evidence generation within wider CGIAR country-level evaluation and learning.

Together, these actions provide opportunities to extend successful CGIAR approaches to innovation and contextual scaling across crops and contexts, while generating stronger evidence on the development outcomes of biofortified beans in Kenya.

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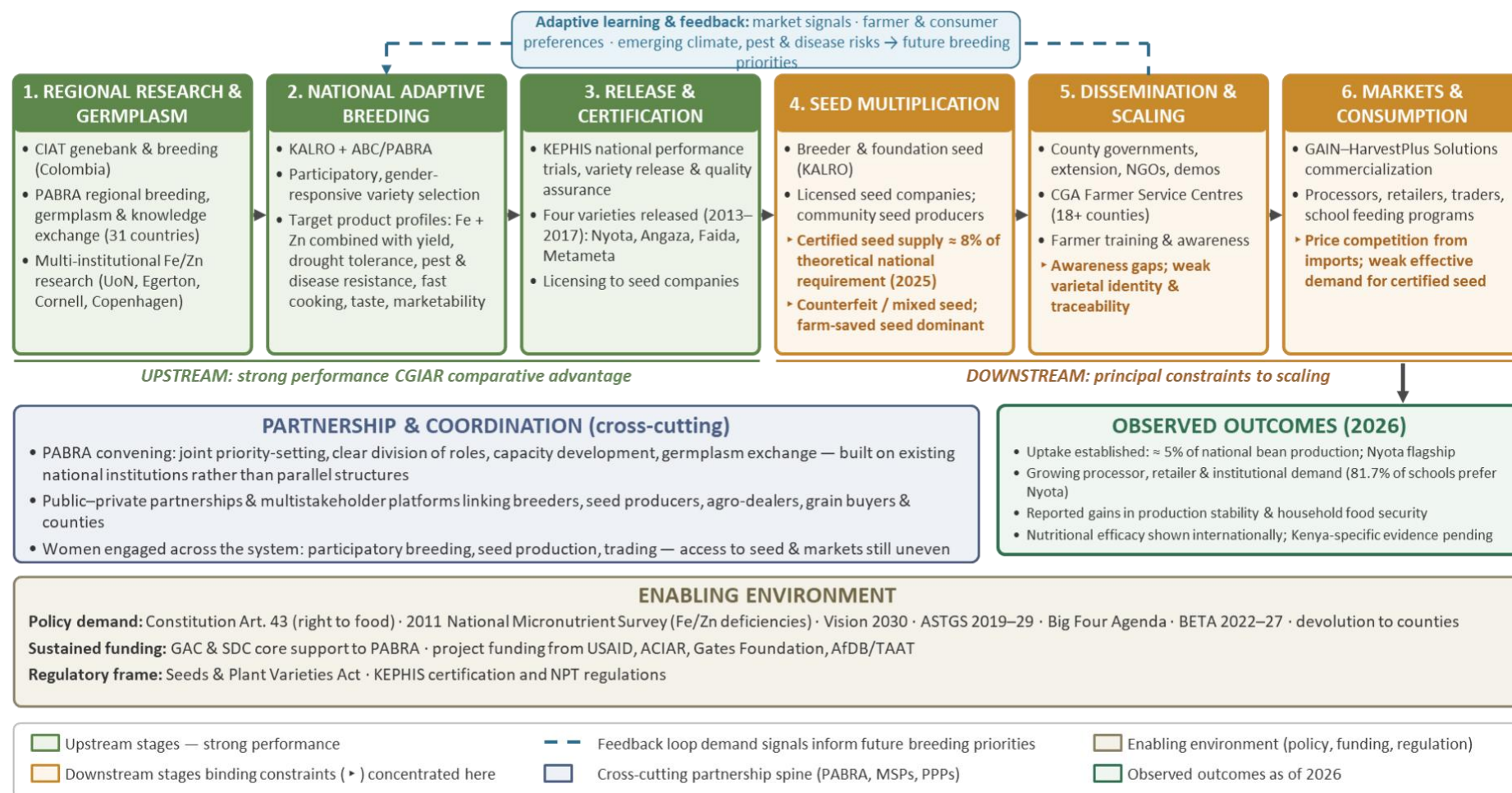
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Annex 2. Additional Figures

Figure 2 below maps the biofortified bean innovation pathway in Kenya across six stages, from regional research and germplasm through national adaptive breeding, release and certification, seed multiplication, dissemination and scaling, to markets and consumption. Color separates performance from constraint: the upstream stages (green) reflect CGIAR's comparative advantage, with CIAT and PABRA germplasm feeding KALRO's participatory breeding and four KEPHIS-released varieties; Nyota, Angaza, Faida and Metameta licensed to seed companies. The downstream stages (orange) carry important constraints, although certified seed supply had expanded to about 8% of theoretical national requirements by 2025; effective commercial demand is substantially lower than theoretical requirements, while farm-saved and counterfeit seed, awareness and traceability gaps, and imports continue to constrain formal seed and grain markets. A feedback loop returns market and climate signals to breeding priorities, while a cross-cutting partnership spine and an enabling policy, funding and regulatory environment frame the whole pathway. By 2024, HarvestPlus Solutions reported iron beans at about 5% of national bean production, alongside growing institutional demand and efficacy evidence that remains international rather than Kenya-specific. Remaining constraints therefore lie particularly in aligning varietal deployment, seed supply, effective farmer demand and viable grain markets.

