

PABRA NARRATIVE CUMULATIVE REPORT

2015-2018

March 2019





Improving food security, nutrition, incomes, natural resource base and gender equity for better livelihoods of smallholder households in Sub-Saharan Africa

Collaborating Organizations

International Center for Tropical Agriculture (CIAT)
Pan Africa Bean Research Alliance (PABRA)
National Agriculture Research Systems (NARS)

Location of Project:
PABRA Countries

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List of Acronyms

CEDO	Community Enterprise Development Organization
CIAT	International Centre for Tropical Agriculture
CSA	Climate Smart Agriculture
DLB	Demand-led Breeding
DUS	Distinctiveness Uniformity and Stability
DR&SS	Department of Research and Special Services
ECABREN	Eastern and Central Africa Bean Research Network
FAO	Food & Agricultural Organization
HIB	High Iron Beans
ICM	Integrated Crop Management
ICT	Information Communication Technology
ISFM	Integrated Soil Fertility Management
ISABU	Institut des Sciences Agronomiques du Burundi
NARS	National Agriculture Research Systems
NGO	Non-Government Organization
OCCS	Office de Controle et de Certification de Semences
PABRA	Pan African Bean Research Alliance
PICS	Purdue Improved Crop Storage
QDS	Quality Declared Seed
SABRN	Southern Africa Bean Research Network
SBD	Solar Bubble Drier
SDC	Swiss Agency for Development and Cooperation
SME	Small and Medium Enterprise
TARI	Tanzanian Agricultural Research Institute
VCU	Value for Cultivation
WFP	World Food Programme
WVI	World Vision International

1 Context of the SDC Project

The current SDC phase of support focuses on improving food security, nutrition and income in the eastern, central and Southern-Africa regions through bean-based research. Targeted investment is provided in two focal countries: Burundi and Zimbabwe. The impact of PABRA interventions on the livelihoods of people in these two countries are highlighted here, and are significant despite political and economic challenges facing their agricultural sectors.

The intermediate outcomes of the project are wider utilization of 1) dry bean products for food security; 2) improved bean-based products for nutrition security; and 3) increased trade of bean products in a gender equitable and sustainable manner.

Four immediate outcomes contribute to these intermediate outcomes. These are:

- i. Increased and gender-equitable access to high-yielding dry bean varieties and productive ICM technologies and related information.
- ii. Increased access to micronutrient rich bean products among the vulnerable groups in a gender equitable manner.
- iii. Increased access to profitable local and national markets in a gender-equitable manner.
- iv. Increased access to skills, information and knowledge providing an enabling environment for bean research and development.

The project ensures sustainable natural resource management and climate resilience, supporting downstream agribusiness activities (such as processing) and linking smallholder farmers and small enterprises to productive value-chains, through bean innovation platform approach. At the same time, improving nutrition and the scaling up of PABRA's food basket approach and gender mainstreaming across all the project components.

The project was officially launched in 2015 and has organized regular stakeholder engagement sessions, where project plans have been developed, roles assigned, and budgets allocated.

This report presents an update of the achievements made since 2015 to date, as well as the plans for 2019 activities. It presents the overall project implementation in the two flagship countries - Burundi and Zimbabwe - followed by a summary of achievements across all countries.

2 Flagship Country Update

2.1 Background

Burundi and Zimbabwe are the flagship countries under SDC support. These countries were chosen based on the unique challenges they continue to face, necessitating investment to support them. Burundi was selected based on the challenges in the agricultural sector caused by political instability. PABRA's role was to support the revival of the bean research programme through capacity building, restoration of bean seed systems, and intensifying linkages among actors in the bean value chains to boost bean production for improved food security and nutrition and incomes. In Zimbabwe, interventions were due to the policy changes that led to economic stagnation and decline. PABRA's role was to strengthen the linkages among the actors along bean value-chains, including the processing industry, to boost local bean production supplying consumers and the local canning bean industries.

Despite these challenges, the two countries have many opportunities for agricultural development. The PABRA interventions have focused on building and transforming the bean sub-sector to demonstrate their significant impact on the livelihood of millions of households.

The following are the foci of the research and development work in these two countries:

- i. Extend the climbing bean technologies in various agro-ecologies of Burundi;
- ii. Strengthen the bean cropping systems to cultivate different bean varieties as part of integrated crop management systems including conservation agriculture, to raise productivity at farm level and bridge yield gaps;
- iii. Develop the seed production and delivery systems: engaging both the public and private sector partners and using various seed delivery options for wide dissemination;
- iv. Support nutrition initiatives linked to biofortified bean varieties and nutrition information;
- v. Increase women's access to agricultural resources for improved bean production, and knowledge of basic nutrition;
- vi. Support capacity building of researchers, development partners, value-chain actors and farmers to enhance relevant skills for improved bean production.

2.2 Highlights of Achievements

2.2.1 Burundi

Common bean is a major food and cash crop for more than 90% of small-scale farmers in Burundi. Beans are an entry point to tackle food insecurity, poverty and malnutrition. The current average bean consumption is about 30 kg per person, per year, which has dropped from 45 kg per person per year before 1993 (pre-crisis era). The lower bean availability is due to decreasing or stagnant bean yield, estimated at 650 kg per hectare in 2014.

INTERMEDIATE OUTCOME 1: Increased bean productivity

Target 2015-2019 (a): 750 kg per hectare bean yield in Burundi.

Progress 2015-2018: bean yield in the intervention areas has doubled from less than 750 kg per hectare in 2014 to 1,450 kg per hectare in 2017 (Fig. 1). Multiple interventions particularly increased access to good quality seed of high yielding varieties coupled with their higher marketability has enhanced farmer investment in improved crop management.

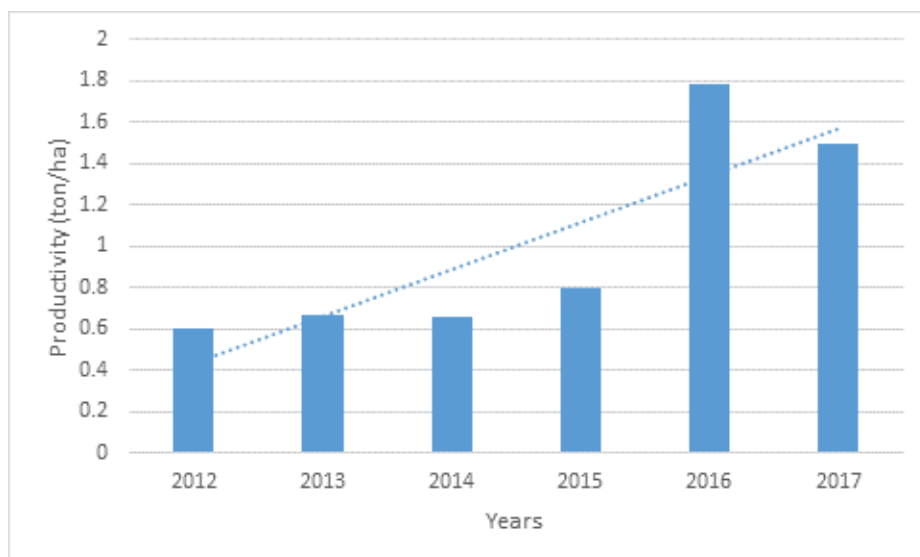


Figure 1: Bean yield (ton/hectare) –Source: FAO, 2017 see <http://www.fao.org/faostat/en/#data/QC>

From the national agricultural statistics, bean yield in Burundi was 750 kg per hectare in 2015 and increased to 1,750 kg per hectare in 2016, but dropped to 1,450 kg per hectare in 2018 due to bad weather conditions. This is equivalent to growth of about 93% above the yield in 2015 - the baseline year. The concerted intervention in bean research and development in the country led by ISABU, CIAT-PABRA and other partners have undoubtedly contributed to the yield growth in the project intervention areas. Actual contribution of the flagship interventions in the farmers’ fields will be estimated based on impact data to be collected through a survey planned for 2019.

Target 2015-2019 (b): 20% increase in area occupied by climbing bean in Burundi.

Progress 2015-2018: The areas under climbing bean in Burundi will be assessed during the impact assessment study. The results will be available in the second half of 2019.

IMMEDIATE OUTCOME 1.1: Increased and gender equitable access to high-yielding dry bean varieties and productive ICM technologies /information

Target 2015-2019 (a): 750,000 households accessing seed of improved dry bean varieties, ICM and labor saving technologies.

Progress: The overall target for the two flagship countries (Burundi and Zimbabwe), was to reach 750,000 households with improved dry bean varieties and ICM technologies by 2019. Despite a sharp increase (see Fig. 2), Burundi’s contribution to this target is a total of 158,727 households led by men and women. These households have access to ICM technologies, some of which were labor-saving, between 2015 and 2018. These can be broken down to: 66,072 households (34,942 led by women and 31,130 by men) that accessed ICM technologies; and 92,655 households (48,180 led by women and 44,475 by men) that had access to variety technologies (Table 1 and Fig. 2).

Table 1. Number of men and women-led households accessing improved bean varieties and ICM technologies in Burundi (2015-2018) in Burundi:

Technology Category	Households led by men and women		
	Female	Male	Total
ICM technologies	34,942	31,130	66,072
Varieties	48,180	44,475	92,655
Total	83,122	75,605	158,727

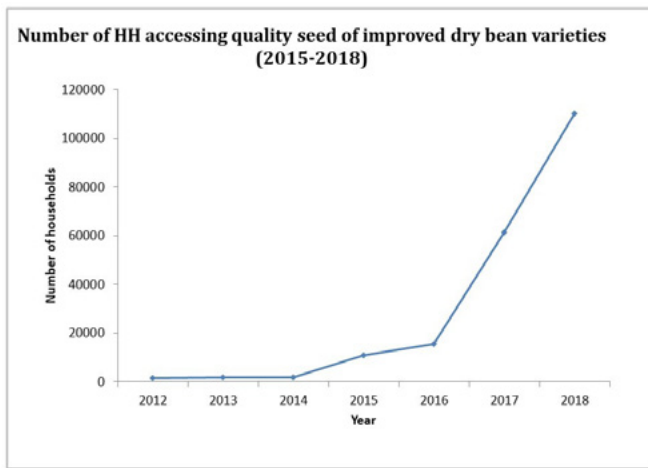


Figure 2: Trend of seed access to smallholders (2012-2018)

Access to bean varieties was facilitated by the increased number of seed producers from 15 producers in 2014, to 55 producers in 2018 (Fig.3). This has positively influenced the increased seed production trend (Table 2). Increasingly, farmers are interested in investing in quality seed of improved varieties and complementary technologies. The ICM technologies, promoted alongside the improved varieties, were mainly: i) Use of good agronomic practices; ii) Use of wooden stakes and string trellis; iii) Use of PICS bag to limit postharvest losses; iv) Use of improved compost (organic) manure; v) Use of combined organic and mineral fertilizers in bean production; and vi) Use of traditional methods to control bean bruchids damage in storage.

Table 2. Evolution of bean seed production before and during the flagship implementation:

Year	Amount of seed produced in tons					
	Nucleus	Breeder	Pre-basic	Basic	Certified	QDS
2012	0	1.769	4.86	0	9.032	14.278
2013	0	3.83	2.456	0	4.571	23.445
2014	0	4.58	3.63	0	12.232	13.794
2015	0.23	2.911	3.217	24.326	4.675	170.9
2016	0.359	3.3495	3.63	43.542	35.779	193.126
2017	1.066	3.536	18.12	56.979	267.993	177.998
2018	1.27	4.942	23.084	138.3	482.259	113.841
Total	2.925	24.9175	58.997	263.147	816.541	707.382

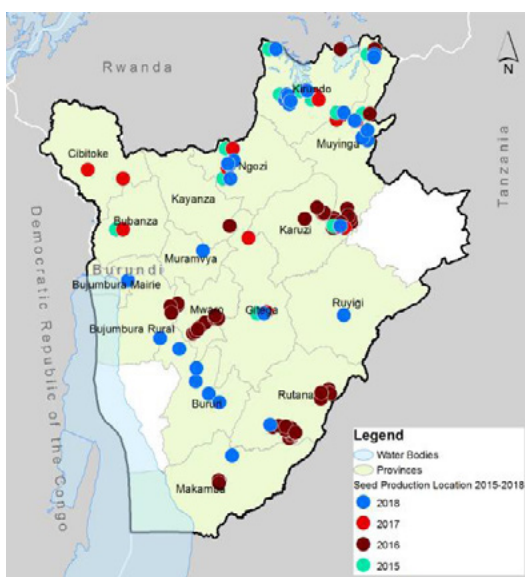


Figure 3: Location of seed producers in Burundi from 2015-2018

OUTPUT 1.1.1: Competitive high-yielding and stress-tolerant varieties developed across various agro-ecologies and cropping systems

Target 2015-2019: 10 new bean varieties of preferred, high-yielding and stress-tolerant dry bean varieties released.

Progress 2015-2018: Burundi released 13 new bean varieties (Table 3) over the 4-year period: 2015 (2), 2016 (1), 2017 (3) and 2018 (7), translating to 130% of the contribution to the flagship target of 10 varieties by 2019.

Table 3. Number of stress-tolerant bean varieties released in Burundi (2015-2018):

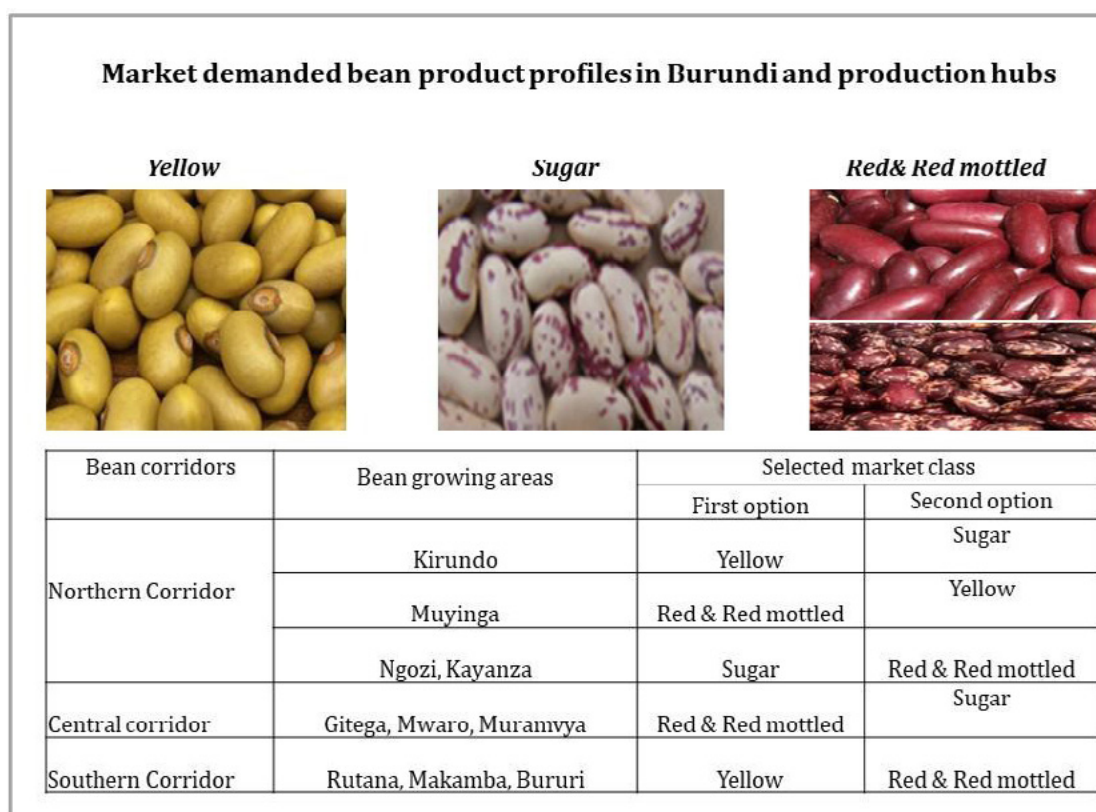
Description	Number of varieties (2015-2018)				Total	% contribution to target
	2015	2016	2017	2018		
Varieties	2	1	3	7	13	130%

The accelerated variety release was attributed to strong and supportive collaboration between ISABU and the National Seed Regulatory Authority (ONCCS). In addition, the setting up of the national release committee has hastened the variety release process.

The released varieties are stress-tolerant and adapt to different altitudes and agro-ecological systems, contributing seed diversity. The breeding programme focused on improving traits with popular market and consumer demand; as well as being high-yielding and drought-tolerant, and diseases resilient.

In response to land scarcity, climbing beans – with higher yields on smaller plots - have been developed. Twenty breeders in Burundi were trained by CIAT –PABRA and other members of DLB team. CIAT–PABRA regional teams, including breeders, market, seed systems and gender specialists – provided support to ISABU bean breeding team and partners to develop marketable and farmer-preferred varieties. Because of this interactional capacity building, ISABU Bean Programme has adopted client-oriented breeding (see Fig 4).

Figure 4: Market demanded bean product profile in Burundi



OUTPUT 1.1.2: Effective and economically viable ICM options for increased dry bean productivity and resilience identified and promoted

Target 2015-2019: Five better economically and farmer proven ICM technologies including conservation agriculture for increased dry bean productivity and resilience developed.

Progress 2015-2018: In Burundi, where arable land is small (0.8 hectares per household), the released bean varieties are promoted together with complementary agronomic practices. All the six ICM technologies listed in Table 4 were promoted to increase bean production on small arable land sizes, surpassing the target of five ICM technologies by 20%.

Table 4. Number of ICM technologies promoted in Burundi (2015-2018):

Type of ICM technology 2015-2018	Total	% contribution to target
<ul style="list-style-type: none"> • Use of good agronomic practices • Use of woods and ropes as stakes for climbing bean • Use of PICS bag to address post-harvest losses • On-farm production of improved compost/organic manure • Use of combined organic and mineral fertilizers • Evaluation of traditional methods to control bean bruchid damage in the store 	6	120

Farmers were receptive to ICM technologies. For instance, farmers from Mugina and Mabayi communities in Cibitoke Province indicated that before using both improved bean varieties and ICM technologies, they were harvesting on average 100 kg of bean grains from their small pieces of land. However, with INFAS project and ISABU support, Raphael Niyitegega planted 15 kg of climbing bean on his small piece of land and harvested 236 kg. Etienne Niyorugaba planted 24 kg of a yellow bean variety, and harvested 234 kg despite inadequate rain. The extra bean harvest helped the families to generate income and pay school fees. As such, these farmers have decided to adopt both improved varieties and ICM.

OUTPUT 1.1.3: Gender specific labor-saving technologies validated

Target 2015-2019 (a): Two gender specific labor efficient techniques/technologies identified.

Progress 2015-2018: Increasingly, there is interest in mechanization by smallholders in Burundi due to several factors. These include youth migration resulting in limited availability of labor in rural areas, the appeal of improved efficiency in farm operations, reduced drudgery and production of quality products. To address these challenges, PABRA in partnership with Missouri State University (soybeaninnovationlab.illinois.edu/events), organized training for 20 private artisans (including two women), to locally fabricate and service low cost bean threshers (see Fig. 5). The multiple thresher will cost approximately US\$2,500 and can be hired out as part of the platform service provision to smallholder farmers.



Figure 5. Training on assembling the multiple crop threshing machine.

A partnership with the private sector is providing imported agricultural machinery and equipment for bean producers. For example, a tractor-pulled planter was tested by three large scale seed producers, and this demonstration has attracted interest from several seed and grain producers due to efficiency gains and labor-saving during planting.

Target 2015-2019 (b): Levels of satisfaction with the technologies.

Progress 2015-2018: Two prototypes of the multiple crop threshing machine were recently assembled. Farmers preferred them because of reduced drudgery, particularly for women since they do most of the post-harvest operations. Wider testing will be carried out from June 2019 when more threshers will be available, and beans will be ready for harvesting.

Though farmers appreciated the efficiency of the tractor-pulled planters, they remain too expensive, and demand for service delivery for the planters is being explored.

OUTPUT 1.1.4: Gender responsive delivery systems for seed of preferred dry bean varieties

Target 2015-2019 (a): 750 tons of new bean varieties produced and disseminated.

Progress 2015-2018: Access to quality seed of improved bean varieties released in the last 10 years, has been key to increased productivity, food, nutrition and income security. Cumulatively, between 2015-2018, a total of 1,447 tons (certified and QDS) of seed have been produced (Table 5), against a target of 750 tons by 2019 for Burundi. The sharp increase in seed supply (Fig.6) has resulted from the project support to decentralized seed producers who are increasingly turning into innovative entrepreneurs (Fig.7).

Table 5. Certified and QDS bean seed produced and disseminated in Burundi (2015-2018):

	Progress made 2015-2018 (tons)				Total	% contribution to target
	2015	2016	2017	2018		
Certified and QDS	176	229	446	596	1,447	193

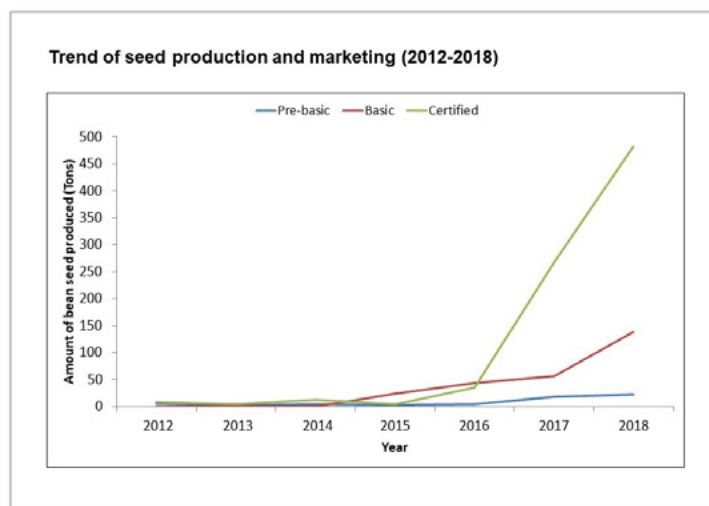


Figure 6. Trend of production and marketing of various seed grades.

The targeted quantity of bean varieties was exceeded by 93%. This is attributed to the strong and positive partnerships between ISABU and stakeholders involved in the seed production system, including individual seed entrepreneurs or farmer group seed producers. These include ONCSS, MINEAGRIE – DPSP, ISABU, COPROSEB, ADISCO, RESEAU BURUNDI 2000+, World Vision International (WVI), Catholic Relief Service (CRS), International Fertilizer Development Center (IFDC), PRODEFI, Seed producers and Farmer’s cooperatives/associations. The number of seed producers increased from 15 in 2015 to 55 in 2018. An association has been established to help them increase their businesses.

Target 2015-2019 (b): Four delivery systems used for dry bean seed and ICM technologies to reach men and women end users.

Progress 2015-2018: In Burundi, three out of a target of four innovative seed and ICM delivery systems were deployed between 2015 and 2018, and these are working well.

i) Use of small package sizes for increased sales of high-quality bean seeds

In collaboration with WV and ONCCS, an innovative way of disseminating bean seeds using small packs was first implemented by a seed entrepreneur, Serges Sayukubara in Muyinga Province (Fig. 7). This approach was introduced by ISABU as a learning experience among PABRA member countries. From the bean seeds Serges Sayukubara harvested during the 2018 season, 1,736 tons were packed in small packs of one, two and five kg. There is increasing interest in the use of small packs, to increase penetration of improved bean seeds among farmers with different purchasing power.



Figure 7: Seed entrepreneur, Serges Sayukubara holding two and three kg small packs of bean seeds.

ii) Delivery of seed, sensitizing and training on ICM

A number of seed producers are registered to produce formal seed. Non-registered farmers produce Quality Declared Seed (QDS). To enhance capacity of non-registered farmers to become registered seed producers, several, training programmes in quality seed production were implemented. Training included good agronomic practices, post-harvest handling, seed business management and platform and corridor establishment.

iii) Creating a network of seed producers and enhancing their capacity on quality seed production

In 2018, a bean business platform was established to allow different stakeholders to communicate as a network and enhance their capacity on quality seed production. The objective was to strengthen the functioning of the platform and improve efficiencies between actors working in production, distribution and consumption hubs. Four highly marketable bean classes were identified and validated for use in bean corridors; these market classes include (a) Yellow; (b) Sugar bean; (c) Red and (d) Red mottled beans.

In the past, seed producers were multiplying different categories of seed (basic, certified) with no link to the market, resulting in low seed flow in the country. Some seed producers ended up selling seed as grain for food consumption in the domestic markets, fetching lower prices. Since the platform was initiated, information exchange between different stakeholders within the platform and seed trade is working better. They have also created a WhatsApp group, which is facilitating good interaction between stakeholders where they communicate demand for seed or produce - which is good for bean business.

OUTCOME 2: Increased utilization of improved bean-based products for nutrition security

Target 2015-2019 (b): 2,000,000 beneficiaries comprising of men, women and children consuming bean-based processed products.

Progress 2015-2018: In the four-year period of project implementation, one major bean-based product, “bean composite flour”, was promoted in Burundi. From the bean composite flour, several bean-based products were processed. They include porridge - the most consumed product for which the flour is made - doughnuts (mandazi), bean puree, bean-biscuits and bean-croquettes. Apart from porridge, which is most popular, the other bean-based products were relatively new. The project has made progress with 1,633,694 (51.9% women) beneficiaries (Table 6) towards the target of 2,000,000 beneficiaries consuming bean-based products in the two flagship countries by 2019.

Table 6. Consumers using bean-based products in Burundi (2015-2018):

	Individuals consuming bean-based products 2015-2018				Total	% contribution to target
	2015	2016	2017	2018		
Bean flour	156,059	378,453	540,500	558,652	1,633,694 (51.9% women)	81.6

The increased use of bean-based products is the result of market supply by processing companies and factories (Totahara, Rengerubuzima and KAFLOB) who joined the bean platforms (see Fig. 8). They drive the bean value-chains, particularly grain producers.



Figure 8: Private food processors and their bean-based products. From left to right, managers of Totahara, KAFLOB and Rengerubuzima bean processing factories

Initially, these factories were only selling cereal-based composite flour. With the technical support provided by ISABU and CIAT, these bean processing businesses were trained to make bean-based products including “bean composite flour”. TOTAHARA started selling the product in 2012. Since then, the factory’s capacity has been enhanced through trainings, provision of equipment and organized exchange visits to increase the production of the bean-based flours. Currently Totahara factory is selling, on average, 6 tons of bean composite flour per month. In late 2016, Rengerubuzima and KAFLOB started selling bean composite flour, making significant sales of the products, selling between 1.5 and 5 tons of flour respectively every month. Rengerubuzima has expanded and opened another outlet in Bujumbura, besides the one located in the Northern Province, Kayanza.

IMMEDIATE OUTCOME 2.1: Increased access to micronutrient rich bean products among the vulnerable groups in a gender equitable manner

Target 2015-2019 (a): 250,000 households accessing combinations of biofortified bean varieties and ICM technologies.

Progress 2015-2018: Between 2015-2018, 81,002 households, 48.0% being women-led, (Table 7) had access to biofortified bean varieties and ICM complementary technologies.

Table 7. Number of households accessing biofortified bean varieties:

	Male or female led households 2015-2018			% contribution to target
	Female	Male	Total	
Number of households	42,121	38,881	81,002	32.4

Participating households were trained to use biofortified beans. In 2015, five biofortified beans were released, increasing to nine in 2016. These bean varieties are used to process bean-based products by five bean processors located in four provinces: Bujumbura, Kayanza, Muyinga and Makamba. CIAT and PABRA nutritionists have trained processors on quality product development for bean flour, puree, bread and biscuits. Communities have been trained to use bean-based products to improve their income and access to nutritious foods. Women were encouraged to participate in the training events within and outside of their provinces, and exchange visits were also organized for bean processors to visit processors in Kenya.

The aim is to increase the number of households with access to biofortified bean varieties, because these varieties are in high demand at markets and fetch better income opportunities.

OUTPUT 2.1.1: Micronutrient rich bean varieties with superior agronomic traits developed

Target 2015-2019 (a): Five biofortified bean varieties released, 750 tons of new biofortified seed varieties produced and disseminated by partners in the flagship countries.

Progress 2015-2018: Between 2015 - 2018, Burundi has released nine biofortified bean varieties (Table 8), all sourced from CIAT, surpassing the target of five. Four varieties (MAC44, RWV1129, RWV1272 and MAC70) were released in 2015; 2 (RWR2245 and RWR2154) in 2016; and 3 (NUV30, VUV91 and NUV130) in 2018.

Table 8. Biofortified bean varieties released in Burundi, 2015-2018:

Official Name	Growth Habit	Year of Release	Yield potential (on station)	Yield potential (off farm)
MAC44	Climber	2015	2500	2000
RWV1129	Climber	2015	2500	2000
MAC70	Climber	2015	2000	1500
RWV1272	Climber	2015	2500	1500
RWR2245	Bush	2016	1200	800
RWR2154	Bush	2016	1200	800
NUV30	Climber	2018	2500	1500
NUV91	Climber	2018	2200	1700
NUV130	Climber	2018	2000	1500

Target 2015- 2019 (b): 750 tons of new biofortified seed varieties produced and disseminated by partners

Progress 2015-2018: Between 2015-2018, Burundi alone achieved a total of 614.6 tons (Table 9), 82% of the targeted 750 tons of certified and quality-declared seed for the two flagship countries by 2019.

Table 9. Certified and QDS seed of biofortified bean varieties produced in Burundi (2015-2018):

Seed Grade	Production (tons) by year				Total
	2015	2016	2017	2018	
Certified	39.01	50.87	99.11	132.46	321.45
QDS	19.51	25.43	49.55	198.69	293.18
Total	58.52	76.3	148.66	331.15	614.6

OUTPUT 2.1.2: Biofortified bean-based products and tools adapted, developed and promoted

Targets: 2015-2019 (a): Three best-bet products were adapted.

Progress 2015-2018: Consumers ranked bean flour as the most preferred due to its versatility, palatability, convenience and nutritional value. The second best ranked was porridge, followed by doughnuts (mandazi). Five bean processors from four provinces, namely Bujumbura, Kayanza, Muyinga and Makamba, are engaged in processing bean flour, while food vendors in the open markets mostly produce bean doughnut (mandazi).

Targets: 2015-2019 (b): Two tools - recipe book and nutrition handbook - developed and promoted; three best-bet products developed through private sector engagement.

Progress 2015-2018: Tool development has started, and will be finalized mid 2019.

OUTPUT 2.1.3: Nutrition-sensitive approaches that support the utilization of bean-based products validated and promoted

Target 2015-2019: Two approaches validated and promoted, such as the food basket approach.

Progress 2015-2018: Three approaches have been developed with a range of partners depending on the bean-based products and the context:

- i. Community school-based nutrition targeting malnourished children. WVI – Burundi in partnership with ISABU initiated a concept of community crèche in Gasorwe and Gashoho communes of Muyinga province. In these community crèches, 6,830 children under 7 years went through therapeutic feeding using biofortified bean-based products. Surrounding farming communities organized into 11 cooperatives comprising 3,500 households, provided the beans. ISABU bean programme provided technical backstopping and training to extension services and seed producers. The results indicated that stunting cases have been reduced by 6% in less than a year. In addition to beans contributed to schools and consumed at home, 568 tons of high-iron beans were marketed, which generated US\$117, 532 to farmers.
- ii. Through partnerships between the Ministry of Health (PRONIANUT), the Ministry of Agriculture, Livestock and Environment and the nutrition-based development programmes, 2,307 women (resource people and change agents) were trained on improved nutrition and preparation of nutritious recipes to support the communities where they are based. The change agents have positively influenced consumption of high-iron beans across Burundi by improving market availability or household food preparations levels.
- iii. Commercialization of bean-based products: Between 2015 and 2018, five small enterprises invested in bean-based convenient and nutritious products, while ISABU, CIAT and PABRA provided the technical support through trainings and networks. The entrepreneurs remained responsible for the production and commercialization of the products. Together, five processors produced 12 tons of products per month compared to 5 tons in December 2017. The number of outlets at markets have also increased.

OUTPUT 2.1.4: Influencing in-country nutrition strategies and facilitate availability of micronutrient bean products

Target 2015-2019: Three policy briefs.

Progress 2015-2018: The Ministries of Agriculture, Livestock and Environment, Education and Health have all started the process of developing policy support to mainstream the inclusion of high-iron bean in the school feeding programs in primary and secondary schools.

IMMEDIATE OUTCOME 3.1: Increased access to profitable local and national markets in a gender equitable manner

Target 2015-2019 (a): 250,000 households selling to profitable markets.

Progress 2015-2018: In partnership with World Vision Burundi, community-owned organizations in villages were supported to use and adopt high-iron beans for better nutrition. Over the years, the number of producers buying the beans reached 220,590 (Table 10), where more than 50% were women. This achievement represents 88% of the 2019 target.

