Commercialization assessment: High Iron Beans in Kenya

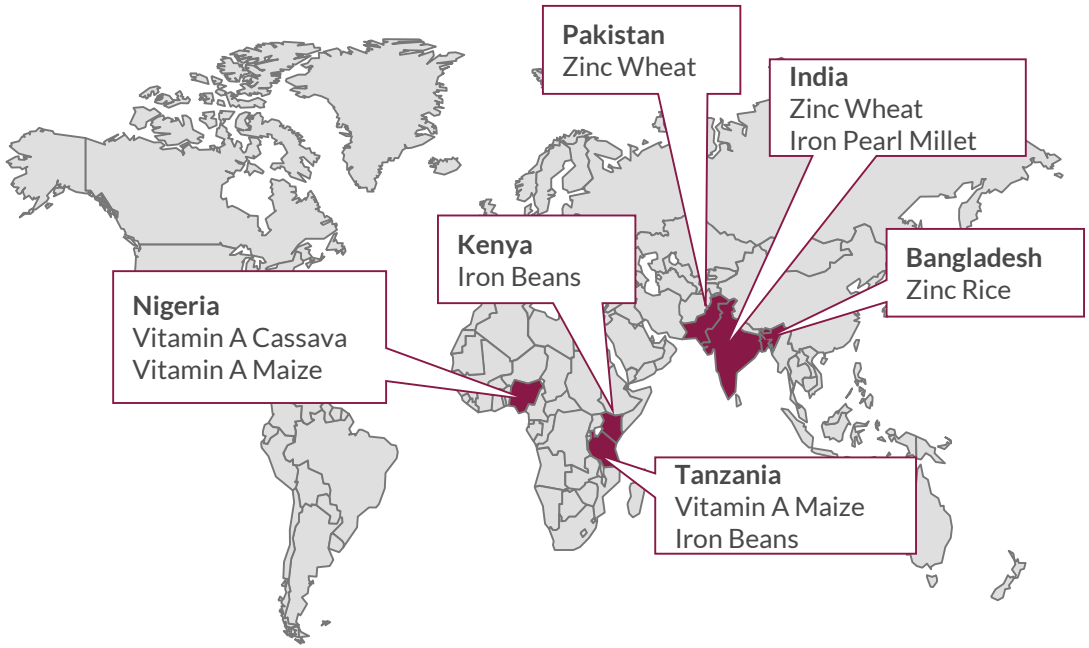
FINAL REPORT FOR GAIN AND HARVESTPLUS

DECEMBER 2019

Recap: Program context

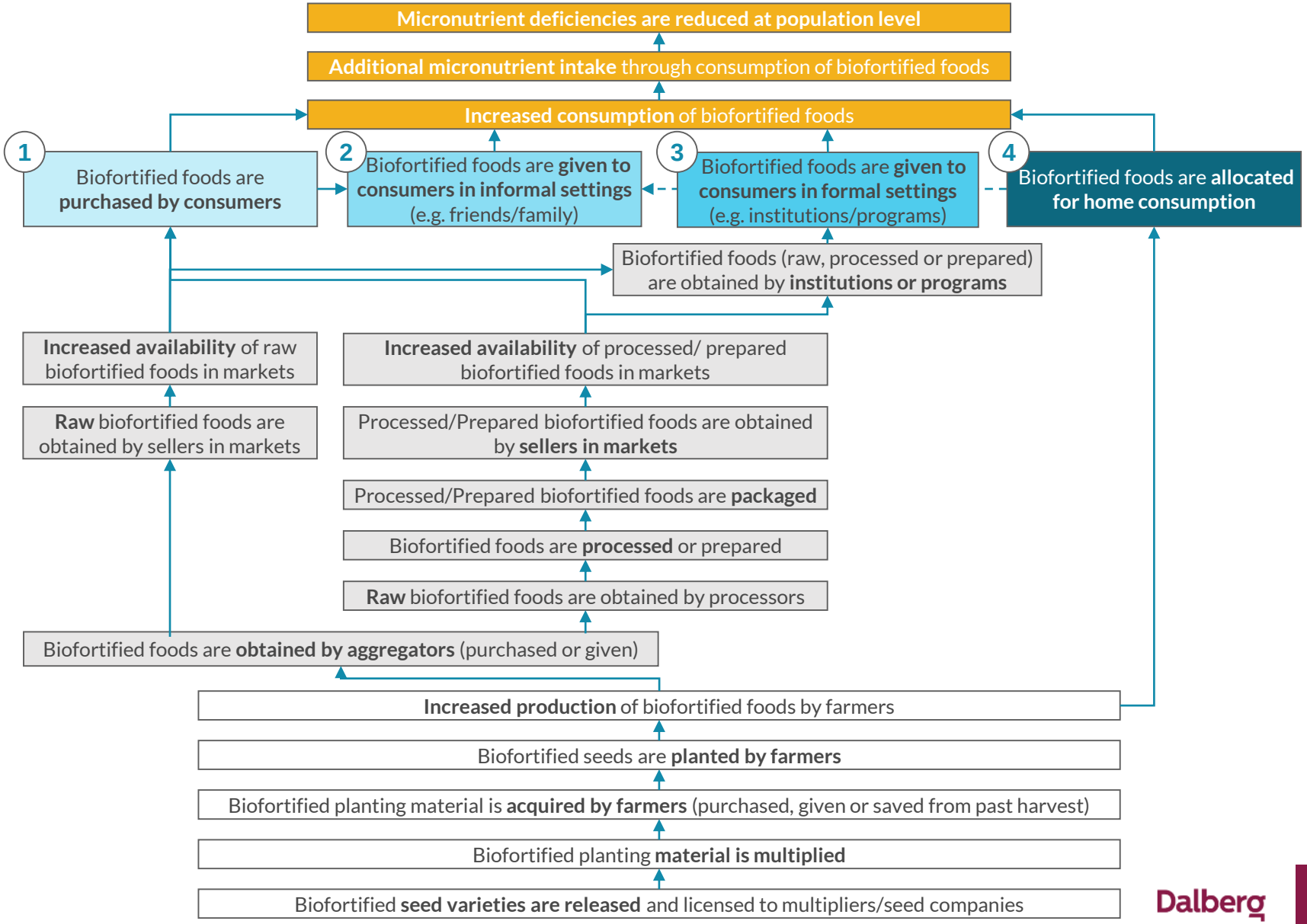
- GAIN and HarvestPlus share an ambition to expand coverage of biofortified nutrient dense foods to at least 200 million consumers. The overall vision of this program is to scale up the commercialization of biofortified foods. Iron beans in Kenya is one of the nine selected crop/country combinations under this program

- In parallel to the GAIN and HarvestPlus teams jointly developing country-level strategies for commercialization, Dalberg is conducting assessments of the potential for scale/commercialization of iron beans in Kenya. This is the draft assessment report, based on literature review and interviews with relevant stakeholders



- This draft report is designed to fit into the GAIN-HarvestPlus planning processes. As such, it is aligned with the Program Impact Pathways in two ways:
  - The potential routes to scale are codified in terms of the Program Pathways: 1. Biofortified foods are purchased by consumers, 2. Biofortified foods are given to consumers in informal settings (e.g. friends/family), 3. Biofortified foods are given to consumers in formal settings (e.g. institutions/programs), 4. Biofortified foods are allocated for home consumption
  - The report focuses on barriers to commercialization, rather than being a systematic and comprehensive report of all aspects of the value chain

Recap: Program Impact Pathways



What is commercialization?

Commercialization can be thought of in three ways:

1. **An end state.** This would see the program drive towards an end state which *is* commercial (does not require ongoing subsidy) even if the tools deployed to get there are *not* commercial themselves e.g. provision of grants for value chain actors[1]. Pathway 3, for example, might fall outside of this definition if public procurement was used to purchase and subsidize biofortified crops for the poor.

2. **A set of levers or intervention modalities.** This would include using market-based tools e.g. access to finance, strengthening value chain linkages, etc. as ways to drive scale, even if the biofortified crop itself was *not* sold [but consumed on farm]. This understanding could mean that all four Pathways are 'commercial', as long as the seed is sold to farmers in Pathway 4.

3. **A a subset of the program Impact Pathways.** GAIN's definition, for this program, is that "Commercialization shall be defined as the process of introducing a new product into commerce or making it available in the market, rather than producing solely for family consumption." This would mean that Pathway 4 is only relevant for its role in production of crops for sale.

The Dalberg assessments do not take a position on which of these is the most appropriate framing for the program, rather seek to lay out "*If* GAIN and HarvestPlus want to pursue [Pathway 1-4], *then* these are the barriers, and this is what might be required".