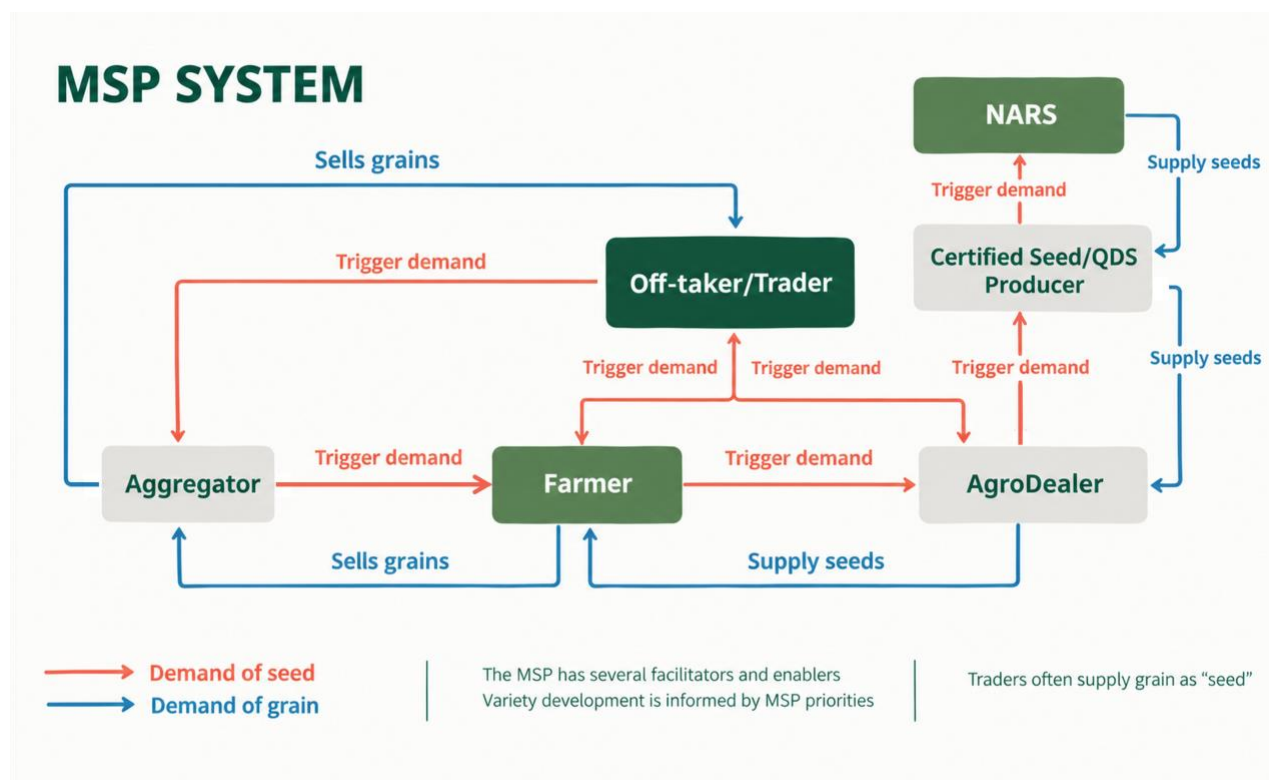
Figure 2. Innovation Pathway

The Biofortified Bean Innovation Pathway in Kenya



Source: CGIAR Kenya Country Evaluation Pilot Biofortified Beans Case Study (2026)

Figure 3. Multi-Stakeholder Platform model linking bean seed supply and grain demand

