Commercialization assessment: High Iron Beans in Tanzania

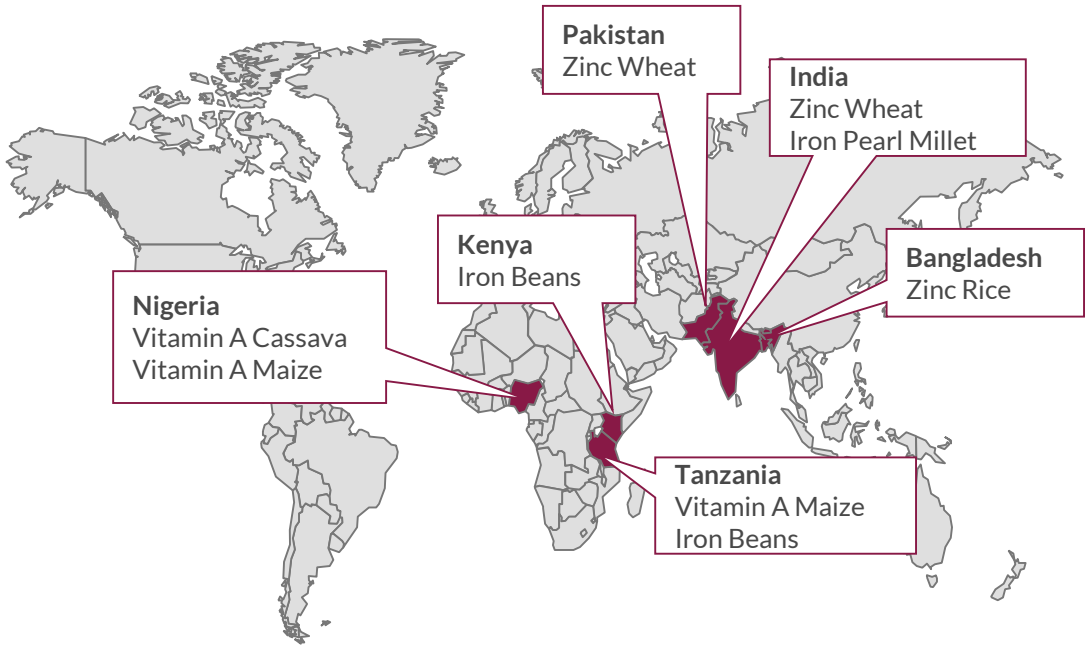
FINAL REPORT FOR GAIN AND HARVESTPLUS

DECEMBER 2019

Recap: Program context

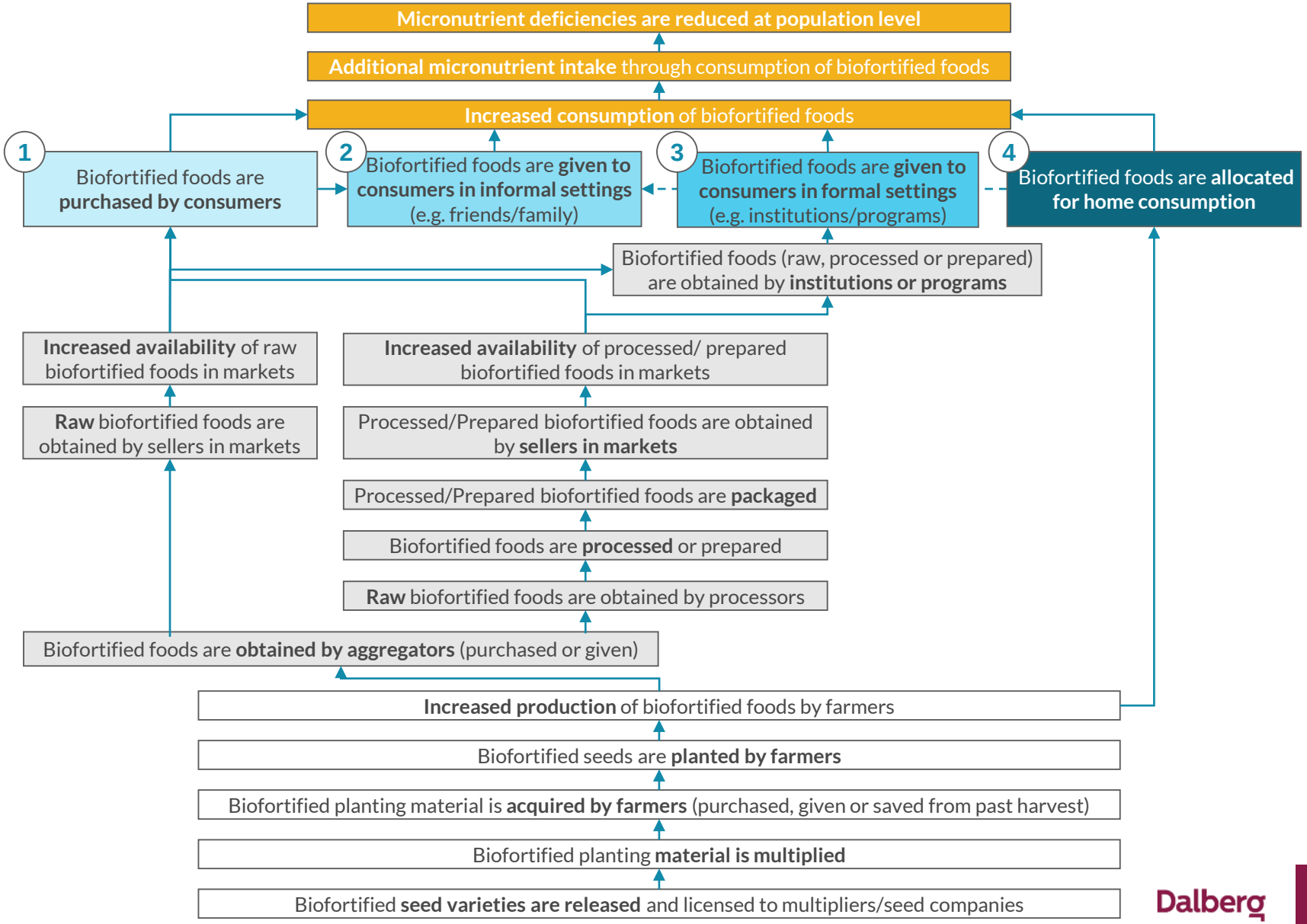
- GAIN and HarvestPlus share an ambition to expand coverage of biofortified nutrient dense foods to at least 200 million consumers. The overall vision of this program is to scale up the commercialization of biofortified foods. Iron beans in Tanzania is one of the nine selected crop/country combinations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

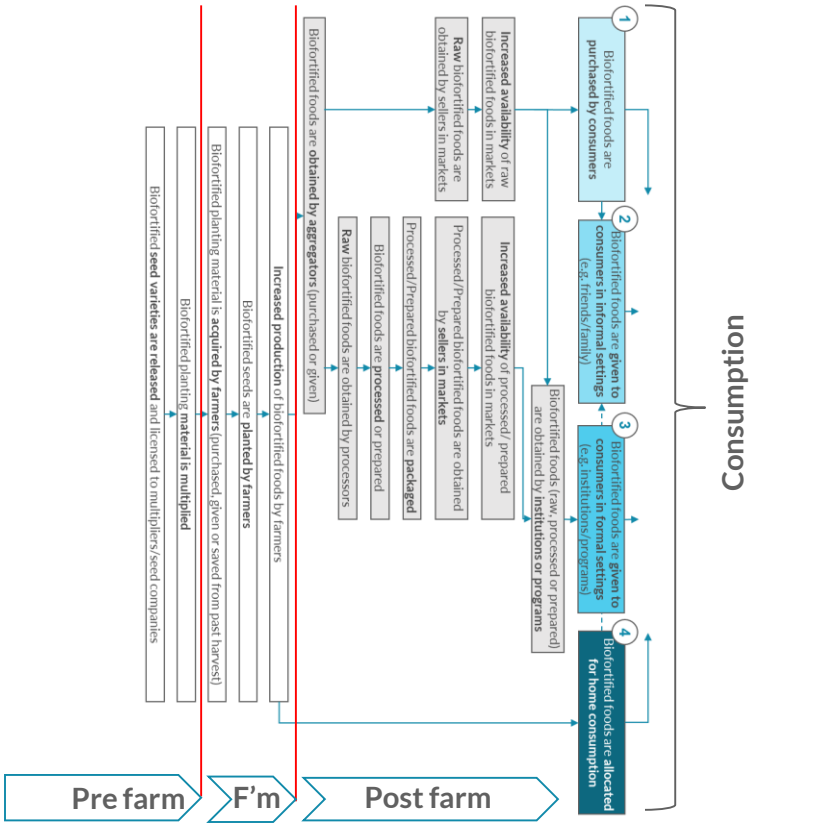
Alignment on the understanding of commercialization will potentially have significant impacts for scale that is feasible, programming, and resource allocation across the portfolio, amongst other things. On farm consumption and public procurement are significant parts of the value chains for a number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

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

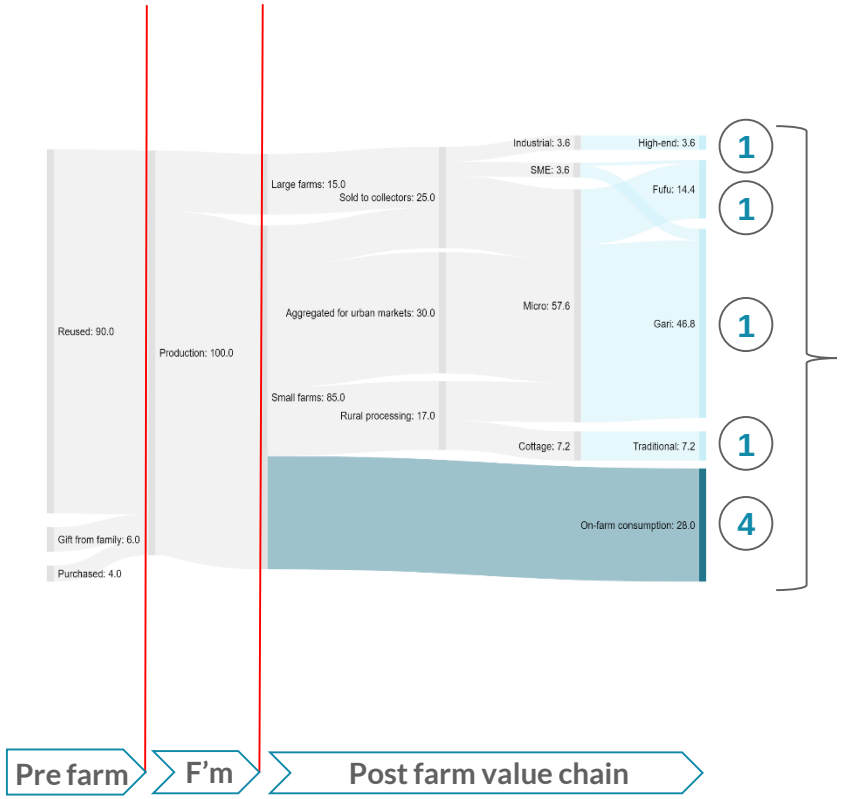
How to read this report (1/2)

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



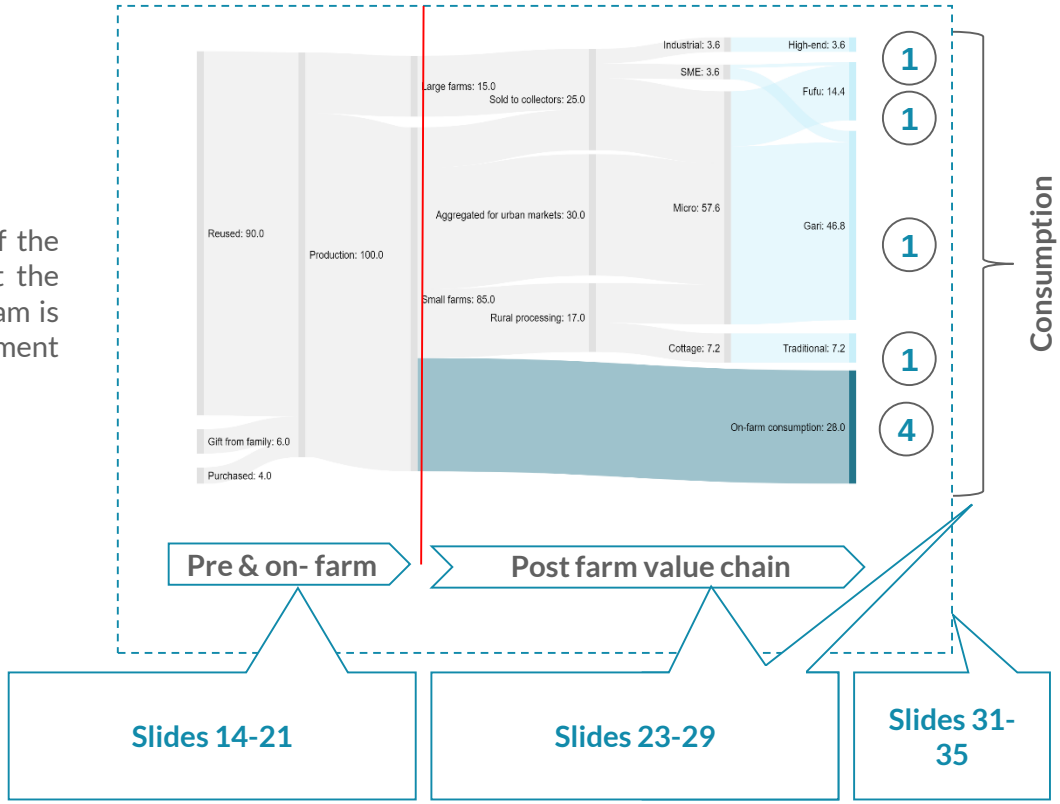
'Sankey diagram' showing relative flows through the value chain



How to read this report (2/2)

- This report is broken down into four 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

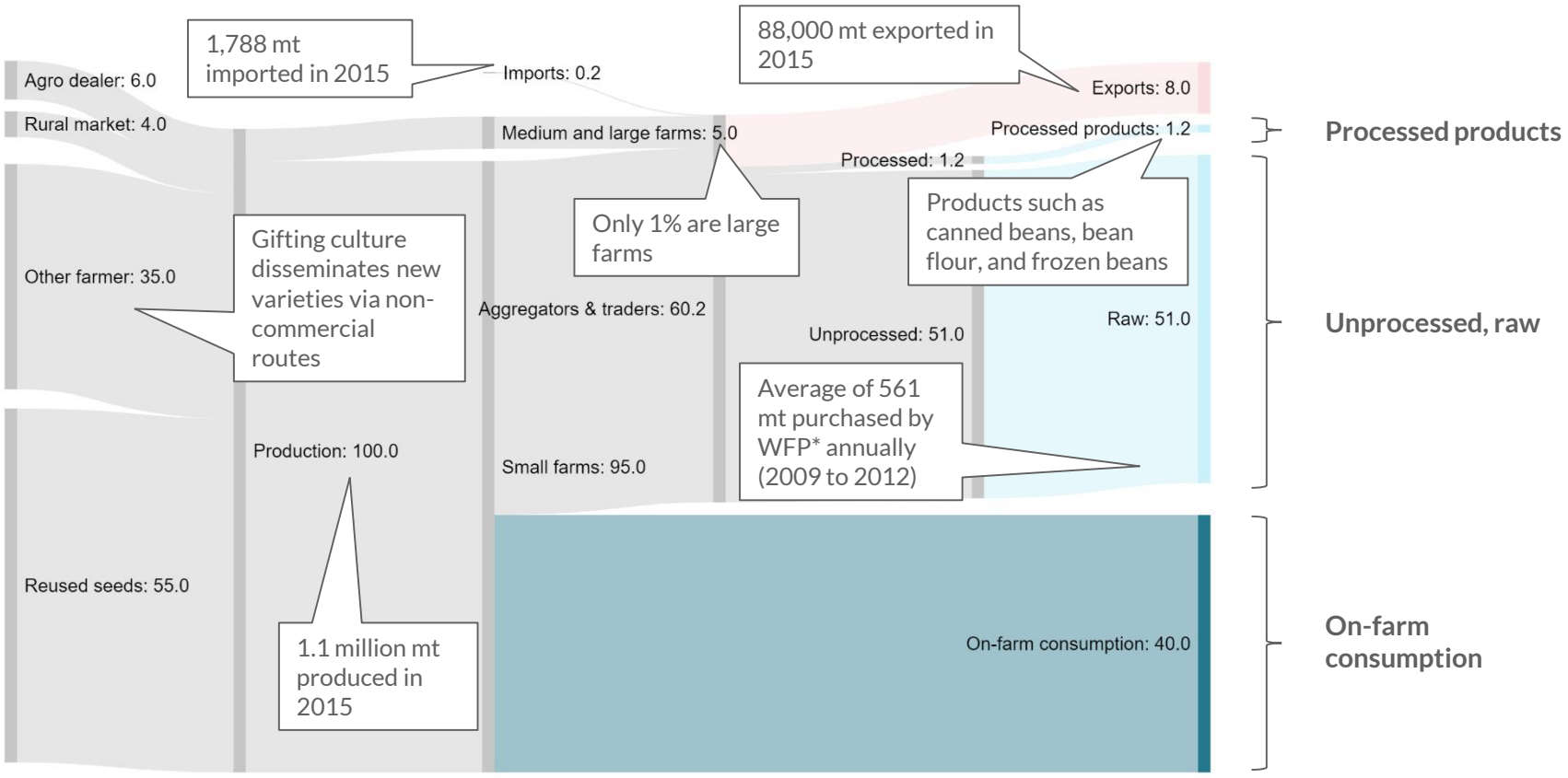
Introduction

- **Iron deficiency affects 30% of women in Tanzania between the ages of 15-49.**[1] 58% of children under five and 45% of women aged 15-49 are anemic.[2,3] Over 75% of rural households depending on beans for daily subsistence.[4] Thus, iron beans represent an opportunity to address nutritional deficiencies in the Tanzanian population
- **Biofortified beans are at an early stage of development in Tanzania.** Two new varieties of iron beans were released in 2018, Selian 14 and Selian 15, both with a yield potential of over 2 mt/ha. The average productivity of current dry beans is 0.98 mt/ha,[5] with production reaching 1.1 million tonnes in 2015[6]
- **Biofortified beans hold solid government support and strong potential for commercialization.** To assess the path to commercialization, we looked at pathways across:
  i. Pre-cooked and processed beans
  ii. Unprocessed beans
  iii. On-farm consumption

(1) Prime Minister's Office, National Multisectoral Nutrition Action Plan, 2016 – 2021; (2) Tanzania Demographic and Health Survey 2015 (TDHS); (3) Tanzania Food and Nutrition Center, Regional Technical and Advocacy Meeting on Adolescent Health and Nutrition, 2017; (4) Selian Agricultural Research Institute Released Seven Improved Common Bean Varieties January 2018; (5) BNFB, New Improved High-iron and Zinc Beans Released in Tanzania; (6) BNFB, Tanzania SITAN report.

The bean value chain is dominated by seed re-use or sourcing from other farmers, and consumption of unprocessed grains

Tanzania is the largest producer of beans in East Africa and exports to neighboring countries; however, it has an unsophisticated chain dominated by unprocessed grain consumption and informal seed sourcing



*World Food Program

ITC, Value Chain Roadmap for Pulses 2016-2020, 2015; Dalberg, Literature Review, 2019; FAO, Institutional Procurement of Staples from Smallholders, 2014; Medard, Factors affecting common beans in Tanzania, 2017; Dalberg interviews and analysis

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 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?

There is 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		**Climbing beans**	**Two iron bean varieties are climbers, whereas most common beans in Tanzania are bush beans.** Thus, they require different planting and farming techniques not known to most farmers.
		**Seed re-use**	**Farmers re-use seeds unless they have a guaranteed buyer demanding the use of specific certified varieties.** Seed producers are reluctant to invest in increasing seed production without proven demand from farmers, and biofortified varieties are limited in their early stage growth by a lack of formal seed demand.
Post-farm & consumption		**Limited processed demand**	**Processed and pre-cooked beans represent just 1.2% of the market in Tanzania, signifying just a small market segment that requires segmented beans.** Consumers do not demand specific bean varieties and are not aware of the potential nutritional benefits of iron beans.
		**Trading in mixed beans**	Without demand for segregated beans, actors along the value chain continue to mix varieties: • **Post-harvest handling techniques are poor**, and contribute to the low quality and mixing issues for downstream buyers. • **Aggregators and traders buy beans by type, judging on appearance only,** and are not aware of the iron bean varieties
Policy & Financing		**Lack of emphasis on biofortification**	The government's nutrition policy focuses on fortification, and risks sidelining efforts to commercialize biofortified crops.
		**Limited school feeding funds**	Funding required for school meals is often late or entirely lacking. Funding is limited and ownership is split across a number of stakeholders.
		**Financing gap**	Actors across the maize value chain have unmet financing needs which prevent greater market formalization.

Viable opportunities lie in retail partnerships and potentially in school meals; seed production could help commercialization

OPPORTUNITIES		PATHWAYS IMPACTED
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.	**Large-scale millers**
School feeding program	**Purchases by school feeding programs could generate the downstream demand required to spur investment and scale throughout the value chain**. This approach could look to work across three groups of stakeholders: 1. *School Boards (to make decisions)* 2. *School Suppliers (to ensure segregation)* 3. *Policy-makers (to drive and track implementation)* Furthermore, children act as agents of change by influencing buying decisions in the home, catalyzing a market effect beyond school purchases and into the mainstream.	**Large-scale millers; small-scale millers; unprocessed, raw**
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.	**Large-scale millers**

Pre-farm & on-farm

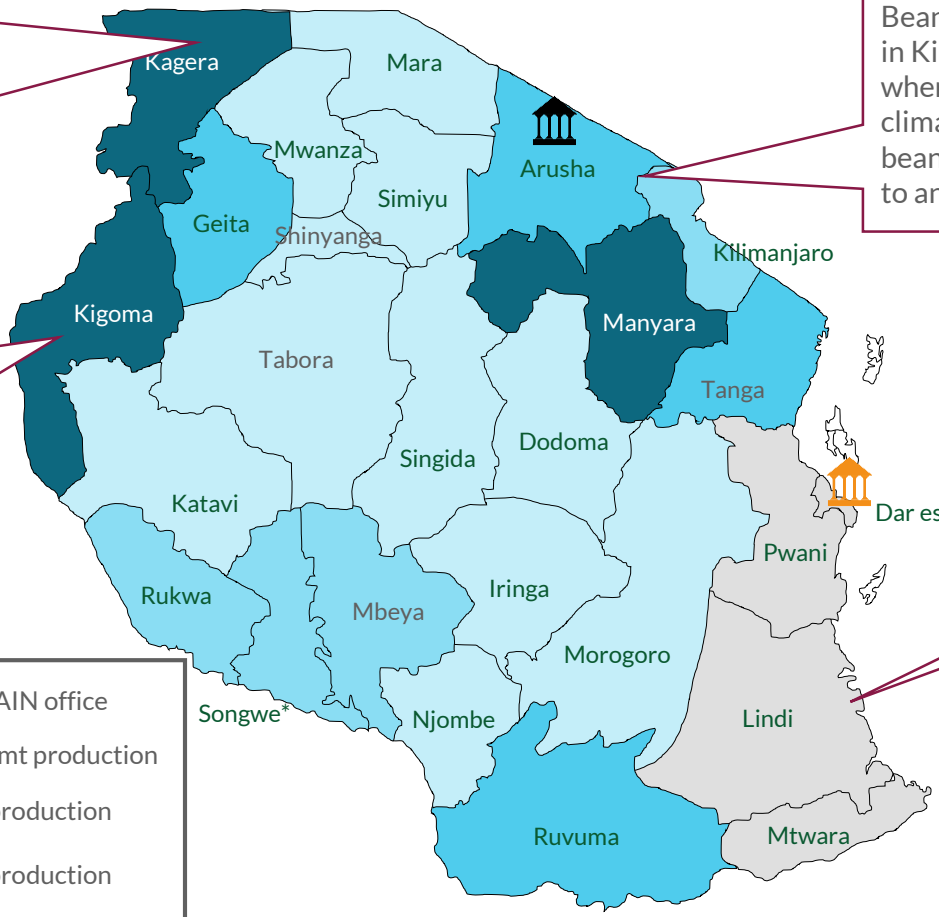
Bean production is concentrated in the northern zone with coastal regions dependent on imports due to climatic unsuitability

The most suitable areas for bean cultivation in Tanzania are in the northern zone particularly Arusha, the lake zone, and the southern high-lands.

Bean yields range from 0.2 mt/ha in Tabora to 0.8 mt/ha in Kigoma.[1]

Beans are grown for export in Kilimanjaro and Arusha, where there is a suitable climate for commercial bean cultivation, and access to an international airport.

Bean production is lower in lowland and coastal regions due to climatic conditions.



CIAT office
GAIN office
Greater than 40,000 mt production
20,000 – 40,000 mt production
10,000 – 20,000 mt production
Less than 10,000 mt production
Insufficient data available

Quick facts (2015)

- 1.1 million mt produced
- 1,788 mt imported
- 88,000 mt exported

*Production combined with Mbeya prior to separation of the two regions

(1) NBS, Annual Agriculture Survey, 2016/17; CIAT website; GAIN website Rory Hillocks, Rowland Chirwa, Phaseolus Bean Improvement in Tanzania 1959–2005, 2016; Dalberg interviews and analysis

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Beans are grown by farmers focusing on home consumption, those aspiring to sales, and more commercial enterprises

Focus on the home

Farmer characteristics

- Smallholder farmer mostly focused on producing beans for home consumption
- Intercrops beans with other crops

Typically gets seeds from

- Re-uses seeds from harvest or buys grains from the market
- Mixing of beans with little regard for the bean variety

Decision drivers

- Cheapest price

Consumption choices

- More likely to keep for home consumption but sells surplus as source of income
- Uses beans as an addition for most meals

Key influencers

- Neighbors, extension officers, church

Aspiring sales-farmers

Farmer characteristics

- Smallholder farmers using better agronomic practices such as proper input use, spacing etc
- Dedicates a part of the farmland for crop sales
- Likely located in the lowlands where climatic conditions are ideal resulting in higher yields

Typically gets seeds from

- Mostly reuses or buys grains from the market

Decision drivers

- Good yields and potential for expansion

Consumption choices

- More likely to dedicate larger volumes of production for sale

Key influencers

- Demo plots, extension workers, media

Regular contract enterprises

Farmer characteristics

- Larger and more established farmers who have regular and consistent contracts from downstream processors
- Practice rotational cropping with maize for soil enhancement purposes

Typically gets seeds from

- Buys certified seeds on a regular basis from agro-dealers

Decision drivers

- Availability to scale, good yields, overall profitability

Consumption choices

- All produce is sold

Key influencers

- Buyers, peer commercial farms, consumption trends

Aspiring sales farmer represent the smallest segment of farmers, yet given their characteristics they represent an ideal target for scaling up iron bean production

Source: Dalberg interviews and analysis, 2019; Icons by the Noun Project

Iron bean varieties were introduced in 2018, and have high yields, strong pest resistance, and fast cooking times

High Iron Beans	
Delivery stage	Successful pilots, but not at delivery stage
Number of varieties released	MAC44 (Selian 14) RWV1129 (Selian 15) Jesca (no longer considered due to lower iron levels)
Market reach	3,530 households reached with BNFB pilot
Volumes	260 kg of Jesca seeds were initially distributed to primary schools[1]
Agronomic characteristics	• Mild altitude climbers • High yields (2.0-3.5 mt/ha) • Pest and disease resistant • Early maturing
Other characteristics	• High iron content (78-90 ppm in Selian varieties) • High zinc content (26-42 ppm in MAC44) • Favorable taste and color

Iron bean in Tanzania

- High iron bean varieties were introduced in 2018 through efforts led by Selian Agricultural Research Institute (SARI). Early tests showed that iron bean varieties were:
  - High yielding with potential average yields of 2-3.4 mt/ha[2]
  - Preferred to analogue varieties by farmers and consumers

Biofortified characteristics

- Selian varieties are red mottled, and mild altitude climbers as opposed to bush growers
- Selian varieties are also tolerant to drought and low soil fertility
- Due to its high yield and pest resistance, Selian varieties are a preferred choice for farmers
- Additionally, farmers have a high willingness to pay for iron bean varieties because their taste and color are preferred by consumers

Variety name	Iron content (ppm)	Zinc content (ppm)	Max yield (t/ha)	Maturity period (days)	Year of release
MAC44	78-90 ppm	26-42 ppm	2.0–3.5	90-110	2018
RWV1129	78-90 ppm	27-43 ppm	1.9–3.4	90-110	2018
Jesca[3]	25-95 ppm	29 ppm	1.5-2.0	60-65	2016

Consumption characteristics

- The iron bean varieties cook within 20-40 minutes, faster compared to some analogue varieties which take more than two hours[2]

Future releases

- Trials for eight more varieties are ongoing

(1) BNFB, End of Project Report, 2019; (3) BNFB, Bean Research and Development in Tanzania, Inception meeting, 2016;(2) BNFB, Fighting Iron Deficiency New Improved High-iron and Zinc Beans Released in Tanzania, 2018; BNFB, Situational Analysis Report for Biofortification and Biofortified Crops in Tanzania, 2017; Dalberg, Literature Review, 2019; Dalberg interviews and analysis, 2019

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Iron bean production is still in the early phases; varieties require different growing practices and the main buyers are processors

	Research and development	Seed production and supply	Production
Features	• Two new varieties of iron beans have been released, both of which are climbers • Jesca is a bush bean but no longer marketed as an iron bean due to lower nutrient levels • Average potential yield is almost four times higher than analogue varieties	• Seed production and supply is still in the early phases • Farmers were initially supplied with through the Building Nutritious Food Baskets (BNFB) project and Tropical Legume III projects	• Agronomic practices for the new varieties are different from analogue beans • Inter-cropping beans and maize to improve soil nutrients is a common practice
Actors	• The research and release efforts were led by Selian Agricultural Research Institute (SARI) • Partners included ARI Uyole, ARI Maruku and the International Center for Tropical Agriculture (CIAT)	• The Swiss Development Corporation (SDC), United States Agency for International Development (USAID) and The Global Canada Affairs supported initial efforts • Seed producers now include Crop Bioscience Solutions	• Smallholder farmers produce 95% of the beans in the country (see slide 9) • Farmers in iron bean production are likely attached to end buyer or out grower scheme • Buyers of grains include Afco Investments and Sokoine University Graduate Entrepreneurs Cooperative (SUGECO)
Economics	• No official data on the amount of iron beans released in the market	• Crop Bioscience has 150 acres dedicated to seed multiplication • In 2019, their supply of seeds has grown up to 20-50 mt • Save the Children received a supply of 5 mt	• There are conflicting reports on the prices of bean grains • Crop Bioscience sells their beans at equal or lower than market price while there are people who buy beans at almost 15% more • Iron bean grains for 1800-2000 TSH/kg compared to 2000-2500 TSH/kg for analogue beans

SNV, Common beans and climate change risks and opportunities, 2019; BNFB, High Iron Beans brochure, 2018; Jean Claude Rubyogo, Coordinator, CIAT Tanzania. October, 2019; Wilfred Mushobozi, CEO, Crop Bioscience Solutions, October 2019; Dalberg interviews and analysis

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Barriers include climbing bean characteristics, the re-use of seed, and a lack of farmer bargaining power

Key barriers	Description
Climbing beans	**The new iron bean varieties are climbers, whereas most common beans in Tanzania are bush beans.** Thus, they require different planting and farming techniques not known to most farmers. The certification process for new varieties is long and costly, so competitive high iron bush beans may not be released on the market for a number of years.
Seed re-use	**Farmers re-use seeds unless they have a guaranteed buyer demanding the use of specific certified varieties.** Grain and beans are purchased from the local market and planted as seed, often due to a lack of understanding of the benefits of buying certified seed, such as improved yields and drought resistant properties. Thus, seed producers are reluctant to invest in increasing seed production without proven demand from farmers, and biofortified varieties are limited in their early stage growth by a lack of formal seed demand.
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 as little as 500 USD/mt in Arusha during harvest periods, and can reach more than 850 USD/mt in Dar es Salaam during times of shortage.[1] A lack of trust in downstream buyers combined with poor contracting arrangements means that brokers simply look elsewhere if prices drop. This unpredictability means that farmers are reluctant to invest in new seeds.

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) EAGC Grain Watch, August 2019; Dalberg interviews and analysis, 2019

Climbing beans | Farmer adoption of iron bean varieties is limited by their ability to practice different farming techniques

Root cause

- Climbing varieties of beans **require a climbing stick or cane to support growth of the vine**. Specific planting and growing practices are needed to deliver high yields
- The **majority of beans produced in Tanzania are bush beans**, which require a different growing technique
- **Climbing beans cannot be mixed with bush beans** during planting, due to the different growing requirements
- The two most promising high iron bean varieties, Selian 14 and Selian 15, are climbing varieties
- The Jesca variety is a bush bean, but has received less positive feedback and has a lower iron content
- The lack of laboratory and testing facilities in Tanzania means that the **certification and licensing process for new varieties is lengthy and complicated**
- Thus it may be years before competitive high iron bush bean varieties are available

"This variety is a climbing crop. This is not the normal bean they are used to, it needs different management, even though productivity is higher"

Revocatus Kimario, Director, SUGECO

Impact on potential to scale

- Climbing beans require farmers to adopt **new planting and growing techniques** in order to achieve high yields
- As climbers cannot be mixed in planting with bush beans, **farmers ability to mitigate the risk of crop failure through mixing bean varieties is hindered**
- Thus, **farmer willingness and ability to change agronomic practices** is likely to impact iron bean adoption
- Furthermore, without the mixing of iron beans with other varieties, there will be a **lower rate of integration in the informal seed system**

"We need to integrate the climbers in the farming system. Its not easy because you are transforming the farming system to a new system that they are more used to"

Wilfred Mushobozi, CEO, Crop Bioscience Solutions

Revocatus Kimario, Director, SUGECO, October 2019; Wilfred Mushobozi, CEO, Crop Bioscience Solutions, October 2019; Dalberg interviews and analysis, 2019

Seed re-use | Farmers choosing to re-use seeds limits the growth of certified seed production

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,** including higher yields, drought and disease resistance – although interest in buying drought resistant seeds is growing as **the impact of climate change is being felt by farmers**
- Re-using seed is more cost effective than buying certified seed, and thus **55% of farmers re-use seeds from their harvest** (see Sankey slide 9)
- **35% of farmers get seeds from family and friends'** harvest produce, whilst 4% purchase grain from local traders to use as seed – a total of **94% seed re-use and just 6% buy certified seeds**
- After harvest, farmers consume approximately 40% of their produce**, save a portion of the rest as seed** for the upcoming season, and sell the surplus

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

"Some of the research institutes promote their seeds to farmers but majority of farmers reuse seeds; others buy from the market."

Jonathan, Department of Nutrition and Food security, Ministry of Agriculture

Jonathan, Department of Nutrition and Food security, Ministry of Agriculture, October 2019; Dalberg interviews and analysis, 2019

Supporting seed producers could help to unlock commercialisation, but is secondary to downstream demand

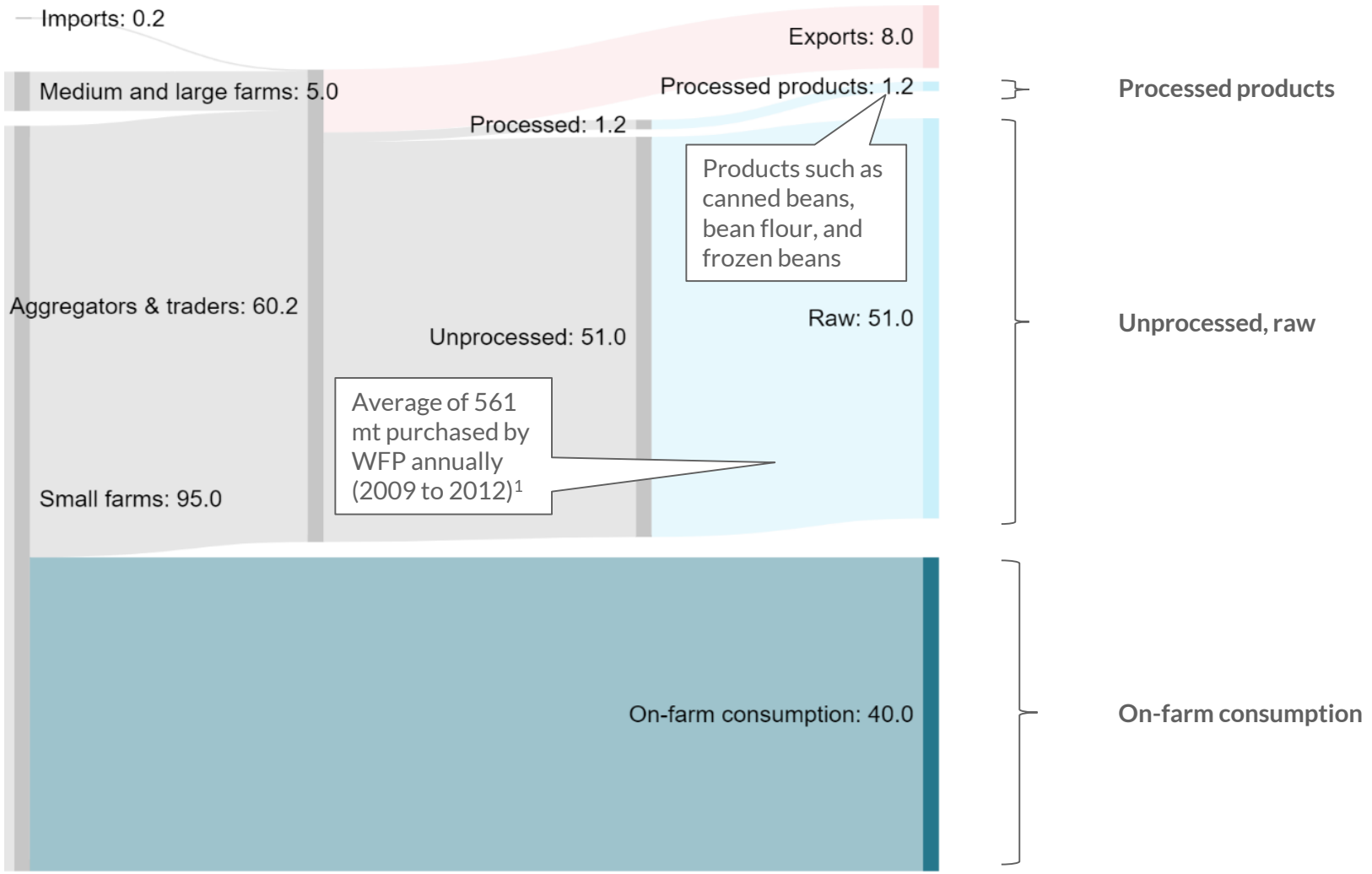
Key Opportunities	Description
Seed production	**Supporting seed producers to access financial and technical support could help them expand seed production.** Seed producers are currently limited in their ability to invest in large bean seed production by a lack of downstream demand. As this begins to 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.*

Opportunities with seed producers 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

*Financing needs are not unique to beans.
Dalberg interviews and analysis, 2019

Post-farm & consumption

Aside from 40% on-farm consumption, most of Tanzania's beans are sold unprocessed and raw



ITC, Value Chain Roadmap for Pulses 2016-2020, 2015; Dalberg, Literature Review, 2019; (1) FAO, Institutional Procurement of Staples from Smallholders, 2014; Medard, Factors affecting common beans in Tanzania, 2017; