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International Center for Tropical Agriculture
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Market intelligence in bean program/PABRA

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WP refocus--(Common bean)
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Cali Campus, 13th Feb, 2023

CGIAR

Several constraints to bean production (Bean atlas, 2020)



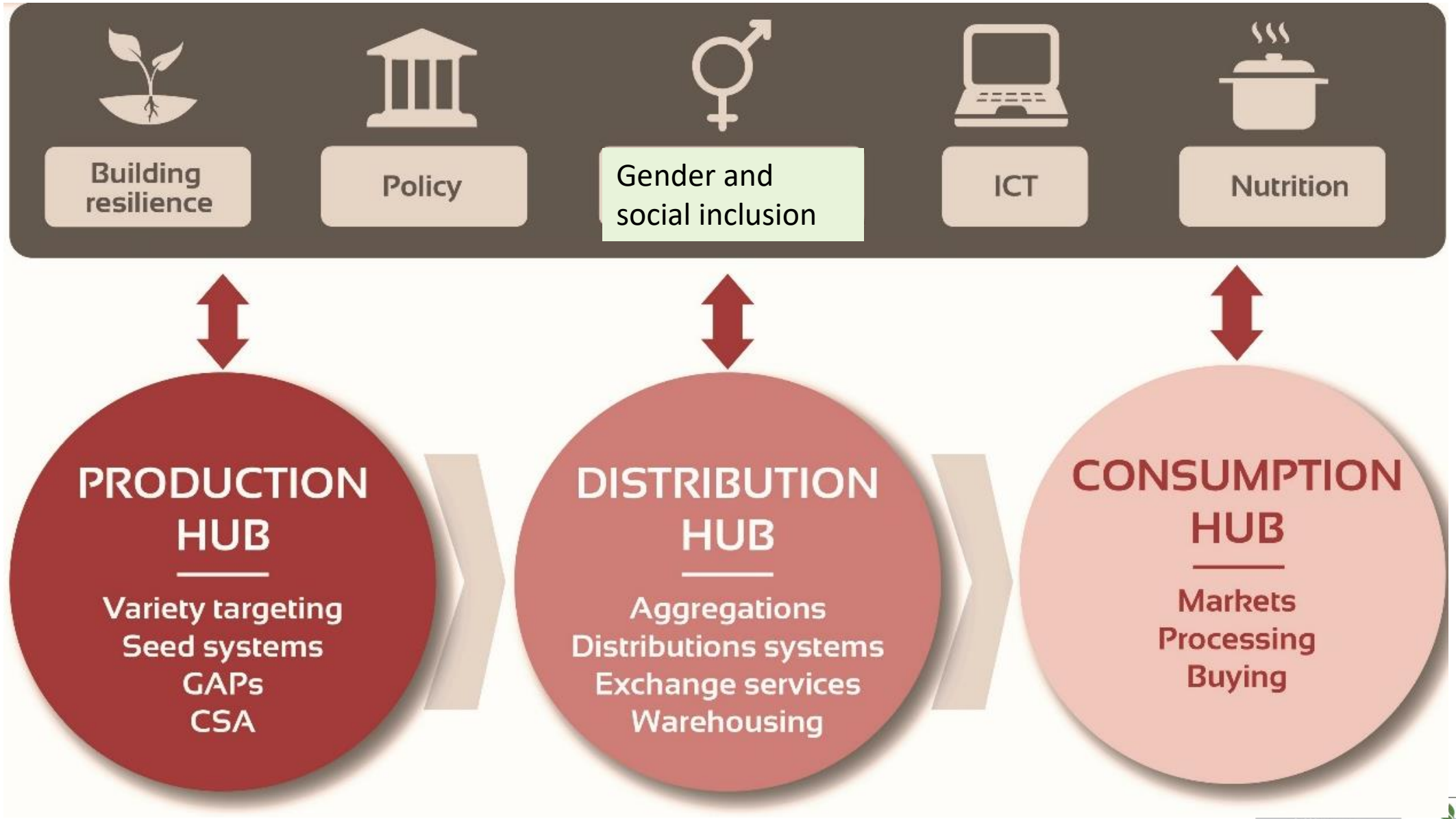
Table 1 Percentage of bean area under each cropping systems

Cropping systems	Eastern	Southern	Western
Maize intercrop	45.3	39.6	25.9
Sole cropping	30.0	51.6	64.8
• Root tuber intercrop	7.4	1.9	5.9
• Banana intercrop	6.5	2.0	1.2
• Sorghum	3.6	0.8	0.9
• Coffee banana intercrop	3.3	0.0	0.0
• Coffee intercrop	3.0	0.3	1.0
• Others intercrops	0.9	3.9	0.5
Total	100.0	100.0	100.0