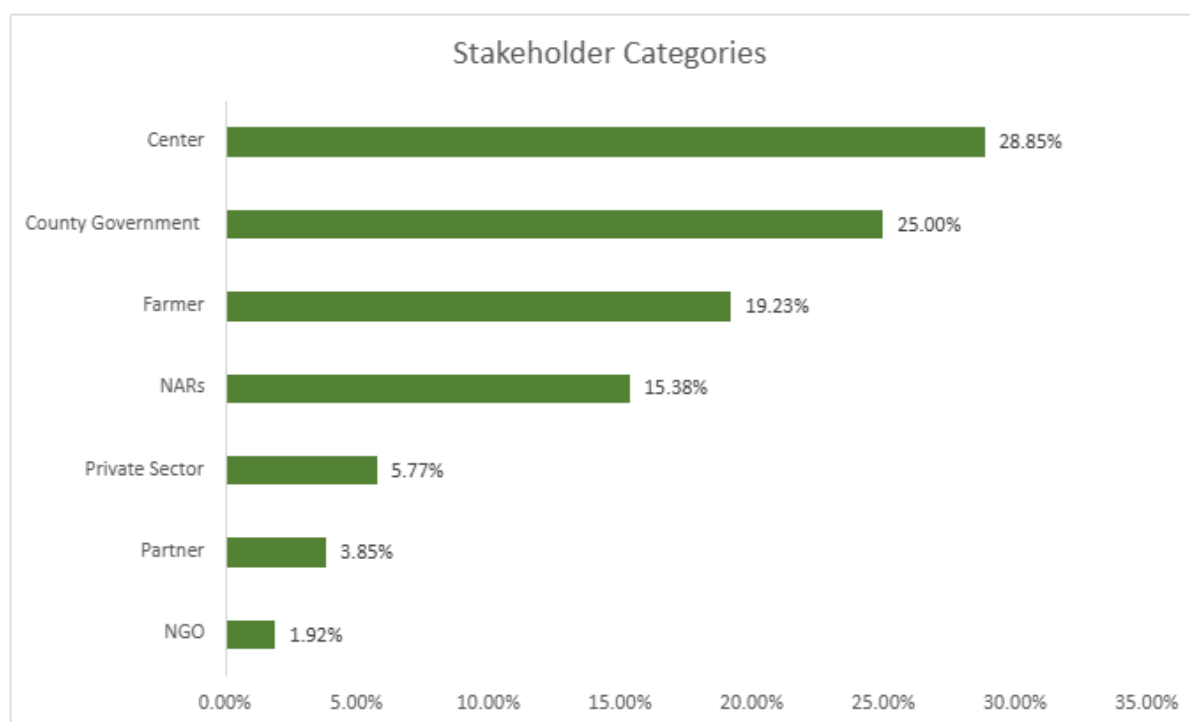


Annex 3. Stakeholders Consulted

A total of 52 stakeholders were consulted, including representatives from:

- Alliance of Bioversity International and CIAT and Pan-Africa Bean Research Alliance (PABRA).
- HarvestPlus Solutions.
- Kenya Agricultural and Livestock Research Organization (KALRO).
- Kenya Plant Health Inspectorate Service (KEPHIS).
- Seed companies - Agripack Seeds, licensed seed producers.
- Development partners-Farm Africa, Cereal Growers Association (CGA), Motherlands.
- County government agricultural extension officers - Bomet/Nakuru/Nyeri/Laikipia.
- Grain processors - Cherubet Foods, Delish & Nutri.
- Producer group near Katumani.
- Athi-River GK Prisons Primary School.

Figure 4. Stakeholder categories included in the case study data collection



Source: Author's calculations

Annex 4. Data Collection Guides

Guide A. Technical Pathway Actors

Alliance Bioversity-CIAT, Pan-Africa Bean Research Alliance (PABRA), IFPRI/HarvestPlus, Kenya Agricultural and Livestock Research Organization (KALRO), Kenya Plant Health Inspectorate Service (KEPHIS), breeders, CGIAR scientists.

Table 3. Guide A. Technical and Pathway Actors

Theme	Guiding question
Respondent profile	What is the organization, position and role in the biofortified bean innovation?
	How long have you been involved?
Innovation pathway & relevance	What problem was the innovation intended to address?
	Why were biofortified beans considered an appropriate solution for Kenya?
	How were breeding objectives defined?
	How were farmer, consumer and national priorities incorporated into breeding?
Research, breeding & variety release	What role did your organization play in the research and breeding pathway?
	What role did PABRA play?
	What roles did KALRO and KEPHIS play?
	What facilitated or constrained the variety release process?
Coordination & partnerships	How were responsibilities shared among CGIAR entities and national partners?

Theme	Guiding question
	How effective were coordination mechanisms?
	What factors facilitated or constrained collaboration?
	Were there overlaps or gaps among partners?
Scaling & effectiveness	How were scaling partners engaged during variety development and dissemination?
	What factors contributed most to dissemination and uptake?
	Under what conditions were some varieties more successful than others?
Evidence & lessons	What quantitative evidence exists (e.g., varieties released, seed companies, adoption, seed production, nutrition outcomes)?
	What are the main lessons and recommendations?

Table 4. Guide B. Scaling and Dissemination Actors

Seed companies, NGOs, county governments, extension services, traders.

