

PABRA means partnership:

Transforming
agriculture in Africa
together





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Contents

- 6** Preface
- 8** Why PABRA exists
- 10** The journey of PABRA
- 13** PABRA principles
- 17** Governance structure
- 22** Network activities
- 31** Serving the PABRA membership
- 34** PABRA's impact
- 36** Co-investment
- 38** PABRA's work continues
- 43** The future of PABRA
- 45** Conclusion
- 46** References



What is your dream for Africa?

My dream is an Africa where there is no poverty, no hunger, but rather one that has plenty of nutritious food that is grown and produced sustainably.

I dream of an Africa where agriculture will be modern and productive, using science, technology, innovation, and indigenous knowledge to drive and increase productivity and overall food production to an increasing rural and urban population. I also dream of an Africa where the agricultural sector will be modern, commercial, profitable, and attractive to investors, and to the continent's growing youths and women. I dream of a day that the hand hoe will be replaced by more efficient and labour-saving tools.

To achieve food and nutrition security, Africa must participate, promote regional, continental, and global markets, and strengthen key value chains. Our policies need to be deliberately tailored, made conducive and supportive so as to take advantage of opportunities offered by technological development and innovations. Enhancing capacities of different stakeholder cannot be emphasized. With a changing climate, Africa needs to be prepared with mitigation strategies, plans, policies, tools and actions that enhance resilience of our production systems and communities.

To achieve the African dream, collaboration and close partnerships among nations, political and trading blocks, institutions, value chain actors and farmers are important. This brings on board complementarities, synergies, economies of scale, and efficiencies.

For two decades, the Pan-Africa Bean Research Alliance (PABRA), a partnership developed and facilitated by the International Center for Tropical Agriculture (CIAT) – a CGIAR Research Center – has fostered a pan-African research and development partnership to strengthen the common bean value chain. Common beans are important food legumes and contribute to the food and nutrition security, income generation and enhances production systems in over 31 countries in sub-Saharan Africa. Over the last 20 years, PABRA has built a multi-stakeholder partnership network across 31 countries including farmers, research institutions, private sector stakeholders, NGO, and governments. PABRA has recounted on a number of success stories, useful experiences, lessons, and challenges that still need to be overcome. Of interest

are the partnerships in sharing germplasm variety development, sharing of resources, sharing of knowledge, capacity building that not only includes individual but also institutions through collaborative efforts.

The new bean corridor approach has defined and is being adapted by PABRA across Africa in the major bean production, distribution, and consumption zones where beans are traded nationally and regionally, which is meant to greatly impact on the bean business. The approach focuses on intensifying production and connects value chain actors with the objective of removing bottlenecks along the value chain and generation of significant economic benefits.

PABRA also shows that gender inclusion in agriculture is a critical element in creating an enabling environment for women, men, and youth to benefit. For example, agribusiness harnesses the power of growing food and accessing markets. In so doing, any formal representation and decision-making outcomes meet the needs and interests of both male and female farmers, especially where gender preferences and needs differ.

Putting together these experiences in this PABRA Model illustrates the power and benefits of partnerships. Although its focus is on the bean value chain, there are many lessons to be learned on a wide range of issues that are applicable in research and development. It articulates the strength of working collaboratively across countries, disciplines, and environments, and with a wide range of stakeholders.

I believe similar partnerships can make valuable contributions to achieve my dream that “Africa can feed Africa.”



Dr. Robin Buruchara
PABRA Director General



WHY PABRA *exists*

The importance of beans in Africa

Beans are essential to the agricultural, nutritional, and economic future of sub-Saharan Africa. In smallholder farm households, they offer a high-value source of protein and micronutrients as well as an opportunity for women's economic empowerment. With increasing urbanization and changing demography, beans will become an even more important food and nutrition crop. This creates investment and business opportunities for farmers and others.

Beans will enrich diets in Africa when they are available locally and knowledge about their properties and benefits is available at household level. In Africa's dynamic, complex context, one-size-fits-all interventions rarely work well. Seizing the potential of beans requires robust, adaptive systems for developing improved bean varieties and

disseminating them to farmers as well as effective market linkages among production, distribution, and consumption hubs.

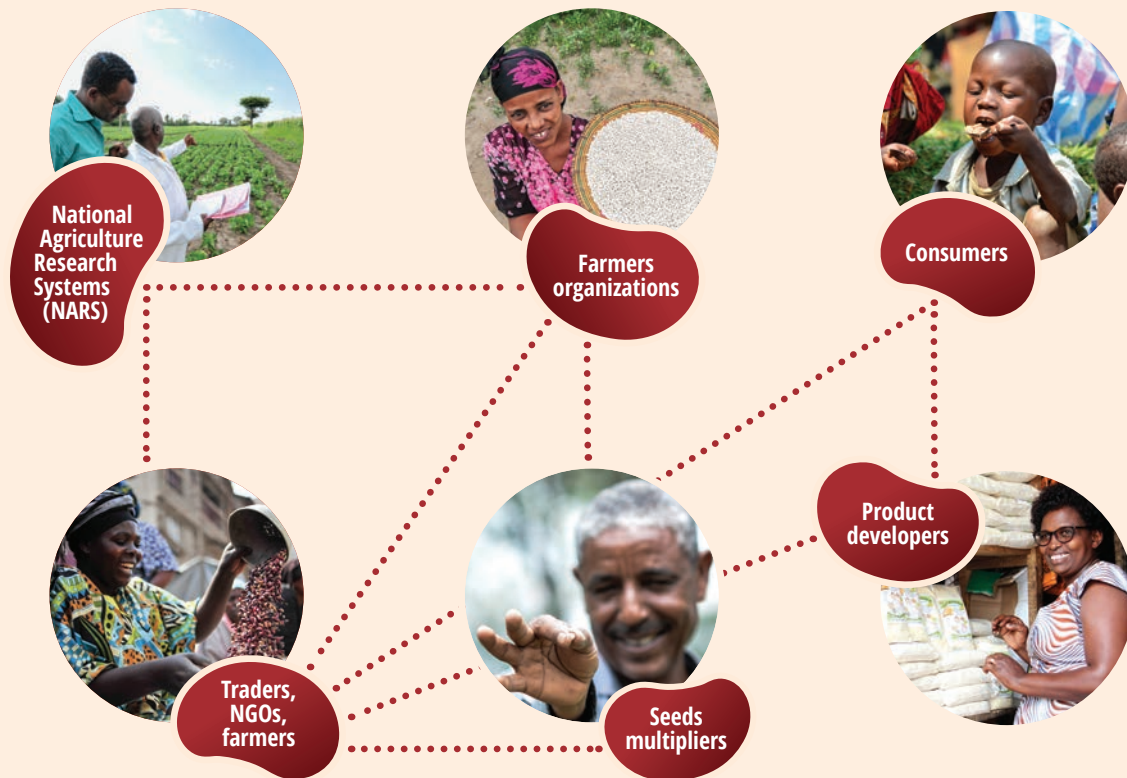
Beans to benefit the rural and urban households

Through research, capacity building, networking, and partnership building, PABRA seeks to enhance food security, income generation, poverty reduction, and empowerment and health of poor communities. As a consortium of African-owned regional bean networks, PABRA's focus is to improve bean productivity, utilization, and commercialization for the benefit of the urban and rural poor.¹ Women play the main role in bean production and are the major beneficiaries of PABRA.

Members of PABRA are leading the push to transform the role of beans in Africa. Along the pipeline from farmer to consumer, they are confronting challenges in production, trade, and consumption of beans, as well as threats to harvests and food security (e.g. pests and diseases, drought, poor soils). The PABRA network contributes to eight of the seventeen UN Sustainable Development Goals through its collective efforts to fight poverty and hunger, improve nutrition, empower women, promote climate-smart agriculture, and build inclusive value chains.

Boosting the benefits of beans

The PABRA network increases knowledge about beans and their use in a range of different products. Members of the network strive to improve dry bean varieties in a gender-equitable manner by expanding access to multiple stress-resistant bean varieties, integrated management options, and micronutrient-rich bean-based products.



Helping national institutions to help their people

PABRA's scientific breakthroughs are supported by highly capable national partners. They are respected engines of science in the public interest. National research institutions are the backbone of PABRA. PABRA's network enhances information empowerment and social capital among national partners.

The diversity of partners and projects are a core strength when it comes to achieving impact, yet often do not fit neatly into research-for-development categories. Often extolled for their importance in scaling up impact, the art of creating and maintaining complex networks is still unfamiliar to many. This model showcases the 'nuts and bolts' of how the PABRA network operates including core principles, governance structures, and activities so that these can inform counterpart programs focused on other commodities and geographies.

Sharing the PABRA model

PABRA's vibrant network model is increasingly recognized for its high impact in bean research for development including its ability to leverage partnerships into many types of co-investment. As pressure intensifies on international research institutions to demonstrate effective partnership engagements and outcomes at scale, PABRA leaders are being called upon to explain the network design, experiences, key success factors, and lessons learned.



THE *journey* OF PABRA

Transforming crop production and tackling constraints

Three decades ago, before PABRA came into being, regional capacity for bean-related research was sparse. Most countries had limited human, physical, and financial resources to undertake research for development. From 1980 to 1995, regional efforts to overcome bean production constraints matured into the PABRA network, which established a framework for collaboration among research institutions in bean-producing areas with similar agro-ecological, production, and socio-economic conditions.

Since 1996, PABRA has undergone tremendous evolution in its effort to serve its stakeholders and to better achieve its goals. In addition to a greatly diversified set of partners represented in PABRA's governance as well as a broader donor base, researchers have shifted from working in

isolation on area-specific projects to working across bean value chains through client-driven, multidisciplinary teams.