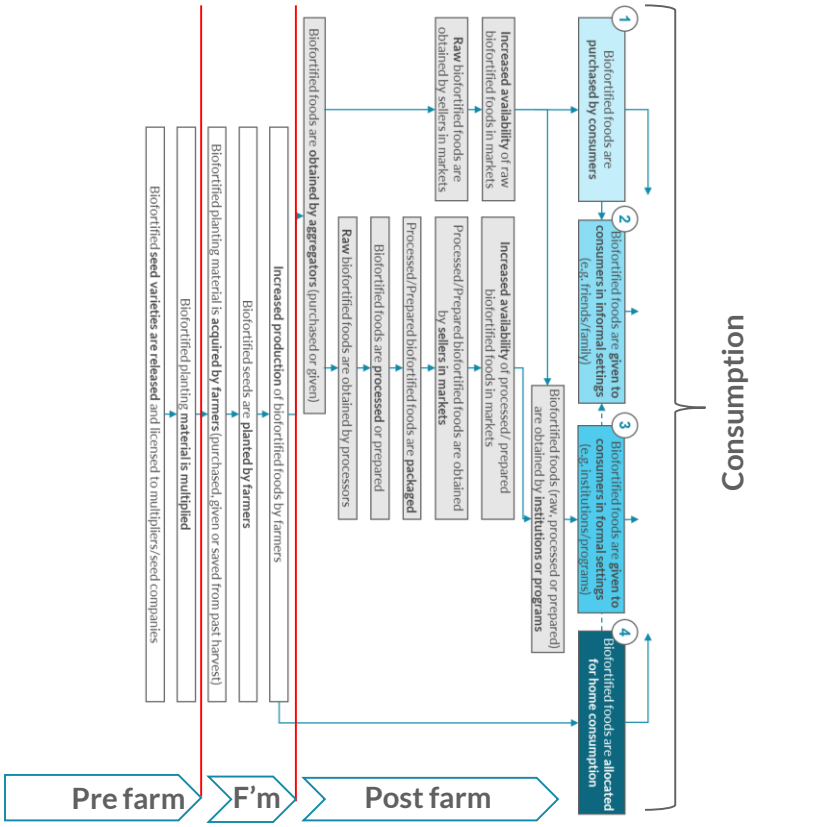
Alignment on the understanding of commercialization will potentially have significant impacts for scale that is feasible, programming, and resource allocation across the portfolio, amongst other things. On farm consumption and public procurement are significant parts of the value chains for a number of the crops under consideration.

1. With the expectation that after the grant, no further subsidy is needed because the market failure is corrected

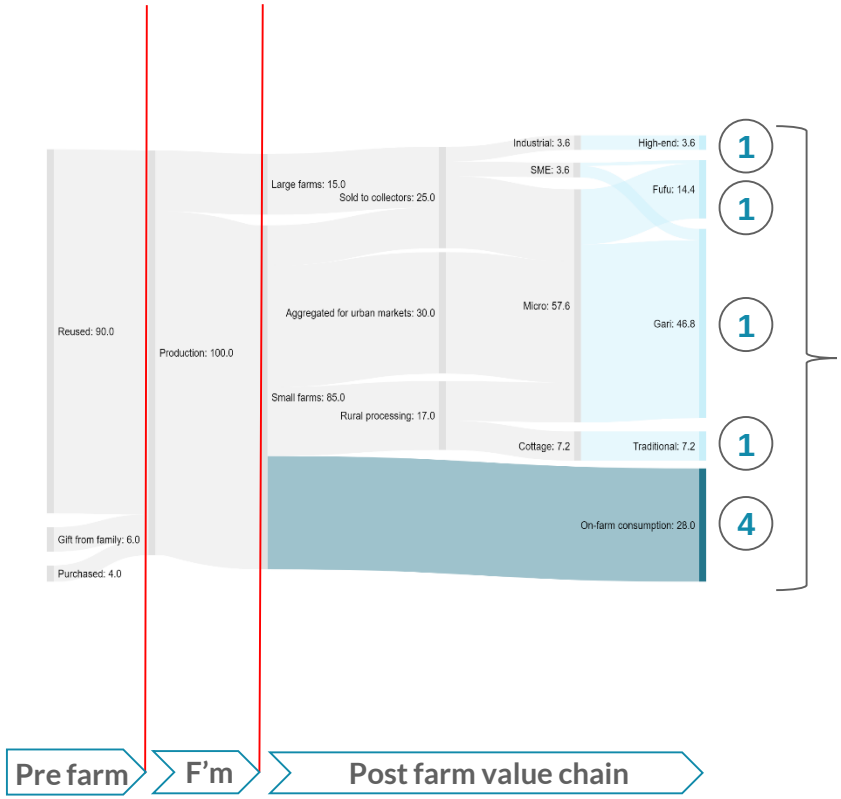
How to read this report (1/2)

This report assesses the potential for commercialization of the crops through the program Pathways. This page highlights how the pathways correspond to a crop value chain. Note below right that there may be >1 'channel' for each Pathway e.g. biofortified foods could be purchased through a number of value chains. Note also that not every Pathway might be material for each crop e.g. Pathways 2 and 3 are not listed below right.

Conceptual outline of the value chain



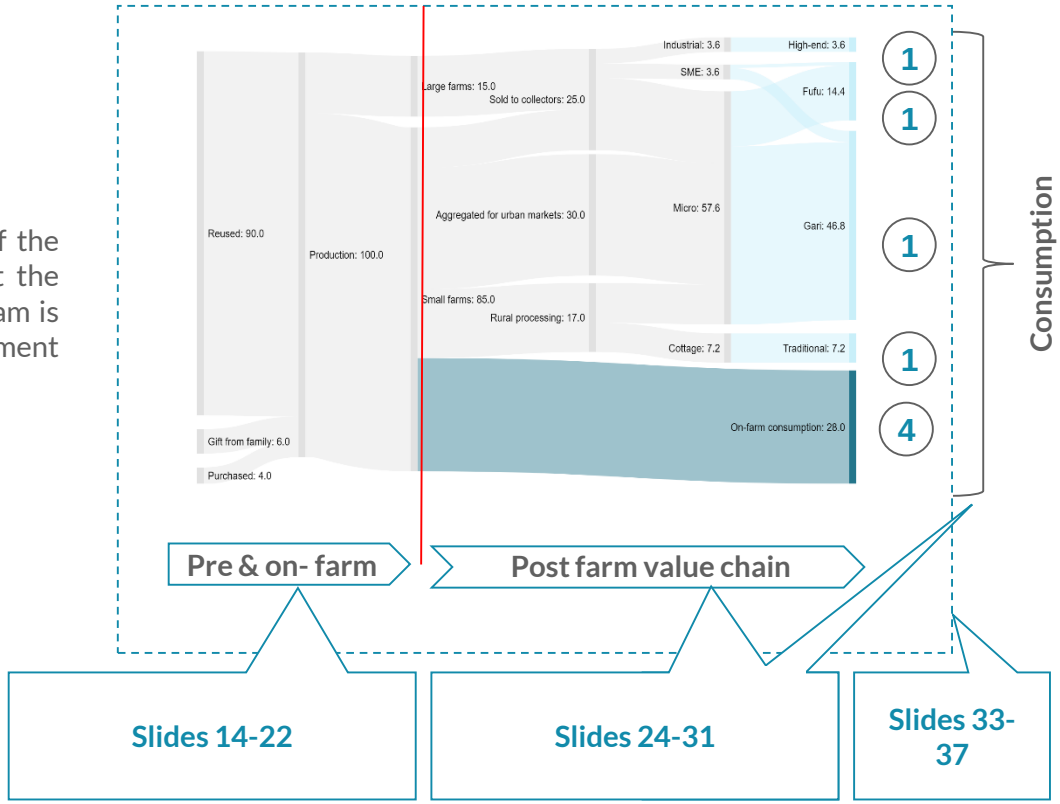
'Sankey diagram' showing relative flows through the value chain



How to read this report (2/2)

- This report is broken down into six sections:
  - Executive summary
  - Pre-farm & on-farm
  - Post-farm & consumption
  - Policy & financing

- The barriers Dalberg identifies at each stage of the value chain should align with and complement the 'Contextual analysis' and 'Barriers' that each team is feeding into the Country Strategy Development template