Table 10. The number of households selling beans to profitable markets in Burundi (2015-2018):

	Male and female – led house selling to profitable markets			% contribution to target
	Female	Male	Total	
Cumulative 2015-2018	114,707	105,883	220,590	88

Target 2015-2019 (b): 100,000 consuming households accessing value added products.

Progress 2015-2018: The number of households consuming value-added products reached 362,000 cumulatively (Table 11), against a target of 100,000 households by 2019. The high positive response to processed bean-based products among consumers favored bean flours. Interest by small and medium enterprises to started processing the products also increased in the last two years.

Table 11. The number of households accessing and consuming value-added products in Burundi (2015-2018):

	Households consuming value-added bean products 2015-2018						% contribution to target
	2015	2016	2017	2018	Total	Target	
Bean flour	34,000	84,000	120,000	124,000	362,000	100,000	362%

The project has increased income and investment opportunities worth US\$54,843 through sales of 58.5 tons of high-iron beans. Among beneficiaries of 136 Village Saving and Loan Associations, with a total membership of 3,036 households, almost 50% are promoting high iron beans. The Associations have registered US\$20,794.5 of savings and accessed loans worth US\$16,604.4. About US\$5,363.8 of revenue has been accrued in interest. The households included single mothers, women leaders, grandmothers, traders and agro-dealers.

OUTPUT 3.1.1: Business models and bean platforms for linking bean farmers to markets promoted in flagship countries

Target 2015-2019 (a): At least one business model and bean platform linking bean farmers to markets has been established.

Progress 2015-2018: Over the years, bean business platforms were established in Burundi, allowing different stakeholders to work in synergy and enabling seed producers to increase bean seed production.

The bean platform was established to strengthen bean value-chains, by improving efficiency of actors working in production, distribution and consumption hubs. Four popular bean classes were identified for the bean corridors. The four bean types correspond to the four bean corridor hubs for Burundi. These include: (i) Yellow bean; (ii) Sugar bean; (iii) Red bean; and (iv) Red mottled. Subsequently, bean platforms were established based in each province and 12 platforms were established to implement the bean corridor work. These platforms elected representatives to become part of the national bean platform in Burundi. Previously, bean seed producers were used to multiply different categories of seed (basic, certified). But they experienced challenges in selling their products, as they were not linked to market. This was negatively affecting the seed flow in the country. The establishment of bean platforms has enhanced information sharing among seed and grain producers, grain traders and other stakeholders. A WhatsApp group of bean seed producers and other stakeholders was created and is facilitating interaction between stakeholders, informing seed production, availability and market.

OUTPUT 3.1.2: Commercial and nutritious bean-based products promoted through value chains in flagship countries

Target 2015-2019 (a): At least one value chain per country for processed products and value chains for nutrient dense bean products established.

Progress 2015-2018: Two value chains along bean seed and bean grains and bean composite flour have been established. The bean-based flour is processed by five small and medium enterprises, four of which have been established over the last two years. The enterprises are situated in different regions of Burundi. A positive response from consumers for value-added products is driving demand. This demand has propelled Totahara's success - one of the enterprises scaling up its processing facilities - more than doubling production of the bean flour products from high iron beans.

Target 2015-2019 (b): One promotion strategy per country for processed products.

Progress 2015-2018: Three promotion strategies were used to encourage consumption of bean products in Burundi. The products were promoted to institutions such as hospitals and NGO organizations to incorporate into their feeding programmes. Other promotional approaches used were special events, exhibitions and mass media (radio) and print media.

Target 2015-2019 (c): One business model used to support trade of processed bean products per country.

Progress 2015-2018: One business model (seller driven-consumer facing model) was used to sell the bean products. The small and medium processors were solely responsible for driving the sale of their products. In 2019, intermediaries such as NGOs and institutions that buy on behalf of other consumers will be explored to increase the consumption of the nutrient-rich bean products.

IMMEDIATE OUTCOME 4.1: Increased access to skills, information and knowledge providing enabling environment for bean research and development

Target 2015-2019 (a): 50,000 people accessing information (through trainings, printed materials, demos, and mass media).

Progress 2015-2018: This initiative was delayed due to the prevailing political situation at the time the project started. Yet the ISABU Bean Programme and CIAT-PABRA in partnership with many development partners developed and disseminated several information materials, communication and knowledge tools on various aspects of bean value chain. Over a four-year period, the number of people with access to information rose to 38,469, which is 77% of the target to be achieved by 2019 (Table 12).

Table 12. The number of people exposed to new skills and knowledge and information through mass exposure:

Progress					
2015	2016	2017	2018	Total	% contribution to target
3081	4214	15,200	15,974	38,469	70.0

Target 2015-2019 (b): Levels of satisfaction with information media are at 70% through trainings, printed materials, demos, and mass media.

Progress 2015-2018: Constant feedback from participants showed that there is a slight increase in levels of satisfaction, from 50% in 2015, through 56% in 2016 and 2017, then 65% in 2018. But the project is yet to hit the target of 70%.

OUTPUT 4.1.1: Women's participation in research and decision-making bodies of PABRA and in bean platforms increased

Target 2015-2019 (a): 40% increase in women's participation in research and decision-making bodies of PABRA, and in bean platforms.

Progress 2015-2018: In Burundi, women were hardly in leadership positions in farmer organizations or associations. In cases where they did, they mainly occupied administrative roles such as secretary and advisory positions, as they were assumed better at handling finances. A gender tracking exercise was conducted in 2017, indicating 20% of women occupy leadership positions as secretaries or treasurer. Because of capacity building trainings on gender at community meetings, regional PABRA meetings and business platform meetings, the percentage of women in leadership positions has increased to 39% across eleven provinces. Currently, women occupy vice chair positions. The repositioning of women in leadership positions has influenced women's access to improved seeds, technologies and market information. More women are producing seeds that are soon to be licensed.

OUTPUT 4.1.3: Skills and knowledge of bean value chain actors (NARS scientists, private sector, farmers, traders, processors and consumers) enhanced

Target 2015-2019: 60 men and women participants benefiting from capacity building initiatives (50% female).

Progress 2015-2018: Between 2015-2018, a total 19,382 (9,303 men and 10,079 women), above 50% female (Table 13), participated in various capacity building initiatives (degree and non-degree training) to enhance capacity building of different stakeholders and increase bean production and productivity.

This contributed 323% towards the overall 60 participants targeted for 2019 across the flagship countries.

Table 13. Men and women participants in capacity building initiatives in Burundi (2015-2019):

	Male and female participants in training			% contribution to target
	Female	Male	Total	
Cumulative beneficiaries (2015-18)	10,079	9,303	19,382	323

2.2.2 Zimbabwe

INTERMEDIATE OUTCOME 1: Increased bean productivity

Target 2015-2019 (a): 750 kg/hectare bean yield in Zimbabwe.

Target 2015-2019 (b): 20% increase in area occupied by bush bean combined with CSA in Zimbabwe.

Progress 2015-2018: Average bean yield was 750kg/hectare in 2018 - an increase above the baseline yield of 672.3kg/hectare in 2016. In 2018, yield was higher, approximately 1050kg/hectare, for farmers using irrigation.

Immediate Outcome 1.1: Increased and gender equitable access to high yielding dry bean varieties and productive ICM technologies and information

Target 2015-2019 (a): 750,000 households accessing seed of improved dry bean varieties, ICM and labor saving technologies.

Progress 2015-2018: Since the inception of the project, there has been increase in access to seed of improved bean varieties, ICM and labor saving technologies for both male and female farmers (Table 14) in Zimbabwe.

Table 14. Number of households accessing quality seed of improved varieties in Zimbabwe (2015-2018):

Year	Households accessing seed		Cumulative Total	Increase
	Female represented	Male represented		
2015	210,000	140,000	350,000	0
2016	288,000	192,000	480,000	130,000
2017	386,160	257,440	643,600	163,600
2018	411,000	274,000	685,000	41,400

Out of the 685,000 households who accessed improved technologies, 411,000 (60%) were female (Table 14). In addition, the 685,000 represents 91% of the target of 750,000 households by 2019. In addition, it reflects a 174% increase above the baseline of 250 000 households in 2014. This means that more farmers are accessing improved technologies than was the case at the beginning of the project. This also means that there is a greater possibility that bean productivity per unit area will increase significantly in future.

Target 2015-2019 (c): 60% satisfaction with the delivery systems for dry bean varieties products and ICM for food security.

Progress 2015-2018: Farmer satisfaction with improved bean varieties and ICM was monitored through a survey conducted as part of the impact assessment in 2018. Out of 650 farmers interviewed, more than 90% demonstrated satisfaction with project-supported varieties for yield performance, marketability and price. However only 53% of farmers were satisfied with the drought tolerance of the varieties, despite high yield capacity. We believe that varieties released recently under the flagship country will address this gap once widely diffused into the farming communities. The survey found impressive levels of satisfaction on the cost of ICM (84% were satisfied with cost attributes) and farmers exposed to at least one ICM technology expressed interest at 40%.

However, few (33%) are satisfied with their effectiveness in dealing with target constraints such as drought and low soil fertility. Often, this is because farmers adapt techniques to cut costs, which reduces the efficiency of a technique.

OUTPUT 1.1.1: Competitive high-yielding and stress-tolerant varieties developed across various agro- ecologies and cropping systems

Target 2015-2019: Preferred high yielding stress tolerant bean varieties released across the two flagship countries.

Progress 2015-2018: During the four-year period, Zimbabwe has registered two stress-tolerant bean varieties: Sweet William in 2016 and Protea in 2018 (Fig 9). Sweet William, a sugar bean type, was released because of its drought tolerance, high grain yield potential and tolerance to diseases of economic importance. Farmers located in dry areas who could not grow beans before, are now venturing into bean production, increasing national production volumes. In addition, Sweet William is in high demand locally, for the domestic dry bean industry in Zimbabwe.

Protea on the other hand, is a small white pea bean for canning. The variety was released not only for its high-yield potential, tolerance to diseases such as rust, common bacterial blight and angular leafspot, but for canned baked beans.

As such, Protea addresses the needs and preferences of the canning industry. Most of Zimbabwe's bean grain for canning is imported from other countries in Africa – mainly Ethiopia and Malawi. Protea has potential to save the country around US\$120,000 per month on navy bean grain imports. More farmers are likely to cultivate navy beans considering the availability of a locally bred varieties and a ready market.

While only two varieties of stress-tolerant beans have been released, it is encouraging to note that four additional stress-tolerant varieties will be presented to the release committee in the second quarter of the year 2019. When these have been released, there will be six improved stress-tolerant bean varieties registered in Zimbabwe by the end of the project.

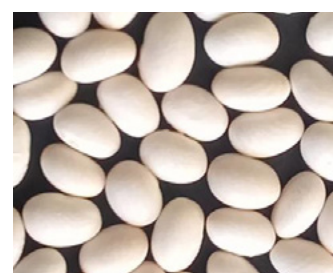


Figure 9: Seed coat appearance of the two released varieties: Protea (top) and NUA674 (bottom)

OUTPUT 1.1.2: Effective and economically viable ICM options for increased dry bean productivity and resilience identified and promoted

Target 2015-2019: Five better economically and farmer accepted ICM including conservation agriculture technologies for increased dry bean productivity and resilience developed.

Progress 2015-2018: Over the past four years, the project has evaluated various existing and new integrated crop management technologies in Zimbabwe. These can be categorized as: i) Integrated pest and disease management (cultural IPM technologies, use of Trichoderma, and use of pesticides); ii) Appropriate bean cropping systems (intercropping, mono cropping and rotations); iii) Seed protection (seed dressing using Apron star); iv) Weed

management (hand weeding, use of herbicides, and mechanical weeding); v) Soil and plant health amendments including use of soil lime, organic fertilizer, bio fertilizer (Wellcrop), inorganic fertilizer, rhizobium inoculation and foliar fertilizer use (Pu Lu tong); vi) Water conservation and management (off-season irrigation, drip irrigation, use of Trichoderma, use of tied ridges, use of conservation agriculture) and vii) Post-harvest management such as use of hermetic storage bags like PICS bags.

Many of these technologies existed in Zimbabwe but they were used on other crops, so the project tested them on common bean. The new technologies included use of i) Trichoderma, ii) Apron Star, iii) Wellcrop and iv) Pu Long Tong, which had not been promoted for bean production before in Zimbabwe. Farmers are currently exposed to more improved integrated common bean production technologies. Use of herbicides saved labor, especially benefiting women who are primarily involved in weeding, and encouraging more farmers to use herbicides.

To facilitate improved access to the various ICM technologies that were promoted the project established and strengthened linkages with private sector partners. Eight private sector partners have been involved in promoting ICM technologies: i) Syngenta - ISFM control of weeds using herbicides and control of fungal diseases using ApronStar; ii) Four seed companies, Pannar Seeds, Agriseeds, Klein Karoo and Seed-Co were all engaged to promote bean varieties alongside control of weeds using different planting spacing; iii) Zimbabwe Earthworm farms, promoting agriculture using organic fertilizers; iv) Earth Microbes, promoting organic fertilizers and v) China Foliar Fertilizer, promoting improved bean production using foliar fertilizers. These initiatives have encouraged the private sector to invest in agro-input supply chains, supporting farmers with better access to agro input services.

OUTPUT 1.1.3: Gender specific labor saving technologies validated

Target 2015-2019 (b): 50% levels of satisfaction with the technologies.

Gender specific labor saving technologies have included herbicides and mechanized equipment. Levels of satisfaction for herbicide use was monitored. From about 58 farmers who responded to survey questions, 81% were satisfied with the cost of herbicides, perceived as low or fair, while 86% were satisfied that herbicides free labor from bean production.

OUTPUT 1.1.4: Gender responsive delivery systems for seed of preferred dry bean varieties

Target 2015–2019 (a): 1,000 tons of seed for new bean varieties produced and disseminated Progress 2015-2018: Since the start of the project, there has been a significant improvement in certified seed production and dissemination. In four years, 3,021 tons of seed has been valued at US\$15,105,000. The yearly increase from 100 tons (2014) to 520 tons (2015); 450 tons (2016); 916 tons (2017) and 1135 tons (2018), with an average production per year of 755 tons, is valued at US\$3,775,000. During the same period, the number of beneficiary households cumulatively increased: 350,000 (2015), 480,000 (2016), 643,600 (2017) and 685,000 (2018) – see Table 15.

Table 15. Volumes of certified seed produced since 2015:

Year	Produced (tons)	Cumulative beneficiaries (HH)	Estimated value of seed in US\$	Baseline 2014 (tons)
2015	520	350,000	2,600,000	100
2016	450	480,000	2,250,000	100
2017	916	643,600	4,580,000	100
2018	1,135	685,000	5,675,000	100
Total across 4 years	3,021		15,105,000	
Average per year	755		3,775,000	

This shows that 685,000 more households are accessing improved varieties than at the start of the project (100,000). The production and dissemination of certified seed has been enhanced through several approaches to break bottlenecks in early generation seed production, such as mutually beneficial public-private sector partnerships. Strengthened collaboration has resulted in increased volumes of certified seed. Increased emphasis on nutrition-sensitive agricultural value chains by the government of Zimbabwe has also increased production of certified bean seed, with subsequent interest by seed companies to multiply and market bean seed. This reinforced dissemination of certified seed through community-based organizations, NGOs, supermarkets and agro-dealers.

INTERMEDIATE OUTCOME 2: Increased utilization of improved bean-based products for nutrition security.

IMMEDIATE OUTCOME 2.1: Increased access to micronutrient rich bean products among the vulnerable groups in a gender equitable manner

Target 2015-19 (a): 250,000 households accessing combinations of biofortified bean varieties and ICM technologies across the flagship countries.

Progress 2015-2018: The government of Zimbabwe launched the National Food Fortification Strategy in 2015 to guide policy and implementation to prevent and control micronutrient deficiencies. Food fortification is the process of adding vitamins and minerals to food during processing. This policy encourages use of biofortified crops by food manufacturing industry. Biofortified bean and provitamin A maize are raw materials in processed food products such as canned beans, beans-maize mix and bean flour. The sale of biofortified bean grain is also widespread in the main supermarkets. Households with access to biofortified varieties and bean-based products has also increased substantially (Table 16).

Table 16. Number of households who accessed bean products across the four years:

Year	Households accessing bio-fortified varieties	Households accessing bean-based products	Total
2015	8,000	3,000	11,000
2016	63,000	10,000	73,000
2017	134,000	25,000	159,000
2018	142,413	85,000	227,413
Total	347,413	123,000	470,413

Table 16 shows a large proportion of households accessed biofortified bean varieties (73%) compared to bean-based products (27%). This is because most programs by the government and development partners are using NUA45 - a biofortified bean variety - in their interventions. As a result, more seed producers have registered to multiply and market the NUA45 bean variety. The number of households accessing bean-based products increased from 3,000 in 2015 to 85,000 in 2018 (Table 16). In 2015, with the mandatory food fortification policy, all value-chain actors in the food processing industry were supposed to fortify their food products with vitamins and minerals including iron and zinc. This initiative, coupled with increased emphasis on nutrition-sensitive agricultural value-chains, has resulted in increased demand for biofortified crops such as beans and provitamin A maize. Therefore, processors such as Cairns Foods Limited and Healthy Foods have commercialized the NUA45 biofortified bean variety.

Nutrition interventions have focused on the following: 1) Use of the food basket approach to develop products suitable for consumption by children under two-years-old, processing beans into flour and mixing with other nutritious food such as baobab powder rich in vitamin C; 2) Promotion of diverse diets at community level, introducing diverse ways of preparing and consuming beans; and 3) presenting bean-based products at exhibitions, forums such as trade fairs, agricultural shows and special events to raise awareness.

Since 2015, nutrition education and promotion activities were concentrated in the north-eastern and southeastern corridors. At community level, the project continues to promote the production and consumption of released, high-iron beans, at trade fairs, field days, agricultural shows and food fairs. Primary schools (17), youth (5) and women groups (11) were part of the nutrition education and awareness campaigns done in collaboration with the Ministry of Health and Child Care, Crop and Livestock Production Department, LEAD Trust Feed the Future project, Cluster Agriculture Development Services and Healthy Foods (Figure 10).



Figure 10: Samanyika Primary School children (Nyanga) tasting various bean-based products as part of awareness creation campaigns on high-iron beans.

The trainings and awareness campaigns on high-iron beans and bean-based products in 2018 benefited 1,581 beneficiaries (571 males and 1,010 females), with 62 high-iron bean demos established. The project team was able to develop fritters, jambalaya, nutritious bean-based flour porridge blend (a mixture of different traditional flour products), pies, biscuits and scones with NUA45 beans as part of its value addition strategy. The products were tested by consumers and promoted widely among the communities. Nutrition teams also marketed the products at the National Trade fair, Harare Agricultural Show and Zimbabwe Traditional and Organic Food Festival.

One women-owned private agro-processing firm, Healthy Foods, was supported to develop bean-based products (flour, porridge) and to brand NUA45 bean packs. Healthy Foods Ltd is now a fully functional nutritious flour processor now serving 19 Pick n’ Pay supermarkets distributed across Zimbabwe.

OUTPUT 2.1.1: Micronutrient rich bean varieties with superior agronomic traits developed

Target 2015-2019 (a): Five biofortified bean varieties released, 750 tons of new biofortified bean varieties seed produced and disseminated by partners in the flagship countries.

Progress 2015-2018: Between 2015-2018, Zimbabwe released one new biofortified bean variety, NUA674, with acceptable grain market (sugar bean) and good grain yield above 2,000 kilograms per hectare.

Target 2015-2019 (b): 750 tons of seed of new biofortified varieties produced and disseminated by partners.

Progress 2015-2018: Between 2015-2018, 903 tons of certified seed of the biofortified bean variety (NUA45) was produced and supplied through a network of seed companies (Table 17), which represents 120% of the target set for 2019. A combined 347,413 households accessed this seed.

Table 17. Volumes of certified seed produced since 2015:

Year	Quantity (MT)
2015	24
2016	96
2017	363
2018	420
Total	903

OUTPUT 2.1.2: Bean based products and tools adapted, developed and promoted

Targets: 2015-2019 (a): Three best-bet products developed across the flagship countries.

Progress 2015-2018: Out of 19 bean-based products developed, three best-bet products were selected. Biofortified bean grain (NUA45 and Cherry bean varieties), bean flour including blended bean-based flour for porridge and samp, a mixture of maize and beans mainly served as breakfast.

A country audit of existing products was conducted in focus groups in Mashonaland East province (Goromonzi, Murehwa, Mutoko and Mudzi districts) where project partners had direct interventions.

In each district, households were trained in bean processing and would assess preferred bean-based products consumed. The results show that farmers value beans as an income-generating crop. They prefer to sell it to the market than process and consume them at home. Although trained, most farmers have not explored the opportunity for bean value-addition. Only groundnuts (peanut butter), cowpeas and Bambara nuts that processed at household level, as they are not so marketable raw. Households acknowledged that they have been trained in processing bean flour and use of bean composite flour, but they are still not using beans for that purpose.

Beans are mostly boiled and stewed. However, the households acknowledged using beans for breakfast as a samp - mixture with maize and sometimes groundnuts, sometimes boiled. None of the households reported consumption of cooked bean leaves. Probably eating the leaves is considered unsafe due to herbicides used to spray beans. On the other hand, upmarket consumers have a wide choice of canned beans, from the dried type as well as fresh grain and green bean pods.

Targets: 2015-2019 (b): Two tools - recipe book and nutrition handbook - developed through community nutrition engagement in the flagship countries

Progress 2015-2018: A bean-based recipe book was developed and shared with Cluster Agriculture Development Services and Healthy Foods and field-tested with HarvestPlus, which also developed a flier on biofortified beans in collaboration with the Ministry of Health under Livelihood and Food Security Program.

An inventory of several nutrition-related tools and products has been developed through key informant interviews with officials from government ministries and several humanitarian organizations such as the World Food Programme, the World Health Organization, UNICEF, the Food and Agriculture Organization and the United Nations Development Programme. Interviews were done in key bean project areas of Gudyanga, Nyanyadzi, surrounding areas in Chimanimani and Mutare, to find out the percentage of farmers aware of key nutrition issues and major sources of nutrition information. The main sources of nutrition information are health extension staff, who gather the community for meetings and use flip charts, small cards and pamphlets to communicate nutrition-related information. Farmers confirmed that sometimes they are given small booklets written in vernacular with critical information. The tools used for promoting food-related matters normally support the consumption of bean as an important protein source.

Over twenty-five nutrition-related tools were catalogued including: nutrition handbooks, recipe booklets, fortification guidelines, micronutrient supplementation handbooks, nutrition surveillance, micronutrient surveys and nutrition garden guidelines. Most of the tools were developed jointly in collaboration with Ministry of Health and Child Welfare responsible for nutrition related issues in Zimbabwe. However, there was a clear gap on specific tools that promote biofortified beans and bean-based products and related social

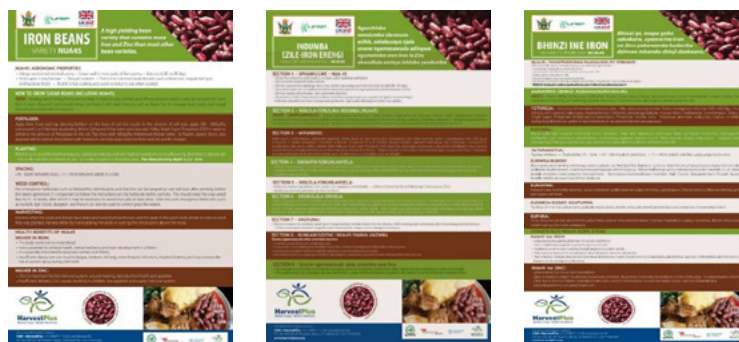


Figure 11: WhatsApp friendly version of the iron bean flier translated in English, Shona and Ndebele

behavior communication tools. As a result, two tools were developed: a bean-based recipe book by Agritex, and leaflets relating to biofortified beans by HarvestPlus, in collaboration with the Ministry of Health and Child Welfare (Fig .11).

OUTPUT 2.1.3: Nutrition sensitive approaches that support the utilization of bean-based products validated and promoted

Target 2015-2019: Two approaches validated and promoted (e.g. the food basket approach).

Progress 2015-2018: Six nutrition-sensitive approaches were used to promote bean-based products. A “healthy harvest” approach was used in Zimbabwe to promote good nutrition from production, processing, preservation and storage of healthy and nutritious food. It encourages people to grow nutritious food and eat the food through practical demonstrations about nutritious food preparation. Biofortified beans were included in the “healthy harvest” promotion gardens in 2014. CIAT-PABRA promotes the food basket approach, involving the preparation of beans in various methods to diversify diets and increase nutrient density of bean-based dishes. The food basket approach develops products suitable for children under two-years-old, processing beans into flour and mixing with other nutritious food such provitamin A maize and baobab powder, rich in vitamin C.

Since 2015, four additional nutrition-sensitive approaches have been promoted in collaboration with the EXTRA project, Livelihoods and Food Security Program project, Ministry of Health and Child Welfare, Cluster Agriculture Development Services and Ministry of Primary Education. The approaches are (i) Home Grown school feeding; (ii) Care groups; (iii) Key Hole Gardens and (iv) Catering industry.

The school feeding approach educates schoolchildren about the nutritive value of high iron beans and the various ways of preparing bean-based products (Fig 12). HarvestPlus and Agritex participated in the celebration of the Third Africa Day of Home-Grown School Feeding that was combined with the fourth workshop between the Africa Union and World Food Programme on Home Grown school feeding. Over 500 delegates participated, and 137 guests tasted the foods, including biofortified bean products.



Figure 12: School pupils show off some of the high iron beans (left); Pupils at Glen View 2 Primary School enjoying lunch made from Vitamin A Orange maize and iron beans (right)

The Key Hole Gardens and Care Groups are promoted in collaboration with the EXTRA and Livelihoods and Food Security Program project. The Care Group model is a community-based platform for scaling out nutrition interventions (Fig 13). Care Group targets pregnant women, lactating women and households with children under two-years-old.

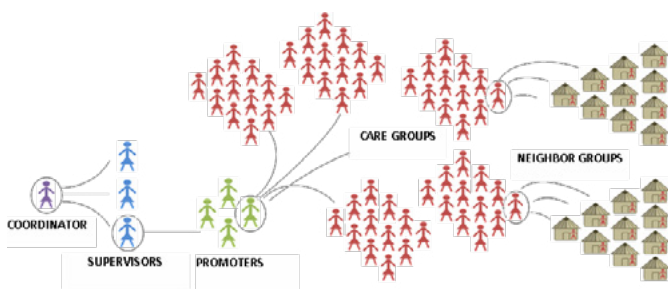


Figure 13: Care Group model, a community approach for scaling out nutrition interventions

Catering industry: HarvestPlus trained catering staff to use and market biofortified foods that included beans. 50 caterers across the project districts were identified and trained on the importance of biofortified crops. The aim is for caterers to serve biofortified crops on their menus.

OUTPUT 2.1.4: Influencing in-country nutrition strategies and facilitating availability of micronutrient-rich bean products

Target 2015-19: Three policy briefs.

Progress: The Crop and Livestock Production Department lobbied for the inclusion of high-iron bean cultivars into government special programmes. The special agriculture programme in Zimbabwe is essentially 'import substitution.' Selected farmers are contracted to produce an agreed quantity of crops with support from the private and public sectors. Funding comes from the private sector. The proposal to include sugar beans in the special agriculture programme was accepted. The next step is to lobby for inclusion of high-iron bean cultivars. Whether biofortified or not, any bean crop can be grown under the programme, and a business, nutrition and economic case for including high-iron beans is in progress in 2019.

A nutrition study conducted among 619 households in Mt Darwin district, in collaboration with the Ministry of Health and Child Welfare confirmed a high prevalence of malnutrition. The study aimed to identify risk factors of malnutrition in the district. Findings will inform policy and direct interventions, with preliminary results show that stunting in children between 6-23 months-old was high at 32% - a public health concern. Children aged between 18-23 months had the highest stunting at 46%. This is coupled with low minimum acceptable diet at 7%, minimum dietary diversity at 16% and minimum meal frequency at 54% in children 6-23 months. The nutrition status of mothers is also poor, with 23% of women eating only around five food groups or more. The largest share of land is cultivated to tobacco. The government plan is to introduce food cash crops such as beans so that households will consume them.

INTERMEDIATE OUTCOME 3: Increased trade of bean products

Target 2015-2019 (a): 50% increase in volumes of improved dry bean varieties traded.

Progress 2015-2018: At farm-level the average quantities of bean traded by producers has grown from 288 kg in 2016 to 358 kg per household in 2018; an equivalent of 43%. The growth is attributed to an increase in volumes traded, with farmers making a surplus, able to sell more in 2018. The target was missed due to slight fall in yield in 2018 due to unfavorable weather. But slowly bean trade is progressing. Between 2015 and 2018, 32,519 tons of beans were traded (Table 18). After the corridor approach is established, we expect more farmers to produce surplus for sale, further exceeding targets.

Table 18. Volumes of beans traded form 2015-2018:

	2015	2016	2017	2018	Total
Volume (MT)	7,351	7,350	7,418	10,400	32,519
% change	-	0%	1%	40%	-

It is expected that produce retained for household consumption would increase - good for food and nutrition security - because of recent hikes in beef prices. Bean volumes traded increased by 40% in 2017 (Table 18), due to stronger bean platforms, to meet demand from processors and grain traders.

IMMEDIATE OUTCOME 3.1: Increased access to profitable local and national markets in a gender equitable manner

Target 2015- 2019 (a): 250,000 households selling to profitable markets across the flagship.

Target 2015- 2019 (b): 100,000 consumer households accessing processed products.

Progress to date: The number of households selling beans to profitable markets has risen steadily from 250,000 (2016); 320,000 (2017) to 500,000 (2018), making a total of 1,070,000 over a three-year period (Table 19), way above the target by 2019.

Table 19. Number of households selling to profitable markets and consumers accessing processed products:

Indicator	2015	2016	2017	2018	Total	% contribution to target
Number of households selling to profitable markets	-	250,000	320,000	500,000	1,070,000	428%
Number of consumers accessing processed products	3,000	10,000	25,000	45,000	83,000	83%

The number of consumers accessing processed products has risen from 3000 in 2015, to 10,000 in 2016; and from 25,000 in 2017 to 45,000 in 2018, contributing 83% towards the target set for the flagship countries by 2019. These have been achieved due to high demand for beans in Zimbabwe - more than 96,000 tons annually. This quantity continues to grow because of the increased government emphasis on nutrition-sensitive agricultural value chains. Currently, Zimbabwe is a net importer of beans, importing more than half its national demand from neighboring countries such as Zambia, Malawi, Mozambique and South Africa. To build its bean production capacity, Zimbabwe is using both the commodity corridor and innovation platforms, to boost bean production and marketable volumes and reduce bean imports. The production and consumption hubs are illustrated in the maps. The corridors in Zimbabwe mainly focus on three bean types: small white bean for the bean canning industries in Harare; sugar beans for the major dry bean market in Harare and other urban centers, and high-iron bean for nutrition and households. Figure 14 shows the bean corridors in Zimbabwe.



Figure 14: Bean corridors in Zimbabwe

Since 2015, the project established five innovation platforms driven by the private sector along the northeastern and southeastern bean corridors, to promote production, trade and bean processing. In 2017, the project collaborated with Welthungerhilfe, an international NGO, to strengthen the use of Information and Communication Technologies such as apps, within the innovation platform areas. This has increased farmers' efficiency in responding to market demands.

With increased government emphasis on nutrition-sensitive agricultural value chains, NUA674 - the newly developed sugar bean variety is in high demand and is boosting production. Private sector investment in bean products (Cairns Foods Ltd, Healthy Foods, PHI and National Foods) is a result of increased consumer demand

since 2015.

OUTPUT 3.1.1 Business models and bean platforms linking bean farmers to markets promoted in flagship countries

Target 2015-2019: At least one business model and bean platform for linking bean farmers to markets promoted.

Progress 2015-2018: Two business models were promoted in Zimbabwe bean platforms. The models included buyer-led models, where a lead firm contracted producers as the main buyer. In addition, producer-led models were also used, especially by producers coming together to aggregate and sell to buyers. Both models were used simultaneously.

OUTPUT 3.1.2 Commercial and nutritious bean-based products promoted through value chains in flagship countries

Target 2015-2019 (a): At least one value-chain per country for processed products and value-chains for nutrient dense bean products established.

Progress 2015 - 2018: Small and medium enterprise partners developed various products from the high-iron bean NUA45. Bean flour is one of the major products developed, subjected to consumer tasting and acceptance. These are being promoted widely among communities. Partners conducted promotional activities to market bean-based products through participation at national events like the National Trade fair, Harare Agricultural Show and the Zimbabwe Traditional and Organic Food Festival. The bean programme has also supported one women-owned private agro-processing firm, Healthy Foods to develop flour, porridge and to brand NUA45 bean packs. The firm was also linked to producers at Innovation Platforms for consistent supply of NUA45 grain. This support has helped Healthy Foods Ltd to become a fully-functional nutritious flour processor, today serving 19 Pick and Pay supermarkets distributed across Zimbabwe.