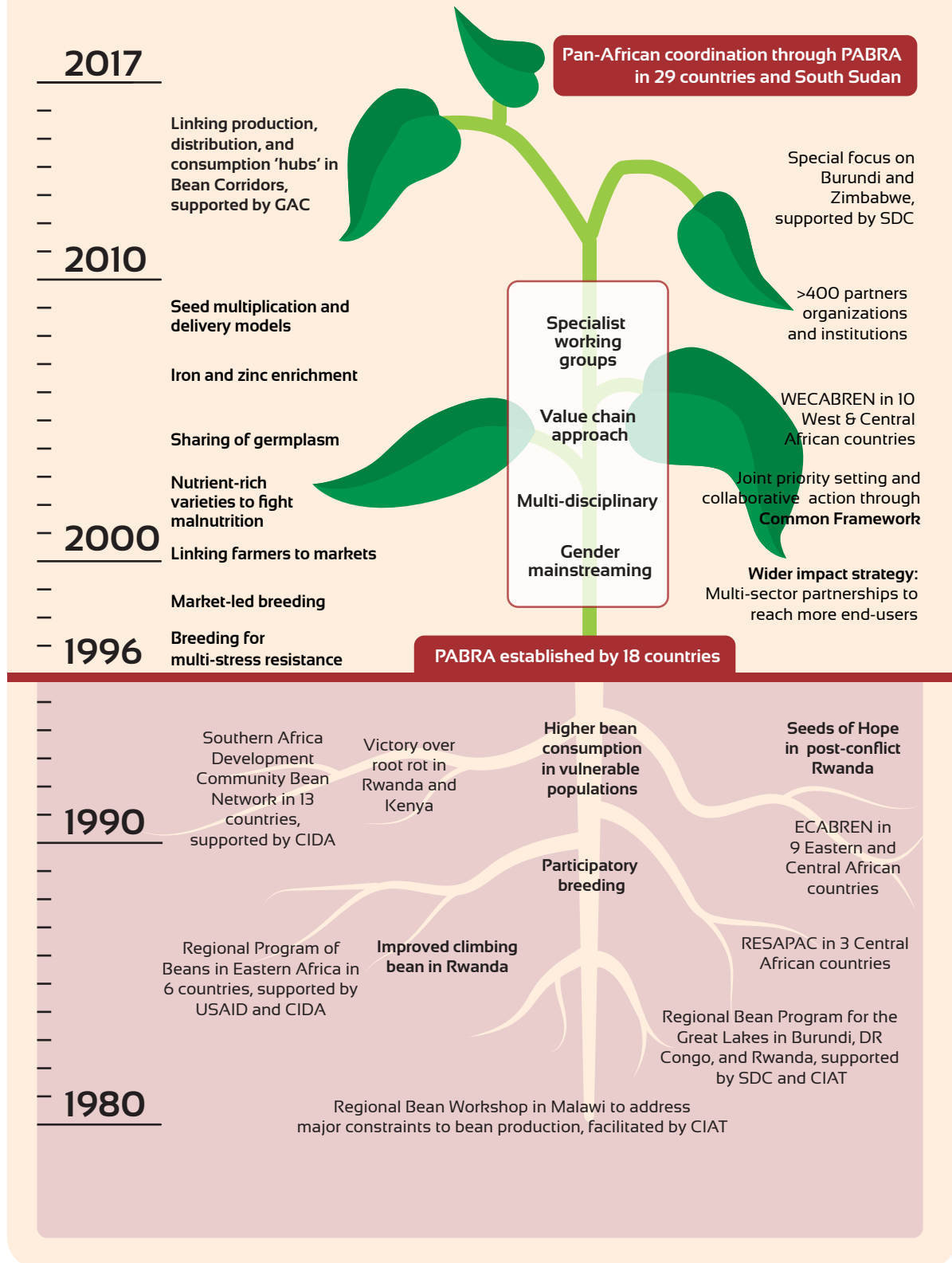
The PABRA network has been organized around a vision for transforming beans from a subsistence crop to a cash crop for smallholder farmers who produce bumper yields of nutrient-rich beans that bring good market prices.ⁱⁱ With its eye on improving food, nutrition, and income security, PABRA members direct their efforts toward:

- Breeding bean cultivars tolerant to multiple constraints and matched to market demands;
- Productivity enhancement through integrated crop management approaches;
- Improving smallholder farmers' access to high-quality bean seed and to profitable local, regional, and international markets;
- Reducing malnutrition by promoting consumption of bean products rich in iron and zinc; and
- Empowering women to benefit from bean value chains.

Through PABRA, 1.4 million farmers (half women) have gained improved market access

Evolution of the PABRA network

With its roots in regional bean networks, PABRA continues to grow its membership, to expand its geographic reach, and to mature as a collaborative platform.



Over the years, PABRA has worked on breeding bean varieties to meet production constraints such as drought and water stress, disease resistance, and water-logging. Under PABRA, hundreds of bean varieties have been released. For breeders, this is a sign of high achievement. But increasingly, the need to focus on farmer adoption became clear, leading the PABRA network to engage a broader set of stakeholders. Additional breeding objectives arose including developing higher productivity, better-tasting, and faster-cooking varieties. In the last decade, understanding market needs has become a central focus.

Bean corridors

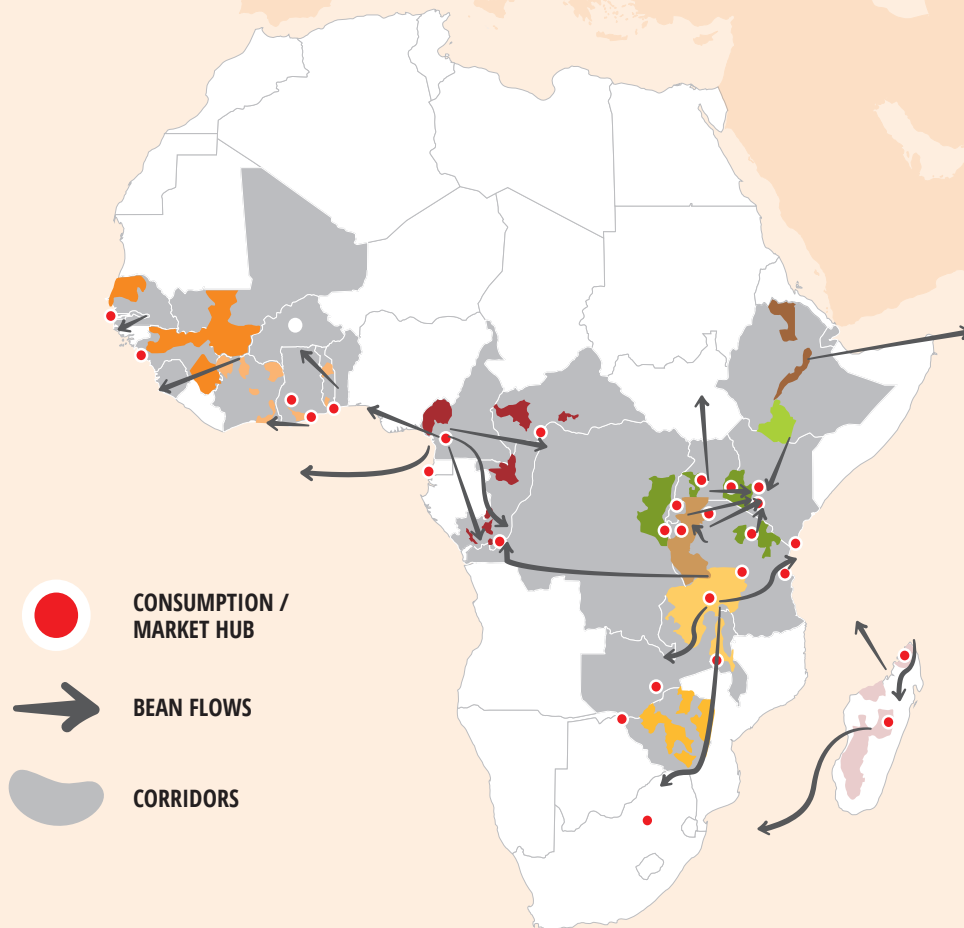
Bean Corridors are PABRA's newest approach to demand-led research and market-driven transformation of rural agriculture. Based on a deeper understanding of what is

needed in bean value chains, as well as early experience in applying a Corridor mindset to white pea bean in Ethiopia, PABRA members have already begun to re-frame, enrich, and systematize their work under the Corridor approach. The central idea is to organize the bean trade in ways that are more beneficial to small-scale farmers and that result in greater production and consumption of these nutritionally important crops. As part of Africa's transition from subsistence agriculture to market-oriented farming, the Bean Corridor approach requires closing the agricultural gender gap that limits women farmers' productivity and profitability by increasing their decision-making role and control over resources.

PABRA activities have contributed to an 86% increase in bean production areas

Bean Corridors in Africa

Better coordination and targeted innovation can intensify production, distribution, and consumption of high-demand bean market classes as well as integrate dispersed smallholder producers into bean value chains and improve the business environment, generate policy support, and increase investment





PABRA *principles*

National institutions at the center

In Africa, the mandate for development of bean value chains lies with the government. National co-investment is essential for advancing bean development. Government policies and approval are extremely important for stimulating broader interest and action among the private sector, NGOs, and sub-national government partners. With its primary focus on National Agricultural Research Systems (NARS), PABRA operates with a governmental mandate in collaboration with farmers, value chain actors, and other end-users of research.

Participation in PABRA is driven by national interests and mutual gain. Implementation happens at the national level. PABRA supports national institutions by helping them to diagnose their problems, come up with home-grown solutions, and implement these in a way that is adaptive

to on-the-ground realities. Explicitly focused on facilitating NARS transformation, the PABRA model emphasizes engaging agents of change, finding and leveraging existing resources, and adapting models for scaling up that fit the context.

At regional level, the PABRA network enables countries to work together to meet their obligations and efficiently use their resources by exchanging germplasm, sharing technical expertise, and linking up with other international organizations. PABRA members share knowledge and foster innovation through a united, site-specific approach. Partners get involved through specific projects or issues (e.g. high-iron beans, pre- and post-harvest technologies, bean product development) and engagement grows from there.

Diverse and inclusive

Participatory decision making is the key to PABRA's effective south-south knowledge exchange and information empowerment. This is a 'bottom-up' process led by people in the field, guided by their collective experience and ideas for how to create positive change. Everything that happens under the PABRA umbrella is devised and implemented through energetic networks characterized by joint priority setting, planning, and agreed division of responsibilities.

“By building deep and wide networks with local partners, paying attention to local similarities and differences, we can boost yields, double – even triple – incomes, improve nutrition, and transform the livelihoods of entire communities.”ⁱⁱⁱ

The inclusive PABRA framework allows for many different kinds of participation and diversity in terms of membership, activities, and bean types. It is a platform that supports collaboration and innovation among partners with highly varied scientific and institutional capacities. Diversity is an important source of PABRA’s strength because it ensures that a broad base of expertise will enrich the network.

Between 2009 and 2014, nearly 13 million households (58% represented by women) accessed improved bean seed developed through the PABRA network

PARTICIPATORY RESEARCH SAVES MONEY AND TIME

PABRA has embraced participatory research to explicitly include farmers in development of new varieties, technologies, and production techniques.^{iv} Early on, through the Great Lakes Region bean program, CIAT applied a participatory plant breeding approach and then, with funding from DFID, tested it in Ethiopia and Tanzania in 2000. This approach has since been integrated into breeding programs in other countries. National bean breeding programs in several member countries are using participatory plant breeding techniques and discovering that they can substantially reduce the time from evaluation to release by at least two seasons along with breeding costs. They also find that the varieties derived from participatory techniques are more acceptable to the full set of stakeholders including farmers, traders, and consumers.

The participatory research for improved agro-ecosystem management (PRIAM) approach was first used in Uganda and Kenya to test soil fertility management combined with improved bean varieties. When the combination successfully led to boosted bean yields, with funding support by the Rockefeller Foundation, PRIAM was later taken up in Ethiopia, Madagascar, Tanzania, DRC, and Malawi.





Comparative advantages add up to mutual gain

Anchored in a shared vision, allocation of responsibilities within and across the three regional networks of PABRA is guided by national interest and comparative advantage in human resources and facilities. Research findings and new technologies are shared among countries, avoiding unnecessary cost and duplication of efforts.

Across the network, some national bean programs are well-staffed with breeders, agronomists, plant pathologists, entomologists, nutritionists, social scientists, and other specialists, while other national programs have only one or two scientists. PABRA members embrace a team mindset in which the goal is for every country to have access to improved bean technologies and to be able to move them quickly to end users

REGIONAL PARTNERSHIPS OVERCOME GAPS IN SCIENTIFIC CAPACITY

Across the PABRA member countries, scientific capacity is highly variable. Yet, several under-resourced national research programs, which do not have breeding programs of their own, have been able to release improved bean varieties through PABRA partnerships. For example, southern DRC, Burundi, Mozambique, and Lesotho have received advanced bean lines and varieties (e.g. iron- and zinc-rich beans; drought tolerant beans; beans resistant to multiple constraints) that were selected for regional suitability through partner countries' breeding programs. Staffed by a sole bean researcher and unable to preserve its improved bean germplasm, the southern DRC-INERA Kipopo bean program was able to access over 650 bean lines - products of CIAT and SABRN member countries - through PABRA membership. Participatory evaluation greatly reduced costs and accelerated release of new varieties from 7-10 years to just 4 years. INERA has since built strong relationships with key partners in civil society, government, and private sector, including farming associations and extension services, that accelerate dissemination of bean-based technologies in Katanga province without incurring direct costs.