Theme	Guiding question
Respondent profile	What is the organization and role?
Partnership with CGIAR	How did your organization become involved?
	What support did CGIAR/PABRA provide?
	How were responsibilities shared?
Dissemination & scaling	Which dissemination approaches were used?
	Which approaches were most effective, and why?
	What role did county governments play?
	What role did markets and private-sector actors play?
Coordination & sustainability	How well were partners coordinated?
	What factors facilitated or constrained collaboration?
	Is dissemination continuing beyond CGIAR support?
	What factors will influence long-term sustainability?
Evidence & lessons	What quantitative evidence exists (e.g., farmers reached, seed volumes, counties covered, adoption estimates, market demand)?
	What are the main lessons for future scaling?

Table 5. Guide C1. Government and Policy Actors

Ministry of Agriculture, Ministry of Health, Kenya Agricultural and Livestock Research Organization (KALRO) leadership, KEPHIS, national and county governments.

Theme	Guiding question
Respondent profile	What is the organization, position and role in the biofortified bean initiative?
Strategic relevance	How well does the innovation align with Kenya's agricultural, nutrition and development priorities?
	How were national and county stakeholders involved in defining priorities?
Partnerships & coordination	How did CGIAR engage with your institution throughout the innovation pathway?
	What roles were played by Alliance Bioversity-CIAT, HarvestPlus, PABRA, KALRO and KEPHIS?
	How effective was coordination among CGIAR, government and other partners?
	What factors facilitated or constrained collaboration?
Policy influence & sustainability	Has the innovation influenced policies, programs or public investments?
	To what extent has ownership shifted to national and county institutions?
	What factors will determine long-term sustainability?
Evidence and lessons	What evidence exists regarding policy uptake, program integration, dissemination, adoption or nutrition outcomes?
	What key lessons and recommendations would you highlight?

Table 6. Guide C2. Donors and Strategic Funding Partners

Gates Foundation, Global Affairs Canada, African Development Bank (AfDB), Swiss Agency for Development and Cooperation (SDC), Alliance for a Green Revolution in Africa (AGRA), Rockefeller Foundation.

Theme	Guiding question
Respondent profile	What is the organization, position and objectives for supporting the initiative?
Strategic relevance	How well did the innovation address your organization's objectives?
	How well does it align with Kenya's agricultural, nutrition and development priorities?
	Why was CGIAR considered an appropriate partner?
Partnerships, coordination & scaling	How effective was CGIAR's collaboration with national partners, PABRA and other stakeholders?
	To what extent were scaling partners engaged from the outset?
	What factors enabled or constrained dissemination and uptake?
Additionality & sustainability	What value did CGIAR add beyond other partners?

Theme	Guiding question
Evidence & lessons	To what extent are national institutions and the private sector taking ownership?
	What are the main risks to sustainability after donor funding ends?
	Which indicators or evidence have been most useful for assessing progress?
	What lessons should inform future CGIAR investments and partnership models?

Table 7. Guide D. End Users and Market Actors

Farmers, farmer organizations, grain traders, processors, retailers.

Theme	Guiding question
Respondent profile	What is the farm/business type, county and role?
	Which biofortified bean varieties have you grown, traded or processed?
Awareness & adoption	How did you first hear about the varieties?
	Why did you decide to adopt (or not adopt) them?
	Which characteristics influenced your decision most?
Dissemination & support	How did you obtain seed or grain?
	Which organizations or people supported adoption?
	What barriers did you experience?
Benefits & outcomes	What changes have you observed in productivity or resilience?
	Have market opportunities or income changed?
	Have household consumption or nutrition changed?
	Will you continue growing or marketing the varieties? Why?
Evidence & lessons	Approximate area planted, yield, seed purchased, grain marketed or processed
	What improvements would you recommend?

Table 8. Guide E. Alternative Focus Group Discussion Guide with End Users

Farmers; preferably separate women's and men's groups, where appropriate.

Theme	Discussion question/exercise
Introductions	Introduce yourself and describe your farming experience.
Experience	When and how did you first hear about the biofortified bean varieties?
	Which varieties have you grown?
	Which organizations introduced the varieties?
Trait ranking exercise	List the most important bean characteristics and ask participants to rank the top five.

Theme	Discussion question/exercise
	Why are these traits most important?
	Where does iron content rank relative to other traits?
Adoption & dissemination	Why did some farmers adopt the varieties while others did not?
	Which dissemination approaches were most useful?
	What barriers limited adoption?
Adoption pathway exercise	Map the pathway from first hearing about the variety to regular use.
	What enabled each step?
Benefits & outcomes	What changes have you observed in production, income, markets or household food security?
	Who benefited most, and why?
Barriers & future improvements	Identify the three biggest barriers to wider adoption.
	What recommendations would you make for future varieties or dissemination approaches?



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