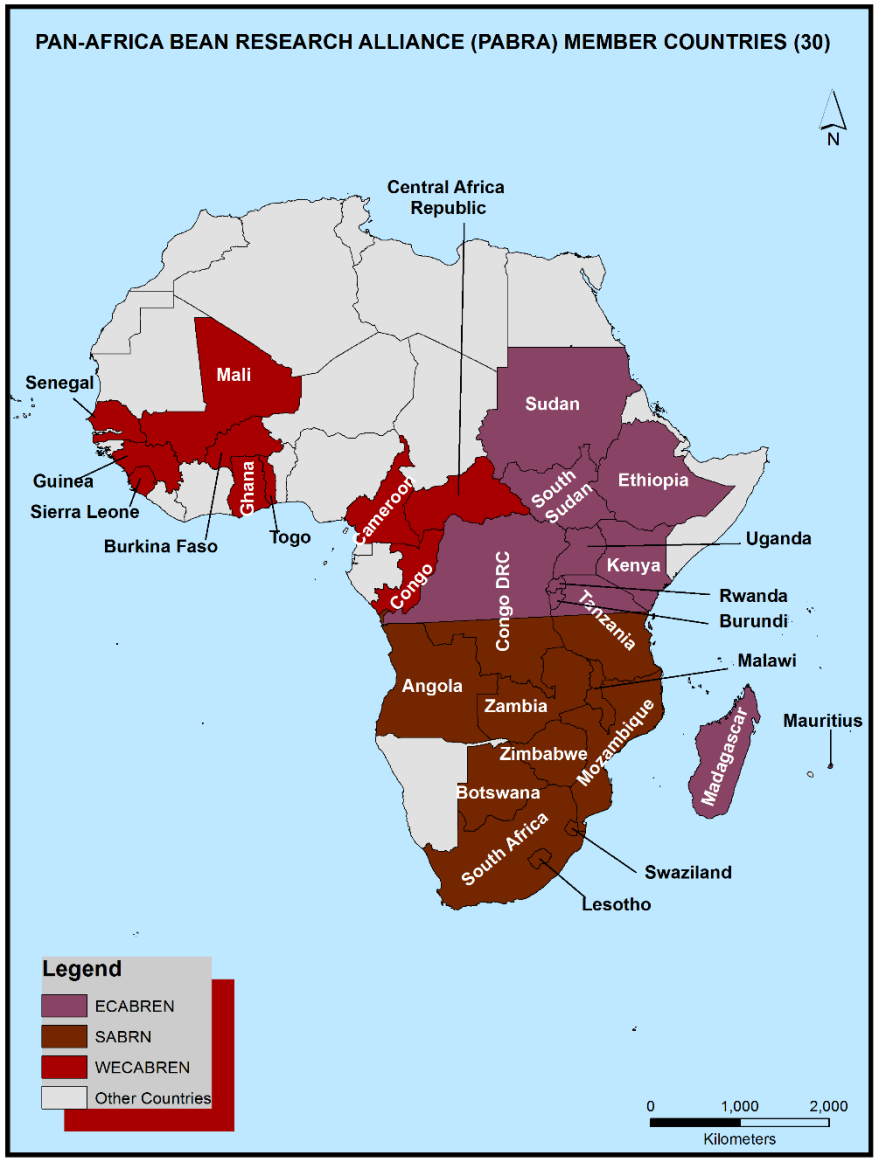
Varied Bean products drive breeding objectives.

- Canning, Pre-cooked (wet or dry), Bean flour products (porridge, baking etc.), Fresh pod, Fresh beans, Dry beans

PABRA Bean Corridor Approach



PABRA member countries 30



PABRA
Pan - Africa Bean Research Alliance
Better Beans for Africa

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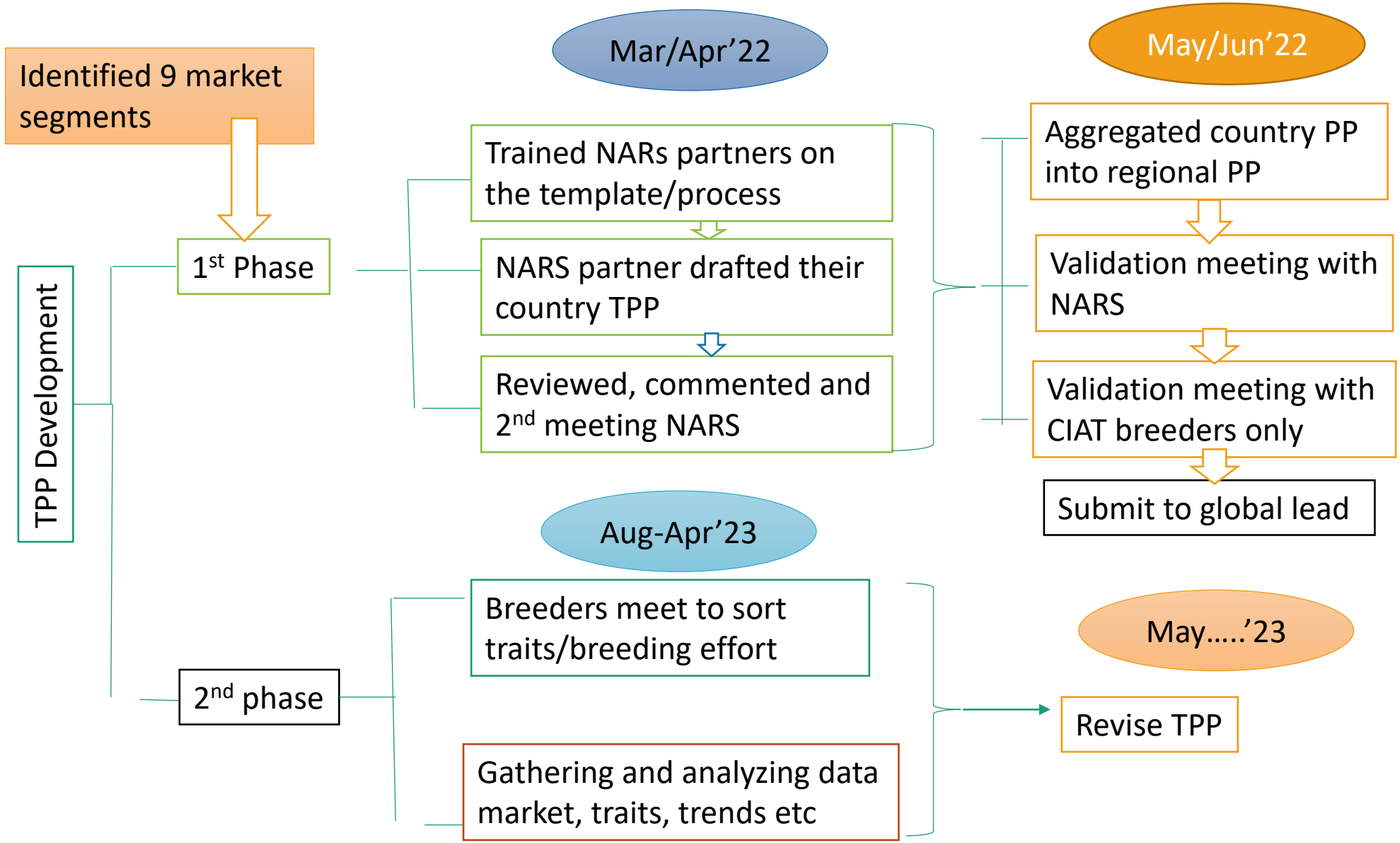
Identified 9 market segments
TPP Development
1st Phase
2nd phase
Mar/Apr'22
Trained NARs partners on the template/process
NARS partner drafted their country TPP
Reviewed, commented and 2nd meeting NARS
Aug-Apr'23
Breeders meet to sort traits/breeding effort
Gathering and analyzing data market, traits, trends etc
May/Jun'22
Aggregated country PP into regional PP
Validation meeting with NARS
Validation meeting with CIAT breeders only
Submit to global lead
May…..'23
Revise TPP