PABRA emphasizes mutual gain. Members recognize that all national bean programs are working on the same commodity, encountering related challenges, and interacting with similar kinds of people. The alliance encourages country partners to lead where they have a comparative advantage, while enabling all members to build capacity through engagement in multi-country initiatives such as market studies.

By sharing best-bet technologies and approaches with their neighbors, PABRA members reduce redundancy and benefit stakeholders in other countries. This way, improved bean varieties can be released more quickly and at lower cost, even in countries lacking an active breeding program.

THE PABRA NETWORK HELPS COUNTRIES RECOVER FROM CIVIL CONFLICT

Many parts of Africa have been affected by violent conflict that disrupts agricultural value chains. As Rwanda emerged from the period of genocide and civil war, the Institut des Sciences Agromiques du Ruanda (ISAR) sought to launch mass seed multiplication for rural communities for beans - the major Rwandese household staple food, and other crops, but did not have the necessary germplasm. Through "Seeds of Hope," seven International Agricultural Research Centers (IARCs) rushed to rescue, multiply, and distribute seeds of Rwanda's six most important food crops. CIAT coordinated multiplication of improved climbing and bush bean varieties, which were grown in Burundi, DR Congo, Kenya, Tanzania, Uganda, Ethiopia, and even Colombia. This network-based intervention allowed the ISAR bean program to regain its footing and put Rwandan farmers back on the path to productivity and food security. Drawing on the experience in Rwanda, PABRA partnership arrangements have also technically, logistically, and financially assisted other areas affected by civil unrest including Burundi and eastern DRC.





GOVERNANCE *Structure*

Broad membership and geographic reach

Focused on increasing connectivity and sustaining social capital, PABRA unites 30 member countries through three regional bean research networks:

- Eastern and Central Africa Bean Research Network (ECABREN)
- Southern Africa Bean Research Network (SABRN)
- West and Central Africa Bean Research Network (WECABREN)

National bean programs are the fundamental building blocks of the PABRA network. A national bean coordinator organizes member participation through some stakeholder forums which include: national bean research teams, NARS,

governments, sub-regional organizations, non-governmental organizations (NGOs), community-based organizations (CBOs), universities, farmers, selected rural communities, the commercial private sector, the International Center for Tropical Agriculture (CIAT), and donors.

“Seed companies are ready to take up new varieties because they have been involved throughout the development process. They participate in demonstrations, which allows for coverage of much wider areas. With demand-led breeding, whatever variety is produced, it meets the needs and preferences of seed companies and their clients.”

Bruce Mutari (Bean Program Leader, DRSS, Zimbabwe)

TPartnerships are at the heart of PABRA and anyone who is keen to advance bean value chains, from researchers to farmers, is a valued contributor. Private sector engagement has grown to include 59 seed companies, 11 large scale grain traders, and 432 farmers’ organizations.

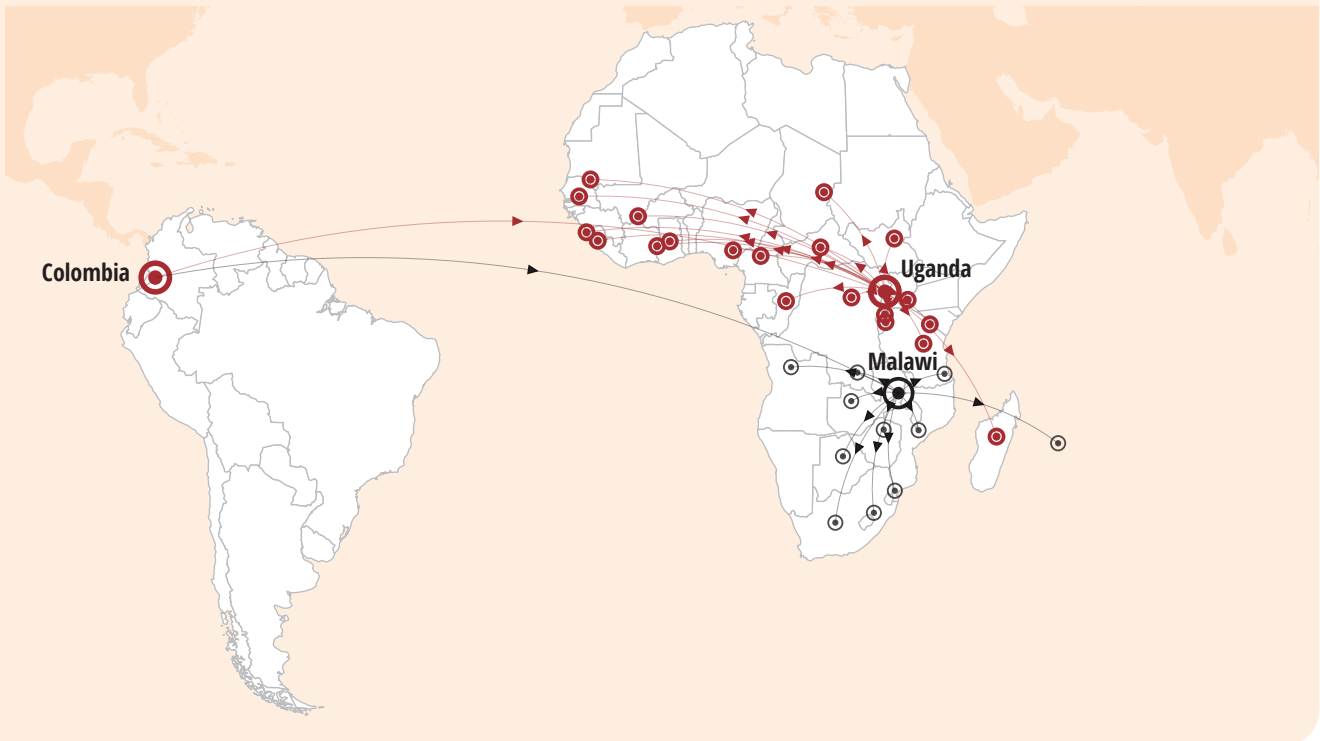
Scaling up PABRA

Investments in specific locations and activities have catalyzed co-investment by public and private sector partners, extending PABRA's geographic reach and impact..

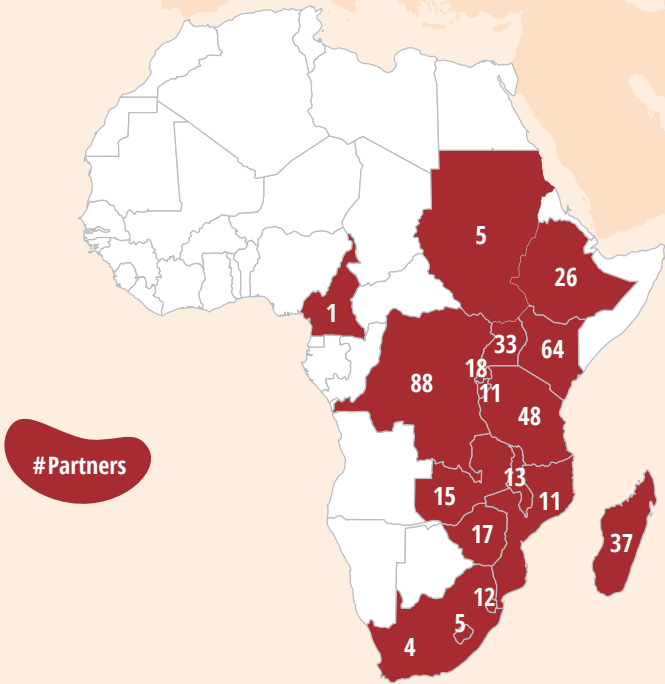
A. PABRA works through three major networks



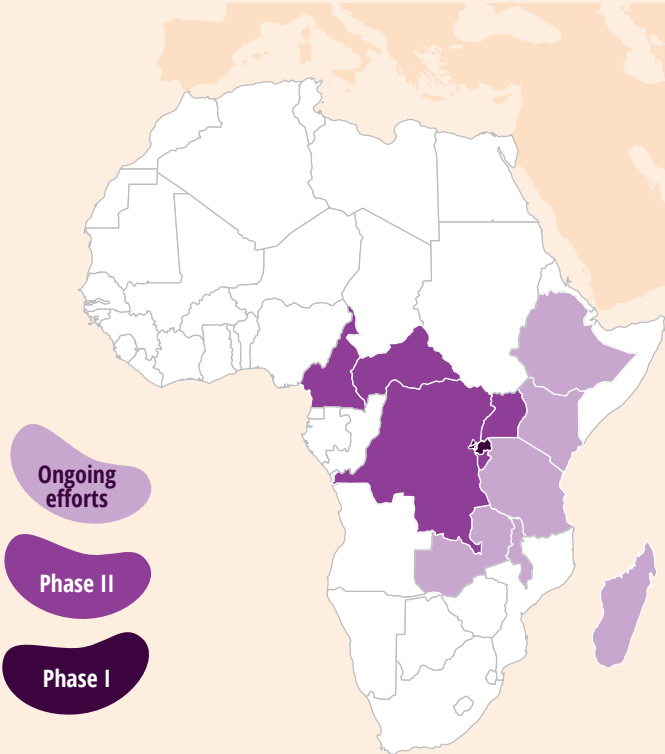
B. PABRA members share improved beans



C. Many PABRA partners contribute to seed multiplication and delivery



D. Climbing beans expanded through the PABRA network



Shared knowledge and decision making

The PABRA program is governed by a Steering Committee of representatives from member country NARS, sub-regional organizations, NGOs, producers' organizations, universities, farmers, private sector, and donors. Steering Committees also govern the three regional bean networks. Emphasizing an accessible decision process, Steering Committee deliberations are conducted in a transparent manner and resolutions are documented and available to PABRA members and donors. Consultative processes for defining research program priorities include openly sharing budget information and joint planning and decision making among stakeholders.

Working groups are the engines generating dynamic ideas that fuel the PABRA network. They are structured around areas of shared interest such as breeding, nutrition, integrated crop management, and markets and address specific elements of PABRA's Common Framework. Designed to facilitate shared learning and creativity, working groups collaboratively discuss priorities, ideas and adaptive strategies tested by others.

“When PABRA members get together at the meetings, we are meeting like brothers and sisters. It's not about competing for who is the best, rather we are trying to move as a team and the network tries to help everyone catch up.”

Dr. Stanley Nkalubo (Bean Program Leader, NACRRI, Uganda)

Annual meetings are a critical ingredient of PABRA's success as a network. These meetings are where the puzzle pieces fit together and partners have a genuine opportunity to shape the agenda, collaborate and engage. All partners convene for a participatory two-day planning exercise packed with discussions, questions, examples, and strategy refinement. After coming to agreement about plans and budgets, partners bring these plans back to their home country for implementation.

A guiding concept for PABRA meetings is that everyone takes what they need: from new technical knowledge, connections with counterparts in other countries, to funds for unanticipated needs. When a new national bean coordinator comes into the role, the annual meetings enable these individuals to quickly absorb the potential and structure of PABRA so they can maximize the benefit they can take. Despite change in national systems, the PABRA network is a source of stability and repository of institutional knowledge shared across countries.