IMMEDIATE OUTCOME 4.1: Increased access to skills, information and knowledge, providing enabling environment for bean research and development

Target 2015-2019 (a): 50,000 people accessing information (through trainings, printed materials, demos, and mass media).

Progress 2015-2018: During this four-year period, 24,832 farmers, extension workers, traders, and seed producers in Zimbabwe enhanced their skills through seed fairs, agricultural shows, demonstrations, trainings, workshops, meetings, field days, trade fairs and food fairs. There was an incremental increase in the number of people with improved capacity: from 1,497 in 2015, to 1,604 in 2016; 9,534 in 2017, and 12,197 in 2018. In 2018, trainings on value addition were provided in 17 primary schools, 5 youth groups and 11 women groups, ensuring that important stakeholders along the bean value chain had basic knowledge about value addition and nutrition. The bean programme also worked with various partners to develop and disseminate 26,927 information materials such as variety catalogues, leaflets, manuals on Improved Crop Management, brochures and farming as a business. These information products focused on various disciplines: bean varieties, integrated crop management, seed production, markets, and nutrition. In addition, through mass media - largely through national radio and TV, over three million listeners and viewers accessed information on biofortification, aired in collaboration with HarvestPlus. Through print media, over 400,000 readers accessed bean-related information on bean characteristics and agronomic requirements of newly released varieties - Protea and NUA674.

OUTPUT 4.1.1: Women's participation in research and decision-making bodies of PABRA and within bean platforms increased

Target 2015-2019: 40% of women involved in research and decision-making bodies of PABRA, and in bean platforms increased.

Progress 2015-2018: A gender tracking exercise was carried out in Zimbabwe. It revealed that there were less than 30% of women in leadership positions at decision-making institutions. Women who managed to occupy these positions were mainly serving as secretaries and advisers. Since 2015, efforts to involve women

in key decision-making processes in bean business platforms have been made. At Nyanyadzi, Gudyanga and Shungudzevhu business platforms, women occupy 50%, 60% and 66% of the positions within decision-making committees respectively. Even though women occupy a significant number of positions in committees, men still occupy all positions of the chair, with only one woman appointed vice chair. Overall, women occupy 57.1% of key positions across the business platforms and this has increased their decision-making power and control at farm and household level.

OUTPUT 4.1.5: Impact assessment of interventions conducted in flagship countries (Burundi and Zimbabwe) and the results disseminated

Target 2015-2019: Impact assessment studies conducted in two flagship countries, and reports or results disseminated.

Progress 2015-2018: The results from the study confirm that the flagship interventions in Zimbabwe have made significant positive impacts on the livelihoods of bean producers. Benefits include improved access to high quality seed, access to crop and seed production knowledge and technologies, increased bean resilience and household food security. Interventions in seed systems have increased the availability of quality seed in the community and positively influenced seed demand. The project intervention wards saw a significant decline of 61% in the average distance that people have to travel to buy seed, from 25 kilometers in 2016 to about 10 kilometers in 2018. There has also been an increase in demand for certified seed, reaching 2.9 kilograms per producer. Approximately 42% of surveyed households benefited from bean capacity building interventions.

Farmer capacity building programs were effective in increasing farm productivity. Farmers with low productivity experienced the most significant yield gains after attending capacity building programmes. The average yield gain of improved varieties is also highest amongst low productivity farmers; about 31% higher in the first and 16% in the second yield distribution quantile. This is a lesson that tailored interventions can reduce yield inequalities.

Adoption of improved varieties promoted under the project has increased three-fold from its baseline rate of 9% in 2016, to about 31% of the surveyed households in 2018. In line with the long-term goal of “improving household food security and reducing poverty,” the study findings demonstrate that through yield gains and bean sales, the flagship has had a positive contribution to quality of life. For example, nutritional education has increased the frequency of vegetable consumption from three to more than four days per week among poorer households, while interventions generally enhanced the likelihood of being food secure. The percentage of households with an unacceptable food consumption score reduced from 12% at the baseline to 8.7%.

The development of innovative public-private partnerships amongst bean breeders, seed producers and traders, smallholder farmers in bean seed production, and technology dissemination is encouraging. This has facilitated access to quality seed by smallholder farmers in the country. This has been complemented by the increased government emphasis on nutrition sensitive agricultural value chains. In 2017, 818 tons of seed was sold, reaching an estimated 163,600 beneficiaries. In 2018, there was a 17% increase in seed sales, raising to 960 tons sold by private and public seed houses to reach approximately 191,296 beneficiaries.

The rising number of beneficiaries accessing bean seed is also due to stronger partner collaboration, successfully increasing demand, production and consumption of diverse nutritious foods, using NUA45 high-iron beans. For example, the INSPIRE project had 74,513 beneficiaries, and the LFSP project had over 28,000 beneficiaries in 2018.

Since 2016, three bean varieties responding to the market needs were released: i) Drought tolerant to and climate resilient Sweet William; ii) disease tolerant Protea, with good canning quality; iii) NUA674, biofortified, high-iron bean for nutrition security. Protea is the first canning bean variety to be released in Zimbabwe, replacing the need to import navy beans to supply the local canning industry and reducing the country’s import bill, by around US\$120,000 per month. Protea beans are already being used by Cairns Foods Limited and Africa Preserves Limited. National Tested Seeds has obtained exclusive rights to multiply this cultivar. The seed rights are for a specific duration to carry out seed multiplication, and once the multiplication is done, the seeds are widely

disseminated. Local supply of improved beans is expected to grow the local canning bean industry, with potential benefits for the whole supply-chain, including smallholder farmers.

This is what PABRA refers to as a 'demand-led' approach: developing improved bean varieties in demand by local clients, coupled with the enabling environment for promoting bean production and consumption. This approach has incentivized commercialization of the common bean. Since 2015, more than 250,000 households have accessed biofortified NUA45 beans and orange maize through promotional seed packs and commercial sales. In addition, more than 500,000 tons of biofortified seeds were delivered to farmers. Furthermore, more than 400 schools have been reached with 8 tons of biofortified NUA45 beans and orange maize in 2018 under school feeding programmes. These efforts have contributed significantly to government school feeding schemes and policies aimed to improve education, food and nutrition security and health.

In line with a mandatory food fortification policy introduced in 2015, several partners such as Cairns Foods Limited, Healthy Foods and Afri Deli have successfully commercialized bean-based products, complementing government efforts to reduce malnutrition. Since 2017, Cairns Food Limited has been canning NUA45 beans in brine and selling them in retail outlets, while also considering canning. Since 2017, Healthy Foods Limited has sold high-iron bean flour, bean porridge and branded NUA45 bean packs through 20 Pick n' Pay retail shop outlets. Furthermore, since 2015, Cluster Agricultural Development Services have sold nutritious bean-based products, reaching 39,000 beneficiaries in 2018.

Around one million households are now consuming biofortified products in Zimbabwe, according to CIAT's HarvestPlus, targeting malnutrition in Zimbabwe. Two operational Innovation Platforms were established in Nyanga and Shurugwi districts in 2018, bringing the total number of Innovation Platforms formed since 2015, to five. It is expected that these efforts will make it easier for farmers to aggregate their produce, attracting more buyers to procure in bulk, and increasing the volumes of beans traded. In addition, farmers at Innovation Platforms are also better linked to processors and buyers.

3 Overall SDC Project Update

3.1 Progress towards meeting targets

Technical delivery of the project

This section presents overall progress in implementation of the technical components of the project. The discussion is organized by immediate outcomes and the achievements take into consideration the set targets and commitment by the partners at country level.

Increased utilization of dry bean products for food security

Target 2015-19 (a): 7.5 million of the households accessing the dry bean technologies – access perceived as using at the level of intermediate outcome.

Target 2015-19 (b): 60% level of satisfaction established in new areas (new refers to new regions and new products).

Achievement in other non-flagship countries:

The SDC project targeted at least 7.5 million households and consumers of improved bean varieties that meet at least 60% of farmer satisfaction. Utilization of improved varieties and complementary technologies have increased over the years, currently at 7.7 million households in 2018. Bean yield has increased at farm level - for example in Burundi, the bean grain yield in project intervention sites increased from 700 kilograms per hectare in 2014 to 1,450 kilograms per hectare in 2017. We believe that the impressive yield gain in Burundi is a result of improved bean varieties and improved agronomic practices, including intensification of climbing beans. Improved planting methods – such as row planting - in Ethiopia and other countries like Uganda and Tanzania, have contributed to raising bean yield at farm level. On average, bean yields were 32% higher among households cultivating new improved varieties, compared with those using local varieties, equivalent to 223 kilograms of additional bean

harvested per hectare from plots planted with new improved varieties. Higher yields and market surplus enable households to earn an additional US\$202 in income from improved bean production.

These results are in line with the overall goal to increase bean productivity and contribute to household food security. Productivity increases allow farmers to produce enough for their home consumption and have surplus for sale. Through bean sales, farmers earn revenue and create employment for others in the value chains. Although expensive, consistent monitoring, tracking and impact assessment surveys were conducted in Tanzania (2016), Ethiopia (2017) and Zimbabwe (2018). The results for Tanzania revealed that the number of households using improved seed varieties grew by 10% between 2013 and 2016 – at an annual growth rate of 3.3%. This confirmed our assumption that commercializing beans is likely to shift the control of bean marketing from women to men.

To make sure women are not disempowered, we are working in Uganda with MasterCard to link women directly with buyers, using e-payment services to immediately reimburse them. Since this enables women access to an immediate market, this is expected to increase their decision-making and control over income in the household. The survey in Ethiopia, based on a national sample, shows that improved varieties were planted by 37% of the bean-growing households in 2016 – almost 1.5 million households.

The survey in Zimbabwe showed that this demand-led breeding approach has been key commercializing common bean, enabling Zimbabwe to supply its own canning bean industry, while also satisfying demand for sugar bean varieties in dry bean markets, and supplying nutritious biofortified food products. Improved bean varieties cultivated in project areas increased from 9% in 2016, to 31% in 2018. Most farmers also indicated satisfaction with the new beans: 70% of survey respondents, asked to rate new bean varieties cultivated on a scale of 1-5, indicated satisfaction with the improved varieties.

INTERMEDIATE OUTCOME 1: Increased utilization of dry bean products for food security

IMMEDIATE OUTCOME 1.1: Increased and gender equitable access to high yielding dry bean varieties and productive ICM technologies/information

Target 2015-2019: 10 million households (50% represented by women) accessing seed of improved dry bean varieties, Integrated Crop Management and labor-saving technologies.

Progress 2015- 2018: The project set out to reach and benefit 10 million households (50% being women) with improved varieties and Integrated Crop Management technologies by 2019. The annual reach for each year is shown in Table 20 and Fig 15.

Table 20. Number of households accessing seed of improved dry bean varieties, Integrated Crop Management technologies across all PABRA countries (2015-2018):

Year				Target	Progress	% Achieved	% Women
2015	2016	2017	2018	2015-19	2015-18		
2,572,469	2,361,166	5,039,067	5,474,364	10,000,000	15,447,066	154	58

In 2018, the project promoted varieties and Integrated Crop Management technologies benefitting 2.74 million households spread across 20 countries. Cumulative over the four years (2015-2018), the interventions have reached a total 15.4 million households (58% women), which is 154% of the 10 million targets for the project phase by 2019.

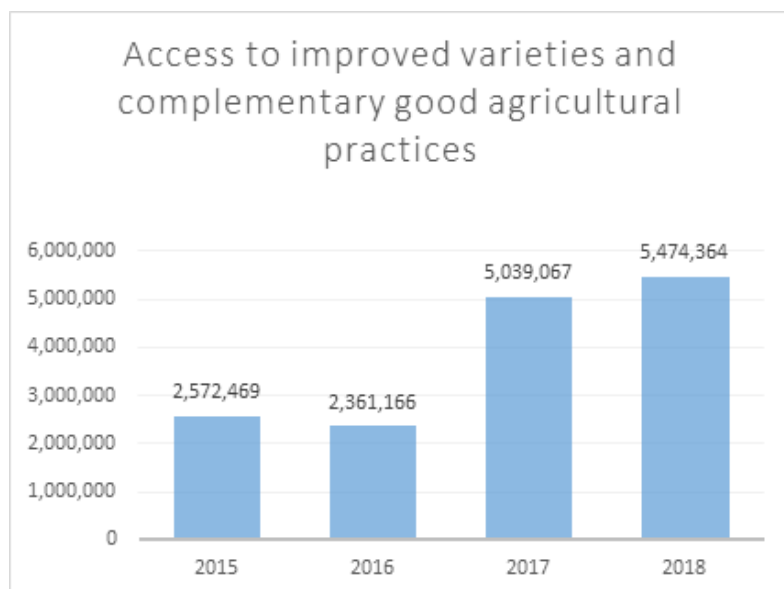


Figure 15: Number of households reached with improved bean varieties and Improved Crop Management technologies across PABRA countries (2015-2018)

OUTPUT 1.1.1: Competitive high yielding and stress-tolerant varieties developed across various agro- ecologies and cropping systems in 20 countries

Target 2015-2019: 40 competitive high-yielding and stress-tolerant, dry bean varieties released.

Progress 2015-2018: In this phase the target is to release 40 competitive, high-yielding and stress-tolerant bean varieties by 2019. Building on bean breeding initiatives from the previous phase, and other complementary projects supported by governments and donor agencies, PABRA member countries have registered several resilient bean varieties between 2015 and 2018. These were distributed across the years as follows: 22 varieties in 2015; 7 varieties in 2016; 21 varieties in 2017 and 31 varieties in 2018, making a total of 81 bean varieties to-date (Table 21).

Table 21: Number of preferred high-yielding, stress-tolerant varieties developed (varieties):

Year				Target	Progress	% Achieved
2015	2016	2017	2018	2015-19	2015-18	Total
22	7	21	31	40	81	202

While the total number of released varieties is double (202%) the projected target of 40 improved bean varieties by 2019, it is important to note that the varieties are coming from a limited number of countries. For example, the countries that registered varieties between 2017 and 2018 were: Burundi (10), Ethiopia (8), Kenya (1), Malawi (12), northern Tanzania (5), South Africa (2), southern Tanzania (2), Swaziland (2), Mozambique (3) and Zimbabwe (2). As such, efforts to register new bean varieties in other countries is required.

The varieties were released for a number of reasons: good yield performance, adaptability to various agro-ecologies (high, mid and low-altitudes); resilience to different types of bean diseases; and stress-tolerance: for example to low soil fertility and drought. Varieties released match those in demand by farmers, traders, processors and consumers for domestic consumption as well as for the regional or export market. Examples include sugar, red kidney, small red, red mottled, small white, yellow beans. Further investment by countries in these key bean corridors is required.

OUTPUT 1.1.2: Effective and economically viable Integrated Crop Management options for increased dry bean productivity and resilience identified and promoted

Target 2015-19: 15 better economically and farmer proven Integrated Crop Management technologies for increased dry bean productivity and resilience, including labor saving.

Progress 2015- 2018: The target under this outcome is to promote 15 Integrated Crop Management technologies for increased dry bean productivity and resilience in east and southern African counties. Between 2015-2018, project partners across PABRA member countries had promoted 56 against a target of 15 technologies by 2019 (Table 22).

Table 22. Integrated Crop Management and labor saving technologies promoted by partners across PABRA countries (2015- 2018):

Year	2015	2016	2017	2018	Progress 2015-18	Target 2015-19	%
ICM technologies	Achieved	13	13	21	56	15	373
Labor-efficient techniques/technologies	-	1	2	14	16	-	-

This represents a 373% contribution towards the phase target. Some of the technologies were similar across the countries. The technologies promoted can be classified into 10 broad categories and comprised of more than 20 distinct ICM technologies: i) Pest and disease management; ii) Appropriate bean cropping systems; iii) Seed protection; iv) Weed management; v) Soil fertility and amendments; vi) Plant growth enhancing technologies; vii) Water conservation and management; viii) Sean staking options; ix) Mechanization; x) Post-harvest management. Due to highly heterogeneous bean production zones across the target countries in terms of climates and soils, a diversity of technologies was necessary. Bean production is done by large scale but mostly smallholders. The farming systems are also varied from sole, rotation and intercropping systems. As a result, there is no single technology package that fits all sites. Technology promoted must fit the environment and farmer conditions.

Technologies that stand out

Mechanization: CIAT PABRA teams collaborated with partners in Tanzania (TARI and CAMATEC) to evaluate and promote use of bean planters and thresher across four sites; Simanjiro, Babati, Meru, Arusha. In addition, mechanized bean threshers (Fig 16) saved labor on manual threshing, reduced post-harvest grain losses through damage, and improved grain quality for trade.



Figure 16: From manual to use of improved bean threshers in Tanzania

Bean suitability mapping: To aid bean technology targeting, PABRA mapped bean growing areas for suitability to match new varieties to appropriate production areas. This has been done across-regions but also for specific countries. The maps are useful to inform decision-making and help define new frontiers for bean intensification. In future, the maps can determine current and future bean-growing areas in light of changing climate conditions. Linkages with private agro-input dealers: Private sector agro-input dealers have been linked with stakeholders to improve access to inputs and demonstrations of the technologies (Table 3). For example, partnerships were

established with Syngenta Limited in Tanzania, Kenya and Uganda to facilitate farmer access to ApronStar- a seed dressing for bean protection. In Burundi and Kenya, partnerships were established with Bell Industries and Ecoplastic, to facilitate access to hermetic storage bags that are now being used to preserve beans after harvest. In Kenya, Uganda and Burundi, links with GrainPro have helped farmers access Solar Bubble Driers for higher quality bean products. PABRA has worked with the private sector to deliver farmer training in safe and effective use of the approved agrochemicals, especially pesticides, herbicides and fungicides to mitigate any negative health and environmental impacts. The training is carried out in line with country pesticide and chemical control regulations. Cost benefit analysis of the Integrated Crop Management technologies: PABRA teams assessed the impact of some of improved management on production and profitability. In general, across the target countries, farmers who use improved seed and accompanying technologies attained a 30% increase in yields relative to those that do not use the inputs. Cost-benefit analyses also show that in the Tanzania bean corridor for example, field demonstrations were carried out jointly with Syngenta Limited, to assess the Cost-Benefit of producing Uyole-Njano bean variety with and without seed dressing using a commercial product ApronStar and fertilizer.

Results indicated that use of ApronStar offered protection against the most damaging diseases and pests, significantly reducing incidences of early-season disease and pests including bean stem maggots and root rots for example, for about 30 days after planting. Combined use of ApronStar and fertilizer resulted in higher yield, compared with the sole application of either input. Use of ApronStar, even without fertilizer application, resulted in a 25% increase in productivity of Uyole–Njano, translating to a 64% increase in profitability (Figure 17).

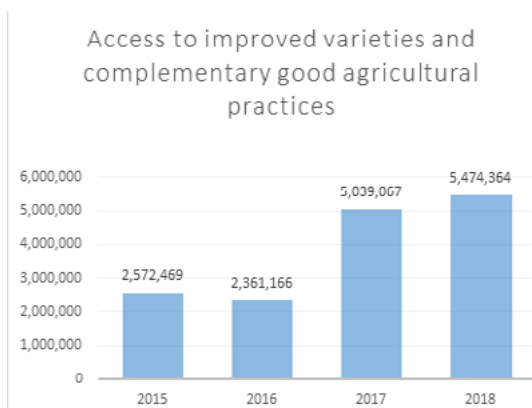


Figure 17: Cost-Benefit Analysis for Uyole-Njano with and without ApronStar and fertilizer

Similar positive results using seed dressing have been reported in Burundi, Kenya, Uganda, the Democratic Republic of Congo and Cameroon. Strategies have been put in place to scale out use of seed dressing across bean corridors.

OUTPUT 1.1.3: Gender responsive delivery systems for seed of preferred dry bean varieties

Target 2015-19 (a): 50,000 tons of seed of new bean varieties produced and disseminated.

Target 2015 - 2019 (b): Six delivery systems.

Progress 2015-2018: Cumulatively between 2015 and 2018, a total of 86,454.3 tons of certified and Quality Declared seed worth US\$129,681,450 were produced, surpassing the target by 72.9%. See Table 23.

Table 23. Certified and Quality Declared Seed (QDS) produced between 2015 and 2018:

Year	Production in tons	Estimated value in US\$	Annual estimated area planted in hectares using a seed rate 60 kg/ha)	% of area covered by new varieties in Africa
2015	20,252.6	30,378,900	337,543.3	4.39
2016	17,057.0	25,585,500	284,283.3	3.69
2017	24,759.7	37,139,550	421,661.6	5.48
2018	28145.0	42,217,500	469,083.3	6.10
Total	90,214.30	135,321,450	-	-

An increase in seed production of 38% between 2015 and 2018 is the result of progressive involvement of the private sector: individuals, farmer groups and large-scale seed producers (Fig 18), who responded to increased demand of quality seed in the bean corridors.

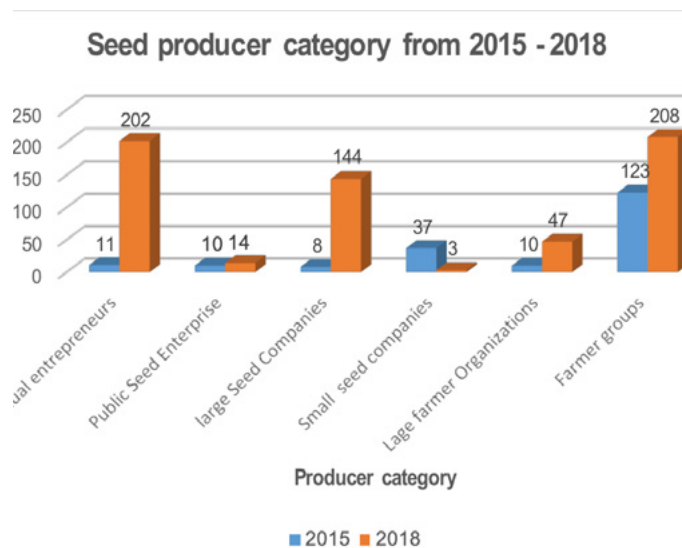


Figure 18: Number of producer categories between 2015 and 2018

INTERMEDIATE OUTCOME 2: Increased utilization of improved bean-based products for nutrition security in a gender-equitable and sustainable manner

Target 2015-19 (a): One million households utilizing biofortified bean varieties and Integrated Crop Management Technologies.

Target 2015-19 (b): 0.5 million beneficiaries utilizing bean based processed products.

Target 2015-19 (c): 70% satisfaction levels amongst men and women using new bean-based products.

IMMEDIATE OUTCOME 2.1: Increased access to micronutrient rich bean products among the vulnerable groups in a gender equitable manner

Target 2015-19 (a): Two million households accessing combinations of biofortified bean varieties.

Target 2015-19 (b): One million male and female beneficiaries accessing bean-based products.

Target 2015-19 (c): 75% satisfaction levels amongst men and women with the delivery system in six countries (2 in each network).

Progress 2015-2018: Over the four-year period, a total of 1.7 million households accessed biofortified varieties against the target of two million households in the phase period, contributing 89% towards achieving phase target by 2019 (Table 24).

Table 24. Number of households accessing combinations of biofortified bean varieties (2015-2018):

Year				Target	Progress	% Achieved
2015	2016	2017	2018	2015-19	2015-18	Total
303,080	382,983	565,500	527,179	2,000,000	1,778,742	89

Access to bean-based products had a target level of one million men and women beneficiaries. By 2018, at least 1.6 million men and women were benefitting from the bean-based products, indicating that the target has been surpassed by 66% (Table 25).

Table 25. Number of male and female beneficiaries accessing bean-based products (2015-2018):

Year				Target	Progress	% Achieved
2015	2016	2017	2018	2015-19	2015-18	Total
316,056	331,056	386,056	626,535	1,000,000	1,659,703	166

OUTPUT 2.1.1: Micronutrient rich bean varieties with superior agronomic traits developed

Target 2015-2019 (a): 20 biofortified bean varieties released; 3,000 tons of seed of new biofortified bean varieties produced and disseminated by partners.

Target 2015-2019 (b): 600 tons of seed of new biofortified varieties produced and disseminated by partners.

Progress 2015-2018: In this phase the target is to release 20 new biofortified varieties with acceptable iron and zinc levels, by 2019. Over the four-year period (2015-2018), PABRA member countries have made remarkable progress in releasing biofortified bean varieties. A total of 29 improved bean varieties were registered across 9 countries, contributing 145% towards the target of 20 bean varieties by 2019 (Table 26).

Table 26. Biofortified bean varieties released across PABRA countries (2015–2018):

	Progress				Total	Target	% Achieved
	2015	2016	2017	2018			
Varieties	6	8	7	8	29	20	145

These were released in 2015 (6), 2016 (8) and 2017 (7) and 2018 (8). However, this was achieved in a few countries: Uganda (5), Kenya (4), Burundi (9), Ethiopia (2), northern Tanzania (2), Swaziland (3), Malawi (1), southern highlands of Tanzania (1) and Zimbabwe (1). The release of these varieties was based on their high grain iron and zinc content relative to local varieties. Apart from high iron and zinc content, these varieties were also released because of their good yield performance and adaptation to various agro-ecologies (high, mid and low

altitudes), resilience to different types of bean diseases, and stress tolerance, for example to low soil fertility and drought. The varieties also fit in the major bean grain market classes. For example, the eight high iron and zinc content varieties registered in 2018, can be grouped in the following market classes: red mottled (2); sugar bean (1); purple – kabulanketi (1); dark red round (2); brown/tan (1) and yellow (1) where sugar, red mottled and yellow fit in the key the bean market corridors. More effort is required to ensure that more countries develop biofortified bean varieties to address nutrition needs for domestic as well as regional markets in the bean corridors.

OUTPUT 2.1.2: Micronutrient rich bean-based products and tools adapted, developed and promoted

Targets: 2015-2019 (a): Two tools - recipe book and nutrition handbooks - developed and promoted in five ECABREN AND 5 SABRN countries; three best bet products developed through private sector engagement.

Progress 2015-2018: The project started with rapid country audits to identify existing bean and bean-based products and promotional materials.

Over the three years, the project has supported country teams to revise or develop new material to promote nutrition. These include bean recipe books, nutrition training manuals, and nutrition handbooks. For example, bean recipe handbooks have been developed in Uganda, Tanzania, Kenya, Zimbabwe, Malawi, Zambia, Burundi, Swaziland and Madagascar. In some countries, the books were translated to local languages (e.g. Tumbuka and Chichewa in Malawi; Portuguese in Mozambique, Kiswahili in Tanzania, Luganda in Uganda, Kirundi in Burundi). The booklets were widely distributed during farmer field days, nutrition demonstrations, and food fairs and are available on the PABRA website: <http://www.pabra-africa.org/brochures-and-fliers/>.

At the start of the project, the project team assessed the potential of private sector to commercialize bean-based products in the different countries. The project established collaboration with several private sector partners in nutritious food processing. These include Lasting Solutions (precooked beans- dry type), Azuri Health Foods (Bean based flours) and Trufoods (canned beans) in Kenya, Nutreal (Bean based flours) in Uganda, Totahara (Bean based flours) in Burundi, FarmFresh (precooked beans- wet type) in Rwanda, Healthy Foods, Cairns Foods and Olivine (canned beans) in Zimbabwe, among others.

OUTPUT 2.1.3: Nutrition sensitive approaches that support the utilization of bean-based products validated and promoted

Target 2015-19: Two approaches validated and promoted (e.g. Food basket approach).

Progress 2015-2018: Considering multiple malnutrition challenges faced by communities, the project aimed to use the food basket approach to increase food diversity, targeting vulnerable populations, for example in schools. The introduction of diverse and biofortified bean products were tested in primary and secondary schools in northern Tanzania in partnership with district councils, as well as with World Vision International in Burundi. The next steps are to develop policy briefs to engage policy makers, parents and donors on the benefits of these partnerships.

OUTPUT 2.1.4: Influencing in-country nutrition strategies and facilitate availability of micronutrient bean products

As result of engaging Government of Tanzania policy makers, particularly the Ministry of Agriculture, Tanzania Food and Nutrition Center – the technical arm of the government responsible for coordination and policy issues on nutrition and Office of the Prime Minister, biofortification was included in the nutrition policy document of Tanzania. It has approved by the Tanzanian parliament. The Minister of Agriculture in Tanzania strengthened this when he officially launched the release of the first high-iron bean varieties.

Link to the coverage of the launch of the high iron bean variety in Tanzania:

<https://www.ippmedia.com/en/news/minister-wants-new-bean-varieties-distributed-farmers>.

Zimbabwe and Uganda have included the high-iron beans in their respective country nutrition policy documents. Similar efforts are ongoing in Burundi.

INTERMEDIATE OUTCOME 3: Increased trade of bean products in a gender equitable and sustainable manner

Target 2015- 2019: Two million tons.

Progress 2015-2018: 2,543,867 tons (127% of overall target).

PABRA continued to use the Bean Commodity Corridor model¹ to support production, distribution and consumption of bean grains and processed products. Results from the countries, including Burundi and Zimbabwe, show that bean production and trade continued on a positive trend. More than 869,000 metric tons of maize went into trade across the countries during the year, compared to 665,000 metric tons in the previous year (Table 27).

Table 27. Volume of bean traded across PABRA countries (2015-2018):

	Progress						
	2015	2016	2017	2018	Total	Target	% Achieved
Traded bean (ton)	418,401	590,604	665,062	869,800	2,543,867	2,000,000	127

There has been a steady increase in bean volumes traded over the past four years (Fig 19). Increased quantities were realized in Ethiopia, Kenya, Tanzania, Uganda, Rwanda, Burundi, Malawi, Zambia, Zimbabwe and Mozambique during the period. Overall, the target of two million metric tons was surpassed by around 27%. Higher volumes traded were also a result of increased production in some countries such as Rwanda, Ethiopia and Zimbabwe. In addition, more producers continued to be engaged in market activities.

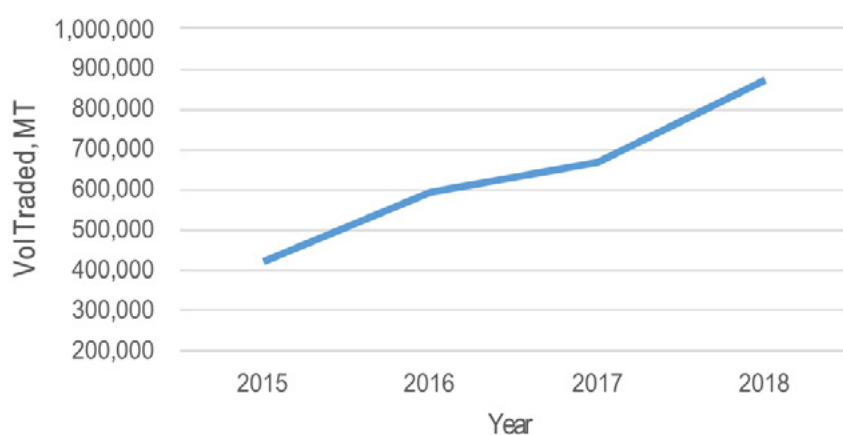


Figure 19. Traded bean volume across PABRA countries (2015-2018)

Under the bean corridors approach, PABRA continues to catalyze production, distribution and consumption of bean products. Emphasis is placed on bean business platforms² to implement bean production, distribution and value-addition activities. The platforms bring together members to increase production of beans of preferred bean types along specific corridors. Six of the nine corridors established are in the SDC supported countries in eastern and southern Africa (Table 28).

1. Commodity corridors comprise of three hubs: production, distribution and consumption hubs. They refer to the flow of products from source to point of use and the hubs are the intensification areas designed to move products. PABRA define nine corridors across Africa.
2. The bean business platforms are the structures that PABRA has established to implement the corridor activities and comprises the key value chain players necessary to move the bean commodity from production through distribution to consumers

Table 28. Bean corridors established in PABRA supported countries and their bean platforms:

Corridor	Country hubs	Driving bean/ market Class	Number of bean business platforms
Sugar Bean Corridor (TAZAMA corridor)	Southern highlands of Tanzania, Northern Zambia and Northern Malawi, extended to Zimbabwe	Sugar Beans	9
East Africa Red Mottled (EAREM corridor)	Kenya, Uganda, Northern Tanzania and Rwanda	Red Mottled	10
Ethiopia Bean Corridors	Ethiopia	Whites and Reds	8
Yellow bean Corridor	Burundi and Western Tanzania	Yellow beans	2
Madagascar Bean Corridor	Madagascar	White bean	1

These include the East Africa Red Mottled bean corridor, the Yellow Bean Corridor, White Bean corridor, Red Bean corridor and the sugar bean corridor in southern Africa. Consolidation of the bean corridors is seen through the new platforms established over the year as part of the implementation strategy of the corridor work, with nine new bean business platforms coming on board.

IMMEDIATE OUTCOME 3.1: Increased access to profitable local and national markets in a gender equitable manner

Target 2015-19 (a): 1.7 million households.

Target 2015-19 (b): 0.8 million consumers accessing processed products.

Target 2015-19 (c): At least 60% levels of satisfaction amongst those who assessed the dry bean products in eight countries, 50% being women.

Progress 2015-2018: Over the four-year period (2015-2018), 1,781,744 farmers were linked to markets for their beans across the countries - a 105% contribution to the target of 1,700,000 set for the project phase. The achievement in numbers linked to markets were observed in Burundi, Zimbabwe, Ethiopia, Rwanda, and Uganda. This trend reinforces increased bean volumes traded during the period. Use of the corridor approach is enabling more transparent production and trade across countries involved, and has contributed to an increase of marketing activities compared to previous years (Table 29).

Table 29. Access to profitable markets for smallholder bean producers:

	Targets	% achieved	2015	2016	2017	2018	Total
# of households selling to profitable markets	1,700,000	105%	43,834	297,500	552,794	887,616	1,781,744
# of consumers accessing processed products	800,000	93%	15,271	217,000	432,000	76,854	741,125

Interest in bean platforms has continued to increase. New platforms are now available in Zambia, Burundi, and Tanzania, where nine new platforms have been initiated. Consumer numbers have also been driven by new varieties demanded by bean product processors and introduction of new products. Recently introduced bean products in Zimbabwe, Burundi, Kenya and Uganda have translated into an increase in consumers to more than 76,000 to date. New canned products were introduced in Zimbabwe by the processor Cairns Foods; in Burundi, larger processing capacity was installed while three new processors joined the platforms. In Uganda and Kenya, new products were launched during the year targeting low-income consumers. Many of these product launches are by small and medium enterprises, which play a significant role in adding value to products and linking smallholders to a markets.

OUTPUT 3.1.2: Business models and bean platforms for linking bean farmers to markets promoted in at least four of the target countries

Target 2015-19 (a): At least one adapted business model per country established.

Target 2015-19 (b): One national-level bean platform consolidated from operational level platforms; one assessment of platform and model performance per country.

Progress 2015-2018: Most indicators associated with business models and linking producers to buyers have been exceeded. The bean corridor model has helped to structure bean production and trade, as well as interactions along bean value-chains among public and private investors. Bean platforms have enabled members and buyers to find easier access the right type of bean grain - and in sufficient amounts. In many countries, opportunities to directly interact with buyers and producers is enhanced. More than 30 platforms are now available for use by bean value-chain actors in target countries. The number grew due to interest from value-chain actors, especially the private sector lead firms at the core of platform establishment. (Table 30).

Table 30. Other achievements under markets:

	Targets	Achieved	2015	2016	2017	2018
Number of business models linking bean farmers to markets	4	5	1	2	2	5
Number of functional platforms	5	28	2	6	8	12
Number of valuechains of processed products analyzed	3	6	1	2	2	1
Number and types of promotion strategies for processed products	4	6	0	1	3	2
Number of business models used to support trade in processed bean products	3	5	0	1	2	2

The next year will focus on enhancing the capacity of platforms to operate sustainable bean enterprises. A number of business models are employed across the bean platforms. Each platform uses at least one model: a buyer-driven, or in some countries, a producer driven model (Ethiopia) or still in others, an intermediation model by organizations or government institutions, for example in Kenya and Uganda examples to guide their bean trade.

PABRA also introduced mobile-based applications to support bean grain trade in collaboration with MasterCard Lab. The application was piloted in the red mottled bean corridor in Uganda, with the private sector partner CEDO as the lead buyer of produce. An initial 17,000 producers digitally registered and 400 farmers piloted the digital trading platform, generating sales worth US\$96,000, indicating great potential. PABRA expects to deepen the scaling of digital trade across Uganda and other countries in 2019. The application allows for replacement of cash payments with mobile payments while also building links with financial institutions, for better inclusion of smallholders and women.

In Zimbabwe, bean farmers are better connected to profitable markets in 2018. After becoming members of bean business platforms, more subsistence farmers are turning to commercial bean production, as a result of networking with bean buyers. Better understanding of market expectations in terms of preferred varieties, quality and grades, as well as low and peak demand periods has been achieved. While a larger proportion of farmers continue to sell via informal channels, it is gratifying to note that prices offered by intermediaries have also begun to improve and are competitive. Perhaps the biggest success story of the bean project has been the renewed belief in beans as a cash crop in Zimbabwe among smallholder farmers. Innovation Platforms and other initiatives have renewed a willingness among farmers to not only grow beans for their nutritional value, but as a cash crop - especially given their long shelf life, ease of handling and processing, and enormous national demand: Currently Zimbabwe is experiencing a national bean deficit of more than 80,000 metric tons.

OUTPUT 3.1.1: Commercial and nutrient dense bean-based products promoted through value chains in seven target countries (three of the countries targeting nutrition and gender sensitive value chains)

Target 2015-19 (a): At least one value-chain per country for processed bean products and in three of the countries, value-chains for biofortified bean products established.

Target 2015-19 (b): One promotion strategy per country for processed products in at least four countries.

Target 2015-19 (c): One model per country in the target countries.

Progress 2015-2018: The number of countries with established value chains for processed nutrient-dense products had increased to nine in 2018 (Table 31).

Table 31. Achievements in value-added products (cumulative):

	Targets	% achieved	2015	2016	2017	2018	Total
Number of countries with processed bean products	7	257	1	2	8	9	18
Number of countries with a promotion strategy	7	242	1	2	5	9	17

The number of countries with promotion strategies has increased over the years (Table 31). A combination of consumer demand and new investment opportunities appear to be driving increased demand for processed bean products, with interest for value-added bean products from private sector and among small and medium-scale enterprises on the rise. This trend will continue, deepening the reach of bean-based products to more consumers. Some of the promotion strategies being used to promote the products include business to business including supermarkets, business to consumer - to direct users - use of special or promotion events such as agricultural shows and exhibitions. In some cases, mass media, such as radio, is used while text messaging and social media are also being evaluated for potential use.

In expanding the access to nutritious products, some small and medium enterprises have introduced new products, others sought to increase the scale of production of the products (Table 32).

Table 32. Processed and nutrient-rich bean products in selected countries:

Value-chain	Products	Country
Precooked bean value-chain	Processed precooked beans (easy to cook beans), dry type	Kenya, Uganda
	Precooked beans, wet type	Rwanda*
	Precooked bean, cooked and frozen type	Zambia
Canned beans	Canned bean products	Kenya, Zambia, Zimbabwe
Bean-based flour	High nutrient bean flour targeting vulnerable and general household consumption	Kenya, Uganda*, Rwanda*, Burundi*, Tanzania, Malawi*, Madagascar
Bean-cereal grain composites	Packed mixtures of bean and other cereals that can be cooked together or processed or milled together by households	Zimbabwe*
Porridge	Porridge derived from bean flour	Zimbabwe, Burundi, Uganda, Kenya and Madagascar

*Includes biofortified bean product value-chains

Five countries launched new products during the year. The diversity of the products increased during the period, for example, canned high- iron bean in Zimbabwe; cooked and frozen beans in Zambia. Some products, such as precooked beans manufactured in Rwanda, are now being exported to Uganda, Kenya and Tanzania, indicating consumer demand for bean foods that are easy to cook.

3.2 Skills and Knowledge Management

Overall project performance

The project has made improvements in tracking results at immediate outcome and output levels. This is credited to improvements the following practices: i) Improved documentation; ii) Use of social media to virtually mentor partners in good monitoring and implementation practices throughout the year; iii) emphasis on reporting against targets and continuous joint review of progress with partners. Results are validated with partners and PABRA outcome (theme) leaders, and these are available in this report. An assessment of the performance of the project towards selected indicator targets at outcome and output level in this phase are presented below.

At outcome level, good progress towards achieving the targets has been made in some indicators, which are already at 100% or above (Fig 20).

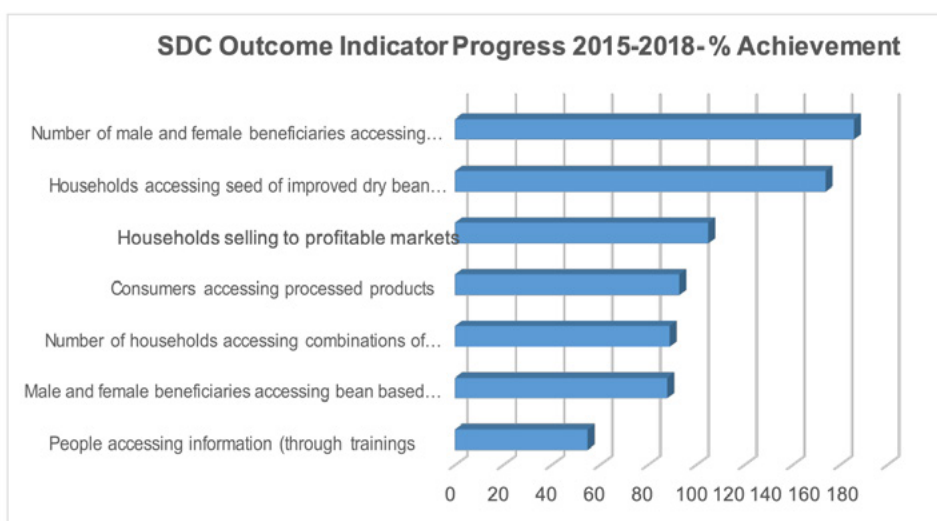


Figure 20: Progress towards meeting the targets in selected outcome indicators, as at 2018

These include: i) Male and female beneficiaries accessing bean-based products; ii) Households accessing seed of improved dry bean varieties, and Integrated crop management and labor saving technologies; iii) Households selling to profitable markets. Other indicator targets should be achieved by the end of the project in 2019. Similarly, at output level (Fig 21), a few indicators are below 100% of the target, where efforts will be ramped up in 2019.

However, most of the targets have already been met.

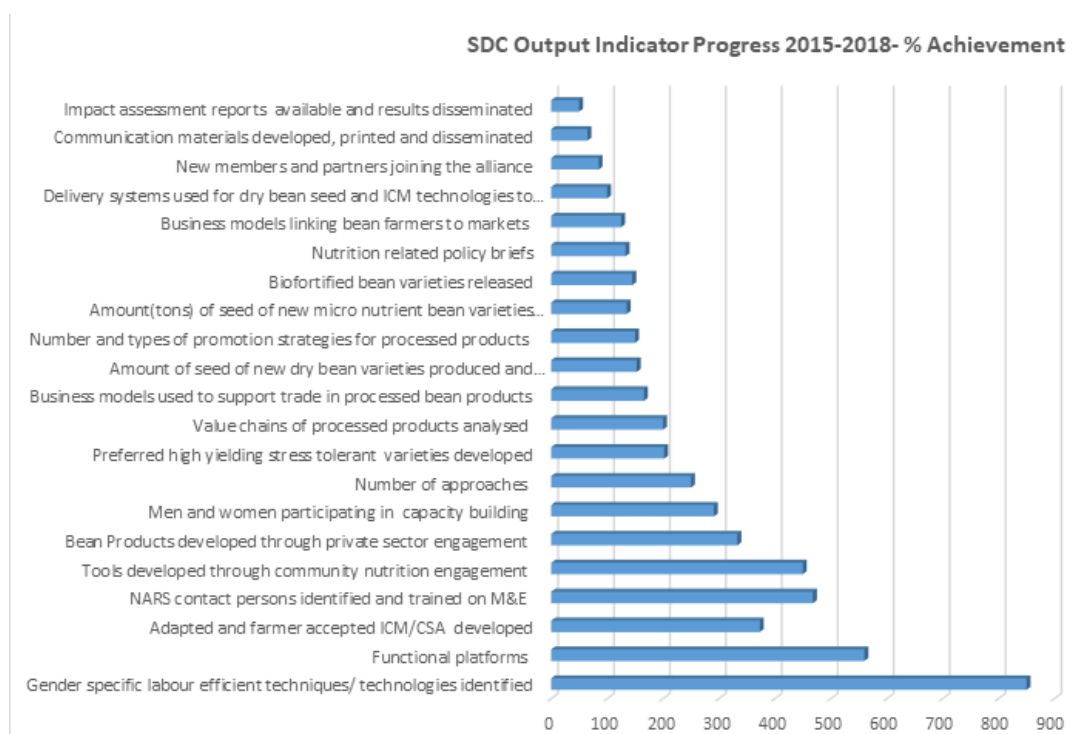


Figure 21: Progress towards meeting the targets in selected output indicators, as at 2018

IMMEDIATE OUTCOME 4.1: Increased access to skills, information and knowledge providing enabling environment for bean research and development

Target 2015 - 2019 (a): 5.2 million beneficiaries of which Trainings – 90,000, websites – 50,000 hits, printed materials – 50,000, demos – 10,000, Electronic media (radio, TV) – 5,000,000.

Target 2015 - 2019 (b): 70% satisfaction (media type & content quality).

Progress 2015-2018: National Agricultural Research Systems, farmers, traders and extension workers, are key recipients of information and skills. The project has a target reach of 5.2 million men and women in the period 2015 to 2019. From 2015 through 2018, the number of people accessing information rose to 2,864,840 - 55% of the project phase target. Out of those reached with information, 51% were women (Table 33).

Table 33. Number of people accessing information (through trainings, printed materials, demos, mass media):

	Progress				Total	Target	% Achieved	% Women
	2015	2016	2017	2018				
People accessing information	43,307	20,084	153,047	2,648,402	2,864,840	5,200,000	55	51

OUTPUT 4.1.1: Women’s participation in research and decision-making bodies of PABRA, and in bean platforms increased/enhanced

Target 2015-19: 40% being women in other organizations other than the Steering Committee.

Progress 2015-2018: In line with PABRA gender strategy, efforts have been made over these four years to influence women participation in decision-making. From 2015 to 2016, women’s presence in leadership positions in innovative platforms was less than 30%, with more women occupying administrative roles such as secretary and treasurer positions. With the introduction of the commodity corridor, we have established business platforms in Rwanda, with 47% of women voted into leadership positions in 2017, influenced by the gender equality

policy in the country. In 2018, we have established and influenced women in leadership positions reaching 50% representation in Cameroon and Zimbabwe. Other countries like Burundi, Madagascar and Tanzania have between 35 - 39% of women in leadership positions. Having women in these leadership positions will give them a voice in the different business platforms and gives them access to information on markets, and training to enable them to make more informed decisions at farm and household level. Presently 43.5% of leadership positions across all countries within business platforms are held by women.

OUTPUT 4.1.2: Capacity of bean value-chain actors (National Agricultural Research System scientists /private sector/farmers traders, processors and consumers) to develop, access and use network products including engagement processes are enhanced

Target 2015-2019: 50,000 men and women participating in various capacity building initiatives (in degree and non-degree) 50% women; At least one tracer study.

Progress 2015-2018: Men and women in the bean value-chain received skills and knowledge in seed production, crop management practices, breeding, bean business formation and facilitation, gender and project monitoring. In the period 2015-2018, recipients of training at both degree and non-degree level, rose to 103,159. This represents a 206% contribution towards the project target of 50,000 by 2019. The biggest number of training beneficiaries are farmers, who receive skills during the course of implementing demonstration plots, fieldwork, fairs and trade shows. Overall 52% of the training beneficiaries are women, however the majority of beneficiaries under traders and extension worker categories (refer to table below) are men (51%) (Table 34). The percentage distribution by category is shown in Fig 22.

Table 34. Number of beneficiaries of capacity building initiatives across PABRA countries (2015-2018):

Category	2016	2017	2018	Total
National Agricultural Research System/Partners/Professional programs	79	265	1,882	2,226
Farmers (Field days, Demo, Trade shows)	9,741	14,527	31,577	55,845
Traders (Platforms/Farmer engagements etc.)	3,311	5,547	12,154	21,012
Extension Workers/Services	584	3,961	8,564	13,109
Others (Don't belong to above category)	5,844	2,113	3,010	10,967
Total	19,559	26,413	57,187	103,159

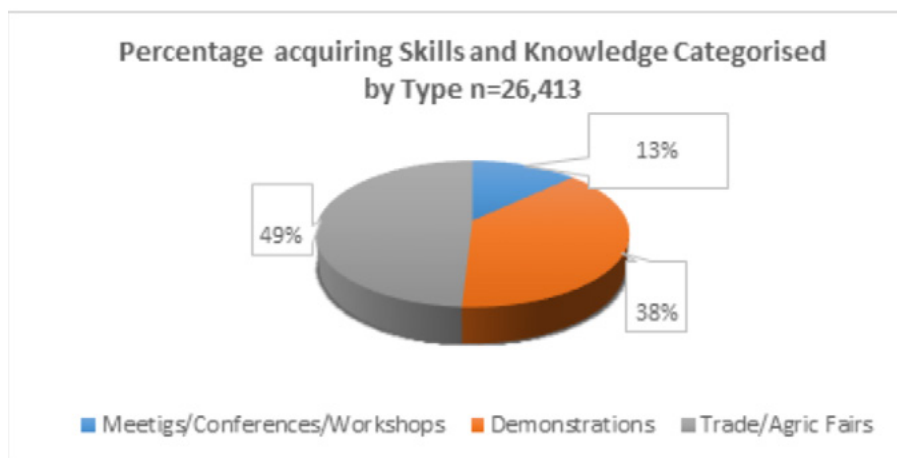


Figure 22: Percentage of number trained by category

OUTPUT 4.1.3: Information and Knowledge products responding to emerging related demands in the PABRA network addressed

Target 2015-2019: Two new web-based applications developed; 100% increase in number of users accessing online products (website, blogs, databases; etc.) 100% increase in number of users accessing print and multimedia communication materials (manuals, posters, handbooks, DVDs etc.).

Progress 2015-2018: The project developed three online information platforms, these are Facebook (with over 484 likes), Twitter (with 1,270 followers), and locally administered WhatsApp groups. These are in addition to the PABRA website and blog posts. The number of blog posts upload grew from two in 2015 to 20 in 2018.

The WhatsApp groups were set up in 2017 to foster facilitation of corridor actors and are actively in use in Uganda, Rwanda, Zambia, Zimbabwe, Kenya and Tanzania. 279 members were interacting on WhatsApp in 2018. In Burundi close to 95% of the discussions on the platform were in the local language- Kirundi. Messages on the WhatsApp groups covered a range of topics, from information on where to find beans, the prices of beans, information on fairs and agricultural shows, discussions on crop production techniques as well as post-harvest practices amongst producers and buyers. The proportion of women participation in the WhatsApp group was 30%.

Between 2015 and 2018, the project supported the development of 65,405 printed information products in the form of banners, brochures, pamphlets, manuals, guides, and flyers (Table 35).

Table 35. Number of printed copies for disseminating information distributed (2015-2018):

2015	2016	2017	2018	Total	Target	% Achieved
1,040	458	25,075	38,832	65,405	100,000	65

OUTPUT 4.1.5: NARS (and value-chain actors) capacity for Monitoring and Evaluation systems are developed inclusively, tested and promoted using Information and Communication Technology tools and in a gender sensitive manner

Target 2015-2019: At least one focal person per country using web enabled Monitoring and Evaluation systems regularly.

Progress 2015-2018: In this phase, the project emphasized digitized data monitoring platforms, with a target of 15 people using digital platforms for data collection. In the project period, we promoted use of digital field books for field trials in 2017. In 2018, we collaborated with NACCRI, CEDO and MasterCard innovation Lab to promote an e-payment application known as 2Kuze. The app can host data collection for tracking data points of interest to the implementing partners. A bean farmer registration form, and a bean production form have been jointly developed on the app and more forms are planned for introduction. In the four-year period, the number of those trained in using the app rose from 67 in 2015, to 183 in 2018.

3.3 Cross-Cutting Elements

3.3.1 Building resilience to climate change

The project integrated various components to build resilience to climate change:

Bean suitability mapping

Previously the project reported on the bean suitability mapping of two highly preferred beans varieties - Lyamungu 90 and JESCA - in Northern Bean Corridor of Tanzania. Using the same approach, the project teams carried out a bean suitability mapping for the yellow bean KAT-B1, for nine countries in east Africa (Fig. 23). The yellow bean is among the most popular bean varieties among consumer for its fast cooking and non-flatulent qualities. It is also preferred by the private sector for making of precooked beans. The mapping showed that the variety is adaptable across Kenya, Uganda, Tanzania, Burundi, Rwanda, Ethiopia, DR Congo and Madagascar, with great potential for large-scale commercialization and cross border trade across the countries in east Africa.

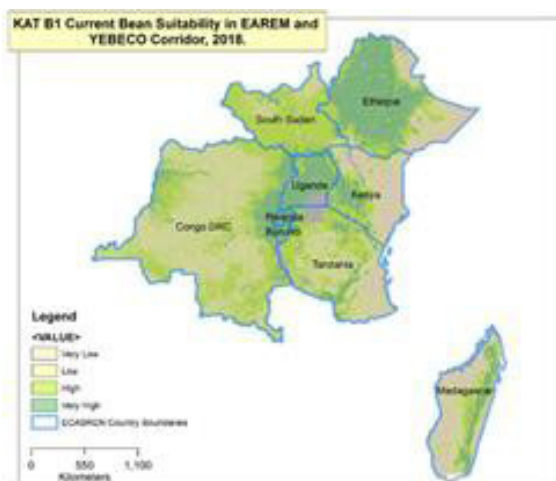


Figure 23: Bean suitability mapping of the yellow bean (KAT-B1) in east Africa.

Climate information services

In Rwanda, bean farmers continued to access climate information provided by the Climate Information Services project by the Rwanda Meteorological Department.

In other countries such as Kenya, the project teams trained farmers to use online weather tools such as AccuWeather (Fig. 24) to get climate information to inform rainfall patterns and farming operations such as when to plant.

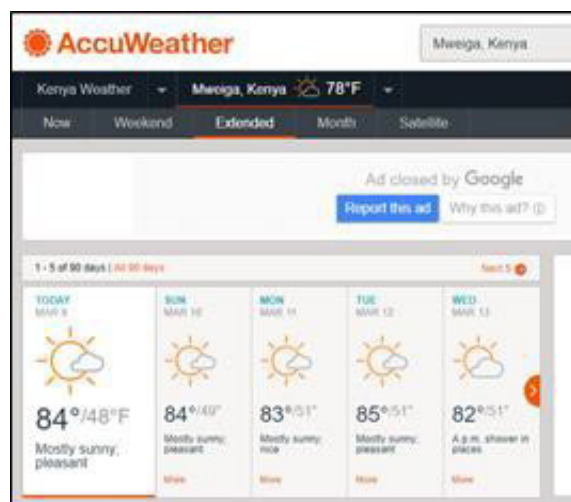


Figure 24: An example of what is seen on the screen when farmers access weather information

3.3.2 Gender mainstreaming across SDC-supported initiatives

Women are primarily the bean producers in Zimbabwe and Burundi. This was generally considered a subsistence crop meant for food, with only excesses sold. Yet bean production greatly reduced because of economic stagnation and political upheaval in both countries. With funding from SDC, CIAT/PABRA and the National Agricultural Research System partners aimed at not only reviving the bean sector, but repositioning women at the heart of bean commercialization.

About 52% of women farmers have been trained in integrated crop management, received high-yielding and stress-tolerant bean varieties; and are at the forefront of bean seed production. For example, Madame Janvier (Fig. 25). She is a seed producer from Musinga, Burundi, and has been able to increase her farm size from 0.5 in 2015 to four acres 2018, increasing seed production from 150 kilograms to 1,850 kilograms respectively. She produces local and improved high yielding bean varieties such as MAC 44, AND10 BIHOGO and KINURE.



Figure 25: Janvier in her 4-acre bean seed production farm

Janvier has been linked to World Vision International through the research institute in Burundi to supply MAC44 - a high-yielding bean biofortified with zinc and iron. Janvier has been able to use the profits from her seed producing business to buy more cows and build a store. She has three temporal employers (two men and one woman) to take care of the cows and work on her bean seed farm. During sowing, weeding and harvesting, she employs about ten hired laborers. She has been able to pay for her children's school fees. Her expectation in the next season is to diversify her bean seed production, by adding G13607 and 1Z0201543 bean varieties, which have a good market price. The main challenges that she faces are accessing stakes for the climbing beans (Fig.25). Staking technologies such as the use of ropes and wires already used in Democratic Republic of Congo, will be introduced in Burundi to overcome this challenge.

Women like Janvier who are seed producers make decisions about what bean type to produce, where to sell and where to invest the proceeds from sales. Usually, women who produce grain mostly lose control over the product during marketing, because the activity is dominated by men. To make sure women are not disempowered as bean commercialization continues, more training and capacity building will be carried out to increase women's farm productivity and link them to buyers who will pay them directly - possibly through e-payments, to make trade transactions more efficient. In addition, efforts will be made to give women more control over the money accrued from their sales. Women's choice of bean varieties has changed over the years, with most preparing and consuming more biofortified beans products. This is due to social learning, sensitization and food demonstrations by CIAT, Harvest Plus and World Vision on the importance of high-iron and zinc beans at the family level, but especially women of reproductive age and girls.

Critical partnerships with organizations like World Vision International, over the years, has not only provided women with loans to invest in biofortified bean production; but also provided a crèche so that women can spend more time on the farm or doing other work as women in turns take care of their children. The crèche also focuses on vulnerable children less than five-years of age, paying special attention to those who are malnourished, increasing food and nutrition security for farm households.

3.4 Emerging Opportunities

3.4.1 Women and youth employment in rural agricultural areas

In Africa today, many young people between the ages of 15-24 are unemployed. Yet this age-group have the potential to transform the African agricultural sector. Despite the tremendous potential the agricultural sector provides, the growing youth population in Africa is turning away from agriculture in rural areas due to drudgery and poor remuneration associated with low-productivity agriculture. Young women especially, in rural areas compared with their male counterparts, also bear the additional burden of unpaid household work. Well-developed bean value-chains can provide employment for young people. To harness such opportunities, the youth need skills in agribusiness entrepreneurship, and innovations that enhance productivity and make bean value-chains more efficient. This requires empowering youth and women to play active roles in business platforms, to benefit from growing business opportunities through public-private partnerships, increasing productivity returns to investment and creating new employment opportunities for the community.

Specifically, there is need to:

1. Foster and enhance women-led and youth-focused networks and engagement in business platforms around entrepreneurship, innovation and agriculture to make the value-chains more efficient.
2. Build the capacity and skills of young entrepreneurs, especially women processors, by providing them with links to a wide range of financial services and private partnerships, to promote their micro, small and medium-sized enterprises in rural contexts.

3.4.2 Mechanization in Agriculture:

Increasingly, beans are gaining importance as a nutritious commodity, and the market is looking for quality grain. Such demand is increasingly attracting farmers' investment in more intensive bean production and more efficient production systems. However, as result of youth migration from rural areas to urban centers, the labor availability at farm-level is becoming limited and more expensive. Very often, farm operations are left to elderly people and women. Therefore, there is an increasing demand and interest from farmers to find labor saving solutions. To respond to such growing demand in the bean sector, there is a need to resolve some critical issues:

- i. In partnership with the private sector, there is need to identify efficient farm machinery and tools that can be adapted to smallholders and emerging commercial farming conditions along the bean value-chains (from ploughing through grain cleaning and sorting).
- ii. Assessing the potential of the private sector-owned business models to provide mechanization services to smallholder farmers.
- iii. Assess to mechanization can spur bean corridor growth and development including job creation along the bean value-chains.

3.4.3 Bean Corridor Approach:

The bean corridor approach aims to economically empower women and youth in rural areas among others, scaling up bean business opportunities. Over the last two years, the potential of the bean corridor model to catalyze production and trade has been demonstrated in several bean corridors. The corridor model was used to accelerate production and market linkages of beans in both Burundi and Zimbabwe. Bean business platforms were used to focus on improved income generation for producers and other value-chain actors. Linking traders and processors directly to producers via bean platforms has incentivized investment in bean value-addition and processing by the private sector, including in Burundi and Zimbabwe, where investors are processing new bean products.

Through the corridor model, women are directly linked to buyers while receiving payments directly rather than going through their husbands or other men. For example, the piloting of digital transactions directly to mobile phones or bank accounts has increased transparency, confidence, ownership, and control of incomes for women bean traders. The corridor model is likely to accelerate employment creation for the youth, piloting new models which do not require youth to own land to produce beans, will be piloted in some countries supported by SDC project over the coming year. Intensification and deepening the corridor model will continue as well as measuring the initial impacts associated with the model in the coming year.

The design of corridors is based on large regions embarking on intensification of production, trade and consumption and thus we see more opportunities in the use of the corridor models to deepen economic benefits and create more job and income opportunities for women and youth. Our vision is to expand the corridor approach to cover more countries within PABRA and beyond.

4 PABRA Work in Media

PABRA bean work has been promoted in various media over the period 2016-2019. Below are links to some of the stories:

Canning industry set for rebound

<https://www.newsday.co.zw/2018/07/canning-industry-set-for-rebound/>

New Bean variety could save Zimbabwe US\$120,000 a month

<https://www.herald.co.zw/new-bean-variety-could-save-zim-us120k-a-month/>

Climate-resilient 'super beans' boost food rations for refugees in Uganda

<https://www.theguardian.com/global-development/2018/jan/24/climate-resilient-super-beans-boost-food-rations-south-Sudanese-refugees-Uganda>

Burundi: Breaking down barriers for beans

<http://www.ciatnews.cgiar.org/2015/11/26/burundi-breaking-down-barriers-for-beans/>

Improved high iron and zinc varieties for better nutrition

<http://www.pabra-africa.org/improved-high-iron-and-zinc-bean-varieties-for-better-nutrition/>

How Africa can capitalize on the Pulse and Oilseed Market Boom

<https://allafrica.com/stories/201810030716.html>

Grandmother inspires better future for Kenyan bean farmers

<https://www.zilient.org/article/opinion-grandmother-inspires-better-future-kenyan-bean-farmers>

Market-based approaches to address food and nutrition security

<http://www.kenyanews.go.ke/market-based-approaches-to-address-food-and-nutrition-security/>

"White gold" beans to beat drought in Ethiopia

<https://reliefweb.int/report/ethiopia/white-gold-beans-beat-drought-ethiopia>

Building partnerships to fight malnutrition

<http://www.pabra-africa.org/building-partnerships-fight-nutrition/>

New, improved bean varieties enhance food security and diet diversity in Malawi

<http://www.pabra-africa.org/new-improved-bean-varieties-enhance-food-security-diet-diversity-Malawi/>

Transforming Landscape and Doubling Incomes

<http://www.pabra-africa.org/transforming-landscape-doubling-incomes/>

Publications:

Report of Burundi seed producers learning visit to CEDO (June 17th – 20th, 2018): <https://hdl.handle.net/10568/96621>(Report)

Adoption and impact of improved bean technologies among the bean growing households in Southern Highlands of Tanzania <http://hdl.handle.net/10568/96888> (Datasets)

Training beneficiaries in the PABRA Project: <http://hdl.handle.net/10568/96246> (Dataset)

Genomics, genetics and breeding of common bean in Africa: A review of tropical legume project: <http://hdl.handle.net/10568/92822> (Journal Article)

Selian Agricultural Research Institute (SARI) Released Seven (7) Improved Common Bean Varieties January 2018: <https://hdl.handle.net/10568/91023> (report)

The effect of climbing bean adoption on the welfare of smallholder common bean growers in Rwanda: <http://hdl.handle.net/10568/90583> (Journal article)

Variety selection and seed quality management in grain legume cultivation <http://hdl.handle.net/10568/98307> (Book Title)

Fighting Iron Deficiency: New Improved High-iron and Zinc Beans Released in Tanzania <http://hdl.handle.net/10568/91724> (Brochure)

Replication Data for: Consumer demand heterogeneity and valuation of value added pulse products: a case of pre-cooked beans in Uganda: <http://hdl.handle.net/10568/98452> (Datasets)

The history of gender and plant breeding in CIAT/PABRA: where are we? And where are we going? <https://hdl.handle.net/10568/97768> (Report)

5 Conclusion

The project has made significant progress towards achieving the set targets in the PABRA frame work across all countries. In some indicators, at outcome and output level, progress to-date has exceeded 100% of the targets set at the start of the project. In particular, and despite the political, economic and environmental challenges in the flagship countries, Burundi and Zimbabwe, the project has made major progress in reviving the bean sector. This has been possible through strong collaboration with the national bean program and local partners, including the private sector in the bean value-chains as the main drivers of the desired growth.

Rapid progress was made in release of adapted consumer and market preferred varieties, and scaling out the technologies to reach end-users. This is due in part to foundations built by previous SDC investment, as well as complementary support from other funding partners among them Global Affairs Canada and the Bill and Melinda Gates Foundation.

Greater focus is now being placed on promoting production and productivity of beans by smallholder farmers themselves. They are also better linked to markets, improved varieties, and information about the nutritional benefits of beans for nutrition.

PABRA's adoption of the Bean Corridor Approach is helping to strengthen linkages along the whole bean value-chain, through production, distribution and consumption. While encouraging more private sector participation and investment, such partnerships also address key challenges to unlock the full potential of the bean sector, to