Market segmentation for common bean varieties

Market Segment Description	Agro-Ecological Zone(s) in the market segment	Countries targeted by pipeline	Breeding pipeline	Pipeline name and description.	Total Ha targeted by pipeline
1. Medium and large seeded bush beans for East Africa	Low and mid altitude areas	Burundi, Kenya, DRC, Ethiopia, Rwanda, N&W Tanzania, Uganda	**Breeding pipeline 1: Medium and large seeded bush beans** **Must Have traits:** High SeedFe, Fast cooking, High yield **Value added traits:** disease resistance to ALS, root rot, BCMV Anth resistance, Drought, Poor soil tolerance, Medium-early maturity Canning quality, color retention, Bruchid and BSM resistance	Medium and large seeded bush beans adapted to the low and mid altitude areas. These have high commercial value and often have a short growing season, making them suitable for many cropping niches where other species do not fit. Resistance to both biotic and abiotic stresses are being incorporated.	Burundi: 201,300; Ethiopia: 144,780; Kenya: 1,004,087; Rwanda: 192,281; Tanzania: 996,000; Uganda: 600,000; DRC: 385,611; Total: 3,524,059
2. Medium and large seeded bush beans for Latin America and the Caribbean		Colombia, Ecuador			Colombia: 34,688; Ecuador: 9,602 Total: 46,202
3. Medium and large seeded bush beans for southern Africa		Malawi, Zambia, Zimbabwe, Mozambique, RSA, Eswatini, Botswana, Southern Tanzania, Madagascar, Angola			Malawi: 322,448; Zambia: 91,000; Zimbabwe: 33,200; Mozambique: 69,073; RSA: 47,144; Madagascar: 32,000; Angola: 710,698: Total: 1,305,563
4. Medium and large seeded bush beans for West Africa		Cameroon, Togo			Cameroon: 199,563; Togo: 155,530: Total: 355,093
5. Climbing beans for East Africa	Mid and high altitude areas	Burundi, Kenya, DRC, Ethiopia, Rwanda, Tanzania and Uganda,	**Breeding pipeline 2: Climbing beans** **Must Have traits:** High SeedFe, Fast cooking, High yield **Value added traits:** disease resistance to ALS, root rot, BCMV Anth resistance Drought, Poor soil tolerance, Medium-early maturity Canning quality, color retention, Bruchid and BSM resistance	Climbing beans adapted to the mid and high altitude areas. These are labor intensive but have high yields, and are an important option for intensifying agricultural production where land is limiting.	Burundi: 359,900; Ethiopia: 3,810; Kenya: 11,675; Rwanda: 302,988; Tanzania: 12,000; Uganda: 320,000; DRC: 19,043; Total: 1,029,416
6. Small seeded bush beans adapted for Latin America and the Caribbean	Low and mid altitudes with heat and drought tolerance	Honduras, El Salvador, Nicaragua, Guatemala, southern Mexico, Venezuela, Haiti	**Breeding pipeline 3: Small seeded bush beans** **Must have traits:** Drought tolerance, High Fe and Zn content Poor soil tolerance **Value added traits:** Bruchid and BSM resistance, heat tolerance, , disease resistance: BCMV, Rust, CBB resistance, Canning quality	Small seed bush beans adapted to low and mid altitudes with heat and drought tolerance. These beans are often cultivated in the most difficult environments, especially with regard to abiotic stress of drught, high temperature and soil contraints. Abiotic stress tolerance is high priority in new varieties, as well as biotic stress resistance.	Ecuador: 2,401; El Salvador: 110,679; Guatemala; 263,659; Haiti: 262,309; Honduras: 167,574; Mexico: 482,958; Nicaragua: 229,465 Venezuela: 61,632; Total: 1,721,881
7. Small seed bush beans for East Africa	Low and mid altitudes with heat and drought tolerance	Ethiopia, DRC, Rwanda, Kenya, Burundi, Uganda and Tanzania			Burundi: 18,300; Ethiopia: 224,790; Kenya: 40,864; Rwanda: 58,267; Tanzania: 12,000; Uganda: 30,000; DRC: 47,606; Total: 431,827
8. Small seeded bush beans for southern Africa	Low and mid altitudes with heat and drought tolerance	Republic of South Africa, Zimbabwe, Malawi, Zambia, Mozambique, Madagascar			Malawi: 6,972; Zambia: 2,000; Zimbabwe: 6,000: Mozambique; 34,536; RSA: 11,860; Madagascar: 32,000; Angola: 133,256; Total: 226,624
9. Small seed bush beans adapted to West Africa	Low and mid altitudes with heat and drought tolerance	Ghana, Cameroon			Cameroon: 15,351; Ghana: 126,953; Total: 142,304

	Target Product Profile					
Market Segment Description	Medium and large seeded bush beans for East Africa					
	Beans, ESA, EAF, Medium and large seed, Red/red mottled & sugar, Low & Mid altitude, Bush, Rainfed, Early					
Crop	Beans					
One CGIAR Region	East Africa Southern Africa					
One CGIAR Sub Region	East Africa					
Countries	Burundi: 201,300; Ethiopia: 144,780; Kenya: 1,004,087; Rwanda: 192,281; Tanzania: 996,000; Uganda: 600,000; DRC: 385,611;					
Hectares in ONE CGIAR sub region	3,524,059					
Material Type	Variety					
Biological Region/Eco System	Low and mid altitude areas					
Growing season	Burundi: (March-July); Ethiopia: (June-October); Kenya: (March-May); Rwanda: (September -December and March-May); Tanzania: (March-May) Uganda: (March-May and September-December); DRC: (February-May and September-December)					
	Trait	Scale	Min Score	Trait requirement	Improve trait	Threshold trait
Color	Red/Red mottled/sugar /yellow/kablanketi/white/brown	Varied, however red mottled commands 30% of current market share followed by sugars, reds and lastly the yellows	Varied, the types all require the same traits and farmers do switch among them based on the strength of a trait in any one of them e.g, taste, cooking time, yield etc.	Essential		Y
Processing traits	Color retention (Color retention after canning/ precooking process)	Color before and after canning/ precooking process the same	>=local check (e.g CAL96)	Nice to have		
	Canning quality	1 to 5	>= 4 Montcalm (human panel)	Nice to have		
	Non darkening/bronzing	Time taken to bronze	<commercial checks	Nice to have		
Consumption traits	Fast cooking (reduction in cooking time) for dry grain	cooking time in min	30% < commecial checks in ECA in specific market group	Essential	Y	
	Taste	1 to 5	>=4 on Sensory analysis scale	Essential		Y
	Seed brilliance	shiny or dull	Shiny and vibrant color	Nice to have		
	Grain swelling on cooking	% volume gain on cooking	>= 30% Volume gain after cooking	Nice to have		
	Soup thickness	Thick or light soup/broth after cooking	Thick soup/broth	Nice to have		
	Soup colour/post-cooking colour	Dark brown or transluscent soup/broth after cooking	Dark brown/reddish colour post-cooking	Nice to have		
	Soft bean coat after cooking	Soft or hard coat post-cooking	Soft bean coat post-cooking	Nice to have		
	Shelf life after cooking	hours under room temperature	>=24 hrs before beans go stale post-cooking	Nice to have		
Nutritional Enhancement Traits	Iron (Fe) grain content	mg per Kg	20-30%> commercial checks in specific grain classes	Essential	Y	
	Zinc (Zn) grain content	mg per Kg	10%> commercial checks in specific grain classes	Essential	Y	
Yield	Gain yield (t/ha)	tons/ha	10%> commercial check (850-1500kg/ha); in specific grain class	Essential		Y
	Yield under drought conditions (drought tolerance)	tons/ha	Yield> commercial check in specific grain class under drought conditions (200-500kg/ha)	Nice to have		
	Yield under excessive rains	tons/ha	Yield> commercial check in specific grain class under excessive rainfall coinditions (100-500kg/ha)	Nice to have		
	Yield under low fertility (Low soil fertility (Low P) tolerance)	tons/ha	Yield>commercial check in specific grain class under low soil fertility conditions(200-500kg/ha)	Nice to have		
	Seed density	gms per 100 seeds	>35gms per 100 seeds	Essentail		Y
Agronomic traits	Early maturity	Days afer planting (dap)	= < 75 dap (RWR2245)	Essentail		Y
	Uniform Maturity	Percent	50% of fully developed pods reach physiological maturity at the same time	Nice to have		
Disease traits	Angular leaf spot resistance	1 to 9	<4 on the Disease severity scoring scale (presence of Phg2 gene); Bench marks: RWR22245, RWR2154, NAROBEAN3/MOORE8802, KATB1, JESCA, SAB713, Nyota)	Essentail		Y
	Anthracnose resistance	1 to 9	<4 on the Disease severity scoring scale; presence of Co4 and Co5 genes; Bench marks: RWR22245, NABE15 NAROBEAN3/MOORE8802, KATB1, JESCA, SAB713, Nyota	Essentail		Y
	Bean common mosaic virus / Bean common mosaic necrotic virus resistance	Presence of bc3 gene	Presence of bc3 gene	Essentail		Y
	Root rot resistance	1 to 9	<4 on the Disease severity scoring scale; Bench marks: RWR22245, RWR2154, NABE14, NAROBEAN3/MOORE8802, KATB1, JESCA, SAB713, Nyota	Essentail		Y
	Common bacterial blight resistance	1 to 9	<4 on the Disease severity scoring scale; Bench marks: RWR22245, RWR2154, NABE14, NAROBEAN3/MOORE8802, KATB1, JESCA, SAB713, Nyota	Essentail		Y
Parasitic weed traits						
Insect traits	Bruchid resistance	Presence of arcelin gene	Presence of arcelin gene	Nice to have		
	Storage pest resistance	% damage	< = benchmark variety	Nice to have		
Production/Multiplication Traits	Bean seeds in pods		number of bean seeds in pods	>4	Essential	Y
Key Competitive Products	NABE 14; Selian 13; KAT B1; CODLMB003; Nyota					

Market data: what do we capture?

- Develop a stakeholders map and use it to assess customer profiles along the value chains
- Compile and analyze consumer preferences and buying behaviors
- Underlying factors that motivate preferences, buying and consumption behaviors
- Use patterns (i.e. consumption, export, processing, etc) of bean types
- Consult with farmers on
  - production context (patterns in production systems)
  - trait preferences in existing variety choices (what is liked and disliked)

WHO is consulted in the Bean corridors?

Production hub		Distribution hub			Consumption hub
Input supply	**Production**	**Aggregator**	**Trading**	**Processing**	**Consumption**
Seed , companies, enterprises Union	Farmers (indiv., group)	Aggregators Union/coops	Retailers Exporters	**Small scale**: street vendor and restaurants **Large scale** processor (exporter)	Rural households Urban households Restaurants, schools, prisons

Facilitators	Local extension offices, Trader assoc., local commercial officer, BoA,

Example of the Checklist: seed company (Ethiopia)

	Guiding Question	Remark
1	Varietal choice	
	Mention the types of beans you multiply for seed by name (variety, local name) and colour- which are the dominant in order of importance (amount multiplied)	[ENUMERATOR: Probe for the bean types below, what is most stocked, most expensive etc.] 1. Yellow beans, 2. Sugar beans (Speckled) 3. Red mottled beans, 4. Red Kidney Beans 5. Large White bean 6. Black beans 7. Cream beans 8. Small red 9. Small white]
2	Trait preference (trait: colour, cook ability, taste, …)	
	Which particular bean variety traits do your buyers (producers) look for in bean seeds when buying from you? Why? Which market (geographic producers)?	[Enumerator: during discussion, try to establish why the trait mentioned is important and which market segment demonstrates that preference. Probe consumers even more for culinary (cooking) bean traits they prefer]
	Mention bean traits you usually go for when deciding to multiply bean seeds? Why?	
	Which variety specific challenges are you encountering in the handling (multiplying, storing, transporting, …)	
	Which improvement in the bean commodity (Given variety traits in the market and available beans) would increase the demand for a particular variety?	
	What do the farmers not like about the beans you sell (UNDESIRABLE TRAITS) that if improved, they would increase their DEMAND?	[Enumerator: 1. Capture these per variety/bean type, 2. ask some of the concerns raised by the buyers about this bean type (where possible try to get variety names
	Employment in the beans value chain	
3.0	Of the total quantity of beans seed harvested, which percentage is sold by variety?	
3.1	In an event that you are dealing in seeds of other crops, please state the proportion/ percentage of the bean farming/trading that is taken up by your seed business	What is the share of bean seeds from total seed business? Ask for explanation for lower, higher or medium proportion
3.2	What is the annual transaction of common bean seed in your business (in MT)	
3.3	How many employees/workers do you employ in your bean business ? (Cleaning, sorting/grading, packaging, loading, unloading, transportation, shop keeping, ...)?	
3.4	Specify employed people by income category (Rich, Medium, Poor)	
	Rich ….%	
	Medium …. %	
	Poor ….. %	

3.5	What is the proportion of men and women workers engaged by each one of the operation	
	Cleaning (total | Male vs Male)	
	Sorting/Grading (total | Male vs Male)	
	Packaging (total | Male vs Male)	
	Loading and unloading (total | Male vs Male)	
	Transportation (total | Male vs Male)	
	Security guards (total | Male vs Male)	
	Warehouse (renting, …) (total | Male vs Male)	
	Sourcing (agents/brokers)	
	Shope keeping	
	Other	
3.6	Which of the following categories of buyers buy beans from you and in which percentages?	
	(b1) Retailors……%,	
	(b2) Aggregators……%,	
	(b3) Coop. Unions……%,	
	(b4) Exporters ……%,	
	(b5) Brokers/ middlemen ……%	
	(b6) Processors ….%	
	(b7) Vendors …%	
3.7	How many employees/workers do you employ in your bean business (production (land preparation to storage) and selling (Transporting and marketing) of beans)?	
3.8	Of these employees, how many are men……., women……., youth……., people with disabilities……	
3.9	Specify employed people by income category (Rich (%), Medium (%), Poor (%))	
3.10	How many other bean grain traders do you think operate in your district? Town?	Local government
3.11	Can you disaggregate them by gender percentage?.....%men……% women……..% youth	Local government
3.12	Can you disaggregate them by scale of business?.....% Large Scale traders ……..% Medium Scale ……% Small Scale Traders (Retailers)…… % Processors ……% exporters(formal) ……% Exporters(informal)	Including ECX and Local government
3.13	Where do you get the bean seed for your business? In what proportion	
	Own …..%	
	Resarch …%	
	Producers….. %	
	Retailers …..%	
	Collectors ….%	
	Other (specify) … %	

Value chain actor	Challenges with current varieties	What consumers dislike about the bean they buy	What should breeders improve to help your business
small-medium scale	➢ postharvest handling	✚ long cooking time beans	• shorter cooking time, weevil resistance
		✚ highly priced beans (yellow beans)	
		✚ light soup as it requires a lot of spices	
large scale aggregators		✚ Discoloration of grain	
Exporters		✚ Inconsistency in color, size and shape	• shorter cooking time, thick soup
Institutions such as schools and prisons	➢ storage weevils		• short cooking time to save fuel, improved taste
			• quick maturing varieties to address scarcity issues
Restaurants		✚ hard coats that consume a lot of fuel to cook	• thick soup, with native taste like that of nambale and Kawula
			• short cooking time,
seed companies		✚ very light soup (e.g yellow bean)	• Breeders not rush to produce many varieties that are not distinct.
		✚ take too long to cook (e.g black beans)	• Names of varieties should be continuous like NABE 1-19
		✚ Small size beans (not preferred by schools and prisons)	
		✚ spreading characteristics--for intercropping systems	
Processors	lighter soup	• some varieties require high temperature	• Develop varieties with soup like that of Nambale/red mottles in Masavu
Farmers	flooding/drought, high price of seed, poor soils	• High tasty beans, good colour (yellow), fast cooking	• Adaptability to flooding, varieties highly demanded on the market, resilient and high yielding

customer analysis along the bean value chains in Uganda:

Customer	Desired traits	Market size (#people)	Growth Potential	Sex	Motivation/ buying behaviour
1.Middle/High income & consumers	**Shorter cooking time** Sweet taste, softness	3,053,250	moderate	♂♀	Health, Convenience
2.Low income household consumers	**Shorter cooking time**, Soup thickness, Larger grain sizes, good taste, **Softness** , **Swelling grains**	13,242,300	High	♂♀	Saving, food security
3.Low end Restaurants and fast foods	**Shorter cooking time**, Larger grain size, Soup thickness, **Sweet taste, softness, Swelling grains**	11,062,500	High	♀	Profits
4.Lower Income schools	**Shorter cooking time**, Larger grain size, Soup thickness, **Swelling grains**, Soup color, **Resistant to storage pest attack**, Softness	7,500,000	High	♂ ♂	Saving, buying bulk
5.Prisons	**Shorter cooking time, Resistant to storage pest attack, Softness**	55,200	Low	♂	Saving, buying bulk