PABRA is creating an internal collaboration space to share knowledge across the broad, dispersed network and to engage partners in communication of what PABRA does and what they see as critical to representing the diversity of PABRA-related activities. This knowledge management system is designed to improve information flow, facilitate sharing of data and experience, and increase alignment among PABRA partners. An additional objective is to increase the capacity of people within the PABRA network to identify and succinctly communicate stories so that monitoring and evaluation (M&E) and communications specialists can relate these to program sponsors. Through PABRA, members are encouraged to use internet communication and file-sharing services, increasing connectivity within and across PABRA countries. PABRA staff scientists also assist national research partners in targeting journals for submission of research papers.

Powerful south-south scientific empowerment

The International Center for Tropical Agriculture (CIAT) is the institutional home for PABRA staff, who coordinate and support the network. The CIAT gene bank is a high-value resource, providing germplasm and technical expertise for national breeding programs, and linking PABRA members with CIAT scientists to enrich strategic research. As the PABRA Secretariat, CIAT supports work planning and serves as the budget manager for this ring-fenced program.

CIAT receives donor funds on behalf of national bean programs and distributes these funds based on allocations agreed to by national partners through the governance mechanisms they have established themselves. Under this arrangement, PABRA resources belong to designated program partners who are not required to submit financial reports to CIAT. Importantly, as one of many PABRA partners, CIAT has a vote at PABRA-level Steering Committee, but does not determine the programmatic direction.

TRANSPARENCY CREATES 'TRUST DIVIDENDS'

Collective ownership of the PABRA platform by national partners has encouraged transparency since the beginning. PABRA's origins are in donor-funded projects to countries that encountered capacity limitations and cross-border bottlenecks. Network arrangements emerged from countries working together, facilitated by their donors. This led to increased interest in better coordination and CIAT was invited to work with existing networks. National programs feel ownership over the network, with CIAT playing the role of facilitator



and financial manager, and therefore feel an obligation to be transparent to succeed.

Participatory decision making is key to generating trust. Under the PABRA model, core funds allocated to specific countries as well as leveraged funds are transparently reported to all network members. PABRA members welcome mutual accountability by sharing what they have accomplished through annual reports and engaging in robust discussion about plans and budget allocations for the coming year. New people joining PABRA can quickly become familiar with how the program operate through network forums, and report transparent information-sharing among themselves.

Trust-building takes time. When a new national bean coordinator comes into the role, they bring energy and ambition to achieve set targets. As they simultaneously come to understand the challenges they face as well as the many forms of support available through PABRA, they increasingly embrace their role within the network. Over time, the full benefits of the network are revealed through opportunities to interact with other scientists, to share protocols, to participate in regional projects, to engage with value chain actors, and to collaboratively mobilize resources.





NETWORK *activities*

Breeding improved bean varieties

Developing bean varieties that can be profitably grown by farmers, meet market expectations, and help to reduce micronutrient deficiencies in sub-Saharan Africa is a core function of the PABRA network. PABRA has long been guided by a demand-driven breeding strategy that develops improved germplasm for market classes of beans that are prioritized in member countries. Originally focused on addressing productivity challenges (i.e. increasing yield, drought resistance), breeding objectives have expanded to emphasize consumer-preferred traits for nutrition, quality, taste, and cooking time.

During the post-colonial period in Africa, development and release of new bean varieties was at a standstill in many countries. Focusing on the major market classes identified nationally and regionally, breeding in the PABRA network has developed bean varieties that combine high

yield potential, resistance to multiple biotic and abiotic stresses, and enhanced levels of iron and zinc. During PABRA's lifetime, 450 new bean varieties, bred for enhanced resilience, productivity, nutrition, or marketability, have been released.⁹ Through technical and financial support from the PABRA network, improved bean varieties are now on offer in local, national, and regional markets.

Farmers adopting improved bean varieties have seen seasonal income gains of US\$500 to 800 per hectare under rain fed conditions and US\$1,000 per hectare under irrigation

Hosting the largest *Phaseolus* gene bank in the world (over 37,000 bean types), CIAT provides an invaluable resource to bean variety improvement in Africa. PABRA enables close integration of breeding efforts between CIAT and NARS scientists and sharing of bean germplasm with vital characteristics including high levels of micronutrients and tolerance to heat, drought, soil acidity, pests, and disease.

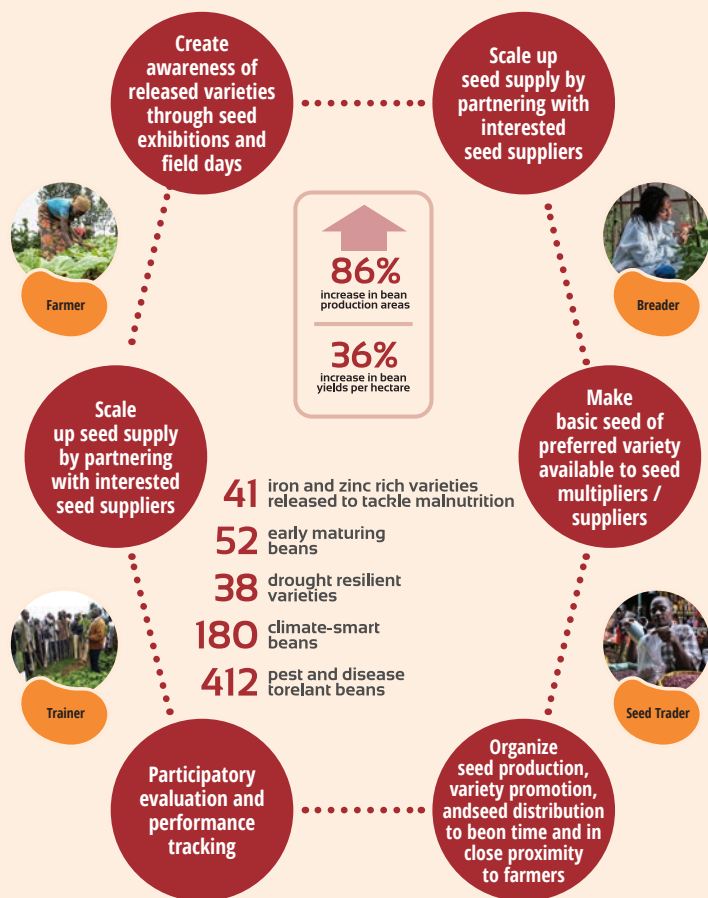
Unlike other germplasm-sharing programs, national partners can devolve their own material from the original germplasm acquired from CIAT and integrate other germplasm.

All the resulting improved germplasm is made freely available. The main obstacle to breeding is usually lack of germplasm and PABRA overcomes this limitation by facilitating germplasm exchange. The PABRA model makes bean genetic diversity accessible as national partners can share germplasm, originating from CIAT and their own breeding programs, in addition to new knowledge, new tools, and breeding protocols.

As one country identifies useful germplasm, they can share it with other countries who test it for suitability in their national context, allowing for fast-track release of new varieties. Due to sharing of germplasm and collaborative testing, several varieties have been released in multiple countries, which reduces obstacles to cross-border trade. For example, the variety RWR2245, originating from the Rwanda Agricultural Board, has been released in Uganda and Burundi and the variety KATB1, originating from Kenya, has been released in Burundi, Ethiopia, Tanzania, and DRC without usual time-delays.

Participatory breeding approach

Breeders, nutritionists, seed companies, farmers, and others, within and across countries, share responsibility for improving different bean traits or market classes



RESEARCH NETWORKS SPREAD INNOVATION WITHIN AND ACROSS REGIONS

Improved climbing beans have been widely adopted across Rwanda and now occupy about 55% of bean-growing areas, generating an additional 13,200 to 22,000 tons of protein per year and improving nutrition of the rural and urban poor. Improved climbing beans have enabled additional gross output valued in the range of USD\$12-20 million. Developed in Rwanda for medium and highland regions characterized by land scarcity and degradation, climbing beans also deliver a three to four-fold yield advantage and pest and disease resistance.

Improved climate bean technology has been spreading to eastern, central, southern, and western Africa. In the 1980s, the regional bean program brought climbing bean varieties to eastern DRC and Burundi. These were later adapted to and adopted in other ECABREN countries (i.e. Ethiopia, Kenya, Uganda, Tanzania, Madagascar, and Sudan) as well as SABRN (i.e. Malawi and Zambia) and WECABREN (e.g. Cameroon) countries.

When a severe El Niño weather cycle brought intense drought conditions and failed maize crops to Malawi in 2016, early-maturing, deep-rooted beans developed through PABRA delivered nutritional stability and income for farming families. With genetic origins in Mesoamerica, the precursors of these 'magic beans' had been conserved in the CIAT gene bank in Colombia, where they were screened for important traits and crossed and selected for drought tolerance. Through the PABRA program, in collaboration with Malawi's Department of Agricultural Research Services, the candidate varieties were sent to Malawi for trials at the research station and in farmer field, which enabled researchers to identify the two best beans for local growing conditions. Next generation testing in Malawi is evaluating the effects of maize intercropping and different combinations of chemical fertilizer and manure on bean productivity. The most important next step is commercial release so that farmers have bean seeds that can help them through drought.

Supporting bean value chains

Effective demand-led breeding requires participatory engagement to ensure that new varieties support a profitable, vibrant bean industry. To forge collaborative partnerships toward effective bean seed distribution systems, mapping bean value chains is an essential step, including:

- Farmers and their organizations (e.g. cooperatives)
- National to district level government agencies (e.g. agriculture, trade)
- Private seed producers, seed enterprises, seed quality regulating bodies
- Agro-dealers, traders, exporters, and their associations
- NGOs working in nutrition
- National and regional research centers and university departments (e.g. agriculture, nutrition, food science) and multidisciplinary research teams
- Bean-related development projects (national, donor-funded)

Seed business development is about commercializing bean varieties once they are released, so that they get into the hands of farmers. Each country has its own policies for trading and selling seeds and its specific constraints to development of a high-functioning bean seed industry. Farmers get bean seeds through many different channels such as agro-dealer shops, markets, seed exchanges, and donations. PABRA works to make sure farmers can use improved bean seeds supplied through these channels.

“Work with seed companies and other value chain partners’ focuses on building trust and helping them to learn and adapt to their own situation. These partners are the real drivers for getting improved bean seed to farmers.”

Rowland Chirwa (Regional breeder and coordinator of SABRN)

By facilitating information flow, training, exchange visits, and linkages to service providers (e.g. financial services), PABRA seeks to improve the capacity and business drive of bean seed and grain entrepreneurs. In several PABRA member countries, national breeding programs have provided breeder seed to local seed companies that have better capacity to multiply the seed and distribute to farmers.

In addition to ensuring farmers have access to high-quality improved bean seeds, PABRA seeks to improve farmers’ access to profitable markets. Bean price is a key catalyst for adoption of improved varieties. For example: innovation platforms bring together farmers, traders, marketers, and processors in a venue for sharing market price information. Farmers can find improved bean technologies, resulting in significant yield increases. In Zimbabwe, positive experiences with a wheat innovation platform spurred the national government to encourage the national bean program to explore this approach.

LEADERSHIP IN INNOVATIVE SEED SYSTEMS

Over the years, a lot of bean research has focused on breeding for higher tolerance to biotic vectors and harsh environments. More recently, there is a push towards bio-fortification, integrated crop management, and development of seed systems that respond to market needs and provide farmers with bean varieties that traders want to buy. When seed companies are involved in participatory variety selection, they expand testing capacity by contributing to field demonstrations and they are ready to integrate preferred seeds into their business.