Executive Summary

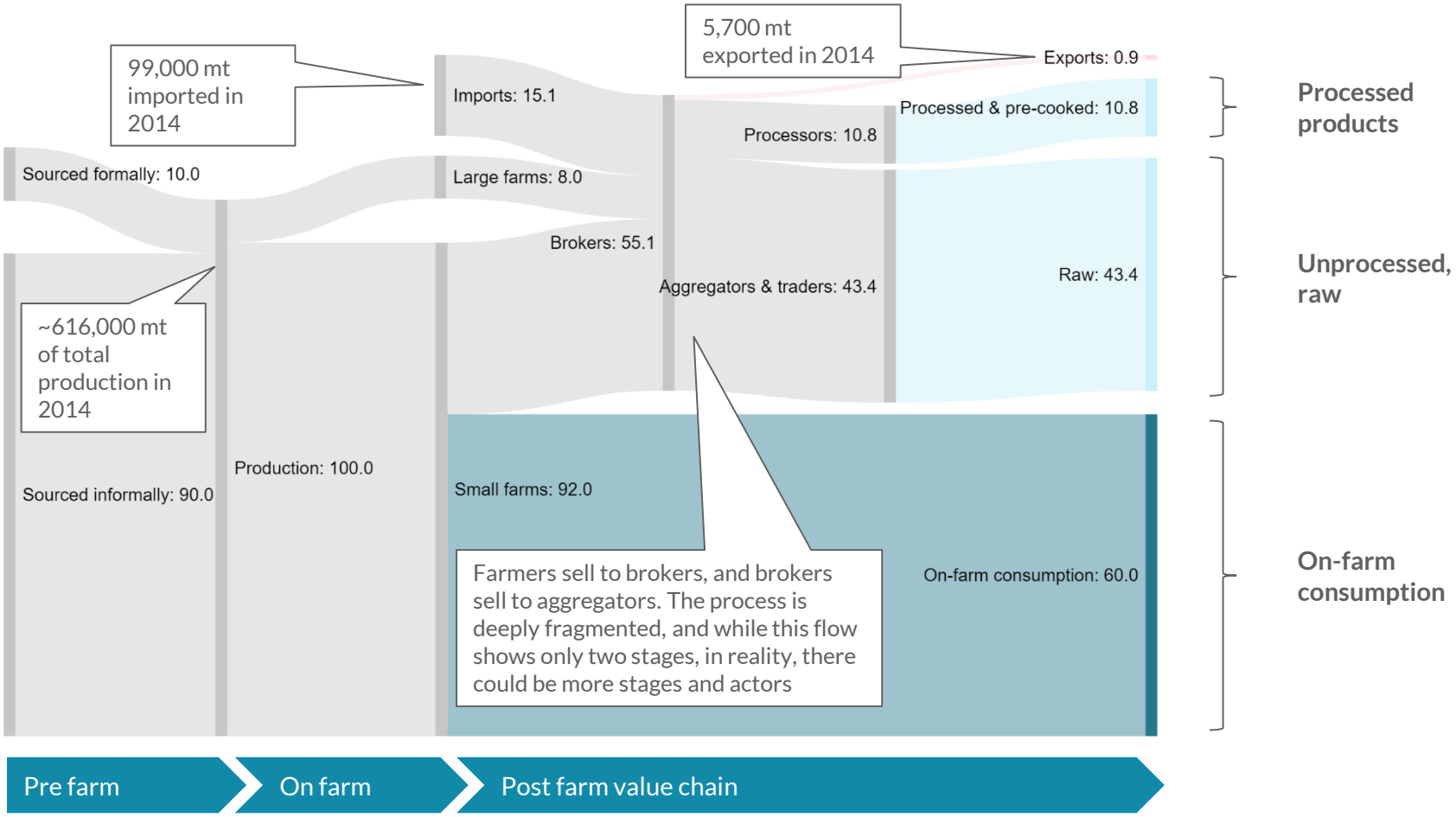
Introduction

- **69% of Kenyan children under the age of five suffer from iron deficiency.[1] Additionally, iron deficiency is a key challenge for 27.2 % of women between the ages of 15-49.[2]** Kenya is the seventh largest world producer of dry beans, which are the third most important staple food nationally, accounting for 9% of staple food calories and 5% of total food calories in the national diet.[3] **As such, iron beans represent a considerable opportunity for tackling hidden hunger amongst the Kenyan population**
- **Iron beans display favorable attributes, but Kenya's iron bean market is at an early stage with four varieties currently available**. The Nyota variety in particular is proving popular with farmers due to its taste and drought resistant properties. Despite release in 2017, the long timelines for scaling breeder seeds means that volumes are only just reaching the formal market
- **We have explored commercialization pathways across**
  i. Pre-cooked and processed beans
  ii. Unprocessed beans
  iii. On-farm consumption
- The growing market for pre-cooked beans represents a considerable opportunity for growth as Kenya's expanding middle class demands convenience and taste options from traditional staples

(1) Kisiangani, Isaac et al. (2015) Assessment of iron status among preschool children (6 to 59 months) with and without malaria in Western Province, Kenya. The Pan African medical journal vol. 21 62. 28 May. 2015, doi:10.11604/pamj.2015.21.62.4560; (2) The World Bank, Development Indicators, 2016; (3) Mohajan, Haradhan Kumar (2014). Food and Nutrition Scenario of Kenya. American Journal of Food and Nutrition 2.2 (2014); Dalberg interviews and analysis, 2019

Seeds are largely re-used and produced on small scale farms; grain is sold unprocessed, with the majority consumed on-farm

Kenya is the world's 7th largest bean producer, and 2nd largest in East Africa.[1] 60% of harvested grains are consumed on-farm, and about 20% of marketed post-farm beans are processed (10.8% of the total).[2]



(1) KenyaInvest, Pulse Sector Investment Profile, 2016; (2) IDRC, Pre-Cooked Beans for Improving Food and Nutrition Security and Income Generation in Kenya and Uganda, 2017; Dalberg interviews and analysis, 2019

Buyers do not distinguish between bean varieties, posing a barrier to the commercialization of iron beans

The bean market is characterized by a highly fragmented value chain, where **buyers distinguish between different types of bean, but different varieties and qualities are mixed together**. Actors have adjusted to this market state, in particular because it favors the numerous brokers, traders and middle-men in the market. However, **iron beans cannot commercialize without being distinguished in the market from other bean varieties.**

Current Situation

Buyers do not distinguish between bean varieties

Demand for beans is driven by visual characteristics according to type. There is no drive to segregate beans according to different varieties within bean types, or to separate beans with different quality or storage attributes.

Future State?

Segregated demand for high quality bean varieties

Demand for beans is driven by quality and variety attributes, in addition to the type of bean. Processors and retailers source directly or use reputable middle-men to ensure quality, variety, and minimal loss of goods along the supply chain.

Finding a future market equilibrium where **buyers and end-consumers have an incentive to distinguish between different varieties**, as well as types of beans, will **enable iron beans to flourish given the high performing attributes of the bean**. This will require shifting the system from the high-end buyers down the value chain.

Dalberg interviews and analysis, 2019

This lack of segregation manifests in barriers across the value chain, with additional challenges in policy and finance

Pre & on-farm	Seed re-use	**Farmers re-use seed unless they have a guaranteed buyer for a specific variety which requires certified seed purchase.** Seed producers are reluctant to invest in increasing seed production without proven demand from farmers, which limits potential market penetration for iron beans.
	Planting mixed beans	**Farmers mix types of bean seed during planting in order to mitigate the risk of crop failure**. The surplus from home consumption is sold, with visually-similar varieties often sold together in a mixed bag; meaning buyers do not know which varieties they are purchasing.
	Lack of bargaining power	**Seasonal production cycles leads to price volatility, and without secure contracts farmers are left without bargaining power**. A lack of lack of trust in downstream buyers means farmers are reluctant to invest in new seeds or specific varieties, as brokers simply look elsewhere if prices drop.
Post-farm & consumption	Limited processed demand	**Processors bypass middle-men in order to source high quality beans direct from producers but remain a small proportion of the market.** Higher quality beans are not integrated into the mainstream value chain.
	Consumer indifference	**Consumers are often indifferent to the varieties they choose beyond the bean type.** There is little awareness of the different bean attributes or the potential nutritional benefits of different varieties. Nutritional benefits alone are unlikely to shift consumer preferences.
	Selling mixed beans	**Without demand for segregated beans, varieties and qualities are mixed.** Different bean qualities and different drying properties mixed in the same bag leads to different rates of decay for the beans. Thus traders cannot rely on the bags being of consistent quality for sale.
	Broker-led market	**Aggregators and traders of produce are informal, fragmented, and tend to buy through brokers with no connection to the farmer.** Traders frequently source from Tanzania and Uganda where there are more centralized and reliable aggregation systems.
Policy & Financing	Lack of policy specificity	A supportive environment for biofortification exists in policy, especially for processed foods; however, there is **uncertain applicability to beans and limited awareness creation.**
	Weak trade regulations	The government has enacted trade policies; however, there has been **limited to no implementation of these polices to avoid over-dumping of imports into the country.**
	Poor regional harmonization	National and County government enacts agricultural policy; however, there are **no checks to ensure alignment, leading to inefficiencies in implementation.**
	Financing gap	Limited access to finance along the bean value chain limits the production & marketing of new varieties.

Dalberg interviews and analysis, 2019

Links to processors and retail partnerships present commercial opportunities to develop segregated demand for iron varieties

OPPORTUNITIES		PATHWAYS IMPACTED
 **Extension services**	**Improving bean planting practices amongst farmers through county extension services, including segregated planting and minimum tradable volumes.** This would enable farmers to sell to more commercial buyers and thus encourage them to buy iron bean seeds from the formal seed market. The propensity to re-use seeds would ultimately accelerate the integration of iron beans across informal seed channels. Such an intervention would require longer time-frames to see results but could ultimately have a larger effect across the market.	**Unprocessed, raw; home consumption**
 **Seed production**	**Supporting seed producers to access financial and technical support could help them expand seed production.** Seed producers are currently limited in their ability to invest in large bean seed production by a lack of downstream demand. As this begins to grow, they will need to access finance for investments such as in irrigation systems and inputs. Additional support such as in managing farmer out-grower networks and marketing to agro-dealers and other customers may also enable them to quickly ramp-up and scale.	**Processed products**
 **Links to processors**	**Enhancing downstream links to processors, thereby increasing the demand for iron beans in the formal seed market.** Ensuring a guaranteed market for the iron beans will ensure that farmers purchase iron bean seed from the formal market. This could be explored through contract farming, outgrower models, or working with targeted aggregators. Such an intervention could have a short-term effect in catalyzing a small channel of the market.	**Processed products**
 **Retail partnerships**	**Working with downstream retailers could help to increase awareness and adoption of iron beans as a high-end product**. Although a narrow market segment, the potential is growing, and the high-end market tends to show early increased willingness to pay for nutrition. Capitalizing on these market trends and supporting retailers with new iron beans products in packaging, marketing and promotions could spur traction in the value-add market.	**Processed products**

Dalberg interviews and analysis, 2019

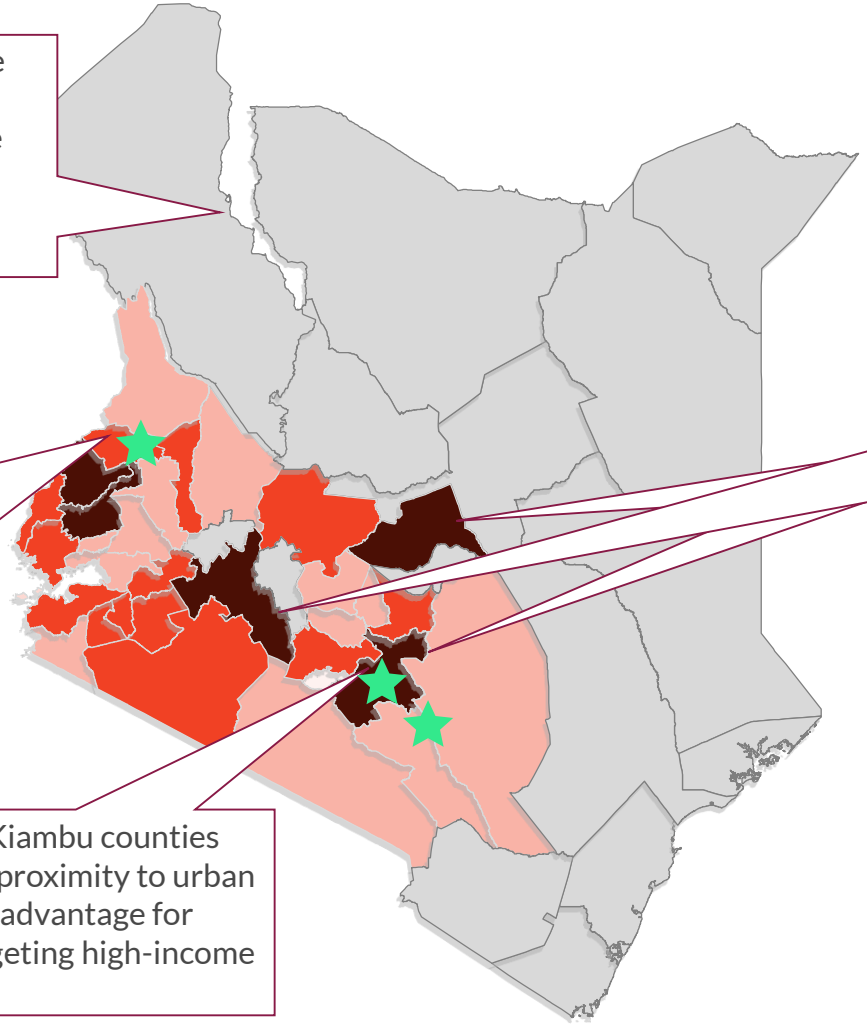
Pre-farm & on-farm

Bean production in Kenya is saturated in the south-western counties; a strategic position for access to GAIN support

Climatic conditions in the south-east make bean production more suitable for the Rift Valley, rather than the coastal or northern regions

Technical support organizations such as KALRO* are located in Nairobi, Katumani, and Bubayi

Nairobi and Kiambu counties benefit from proximity to urban markets – an advantage for products targeting high-income consumers



Quick facts

- 726,160 mt of beans produced in 2016
- 93,116 mt of beans were imported in 2014 (mostly raw and unpackaged)
- 5,716 mt of beans were exported in 2014

Highest producing counties are Nakuru, Machakos, and Meru with 54,000, 53,000, and 50,000 mt production respectively

* Kenya Agricultural and Livestock Research Organisation

KALRO, Bean Production by County, 2017; Dalberg interviews and analysis, 2019

Dalberg

Beans are produced by farmers focused on home consumption, aspiring sales farmers or contract farmers

Focus on the home

Farmer characteristics
- Smallholder farmer mostly focused on home consumption
- They intercrop with maize and other legumes

Typically gets seeds from
- Always re-uses seeds
- Buys or gets the seed from neighbors or the informal market

Decision drivers
- Cheapest price and drought resistance

Consumption choices
- More likely to keep for home consumption (>60% of produce is consumed at home)
- Surplus is sold to traders in local markets

Key influencers
- Neighbors, church, local media

Aspiring sales-farmers

Farmer characteristics
- Smallholder farmers practicing more advanced farming techniques, like planting and harvesting pure varieties, proper post-harvest handling, etc
- Contracted by downstream buyers
- Dedicate a minimum tradeable quantity per crop variety in order to sell higher volumes

Typically gets seeds from
- Will invest in buying new varieties if assured of downstream buyers for produce

Decision drivers
- Good yields and potential for expansion

Consumption choices
- Majority of produce is sold

Key influencers
- Government extension workers, downstream buyers[1]

Regular contract enterprises

Farmer characteristics
- Larger and more established farmers who have regular and consistent contracts from downstream processors
- Processors growing their own produce
- Practice rotational cropping with maize to maintain soil structure and nutrient levels and to prevent soilborne pests from getting a foothold in the farm

Typically gets seeds from
- Buy new seeds on a regular basis from seed distributors

Decision drivers
- Availability at scale, good yields, overall profitability

Consumption choices
- All produce is sold

Key influencers
- Buyers, peer commercial farms, consumption trends

Aspiring sales farmers are the smallest group of the three farmer archetypes – however, they are a key target for commercialization of iron beans as they transition to primarily producing for sale

(1) Dalberg interviews and analysis, 2019 – Florence, Extension officer, Nakuru; GrowVeg, Growing Beans from Sowing to Harvest, 2018; Farmers Weekly, 2012; Icons by the Noun Project

Dalberg

Iron beans are in pilot stage and varieties have been sold to seed producers and farmers in just ten counties

Iron Beans	
Delivery stage	Small-scale seed production contracted out in 2017/18
Number of varieties released	Three varieties released by PABRA • Angaza • Nyota • Faida
Market reach	70 farmers in ten counties (2019)
Volumes	2.5 mt of seeds purchased by farmers (2019)
Agronomic characteristics	• Early maturity (60–85 days) • High bacterial blight resistance • High yields (1.2–2.5 mt/ha)
Other characteristics	• Rich in iron (95–97 ppm) • Rich in zinc (39–57ppm)

Farmer pilot

- Iron bean varieties were sold to 70 farmers in ten counties by the Kenyan Cereal Growers Association (CGA) in 2019. Results from this pilot showed:
  - High performance despite drought
  - High performance despite heavy rains
  - Overall farmer satisfaction

Biofortified characteristics

- Iron bean varieties are resistant to common bacterial blight
- The Angaza variety performs best in medium and high potential areas with 450-550 mm of rainfall; however, some field trials showed stronger results from Nyota
- Iron bean varieties thrive in several soil types, but are best-performing in well-drained soils with a pH of 6.0–7.0
- Iron bean varieties also have high yields which means that farmers prefer using them – signaling a high commercial potential

Variety name	Iron content (ppm)	Max yield (t/ha)	Shortest maturity period (days)	Seed rate (kg/acre)	Year of release
Angaza	97	2.5	80	25-30	2018
Nyota	95	2.2	60	20-25	2018
Faida	*	2	84	32-40	2018

Consumption characteristics

- Iron bean varieties cook in less than two hours, compared to some analogue varieties which cook in two to three hours
- The Nyota variety is good for processing to beans flour

*While KALRO has listed Faida as an iron variety, the only information available is on its zinc content (>56 ppm)

CIAT, KALRO, PABRA, High Iron and Zinc Bean Varieties in Kenya, 2019; CGA, Iron bean seed purchase, 2019; Reuters, Pre-cooked beans could turn down heat on Africa's dwindling forests, 2016; PABRA, Policymakers at the center of High Iron Bean promotion in Kenya, 2018; Dalberg interviews and analysis, 2019

The government breeds new iron bean varieties, which are multiplied and sold to farmers through two licenced companies

	Research and development	Seed production and supply	Bean production
Features	• KALRO* conducts research on development of new bean varieties • KALRO distributes breeder seed to licenced companies • First batch of seed developed and produced in 2017/18	• Seed producers contract small companies and trained smallholder farmers to multiply the breeder seed • Seed producers and multipliers sell seed to farmers from their shops or agrovets	• Farmers regularly intercrop beans with maize and other legumes • Production is characterized by seed re-use and mixing of bean varieties during planting • Production is primarily for home consumption
Actors	• KALRO works with breeders to develop new varieties • CIAT* facilitates and promotes the development of new seed • PABRA* promotes the development and release of new varieties into the market	• Seeds are multiplied by contracted smallholder farmers in partnership with producers and then distributed to farmers • Two producers of seeds; Bubayi (Nyota) and The East African Seed Company (Faida and Angaza)	• Bean production is dominated by small farmers, who often do not view beans as a cash crop • Small farms account for 92% of all production, large farms account for just 8%
Economics	• In 2017/18, PABRA released 3 varieties - Nyota, Faida and Angaza	• In 2017/18, Bubayi Seeds produced 30 mt of Nyota, selling at price parity with other bean seeds (KES 500/2 kg) • East African Seed Company sells Angaza and Faida at a higher price than other bean varieties (KES 550/2 kg bag vs KES 500/2 kg bag) • In 2017/18 HarvestPlus worked with 19,000 households to produce seed	• In 2014, total production of beans was approximately 616,000 mt • In 2019, prices varied from 4,000 KSH for a 90 kg bag in harvest season, up to 9,000 KSH during times of shortage • The first harvest of iron beans was in April 2019, so prices and volumes have not yet been circulated

*KALRO - Kenya Agricultural and Livestock Research Organization; PABRA - Pan-African Bean Research Alliance; CIAT - International Center for Tropical Agriculture

KenyaInvest; Dalberg interviews and analysis, 2019; Interview, Anne, Oct 2019

Dalberg

Pre-farm and on-farm barriers include seed re-use, the mixing of beans, and the lack of farmer bargaining power

Key barriers	Description
Seed re-use	**Farmers re-use seed unless they have a guaranteed buyer for a specific variety that requires certified seed purchase.** They largely grow on beans for home consumption (60% of total volumes are consumed on-farm). Seed producers are reluctant to invest in increasing seed production without proven demand from farmers, and without seed re-use in informal markets, the potential scale for iron beans is fundamentally limited.
Planting mixed beans	**Farmers mix types of bean seed during planting in order to mitigate the risk of crop failure**. Different varieties have different drought and pest-resistant qualities, and thus farmers mix different types to ensure that some survive. The surplus from home consumption is sold, with visually-similar varieties often sold together in a mixed bag. This makes it hard for processors to buy from smallholder farmers as they do not know which varieties they are purchasing.
Lack of bargaining power	**Seasonal production cycles leads to price volatility and creates uncertainty in the market, and without secure contracts farmers are left without bargaining power in the market**. Prices fall to 573 USD/mt during harvest seasons and as high as 823 USD/mt with shortages.[1] This unpredictability, made worse by changing climate patterns, means farmers are reluctant to invest in new seeds, and do not view beans as a cash crop. A lack of lack of trust in downstream buyers further compounds the issue, as poor contracting arrangements mean that brokers simply look elsewhere if prices drop.

These barriers may be particularly difficult to overcome in the context of a smallholder-dominated value chain, characterized by low levels of sophistication and minimal technical inputs.

(1) East Africa Grain Council, Grain Watch, Sep 2019; Dalberg interviews and analysis, 2019

Seed re-use | Farmers re-use harvested seed, which limits demand and thus production of certified seed varieties

Root cause

- Farmers **do not buy certified seeds from the agro-dealers or seed producers unless they have a guaranteed downstream buyer**, due to the cost associated with buying the certified seed
- Many are **unaware of the benefits of using certified seeds,** which include higher yields, drought and disease resistance
- Farmers **produce primarily for home consumption** and thus, **affordability is a key driver to their choice of seed.** Re-using seed is more cost effective than buying certified seed, and thus **90% of farmers re-use seeds** (see Sankey slide 9)
- Farmers also get **seed from family and friends'** harvest produce, and they can purchase grain from local traders to use as seed
- After harvest, farmers consume approximately 60% of their produce**, save a portion of the rest as seed** for the upcoming season, and sell the surplus

"Most of the farmers who live here, that is my farmers, came to this place in 1978. So it is four decades, and they have not changed the bean variety that they started planting four decades ago.."

Florence, Extension Officer, Nakuru County

Impact on potential to scale

- Small-scale seed production is often **reliant on lower-yielding out-grower schemes** rather than efficient commercial seed production practices
- **Large-scale seed production benefits from economies of scale;** for example, using center-pivot irrigation systems. These systems are costly and require investment
- As a result of the seed re-use culture which limits demand for certified seed, there is **reluctance from seed producers to invest in increasing production of certified iron bean seed varieties**
- Furthermore, if certified seeds are only bought by farmers with downstream contracts, **interaction with the mainstream aggregation market is limited**
- **Iron beans will rarely enter the informal market and thus will not become part of the pattern of seed re-use.** This limits the commercialization opportunity through the informal market

"If we grow commercially then we want a contract. If we plant, we want to know where these beans are going. Then we will buy the seed"

Cereal Growers Association

Dalberg interviews and analysis, 2019

Planting mixed beans | Farmers mix seed when planting, causing mixed quality and varieties of beans in downstream aggregation

Root cause

- Smallholder farmers face different risks such as unpredictable rainfall, pests and diseases
- Different bean varieties have varying tolerance to these risks; **thus farmers mix different varieties to mitigate against the risk of crop failure**
- As most smallholder farmers **re-use seed, it is hard to tell what they plant unless** they keep close track of their varieties
- **Smallholder farmers produce beans mainly for home consumption** and consume the beans in a mixture with maize, which does not require segregated varieties
- Hence, they have **no preference for consuming segregated varieties**
- As a result, the **surplus produce that is sold is frequently mixed, often with varieties that look the same but are in reality different**

Impact on potential to scale

- **Buyers cannot tell beans they purchase** from smallholder farmers as harvested mixed beans are **visually indistinguishable**
- Aggregators cannot tell the difference between similar looking types of beans, hence **there is no segregated value chain for different beans**, including iron varieties
- **Different bean varieties have different storage attributes**, thus some last longer whilst others rot
- **Different bean varieties have different cooking attributes**, presenting a challenge for processors and consumers looking to cook beans in the same bag
- Thus, **mixing is a hindrance to downstream scale** as **one cannot guarantee quality or nutritional content of the average bag of beans**

"We look at the color and size of the beans to ascertain the variety..."

Dickson, Distributor, Nakuru County

"If you take a handful of beans you will find all sorts of different kind of beans. They are not separate varieties that if you want Nyota, then you get Nyota as it should be, you will find it mixed with all the others..."

Anne, Government Official, Kiambu County

Dalberg interviews and analysis, 2019

Lack of bargaining power | Fluctuating prices and poor contracting fail to give farmers the confidence to invest

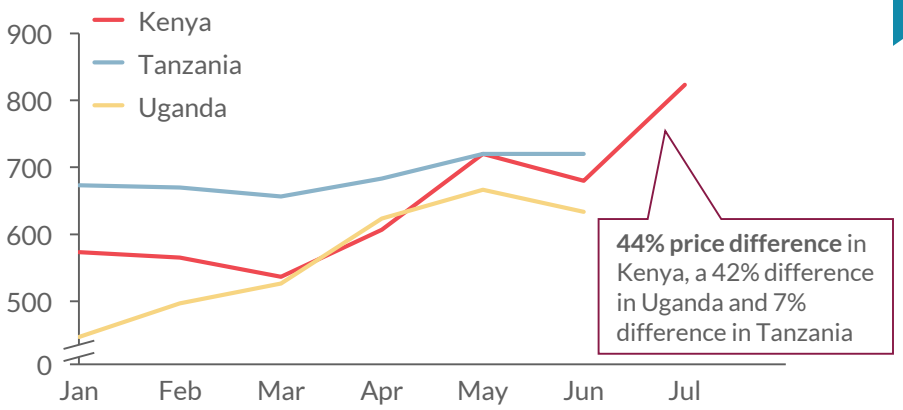
Root cause

- Bean grains are susceptible to pests and diseases, and **with more variable climate patterns, crop failure is common**
- As a result, **bean prices can be as low as 537 USD/mt during harvest seasons, and as high as 823 USD/mt with shortages** – a 44% difference in seven months[1]
- **Some brokers and processors draw up contracts with farmers** to ensure that they have adequate bean supply
- However, buyers control the market. Poor contract enforcement **allows brokers to cancel agreements if they find cheaper prices** from neighboring regions or countries

Impact on potential to scale

- **Poor contract enforcement and low levels of trust** means that price volatility issues are hard to solve
- **There is no guarantee** for the purchase of beans produced, or assurance of bean supply from farmers
- **Farmers are not incentivized to invest in new seeds or expand their bean production beyond home consumption** since they are unsure of downstream demand and the prices they will be able to sell at
- Thus a lack of bargaining power stands as a barrier to the commercialization of high iron beans, as **farmers do not view beans as a cash crop worth investing in**

Average bean prices in Kenya (USD/mt)



"When most farmers harvest during the high season in August, every farmer will want to sell their produce and when there is abundant supply prices tend to drop as farmers compete to sell their produce."