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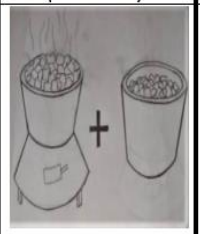
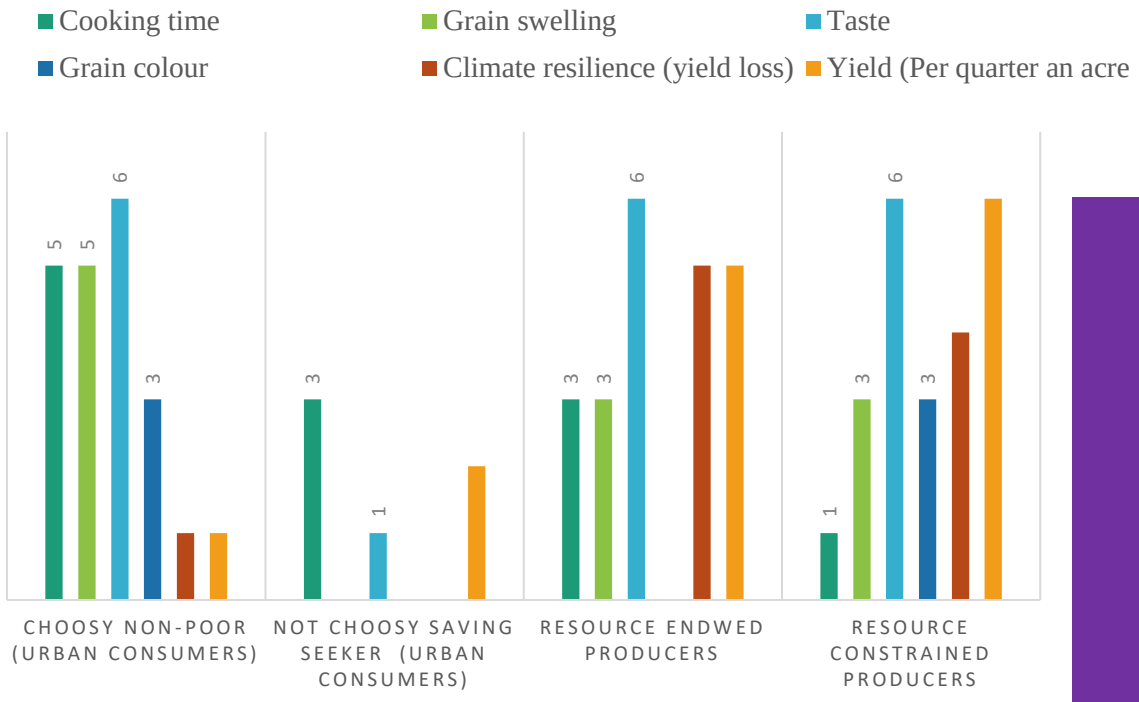
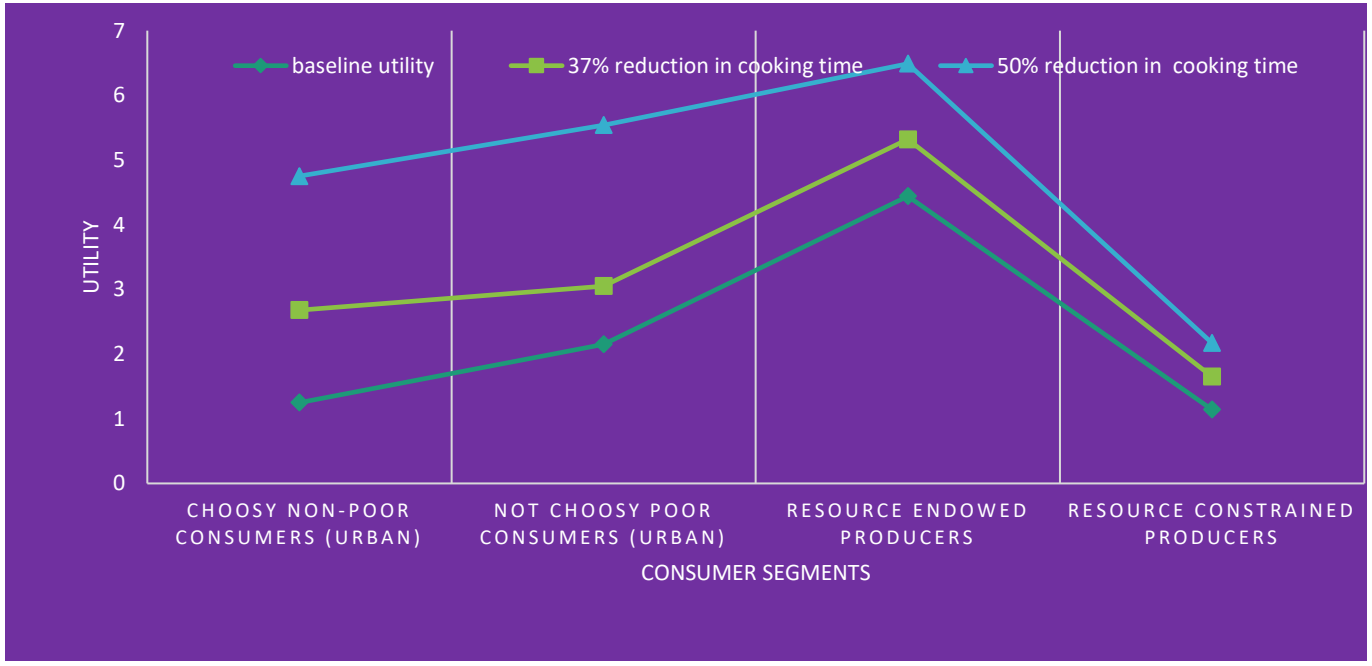
Choice task example

Choice Set 7							
	Attributes						
	Cooking time (Minutes)	**Taste**	**Swell on cooking**	**Grain color**	**Climate resilience**	**Yield**	**Price**
Option A							
	60 Minutes *(1 stoves)*	Somehow tasty	Swell	Red	Not resilient *(More than 30% YL)*	60kgs /0.25acre	0% increase
Option B							
	90 Minutes *(1.5 stoves)*	Not tasty	Don't swell	White	Resilient *(Less than 10% YL)*	150 kgs /0.25acre	30% increase
Option C	Neither option A or Option B, I prefer the beans I am currently consuming and at their prices						

Bean trait Preference and demand analysis in Uganda



Utility from reduced cooking time



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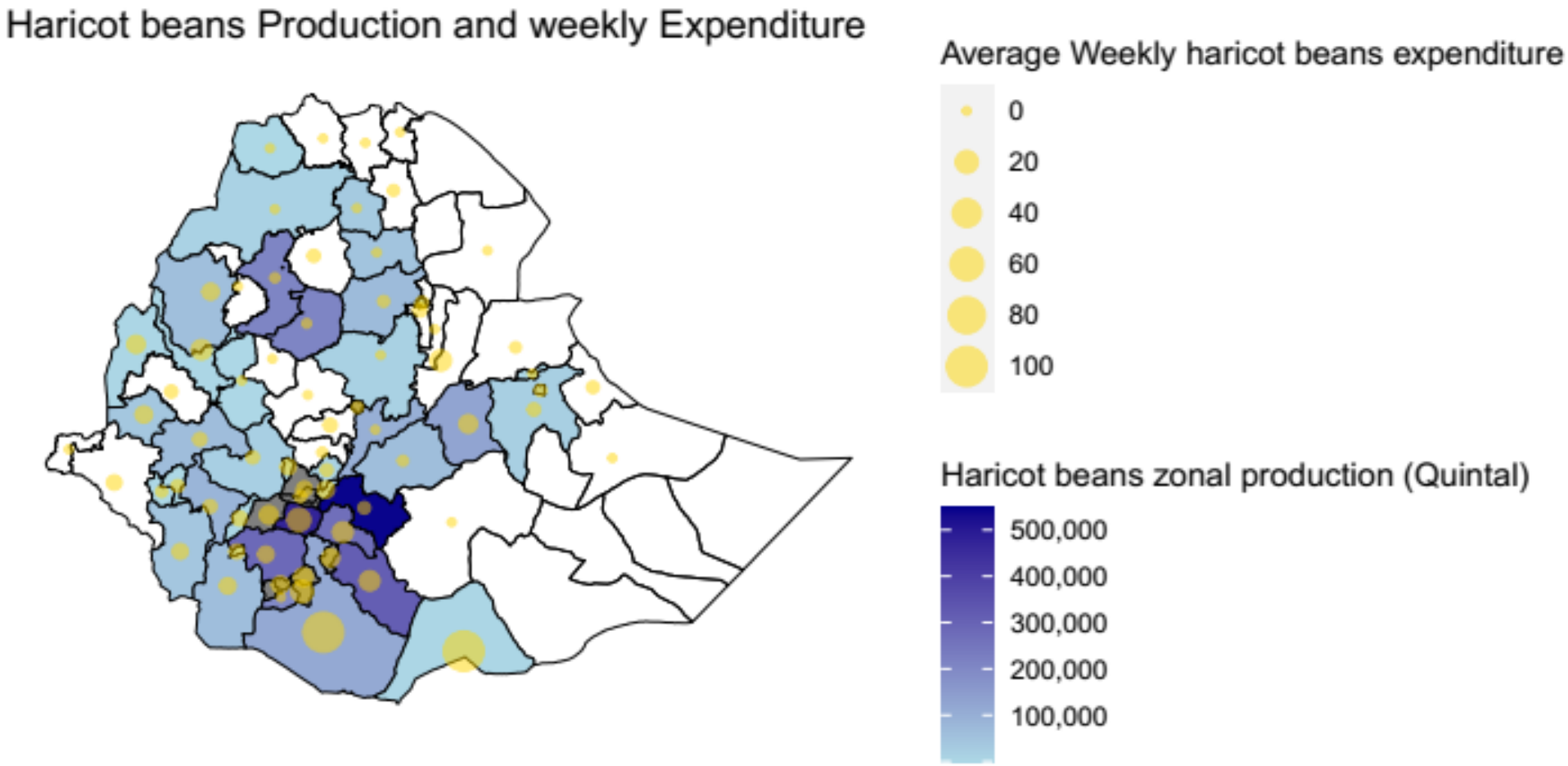
Potential benefits for investment in key traits. Reduced cooking time

- potential cost saving with faster cooking beans at 30% reduction

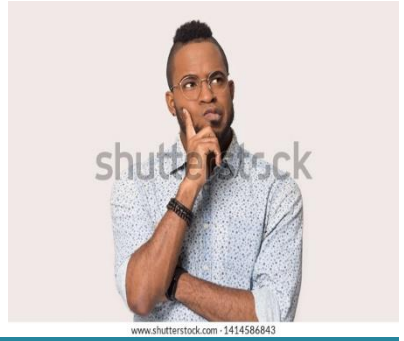
Country	Population	Quantity of dry beans consumed (tons) per year	cost of cooking dry beans per year (USD)	Potential cost saved (USD) from reduced cooking time beans
Burundi	12,000,000	378,000	525,420,000	183,897,000
Kenya	53,771,296	639,878	889,431,007	311,300,852
Tanzania	59,734,218	851,213	1,183,185,523	414,114,933
Rwanda	12,952,218	316,423	439,827,533	153,939,637
Uganda	45,741,007	823,338	1,144,439,995	400,553,998
Total for five countries	**184,198,739**	**3,008,852**	**4,182,304,058**	**1,463,806,420**

Benefits: Cost saving for consumers, healthy benefits—reduced inhaling smooth, environmental benefits----reduced tree cutting

Common Bean Production and Consumption Map.. Ethiopia

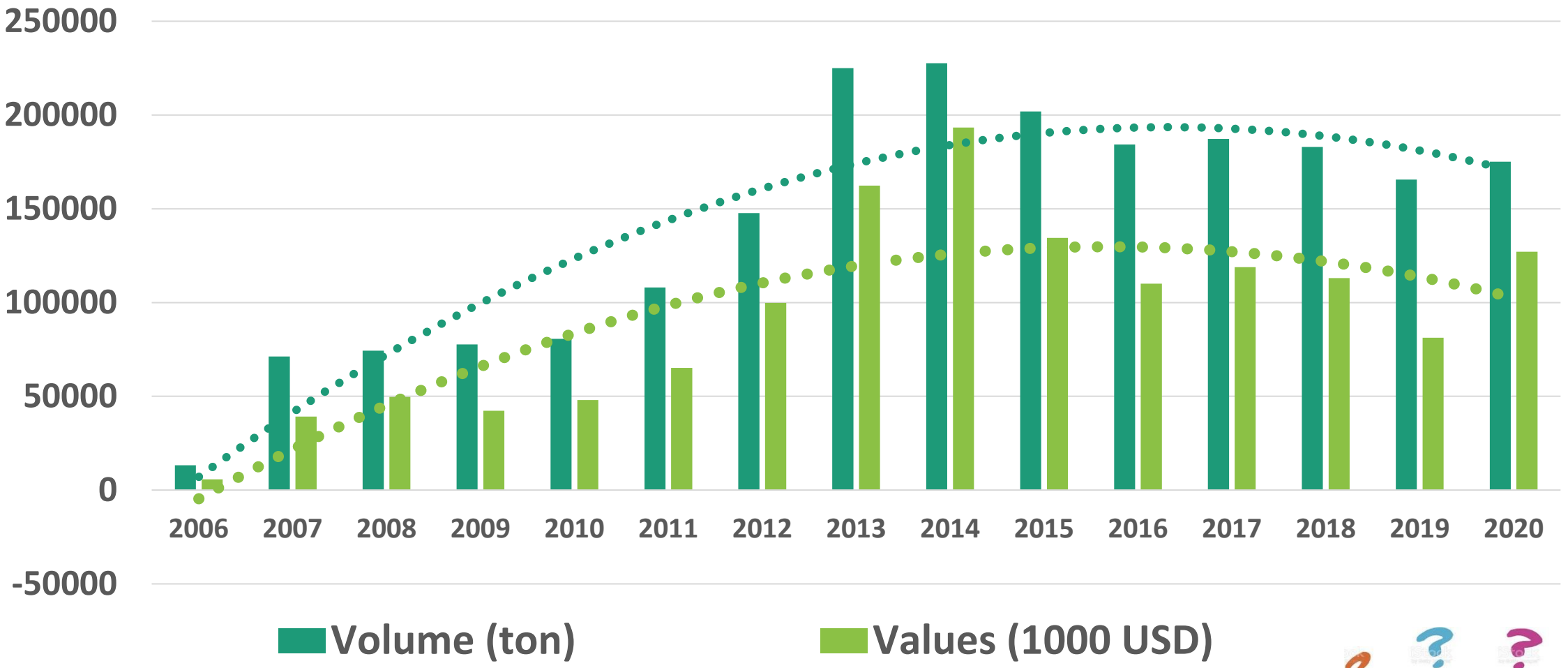


Sources; LSMS 2015/16 and CSA 2015/16



What do all these consumers/ buyers need?

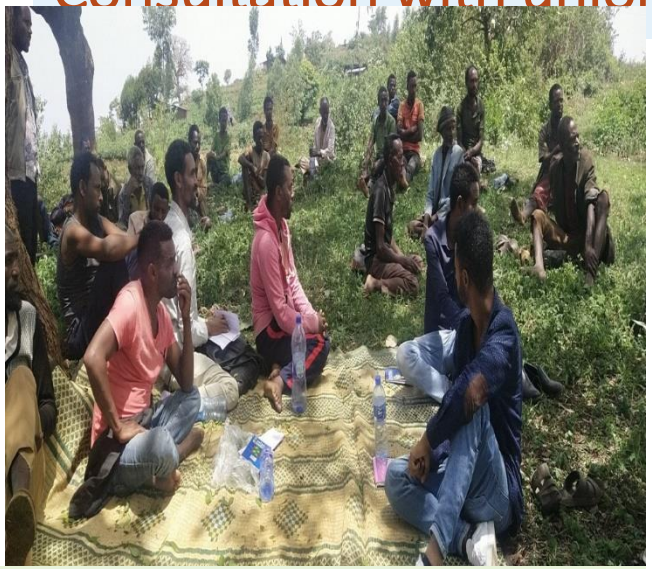
Trend: Export volume and Value… Ethiopia



- Moving to new areas, demand for traits
- GROWING DOMESTIC COMSUMPTION (>70%)

Consultation with value chain actors in Ethiopia …

Consultation with unions and their associations



ECX, Sodo warehouse

ECX, Hawassa warehouse

Does MSP-based PV testing approach accelerates uptake of new market demanded varieties by men, women and youth farmers?

- 4 testing sites were identified
- Partners agreed on 4 types of bean varieties for market: sugar bean, red mottled, kidney and small white pea
- 15 varieties under trials at the 4 sites (5 newly released, 10 older but promising varieties)
- 39 demonstration farms have been established for variety selections (PVS)
- 4 on station trials in 4 locations have also been set up

In the next steps: 2023-2025

- Expand on market intelligence data gathering to more countries
  - strengthen the linkage between social sciences with breeding and seed systems NARs crop programs for laying the ground for adoption of PP.
- Aggregate data into regional market segments to project potential impact and do some foresight analysis on trait demand
  - Revised market segments and PP
- Co-create mechanisms and infrastructure for tracing impact metric to monitor changes in adoption rates, variety turnover etc

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Thank you!

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