A key challenge is that the multiplication ratio is very low for common bean. To produce 1,000 kg of bean seed, 100 kg of breeder seed must be planted. Government breeding programs are limited to the land available at research stations, so seed multiplication lags behind seed industry demand. To achieve adequate volume of bean seed, private seed companies (commonly smaller, emerging companies) can be licensed to produce early generation seed (pre-basic and basic seed) of publicly developed bean varieties, accelerating their commercialization.

In Malawi, early generation seed volumes were not able to meet rising demand for certified bean seed. Through PABRA, a cost-sharing scheme was developed between the national bean program and private companies in which government breeders provided parent seed material, expertise, and monitoring and a private company provided land, labor, and inputs like fertilizer, irrigation. Under the agreement, the value of the contributions of each party was estimated and used to develop a ratio for allocating resulting bean seed (with right of first refusal if any party chose not to use their allocation). After harvest, the breeders received 25% of resulting seed and the company received 75%. This arrangement enabled a 10-fold increase in breeder seed.



MULTI-SECTOR PARTNERSHIPS TRANSFORM BEAN MARKETS

The PABRA network includes dozens of private sector partners including seed companies and grain traders, which have contributed to shortening the process of variety releases in several PABRA member countries.

When disease delivered a catastrophic blow to their maize in 2012, Kenyan farmers got much-needed relief from the rapid release of improved bean varieties to replace low-yielding plants. For example, KK-8 is a large, red mottled bean that is early-maturing, high-yielding, root rot-resistant, and quick-cooking that was quickly and effectively made available to farmers through a partnership among PABRA, Bubayi Products Ltd, One Acre Fund, and Kenya Agriculture and Livestock Research Organization (KALRO). A family-run seed business in Kenya's North Rift region, Bubayi had identified a ready market of 167,000 potential customers and knew they had the necessary infrastructure, land, and skills to produce high-quality bean seed. In 2014, through a Syngenta Foundation supported PABRA project, Bubayi was supplied with 80 grams of high-performing CAL194 bean, which they multiplied to 7,550 kilograms of market-ready breeder seeds in just two years. Licensing agreements with companies to produce breeder seed and basic seed have allowed them to produce 250 tons of certified seed in just 4 years. It would have taken traditional breeders 10-12 years given their limited resources and land. One Acre Fund mobilized their links to local extension offices to organize demonstration projects with research station personnel. Partnership with companies and NGOs increased the visibility of beans and built support in county-level governments, which play a key role in setting priorities for agricultural development.

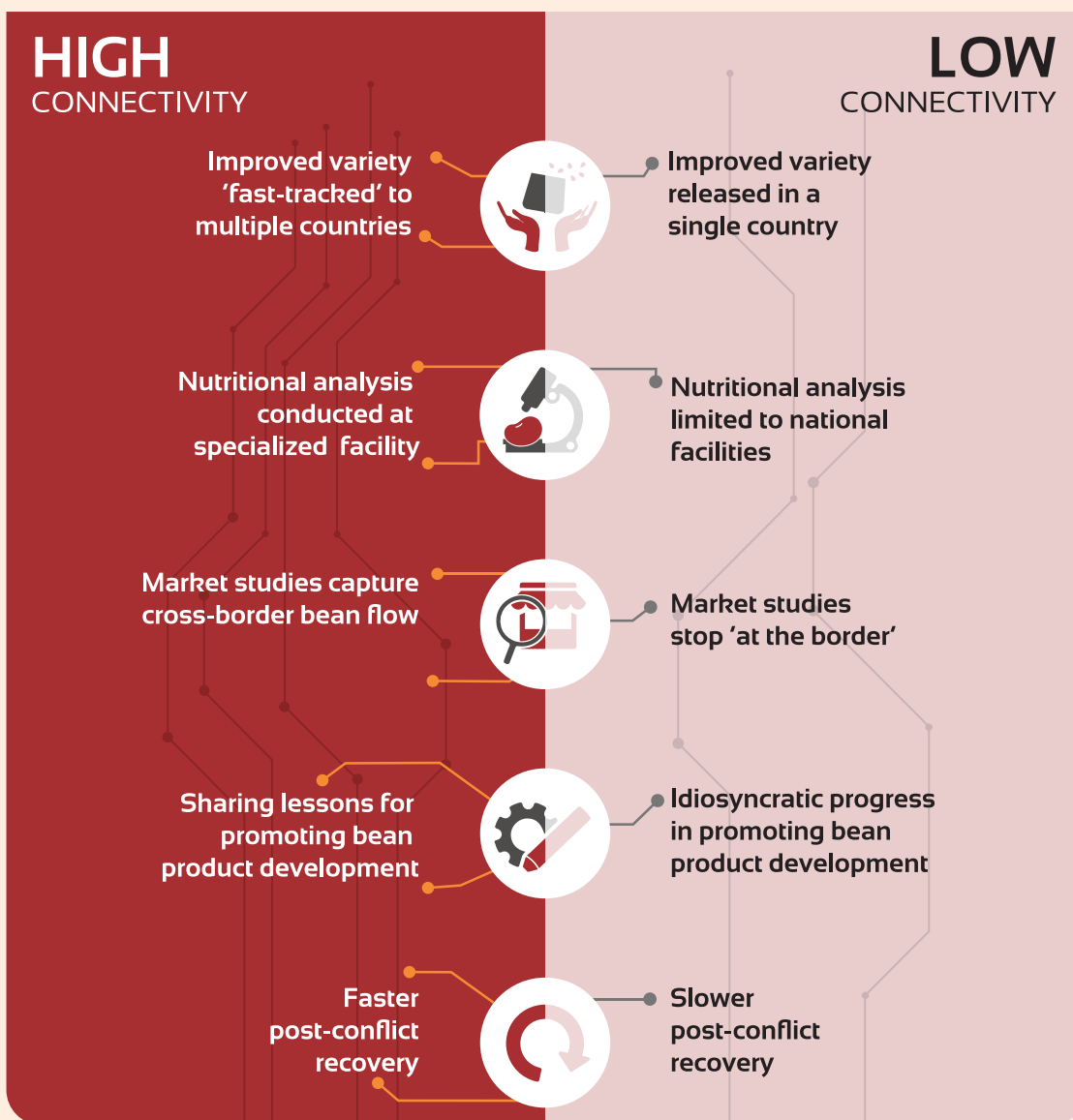
Farmers in Ethiopia have benefitted in a similar way from multi-sector partnership. To meet identified market demands, Agricultural Commodity Supplies (ACOS) asked the Ethiopian Institute of Agricultural Research (EIAR) for help. Through a PABRA partnership, EIAR and CIAT bred higher-yielding beans, that were more resilient to local pests, diseases, and drought. EIAR, CIAT, and seed value chains actors designed a seed system to provide access to ~2 million Ethiopian farmers. In 2004-2012, access increased from 20% to 75% of farmers in major bean-growing areas, the area under beans in Ethiopia increased 82%, and production tripled from 117,750 tons to 378,802 tons. Harvests of these 'white gold' beans rose from 0.75 tons per hectare to 1.6 tons per hectare, and export volume increased 15-fold, from US\$8 million in 2004 to US\$120 million in 2015. The price of white pea beans has increased from US\$200 to US\$600 per ton.

Armed with knowledge about consumer demand, PABRA partners can develop varieties that meet the needs of producers, traders, processors, and rural and urban households. Recognizing that information gaps hindered the potential of market-led breeding, in 2013, the PABRA network decided to undertake an extensive survey to better understand how different beans varieties were being traded, where they were moving to and from in the region,

and how they were being used. This market study surveyed approximately 800 traders and the resulting information was used to inform breeding objectives. The study was implemented by interested PABRA member countries. At the country level, the design was adjusted to the national context. On-the-ground execution was delivered by the national bean programs with support by PABRA staff, who also coordinated participatory analysis of study findings.

PABRA builds connectivity and enhances 'bean flow' in value chains

Comparison of 'bean flow' for improved varieties in low- and high-connectivity systems. When connectivity is low among researchers, breeders, producers, seed companies, traders, consumers, and others, it is difficult to accelerate transformation of bean markets. When connectivity is high, faster progress is possible toward improved bean productivity, utilization, and commercialization for the benefit of the urban and rural poor



Improving nutrition through beans

PABRA is committed to seizing the tremendous potential of beans for improving human nutrition. Increased bean consumption is linked to reduced deficiencies in protein and micronutrients such as iron and zinc and lowering the risk of childhood stunting and chronic diseases such as anemia, diabetes and heart disease. Making desired bean varieties and products available to households through improved bean value chains, as well as effective public communication, are key to better integrating beans into diets in Africa and securing the associated public health benefits for rural and urban populations.

Given their high nutritional value, simply increasing public consumption of beans can improve diet quality. Tactics include developing and disseminating bean varieties that meet consumers' taste and cooking preferences - fast-cooking varieties require less energy to prepare - and incorporating beans into food products including porridge, baby food, breads, prepared foods. School feeding programs are a promising avenue for integrating beans into diets and value chains. For example, following a PABRA pilot study, Madagascar replaced sesame with beans in its school feeding program.

PABRA is increasing its focus on bean product development, including breeding with cooking and taste qualities in mind, as well as value chain processes that offer urbanizing consumers packaged wet or dry pre-cooked beans or novel products such as bean jam. This requires engaging new types of value chain actors such as food processors that recognize the business opportunity. Early lessons are available to PABRA partners from Kenya and Rwanda where this is already happening.

To support improved nutrition and livelihoods, PABRA has partnered with the HarvestPlus program on bio-fortification to increase iron and zinc bioavailability in high-yielding beans with multiple stress tolerance. This partnership brings special emphasis to ensuring that women are primary beneficiaries and that introduced varieties enhance household diets as well as incomes.

“Sometimes it’s as simple as a cookbook. In many parts of Africa, beans have been seen as a ‘sauce’ for staple foods. Through simple trainings and cookbooks, other potential uses of beans such as flour, porridge, and snacks have been embraced.”

Rodah Zulu (Nutritional facilitator, PABRA-CIAT)

PABRA emphasizes evidence-based interventions and has been increasing leadership in nutrition research. Priority

research questions emerge through regular interactions among national stakeholders. For example, in Rwanda, inquiries from a government minister spurred efforts to investigate the prevalence of malnutrition in farm households and brought attention to the disconnect between agriculture and nutrition. In Tanzania, recognition that high-iron beans cannot be visually differentiated from regular beans triggered a study on drivers of food choice. This study revealed that information and knowledge about the impact of eating beans on health for example, is enough to shift consumer behavior. Research ideas are brought to PABRA working groups and can be integrated into work plans.

“As a result of our partnership with PABRA, I can now buy school and Christmas needs for my children and also participate in ‘njangi’ meetings, thanks to Haricot beans activity.”

Siri Bella Ngoh (Gender focal person and female farmer in Babessi, Northwest Region, Cameroon)

If properly equipped, women can become change agents for promoting the production, consumption, and utilization of dry beans and bean products. This requires integration of gender considerations into research objectives, technology development, extension strategies, and evaluation frameworks. PABRA research efforts will be directed to understand differences between men and women in decision making, preferences – for example for climate-smart technologies, or digital finance - and access to information and financial services, and associated drivers of behavior change to enable evidence-based intervention design. For example, researchers will test and evaluate models for disseminating labor- and cost-saving technologies to women. Capacity to collect, analyze, and use intersectional, disaggregated data relevant to gender-responsive interventions can be strengthened through the PABRA network.

Women’s participation rate is 38% in bean innovation platforms and 43% in PABRA institutions overall

Bringing nutrition specialisms into bean research design is essential to ensure that bean breeding programs drive household consumption, while also meeting the expectations of farmers and seed and grain traders. PABRA is helping national bean programs to build awareness and strategic alignment among molecular biologists, pathologists, breeders, entomologists, agronomists, nutrition experts and practitioners, including producers, extension advisors, agribusiness technicians.



BRINGING NUTRITION INTO FOCUS

Sparked by growing international recognition of the disconnect between agriculture and nutrition, since 2010, PABRA has expanded its focus to include nutrition and health. This has involved bringing new partners and approaches into a network in which collaborative activities and processes were well advanced. Given that agriculture and health often operate in 'silos' in research and government, integrating nutrition into PABRA has required real effort and adaptability. A Nutrition Core Team was created to be platform for incubating ideas and projects from member countries. Nutrition partners from different countries were able to learn from each other and understand common issues (e.g. engaging community-level networks through NGOs; working through health centers and schools).

To more effectively bring nutrition into the PABRA planning process, the Nutrition Core Team began

to meet immediately before the annual Steering Committee meetings so that they had nutrition-focused national reports, work plans, and budgets all worked out and ready to be included in PABRA-wide planning. Representatives from Madagascar, where beans are widely grown, proposed testing substitution of bean flour for sesame as the designated protein source in their school-feeding program. Integrated into the PABRA work plan and budget, this idea matured into a 6-month pilot with the national nutrition agency, ONN, that led to a change in policy, supported by engagement with several ministries of health, agriculture and education. It also resulted in private sector production of bean flour.

Nutrition looks at the consumer as the primary client, while breeding looks at the farmer as the client. Identifying gaps between agricultural production and nutrition (e.g. overemphasis on beans as commodity



crops rather than as food) is an important tactic for making nutrition an explicit part of national agendas. Zimbabwe, which already had a solid multi-sector link between agriculture and nutrition, shared their experience with the Health Harvest program, enabling other countries to understand how best to direct energy and resources. The PABRA nutrition team works with the SUN movement and other NGOs to increase focus on nutrition. Support from UNICEF, which is focused on water, sanitation, and hygiene (WaSH), was secured by demonstrating the links among WaSH, agriculture, and nutrition.

Achieving improved nutrition requires shifting attitudes, filling knowledge gaps, and engaging with partners in other sectors that are not focused on agriculture. The initial focus of the PABRA nutrition team was at the community level (e.g. teaching women to use bean flour)

and, recognizing that building demand is key, steadily expanded into private sector engagement (i.e. SMEs commercially producing bean-based products). In many parts of Africa, bean consumption has been perceived as a 'sauce' for staple foods and awareness of other potential uses (e.g. flour, porridge, snacks) has been low. Through simple trainings and cookbooks, diverse uses of beans have been embraced. In 2012, through a training in Burundi, despite the context of civil strife, new bean consumption strategies (e.g. bean flour) caught on, leading the private sector to begin producing bean flour in response to demand. Innovations are also being shared through PABRA such as the bean jam developed in Swaziland (which was awarded by an international product development competition) and bean products for diabetes being developed in Zimbabwe.

Connecting up trade

Beans are a highly traded commodity in East and Southern Africa, yet over 90% of beans move through informal trade channels. Many bean traders lack access to market price information and bean trade is hampered by cross-border trade restrictions, low tradable volumes, and high transaction costs. These factors combine to limit how smallholders, especially women, participate in bean markets. Traditionally, interventions in agricultural value chains seek to improve the productivity of cash crops. Yet, PABRA research has found that hunger and stunting can be prevalent in high production areas. This suggests that eradicating malnutrition requires disrupting the way food systems work.

Through corridors, economic intensification is focused on enhancing the efficiency of bean flow across areas of bean production, distribution, and consumption. Production hubs – areas where large volumes of beans are, or could be, produced – can be intensified through variety targeting, seed system enhancement, and promotion of good agricultural practices. Bottlenecks at distribution hubs – aggregation centers, storage points, and commodity exchanges – can be minimized through provision of exchange services and warehousing so that improved beans reach more consumers. In consumption hubs – major market outlets, processing units, and supermarkets – interventions focused on consumers, processors, bean dealers, and retailers can make beans more available, affordable, and appealing for consumers, leading to better nutrition and health.^{iv}

“Rather than trying to promote adoption of improved beans everywhere, the Bean Corridors approach is targeted toward areas with high potential, where surplus bean production, aggregation, and marketing is possible.

Eliud Birachi (Market economist, PABRA-CIAT)

Implementation of the Corridor approach requires ‘working backwards’ from a broader set of considerations linking value chain actors. Farmers can make better decisions about when and where to sell their beans if ICT systems give them access to up-to-date market price information. Increasing connectivity among bean farmers and buyers can create a better business environment in informal bean markets. Sharing market insights with processors can encourage bean-based products. Communicating with policy makers about the socio-economic potential of bean Corridors can unlock investment in bean value chains and facilitate resolutions to cross-border trade barriers. Innovation

platforms focused on integrating improved nutrition and harmonizing activities in production, distribution, and consumption hubs in specific Bean Corridors can transform these systems to deliver higher quality diets.

“With the new PABRA model of working in Bean Corridors, working with stakeholders will become easier. The most interesting part of this model is that gender was given a high consideration to allow women and youth to also benefit from bean commercialization.

Chantal Ingabire (Gender focal person, Rwanda)

Bean Corridors can offer women opportunities to materially improve their livelihoods. Each Corridor’s business platform has a gender focal person to facilitate gender mainstreaming. Activities shift the attitudes and gender norms that discourage women’s equal participation in decision making. Going forward, PABRA research will investigate Africa’s largely informal bean markets to understand the drivers of market behavior and food choice that could be shifted to promote safe, diverse, and nutritious foods. This requires understanding the incentives influencing the private sector and how specific groups, such as the fast food industry, might be encouraged to better integrate beans into their businesses. Research on diet nutrition can illuminate what constitutes a healthy diet in the African context to inform change.^{vii} Testing interventions on dietary behavior, especially for mothers and children, will clarify how best to create demand for nutritious food in specific contexts.





SERVING THE PABRA *membership*

Building capacity

PABRA has supported 33 NARS scientists to enroll in post-graduate study programs at national and regional universities since 2008. PABRA coordinates a wide array of training opportunities to ensure that partners have the knowledge and skills needed to overcome constraints in bean technology development, dissemination, and use. Over 4,000 stakeholders – of which 20% are women – have participated in training courses on topics ranging from bean variety development (e.g. marker assisted selection, participatory breeding and variety selection), seed systems, and integrated agronomic management (e.g. soil fertility, water use efficiency, pests and diseases, participatory diagnosis), to post-harvest quality assurance and marketing. Trainings also build skills in rural innovation, developing promotional materials, gender considerations, and participatory monitoring and evaluation.

US\$24 million has been saved over a 10-year period by investing in beans that contribute to soil fertility improvement, mainly through nitrogen fixation

Building infrastructure capacity requires significant investment, and capital for national programs is challenging. While PABRA funds can often support purchase of smaller types of equipment, it is a heavier lift to cover the expense of larger lab equipment that would advance analytical capacity. As PABRA crafts a capital investment strategy to increase research efficiency, existing facilities are shared among network members (e.g. iron and zinc analysis by the HarvestPlus-funded X-Ray Fluorescence machine in Rwanda; nutrition analysis at a Nairobi lab) and some analysis is outsourced.

Back-stopping national partners

The fundamental role of PABRA staff scientists is supporting the national partners to find and implement solutions to the challenges they have identified. This role begins at problem diagnosis and stakeholder engagement and extends through training, implementation, ongoing consultation, evaluation, and program adjustment. Back-stopping is an essential staff

function including frequent interactions with partners and regular in-country visits.

Participatory research design and analysis is a perennial feature of back-stopping visits. PABRA staff can help to detect ‘missing pieces’ and advise on feasible strategies. However, it is national partners who lead research and implementation, supported by PABRA staff in a ‘training by doing’ model. Mentoring support is important for new national bean coordinators, as they build their work plan and forge working relationships, to ensure that these individuals are connected to PABRA’s broader activities.

When visiting national programs, PABRA staff promote multi-disciplinary and multi-sector engagement by deliberately reaching out to partners working in nutrition, food processing, commodity trading, and other areas outside the traditional ‘silo’ of agricultural production. By spelling out potential roles and explicitly inviting participation, staff expand the ‘people power’ behind PABRA.

“PABRA staff engage agents of change rather than trying to do it all themselves. PABRA is inclusive through and through.

Mercy Lung’aho (Nutritionist, PABRA-CIAT)

Back-stopping visits encourage buy-in from government stakeholders by creating an opportunity to showcase the larger PABRA support structure. These visits generally last several days to allow adequate time to travel to local communities, participate in trainings, and meet jointly with international, NGO, and business partners. These interactions encourage reflection, clarify specific successes and challenges, and reveal emerging opportunities and research needs. Back-stopping also supports co-learning and evaluation as PABRA staff get to see on-the-ground activities and results and understand how different funding sources have been leveraged to maximize impact.

PABRA staff are on call

Dedication, empathy, risk tolerance, and perseverance are important assets for effectively supporting collaboration within bean value chains. PABRA staff focus on being responsive to national partners and building relationships and trust across the network. PABRA staff cultivate a flexible, approachable style anchored in a respectful, collaborative mindset.

Capacity across PABRA countries is highly varied, requiring specific strategies to support countries based on what they can do and creative efforts to address imbalances across the network. Some countries can be supported from a distance, while other countries need more on-the-ground assistance.

For example, some countries have senior researchers who can readily implement agreed methodologies when conducting multi-country studies. In other countries, junior researchers are hired on a project basis and they commonly need reinforcement to effectively adapt study designs to their national context.

Peer learning

PABRA facilitates exchange of technologies (e.g. bean germplasm) and expertise (e.g. activating seed systems and bean product development) among network members and supports demand-led research, program development, and impact assessment in bean value chains. Exchange visits can be catalytic for countries seeking to replicate successful strategies for private sector engagement, integration with nutrition and health communities, and other new approaches.

Responsible for brokering interactions within regional networks and across the wider PABRA network, PABRA staff serve as transnational vectors of the knowledge and experience developed in member countries. As focal



points for multi-country initiatives, staff scientists foster peer learning and partnering within and across countries. When supporting multi-sector stakeholder meetings (e.g. producers, seed multipliers, traders, exporters, researchers, government representatives), PABRA staff encourage a pragmatic approach that recognizes the status quo and moves forward based on common interests

Sharing knowledge

“The work doesn’t end with improved varieties as agronomy and integrated crop management are an essential complement to seed systems.”

Enock Maereka (Seed business development specialist, PABRA-CIAT)

Information and knowledge sharing is a fundamental benefit of participation in the PABRA network. PABRA has developed an online bean database^{viii} and a Bean Atlas that house information on access and utilization of bean

varieties, crop management technologies, seed systems, nutrition, gender, bean markets, and capacity building. PABRA also works with organizations that administer ICT-based platforms, such as eMkambo, that increase farmers’ access to technical information such as prevailing weather conditions, agronomic tips, and market information such as bean prices, current buyers. PABRA partners with institutions for development and dissemination of bean-based resource manuals in national languages such as Swahili, Amharic, Luganda, Kinyarwanda, Chichewa, Tumbuka, Runyakore, Kirundi, and Malagasy.

PABRA is forming partnerships with non-governmental, community-based, and private sector organizations already working to increase gender equality in Bean Corridors. Gender profiles are being developed for production, distribution, and consumption hubs to define relevant challenges and interventions and to inform NARS, national governments, and regional level activities. For each Bean Corridor, gender manuals will offer guidance on local contexts and changing socio-economic and political realities.





PABRA'S *impact*

Measuring performance

All PABRA partners: national bean program leaders, PABRA-CIAT staff, NGO and private sector actors contributing to value chain initiatives, build a shared understanding about the network's goals. The Common Framework enables everyone participating to see the big picture and how their particular objectives and projects fit in. The Common Framework also promotes mutual understanding about how the network intends to deliver, collectively, on commitments.

Over time, PABRA has built procedures for demonstrating how the network has performed against measurable targets. For any new project, PABRA develops a performance measurement framework, which specifies indicators related to the impact pathway, theory of change, and logic model, for review by project funders. Based on these performance measurement frameworks, the PABRA program undertakes

routine monitoring and evaluation to track activity implementation, delivery of outputs, project products, and immediate outcomes. PABRA also tracks capacity building across the network through a database of trainings that is periodically reviewed to understand informal knowledge and skills transfer and to scan opportunities for improvement.

“The PABRA partnership and networking model is a powerful tool to reach, engage, and empower women, men, girls, and boys to achieve inclusive growth for all.”

Eileen Nchanji (Gender specialist, PABRA-CIAT)

Assessing impact

Impact assessment studies are undertaken when resources are available and when adequate time for the effects of a new bean technology to take hold. The impact assessments aim to understand the impacts of bean-related innovations. Participating countries collaboratively develop studies that are flexibly implemented by national bean programs. The process begins with PABRA scientists preparing an initial study concept aligning with donor expectations, the performance measurement framework, and the budget. They share this concept with the national bean teams



who discuss ways to adapt it to their national contexts. Through early stage involvement in the study design and co-development of the budget, national teams take full ownership for study implementation. Collaborating on the design process is also a mechanism for mentoring more junior researchers.

A recent study in the SABRN region assessed partner perceptions of the PABRA program, indicating that partners value PABRA as a mechanism for engaging with colleagues across SABRN as well as a platform for gaining access to a diverse set of resources. The study also revealed that national team leaders perceive PABRA staff scientists as providing significant value while the scientists themselves believe they are not doing enough. In many ways, this finding aligns with the PABRA principle in which staff’s primary role is to help national institutions develop and implement their own solutions. Some studies engage international research partners who contribute expertise and leveraged resources. For example, senior researchers at the University of Michigan joined forces with PABRA to implement a study in Zambia, providing training to NARS scientists and assisting with analysis.

“Their results are our results.”

Rachel Muthoni (Monitoring and evaluation specialist, PABRA-CIAT)

National partners recognize the value of systematic evaluation for documenting progress, for drawing lessons,

and for providing evidence of their achievements to donors, policy makers, and other constituencies. Results from monitoring and evaluation and impact assessments are presented in various PABRA-organized fora (e.g. Steering Committee meetings, workshops) where they contribute to planning discussions about impact-oriented interventions.





CO- *investment*

It's all about leverage

With a core budget in the range of US\$4 million annually, direct funding to the PABRA program is relatively minor given all the work that happens across the PABRA network. Major elements of the core budget include PABRA staff, meetings and trainings, and funds to partners for in-country activities. The program leverages approximately US\$100 million each year from public, private, and NGO sources.

Governments make significant contributions including paying national staff and providing access to land and vehicles. National partners are increasingly gaining bilateral support for bean-related projects by capitalizing on PABRA functions including scientific back-stopping, capacity building, market studies, and network connectivity. By aligning both core and leveraged resources, the Common Framework enables donor harmonization and catalytic use

of short-term funding. Crises often unlock financial support from donors, for example the Ethiopian drought response; post-conflict support in Rwanda. By aligning this support to the PABRA framework and longer term investments, short-term needs are met while building the foundation for sustainable bean value chains.

Under the Common Framework, every bean-related initiative and funding source in a member country is reported as a contribution to the PABRA alliance. Annual reporting details national work plans, aligned with the five-year PABRA framework, including engaging and catalyzing government and private sector investments. Success in leveraging project funding allows for sharing core PABRA resources as 'top-off' funds across member countries based on where they are most needed.

While national programs generally receive US\$40,000 to 60,000 per year through PABRA, national allocations may be less to countries that have successfully secured support from government and the private sector. These modest national allocations are valued by national governments provide back-stopping visits, in-country trials, travel to national stakeholders' meetings or cross-border arrangements to stimulate the bean economy. 'Top-off' funds – even if only a few hundred dollars – can make a big difference as they can cover emerging needs that were not anticipated in proposals to donors.



Over a 17-year period, a US\$16 million investments in bean variety improvement and crop management practice generated benefits close to US\$200 million for more than 5.3 million rural households

Collaboratively mobilizing resources

PABRA members supporting each other to generate bilateral projects and resources. Through PABRA, partners can access training in proposal writing skills for developing robust proposals, helping NARS to mobilize resources from competitive grants programs for national and regional projects. Some donor Request for proposals require multi-country submissions and the connectivity and trust among PABRA partners is an important advantage.

Multi-disciplinary engagement within PABRA is also helpful for meeting growing expectations that research funding will generate multiple types of benefits (e.g. value chain and nutrition impacts). PABRA members decide together which central locations have the best comparative advantage, such as trained personnel, and then work with donors to establish required facilities. Similarly, for student training, PABRA members debate which countries should serve as hosts and commonly students conduct their research and receive their degree in multiple countries.





PABRA'S WORK *continues*

PABRA's 20-year legacy is significant. The number of countries experiencing positive bean yield productivity trends has increased. Ethiopia, for example, has been highly successful in generating improved bean varieties, multiplying seeds, and engaging traders and government, leading to a booming market in which beans have become an attractive cash crop. Countries like Uganda, Tanzania, Rwanda, and Malawi have joined Ethiopia in enjoying productivity growth and their export bean trade is growing, providing further incentives for farmers to intensify production and tap lucrative bean markets.

As part of its mandate to improve food and nutrition security of rural and urban populations with a focus on women and children, PABRA had reached 6 million households by 2008, surpassing its original target of 2 million. The network has built partnerships with approximately 350 providers of training, technology dissemination, and other services and has provided seeds

to female farmers, increasing women's social stature within their families and communities. PABRA programming has reached 27 million farmers with nearly US\$2 million in quality bean seed.

Ever-better beans and seed systems

However, there is much work yet to be done to fulfill PABRA's mandate for poverty reduction, food and nutrition security, and improved natural resources and ecosystem services. The need to develop improved bean varieties is continuous given shifting production constraints and dynamic market demands. The tremendous genetic diversity housed in the CIAT bean gene bank promises transformative solutions to the challenge of reliable, profitable bean yield in the face of soil and water limitations and pest and disease burdens such as bean stem maggot.

Successes in national programs can be extended by breeding in other desirable attributes. In Malawi, for example, the performance of 'magic beans' could be enhanced by incorporating larger seed size and shorter cooking times into drought-resilient bean materials. Disease resistance could be added to bio-fortified beans developed in Uganda. Agronomic research could build on existing knowledge to, for example, reveal optimum planting densities in cereal maize-bean cropping systems or reduce the need for herbicides while also creating employment opportunities.

Fast-track release of improved bean varieties is a signature success of the PABRA network model. However, despite high potential for nutritional security, the pace of variety release has not accelerated in all PABRA countries. Inadequate supply of breeder seed prevents seed multipliers from distributing improved beans, hindering private sector investment. In addition to tracking the amount of available breeder seed for each improved variety in the performance measurement framework, PABRA can also encourage arrangements between breeders and seed companies for production of breeder seed like the contract between the University of Nairobi and the Kenya Seed Company (Simlaw Seeds Ltd).

In the future, the market will be the driver for all PABRA activities. Under the Bean Corridor approach, technology development and process facilitation will be focused on hubs of production, aggregation, and consumption. Demand-led breeding will focus on targeted development of varieties based on information about beans that are demanded in large volumes and targeted market supply.

Innovative approaches to multi-objective, demand-led breeding

PABRA has witnessed very positive outcomes from its demand-led breeding approach. However, as bean breeders have embraced a broader set of objectives, their job has become harder. Demand-led breeding narrows the scope of what a breeder can do as they must account for different needs along the value chain. Farmers, traders, exporters, and consumers have distinct demands and may not be

aware of bean characteristics that are high priority for other groups.

“Everyone wants to be successful in their own task. As a breeder, I want to see successful varieties benefit producers through higher production. It’s like looking at your kids graduating from school to see producers and traders and others benefitting.”

Dr. Berhanu Amsalu Fenta (Bean Program Leader, EIAR, Ethiopia)

Climate change forecasts present a gloomy picture for beans. Without genetic and agronomic adaptations for drought and heat stress, the world could lose 50% of its bean production areas. This will require a continuous process of building multi-stress resilience, which demands more crosses, more years, and more generations per year. Importantly, bean performance objectives can involve more than one attribute. This is the case with drought resistance, which can be achieved by modifying multiple characteristics such as timing of flowering and pod and seed set and capacity to maintain positive turgor and metabolic activity.

Eating habits are changing across a fragmented consumer base. Consumers do not want only a single variety. Companies have begun asking for bio-fortified beans in

FAST TRACKING

When a new, improved variety is developed, PABRA facilitates faster, broader dissemination through germplasm and knowledge exchange among all member countries. This is especially important for national breeding programs with low capacity for developing new varieties as they can access varieties already registered or released in other countries and focus on testing in local agro-ecologies and markets.

Through funding by HarvestPlus, MAC 44, a bio-fortified, high iron and zinc bean variety was developed, tested, and released in Rwanda and DRC and subsequently released in Uganda, Northern Tanzania (which had had no new releases for the past 10 years), Malawi, Kenya and Burundi - which had no national breeder at that time.

In southern Africa, regional seed policies specify that a new variety can be proposed for release after one season of evaluation if it has already been released

in two other countries. Zambia released several bean varieties that could be fast-tracked for release in Zimbabwe after evaluating their adaptability and micronutrient content. This allows the Zimbabwe program to start further ahead including in acquiring seed in volume.

In Swaziland, seven years ago, no bean varieties were nationally registered or traded by seed companies. Now there are more than 10 registered bean varieties and Swaziland has supplied bean seed to another country. A highly motivated national bean coordinator as well as an FAO initiative fostered interaction among bean value chain actors and secured assistance from an advisory company, Palladium (formerly GRM). Through this initiative, sugarcane farmers in Malawi planted 500 kg of high-iron bean seed as a break crop, providing residual nitrogen and breaking the disease and pest cycle. This allowed faster production of large quantities of bean seed and demonstrated viability to seed companies.

specific market classes. Where electricity costs are rising, consumers will need fast-cooking or pre-cooked beans.

PABRA has already been responding to these emerging needs. For example, PABRA worked to find a processor willing to pre-cook, package, and distribute beans in Kenya and Uganda for an IDRC-funded project focused on changing lifestyles and energy sources. The project focused on schools to reduce need for charcoal and firewood, gender, and nutrition and led to construction of packaging and distribution facilities in both countries.

In Zimbabwe, the canning industry recently shifted its preference for white beans to large red kidney and butter beans, sending a signal that breeders should work on these new market classes. PABRA has gained experience in responding to canning industry needs through a multi-country collaboration that led to the release of new varieties suitable for canning in Ethiopia, Kenya, and Tanzania in 2017. Policy signals can also shape breeding objectives. In Zimbabwe, for example, there is mandate that every value chain player should fortify food products.

To reconcile the growing list of breeding objectives - production constraints, market preferences, nutrition - each country in the PABRA network focuses on its specific constraints to incorporate into variety development. At the same time, if research is going to keep up with dynamic demands, ongoing innovation is needed. This will likely

involve new ways for bean value chain stakeholders to work together to convert innovative ideas into commercial enterprises.

Building country capacity

To achieve wider impact, the PABRA program strives to equalize scientific capacity and increase research efficiency across all member countries. While the most active countries have seen dramatic gains in the bean sector, other countries need help in establishing effective strategic partnerships. Empowerment of national bean programs hinges on boosting professional capacity and institutional commitment. For example, mentoring breeders to focus breeding objectives and operate with a more commercial mindset, demonstrating results of specific investments. If public breeding programs can become more investment-worthy to investors, they could amplify the impact of their work.

While collaboration among lower and higher capacity countries can ameliorate some disparities in human resources, it cannot fully compensate for gaps in educational level, which can reduce the level of benefit a country can derive from participation in the PABRA network. Bean scientists are also 'aging out' of the field and, without adequate investment, the training and mentoring gaps will emerge. These trends underscore the importance of



increased investment in degree training. When donors provide resources to support interns at national bean programs, young scientists can learn how the program works and become strong candidates for NARS positions as they open.

Historically, breeding and agronomy have been more heavily prioritized in government and donor funding. Funders can visit bean field trials more easily than they can observe nutrition peer learning programs. Yet national bean programs need improved systems to plan, implement, and evaluate their nutrition efforts. This includes increasing the number of nutrition scientists rather than relying on breeders or agronomists to tackle nutrition issues.

Structured export markets

Increasing the visibility of nutrition programming and its impact will be important for securing donor engagement and support as well as for expanding awareness within national governments of the broad set of potential benefits associated with making beans a priority crop. When beans are not explicitly included in a country's export strategy, it is more difficult to secure donor and private funding. In Ethiopia, the government included beans in the Ethiopian Commodity Exchange. This structured market has helped bean traders overcome aggregation and warehousing challenges, accessing market information, and reducing

transaction costs. Lessons from the Ethiopian experience can inform discussions about structured markets in other PABRA countries.

To more effectively seize opportunities for improving nutrition, the PABRA network needs to fortify its research base. This includes the factors and mechanisms of bioavailability (e.g. digestibility in addition to nutrient concentration) as well as absorption and efficacy studies. Recent discussions within PABRA are exploring how to finance nutritional quality tests and cooking characteristics of beans. While analytical equipment can be costly, nutritional analysis at an early stage in the breeding process is important to ensure that high-nutrition varieties are not eliminated.

Understanding economic empowerment is an important challenge going forward. For example, a recent seed systems study showed that, the greatest financial gains among seed enterprises were those who can access high-quality land. Disaggregation of data in a recent consumption study found that some very low income people do not have access to beans in their diet. PABRA can also investigate the complex connections between income and bean consumption, especially among vulnerable groups.

EMPOWERING WOMEN IN BEAN VALUE CHAINS

Weak markets access limits smallholder farmers' ability to accumulate resources. By mainstreaming gender equality at all levels, PABRA especially seeks to reduce the unique barriers faced by women farmers, such as restricted mobility, childcare demands, limited credit access, and low social capital and decision making authority. Efforts to empower rural women emphasize improved access to information (e.g. market prices), financial services (e.g. separating funds into bank accounts, mobile money, and cash), and low-cost labor-saving technologies that can increase bean productivity, household nutrition, and control over income.

PABRA activities will increase women's access to digital information on the volume of available seeds and market demand for bean seed, grains, and products as well as digital information exchange with other women

bean farmers and potential buyers. Strengthening links with processors can help to reduce post-harvest losses. Within each regional network's Steering Committee, activities for women's empowerment and advocacy for resources will be promoted to scale up gender equality measures.

To increase women's financial inclusion, PABRA will foster linkages between groups such as women's cooperatives and retail banks, mobile network operators, and insurance companies that seek to expand services for low-income populations using ICT innovations. Women will be provided with financial education and business skills training to boost and improve agronomic and entrepreneurial skills. For example, to meet domestic needs or international markets and to increase their capability and confidence to self-advocate and embark on market-oriented farming. For example, 'woman2woman' mentoring can build advocacy skills at the household and community level.

Strengthening regional collaboration

The three regional networks in PABRA are essential platforms for building capacity of national bean programs. Investment in shared resources across these regions, such as analytical equipment at central facilities, is critical to efficient growth of the bean sector. Both ECABREN (in Uganda) and SABRN (in Malawi) have regional bean gene banks and efforts are underway to establish one in WECABREN where bean production is on the rise due to availability of high-yielding, short-duration, high-nutrition varieties.

Within each region, harmonization of seed policies is urgently needed to meet the growing demand for bean seed. Free movement of regionally released bean seed from one country to another would remove obstacles to cross-border seed trade, creating more attractive regional bean markets. For example, bean farmers across the Mozambique-Malawi border have a common culture with similar bean needs, but regulations are quite restrictive and limit which seeds can move across borders. Through regional PABRA networks, bean value chain stakeholders can proactively engage with policy makers around a vision for a vibrant bean-based industry that creates employment opportunities for input provision, mechanization, transportation, trading, processing and financial services.

Beyond beans?

The world is changing rapidly and the PABRA alliance needs to anticipate how to deliver innovative solutions. With the Scaling Up Nutrition movement and other forces driving toward a food systems approach, PABRA's focus on bean value chains and nutrition has made an important

contribution. But there is more to do to effectively integrate beans into resilient, equitable food systems. New frontiers range from multi-commodity research on cereal-bean production systems to use of Artificial Intelligence in Nutrition Early Warning Systems.

National bean programs, especially NARS, are essential to increasing confidence and catalyzing national government investment in bean-related extension and infrastructure through field days and other outreach events. The bean industry is gaining traction and visibility. In Ethiopia, for example, white pea bean grew from a US\$7 million to a US\$150 million annual crop. Such evidence is needed to demonstrate 'bank-ability' and stimulate commercial investment to accelerate payments to farmers. PABRA partners are building a foundation for value chain actors to contribute financially to research, supporting breeding programs that respond to value chain actors' needs.

By channeling resources and investment toward improved growth, marketing, and consumption of beans, the Corridor approach offers tremendous potential for farmers, including women farmers, to make important income gains and for communities to gain better access to nutritious food. The Corridor approach is at the heart of PABRA's strategy for achieving impact at greater scale by helping partners all along bean value chains to work together. The approach can be applied to any commodity, turning production of small quantities into large quantities that can influence economic development.





THE future OF PABRA

The transformative potential of beans for increasing income, improving nutrition, and empowering women and youth is relevant to a wide range of scenarios in Africa. The PABRA model provides ‘future proofing’ through its diverse membership and committed partnerships, which facilitate rapid identification and creative responses to emerging needs.

An ever-evolving network

The PABRA model must remain responsive to shifting global trends. It must keep pace with the expanded and diversified PABRA membership and regional demands. While NARS are still at the core of PABRA, a broader set of research institutions, public agencies, and private sector entities are playing large roles in research, bean value chain development, and resource mobilization. To keep the alliance vibrant, the PABRA governance structure should

provide these partners with real opportunities to shape the agenda and recognize their contributions.

Participatory decision making and multi-sector collaboration always require significant commitment and encounter obstacles along the way. Along with many successes and ongoing improvement, complex networks will always experience imperfect communication, funding gaps, payment delays, interrupted flow of data and information, and differing levels of support by high-level decision makers. While part of PABRA’s strength is that the many partners derive a wide array of specific benefits, managing highly diverse expectations and interests brings its own challenges.

Efforts to align objectives across disciplines and sectors calls upon partners to think outside the box, which is not always comfortable. Importantly, there is variation in how partners self-identify as part of PABRA. Governmental officials appreciate the solutions that emerge from the PABRA network, but are not always aware of how these solutions come about. It would be useful to cultivate a deeper understanding of the PABRA ‘brand’ by articulating more clearly what the PABRA network achieves across Africa.

Maintaining core PABRA functions

National and other partners have increasingly attracted support for bean-related work through bilateral projects and other leveraged funding. This is a very good outcome reflecting significant improvements in capacity, including effective proposal writing, through the PABRA model.

However, funding for the core PABRA program, which enables the many functions that undergird bilateral projects (e.g. back-stopping, germplasm exchange, training), has not experienced proportional growth.

Looking ahead, a shift in funding away from core PABRA functions could result in erosion of the central structure that enables the many network benefits and funding synergies. Dis-investment in low-cost, high-value activities ranging from Common Framework development to annual reporting could lead to a time-consuming and costly need for re-inventing lost structures and functions. If bilateral projects obscure the focus on Pan-African networking, countries with lower capacity national programs are at risk of losing momentum.

“To avoid re-inventing the wheel and build on steps already taken, the PABRA network needs long-term commitment from donors based on demonstrated impacts.”

Jean-Claude Rubyogo (Seed systems specialist and coordinator of ECABREN)

Sustainability of the PABRA model depends on long-term commitment from various partners and stakeholders based on demonstrated impacts of the network.





Conclusion

A track record of success

Members of the PABRA network have been transforming agriculture for better incomes and diets in Africa since 1996. Over the last 20 years, the work of PABRA has ensured that farmers in Africa can be more responsive to challenges like climate change, market price volatilities, pests, and diseases. They are more informed of new technologies, new practices and emerging market opportunities.^{ix} Bean value chain actors such as seed and grain traders, bean product developers, and consumers have been empowered to seize business opportunities and to improve household nutrition.

The PABRA model has been used to great effect across the alliance. In addition to facilitating collaborative research, PABRA links partners in multiple countries and sectors, solidified through joint priority-setting, planning, implementation, and reporting. The result is a diverse, participatory network capable of generating innovative technologies and putting them into the hands of farmers and other value chain actors.

The PABRA network has earned the long-term support of its core donors who appreciate that investment in a robust network has achieved faster national and regional impacts. All PABRA funders have benefitted from the hard work that goes into building a truly collaborative Common Framework. Committed engagement and co-investment by national governments signals their recognition of the economic and societal impacts of vibrant bean value chains, including poverty reduction, gender empowerment, and better public health.

A model for CGIAR programs

All CGIAR research centers and programs have a mandate to extend the benefits of research to their client groups through partnerships. PABRA puts into practice the central mission of the CGIAR system; supporting NARS to solve nationally determined challenges. The PABRA program is unique in the degree of connectivity between CGIAR researchers and in-country partners.

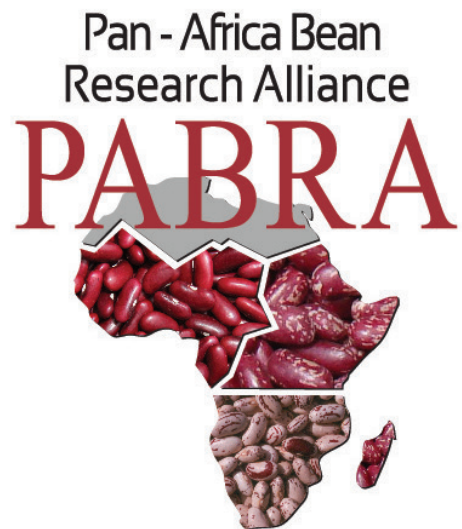
In particular, PABRA has ‘cracked the code’ for vibrant engagement with national partners including genuinely transparent, decentralized decision making and sharing the credit among all contributors. The PABRA network presents a powerful model for broad-based, long-term engagement that leads to massive scaling and co-investment. CGIAR leaders can replicate and adapt PABRA approaches in their own programs.

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The impact of improved climbing beans in Rwanda.
N.Palmer, CIAT.



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