Mwiti, Broker, Meru County

(1) East African Grain Council, East African Grain Markets and Trade, 2019; Dalberg interviews and analysis, 2019

Opportunities in extension services and seed production can act as supporting enablers to commercialization

Key Opportunities	Description
Extension services	**Improving bean planting practices amongst farmers through county extension services, including segregated planting and minimum tradable volumes.** This would enable farmers to sell to more commercial buyers and thus encourage them to buy iron beans from the formal seed market. The propensity to re-use seeds would ultimately accelerate the integration of iron beans across informal seed channels. Such an intervention would require longer time-frames to see results but could ultimately have a larger effect across the market.
Seed production	**Supporting seed producers to access financial and technical support could help them expand seed production.** Seed producers are currently limited in their ability to invest in large bean seed production by a lack of downstream demand. As this begins to grow, they will need to access finance for investments such as in irrigation systems and inputs. Additional support such as in managing farmer out-grower networks and marketing to agro-dealers and other customers may also enable them to quickly ramp-up and scale.

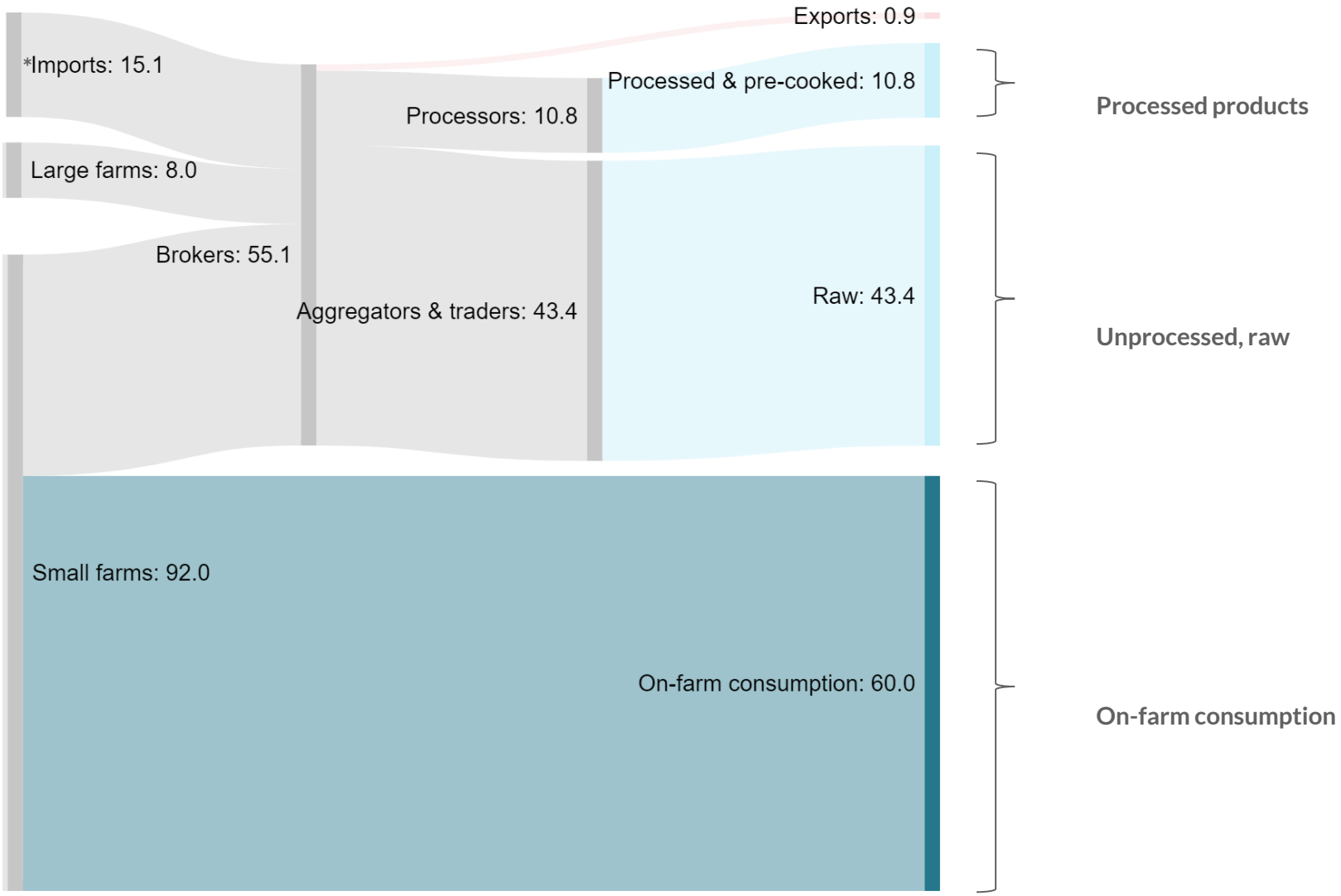
Extension services are targeted largely at farmers who re-use seeds and sell to the raw, unprocessed channel. As downstream demand for certified seed comes from the processed channel, this intervention will be limited in its ability to catalyze seed demand unless also accompanied by demand creation at the processor-level (see slide 31)

These opportunities could act as supportive interventions to commercialization but are not commercially viable in their own right. Impact may be limited in the context of a smallholder-dominated value chain.

Dalberg interviews and analysis, 2019

Post-farm & consumption

Post-farm, beans are consumed on-farm, as raw grain, or processed products such as composite flour and canned beans



*The total node flow is more than 100% because imports add an additional 15.1%,
KenyaInvest, Pulse Sector Investment Profile, 2016; IDRC, Pre-Cooked Beans for Improving Food and Nutrition Security and Income Generation in Kenya and Uganda, 2017; McGuire, S. & Sperling, L. Food Sec. (2016); Dalberg interviews and analysis, 2019

Dalberg

Processing has the greatest commercialization potential due to the value-add, but unprocessed beans are necessary for scale

	Features	Primary consumers	Drivers
Processed products	• Involves value-add to beans past their harvest state • Processors often have a direct link to producers • Raw processed beans are cleaned, re-packaged into plastic bags and branded • Pre-cooked processed beans are canned or packaged	• Sold by retailers to individual consumers, primarily in urban markets • Likely to be a growing channel – approximately 50% of the population is projected to be urbanized by the year 2030, up from 34% in 2011[1]	• Convenience through short cooking times • Good taste • High nutritional value due to growing awareness on nutrition • Causes lower levels of flatulence
Unprocessed, raw	• The channel is highly fragmented; driven by brokers • Aggregators, traders and smallholder farmers sell to the final consumers	• Institutional buyers such as schools, prisons, NGOs, hospitals, etc • Individual buyers, buying beans from small traders around their settlements	• All season availability of the beans incentivizes consumers to purchase certain varieties • Affordability is a major driver for rural consumers • Fuel saving through short cooking times
On-farm consumption	• The largest consumption channel of produce by smallholder farmers • No intermediaries required • Beans are of mixed-variety (segregation is not important)	• Smallholder farmers (consume ~60% of all their farm produce) • They primarily eat beans in githeri, a Kenyan staple food made of mixed beans and maize	• Availability of the beans, especially beans that have survived until harvest time

(1) Institute of Economic Affairs, Kenya Urban Areas Performance Index Report, 2017; IDRC, CRDI, Pre-Cooked Beans for Improving Food and Nutrition Security and Income Generation in Kenya and Uganda, 2017; Dalberg analysis and interviews, 2019;

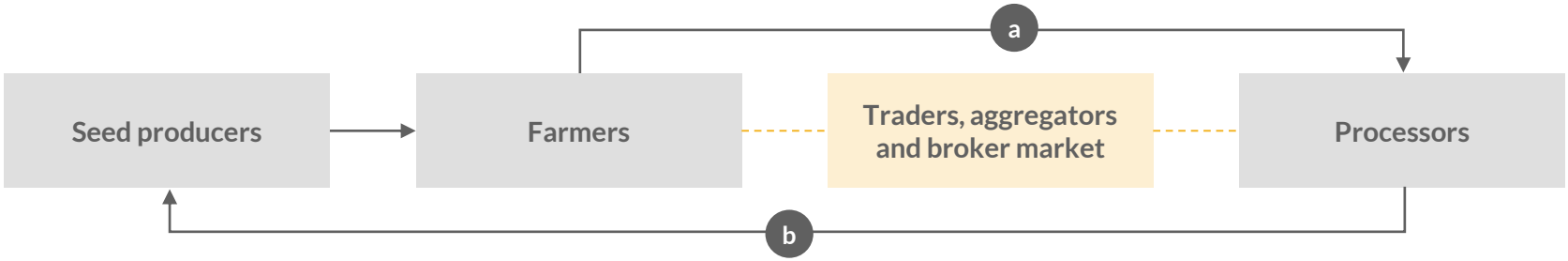
Post-farm barriers include limited processed demand, consumer indifference, selling mixed beans and a broker-led market

Key barriers	Description
Limited processed demand	**Processors bypass middle-men in order to source high quality beans direct from producers, but remain a small proportion of the market.** Beans cook at different rates, and thus the 'pre-cooked' bean sellers require consistency of variety and quality. Contract farming to ensure seed quality and segregation is growing, as processors are forced to deal directly with producers. In bypassing the mixed bean markets, higher quality beans are not integrated into the mainstream value chain.
Consumer indifference	**Consumers are often indifferent to the varieties they choose beyond the bean type.** There is little awareness of the different bean attributes or the potential nutritional benefits of different varieties. This may change as demand for processed goods increases, but nutritional benefits alone are unlikely to shift consumers away from long-standing preferences.
Selling mixed beans	**Without demand for segregated beans, varieties and qualities are mixed. Post-harvest handling techniques are poor, and contribute to the low quality and mixing issues for downstream buyers.** Farmers sun-dry beans, and beans are also mixed at this stage of the post-production process. Different bean qualities and different drying properties mixed in the same bag leads to different rates of decay for the beans. Thus traders cannot rely on the bags being of consistent quality for sale.
Broker-led market	**Aggregators and traders of produce are informal, fragmented, and tend to buy through brokers with no connection to the farmer.** Brokers buy from many different farmers and the difficulty of distinguishing different bean varieties means that there is a high risk of mixed beans being sold in the same bag. Traders frequently source from Tanzania and Uganda where there are more centralized and reliable aggregation systems.

Dalberg interviews and analysis, 2019

Limited processed demand | Processors bypass middle-men to source quality beans, but demand for certified beans remains low

1 **Processors that require beans to be segregated by variety only make up a small share of the market, and do not drive bean variety adoption at scale in the unprocessed market**



a **Processors who require segregated bean varieties are forced to bypass the mainstream broker and trader market to source directly from farmers**

- The processors have established relationships and often set up their own production facilities
- Processed and packaged beans make up 10.8% (see Sankey slide 9) of final consumption, with not all of it requiring segregation

b They **work with seed processors** to make sure their farmer/outgrowers are using certified seed, provided by the seed producers

- The processing channel acts as a **separate supply chain for high-end processed products**
- Not all packaged beans are segregated, and this direct connection to production is required only for low volumes of beans
- Thus, the **upstream demand for segregated, certified beans makes up a small proportion of total demand**
- Without guaranteed demand for certified beans, farmers will not buy the seeds, thus **iron beans will not be adopted, nor will they be re-used in the mixed value chain**

"So far with the micro-nutrient beans especially for Nyota, I have a company which is processing the pre-cooked beans. During the harvests of Nyota that is in the farms, they will come to buy from the farmer."

Extension Officer, Nakuru County

KALRO – Omondi, Market arrangements used by small-scale bean farmers in Kenya, 2019; Dalberg interviews and analysis, 2019

Consumer indifference | Consumer indifference to bean varieties & low nutrition awareness limits uptake of iron beans

1 Consumer indifference to different bean varieties and low awareness of nutritional benefits hinders demand for specific, segregated bean products

- Traditionally, most consumers in Kenya purchase the most affordable bean, choosing beans by their 'family' or type of appearance, for example yellow, red mottled, black, etc
- There is a **high preference for beans that are red mottled** as they make the Kenyan stapled food 'githeri', but consumers show willingness to buy any red mottled beans rather than any preference for specific varieties
- This **consumer indifference for bean varieties drives the lack of segregation in the main raw, unprocessed bean channel**
- Furthermore, nutritional awareness among consumers is very **low, as there is little to no education and information** on the nutritional value of iron beans
- As a result, the consumer **demand for specific varieties of highly nutritious beans is limited**

2 This may change as demand for processed goods increases, but nutritional benefits alone are unlikely to shift consumers away from long-standing preferences

- Approximately 50% of Kenya's population is projected to be urbanized by the year 2030, up from 34% in 2011[1]
- As **the growing middle class demands increased convenience and taste attributes from food**, this is likely to drive growth in the processed and pre-cooked bean sector, which require segregated bean varieties
- Improved desire and willingness to pay for nutritional content could be a key feature of marketing to this consumer segments. However, **nutritional benefits alone are rarely sufficient to change consumer preferences and behaviour**
- **Consumers also need incentives such as good taste, affordability, cooking attributes and aspirational branding to encourage change**. For example, yellow bean varieties are growing in demand due to their perceived ease of cooking and low flatulence levels. Iron beans will need to emphasize benefits of taste, cooking and price as well as nutritional attributes

(1) Kenya Urban Areas Performance Index Report, 2017; Dalberg interviews and analysis, 2019

Selling mixed beans | Poor post-harvest handling and storage result in mixed beans and loss of produce

1 **Smallholder farmers lack the post-harvest information, skills and technologies required from field production to the final processing facilities, resulting in losses and selling of low-quality, mixed produce**

Post-harvest physiology

- Farmers lack the know-how and equipment in the **time period from harvest or removal of the plant from its normal growing environment to consumption**
- Most of the farmers harvest mixed seed. However, they do not know the **different drying and aeration requirements for these varieties**, increasing the probability of packaging beans that are not fully dried, which leads to **rotting and consequently significant losses**
- In addition to this, farmers **do not clean their produce or separate varieties** as they have no incentive to do so. Where cleaning is done, it is very minimal, removing only the big, visible dirt

Storage

- Storage has an impact on the quality of beans. **Poor storage of beans results in beans that are hard to cook, seed discoloration and insect infestation**
- **Farmers lack quality storage and are unaware of what constitutes a good post-harvest storage quality**. It constitutes moisture content, storage temperature and time
- In Kenya, 30% of losses are due to poor storage[1]
- Lack of good storage facilities can lead to farmers settling for low prices**.** Farmers need to sell their produce at current spot prices as they **cannot store their produce to await higher market prices**

Transportation

- Improper handling and transportation of produce between the farm and the homestead **increases the risk of mixing different bean varieties, if they are transported together, without clear segregation**
- Thus, traders end up with **mixed beans which hinders traceability of different bean varieties**

"The main challenge is if we buy bad, rotten beans that are not well preserved, especially if we buy beans that have not fully dried, which develop mold very fast during storage and this results into losses for us."

Ann, Trader, Nairobi

(1) Uebersax, Mark & Siddiq, Muhammad, Postharvest Storage Quality, Packaging and Distribution of Dry Beans, 2012; A. A. Ramin - Advanced Postharvest Physiology; Dalberg interviews and analysis, 2019; Icons by the Noun Project

Broker-led market | Fragmentation of the bean value chain limits farmer bargaining power, with poor downstream linkages

1 Farmers do not cooperate or produce sufficient minimum tradeable volumes to give them bargaining power in the bean marketplace

- Farmers **sell most of their surplus produce to local brokers**, with very few aggregators buying directly from the farm
- As farmers mainly produce for home consumption, **the surplus sold frequently does not meet the minimum tradeable volumes that brokers require**
- There is **low levels of cooperation among** the different actors in the sector, especially farmers**.** Farmers rarely pool produce to meet minimum tradeable volumes (estimated at approximately one-acre harvest)
- Thus, **farmers lack the bargaining power** they could get from such groups when they sell their produce to the buyers
- Brokers have exploited this opportunity to buy beans at the lowest prices, leading to **low trust levels between buyers and farmers**

> *"We buy from brokers who import the beans from Uganda."*
>
> Dickson, Distributor, Nakuru County

> *"So my produce from Meru which may be slightly higher [in price] than the one I imported"*
>
> Mwiti, Broker, Meru County

2 Brokers control the fragmented downstream market, posing a challenge for segregation of new varieties

- Seasonal price volatility means that **brokers also look for beans aggregated in neighboring regions and countries**
- Brokers then sell to other traders, and the **bean value chain is highly fragmented between brokers, aggregators, wholesalers and retailers**
- Thus, creating **effective market linkages between Kenyan farmers and buyers seeking large volumes is a challenge in the bean market,** and a hindrance to the adoption of new bean varieties

International Trade Center & Ministry of Industrialization and Enterprise Development, Value Chain Roadmap for Pulses, 2016-2010; Dalberg Interviews & Analysis, 2019; Dalberg interviews and analysis, 2019

Linking processors and developing retail partnerships present commercially viable opportunities

Key Opportunities	Description
Links to processors	**Enhancing downstream links to processors, thereby increasing the demand for iron beans in the formal seed market.** Ensuring a guaranteed market for the iron beans will ensure that farmers purchase iron bean seed from the formal market. This could be explored through contract farming, outgrower models, or working with targeted aggregators. Such an intervention could have a short-term effect in catalysing a small channel of the market.
Retail partnerships	**Working with downstream retailers could help to increase awareness and adoption of iron beans as a high-end product**. Although a narrow market segment, the potential is growing, and the high-end market tends to show early increased willingness to pay for nutrition. Capitalizing on these market trends and supporting retailers with new iron beans products in packaging, marketing and promotions could spur traction in the value-add market.

As these interventions focus only on the processed market, and thus the formal market for certified seeds, scale will be limited unless also coupled with enabling extension services that ensure farmers start to re-use iron bean seed and sell to traders in the raw, unprocessed channel (see slide 22)

Dalberg interviews and analysis, 2019

Policy & financing

Barriers remain in the wider ecosystem: nutrition policy, trade regulations, regional harmonization and the financing gap

- In addition to the factors discussed on Kenya's bean value chain, government policies which can either support or hinder the commercialization of biofortified foods are consequential to this project. Thus, given the timeframe and ambition of the program, the analysis below focuses on aspects of policy and finance that GAIN and HarvestPlus could feasibly influence
  - Current interpretation of the policy, and its limitations
  - Measures that can support the impact of policy implementation
- In terms of 'policy', the analysis considers multiple types of policy: norms, standards, and regulation
- **For iron beans in Kenya, we see four main barriers in policy and finance**:

Lack of policy specificity

A supportive environment for biofortification exists in policy, especially for processed foods; however, there is uncertain applicability to beans and limited awareness creation.

Weak trade regulations

The government has enacted trade policies; however, there has been limited to no implementation of these polices to avoid over-dumping of imports into the country.

Poor regional harmonization

National and county government enacts agricultural policy; however, there are no checks to ensure alignment, leading to inefficiencies in implementation.

Financing gap

Limited access to finance along the bean value chain limits the production & marketing of new varieties

(1) Beyond traditional pillars of [written] policy, and finance, there are deeper, often cross cutting issues that will impact on the ability of the biofortified crop to reach commercial pathways to scale:
Policy coherence – Do different decisionmakers have clear and aligned visions for how a biofortified system should work?
Institutional incentives – Is biofortification a priority or not?
Effective coordination – Are the different actors talking with one another? Are there clear platforms for alignment?
Capacity & agency – Do the different actors in the system have awareness as well as the technical capacity or general capabilities to scale biofortification?
Often these issues are very hard to influence, and outside the remit of GAIN/HarvestPlus to intervene in. However, they are important to note and track, especially where they are crucial to a given pathway e.g. Government capability as crucial to a public procurement led pathway

Lack of policy specificity | Policies do not apply specifically to beans; programs have failed in raising nutritional awareness

1 A supportive environment for biofortification exists in policy, especially for processed foods; however, there is uncertain applicability to beans and poor stakeholder adherence

- **Biofortification is explicitly mentioned in the National Food and Nutrition Security Policy** (2012) as one of the four key interventions to address micronutrient deficiencies
- Additionally, **fortification is mandated for processed goods**, and there are policies which focus on standards and guidelines for the labelling of pre-packaged foods
- However, **the applicability to beans is unclear, and the concentration on pre-packaged foods excludes a vast majority** of foods that are sold without packaging
- Finally, **penalties for value chain actors who do not adhere to these policies are unclear**, and there is little information as to compliance given the 'invisible' nature of the fortified beans to consumers

2 The supportive environment has not translated into the government raising awareness for biofortification

- Despite policy action, the government has not invested in raising awareness of biofortification for either farmers or consumers
- Thus, **farmers are unaware of biofortification** and the presence of iron bean varieties. They are **not incentivized to plant iron bean varieties,** or expand any existing iron bean production
- The **low consumer awareness of biofortified foods means any iron bean retailers must sensitize consumers to the nutritional benefits** and combat any potential misunderstandings, in order to convert consumers into awareness, acceptance, and purchase

"I have not heard of any iron beans. And where can we find them?"

Broker and Distributor, Meru County

Kenya National Food Fortification Strategic Plan, 2018-2022; Interview, Leah and Dan, 31 July 2019; Overview of food fortification program, 2019; Dalberg Literature Review, 2019; Dalberg interviews and analysis, 2019

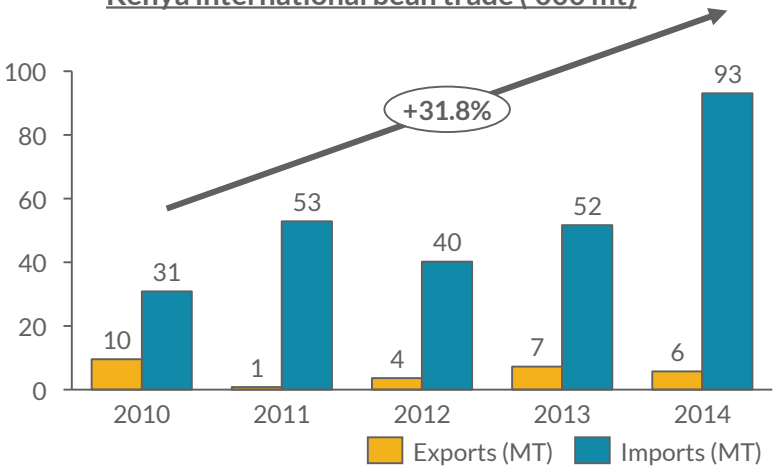
Weak trade regulation | Ease of importation has enabled brokers to thrive, contributing to value chain fragmentation

1 **Trade facilitated by the Common Trade Protocol has enabled mass imports of beans, to the benefit of brokers and contributing to the fragmentation of the bean value chain**

- Across East Africa, **The Common Trade Protocol** has been an enabler of cross-border trader, allowing traders to move goods across the borders
- Additionally, Kenya drafted the **Kenya Trade Remedies Act**, which recommends the establishment of the Kenya Trade Remedies Agency to investigate dumping and impose trade safeguards
- However, there is **poor implementation of these legal and regulatory frameworks meant to safeguard the country from dumping and over-importation**

- The **bean sector has few barriers to entry and multiple players acting as middle-men**
- Brokers take **advantage of availability of beans and low prices across East Africa** to import beans and sell them to traders who value the convenience of a one-off bulk purchase. Dry bean imports to Kenya increased by 32% from 2010 to 2014[1]
- The broker market has thrived to the detriment of Kenyan farmers who cannot compete with the cheaper prices. Brokers continue to control the market, contributing to the **value chain fragmentation and hindering the traceability of new bean varieties**

Kenya international bean trade ('000 mt)



*"In Kenya we have a Broker-led market system and in Uganda we have an Aggregator-led market system…We are just **disorganized, and our trade systems are not properly regulated** and where there are regulations, they are flaunted...and that is **why we have so many imports.**"*

CEC Agriculture and Livestock, Nakuru County

(1) East Africa Grain Council, East Africa Cross Border Trade Bulletin, April 2019; International Trade Center & Ministry of Industrialization and Enterprise Development, Value Chain Roadmap for Pulses, 2016-2020; Dalberg Interviews & Analysis, 2019

Poor regional harmonization | Poor policy harmonization causes confusion regarding policy enforcement & implementation

1 **The national and county governments in Kenya have not harmonized their policy making process, or even the policies they have enacted**

- The devolution process initiated by the 2010 Constitution of Kenya **generated a new distribution of responsibilities and functions between different governing and administrative bodies,** distributed across the national and county governments
- **However, there is lack of harmonization of agricultural policies at the two levels of the government**
- As a result, there exists **some confusion regarding the implementation and enforcement of policies as** well as the fulfilment of these responsibilities
- This has resulted in **gaps on monitoring progress on agricultural initiatives,** and a lack of coordination among the stakeholders **leads to inefficient sector development and implementation of policies**
- **Tracking progress on extension services and program implementation is a challenge given the different reporting and operating procedures at different levels of government**. This may affect the delivery of iron bean programs that work in partnership with government extension services

"Eight years ago they could aggregate the data but when extension services were devolved, it became very hard to collate data that is segregated among the counties. These figures may not even be correct within the county as the extension officers are not keenly followed up on"

Ken Orumo, Ministry of Agriculture and Irrigation

International Trade Center & Ministry of Industrialization and Enterprise Development, Value Chain Roadmap for Pulses, 2016-2010; Dalberg interviews and analysis, 2019

Financing gaps | Limited access to finance along the bean value chain limits the production & marketing of new varieties

	Pre farm	On farm	Post farm value chain
Existing financial relationship	• **Government budgetary allocation and NGOs** provide financial support to institutions conducting research and development of new seed varieties • Small private companies invest in seed multiplication and distribution, but have limited financial support to enhance seed multiplication	• **SACCOs and chamas** are the most significant providers of credit for smallholder farmers • Formal institutions focus on **group lending and large commercial farms** • **Credit products often packaged with crop insurance**, but has high interest	• **Large-scale buyers have access to financial institutions**, and can provide contracts to producers

Financial needs and gaps	• **Researchers –** finance to conduct further research and marketing of new bean varieties
	• **Government agricultural services –** limited budget allocation to promotion of new crop varieties e.g. county governments have no resources allocation to support marketing
	• **Seed producers –** finance to contract large scale farms to increase seed production capacity
		• **Agro-dealers and seed companies -** finance and incentives for provision of advisory services for input use and adoption of new seed varieties
		• **Smallholder farmers have**
		  • Limited working capital for farm inputs, asset finance for post-harvest facilities, or crop insurance
		  • **40% of produce is sold** (see Sankey slide 9) warehouse liquidity support is required to allow smallholder farmers to undertake hold and sell strategy, or use of produce as collateral
			• **Brokers, aggregators, wholesalers and retailers -** working capital to purchase from farmers, storage chemicals, capital expenditures for new warehouses, fuel, maintenance and new vehicles to transport beans
			• **Processors -** working capital buying beans, value add and scaling production capacity, marketing new products
			• **Smallholder farmers** - limited farmer association for beans to negotiate on prices and contracts

"Actually when you do research you normally don't get a budget for marketing and advertising, so nobody would know about those beans unless there is a concerted effort to finance and market them."

Immaculate, CEC, Nakuru

KNBS 2014; USAID 2010; AGRA 2010; FSD 2012; MoA; Dalberg Interviews and Analysis, 2019

Dalberg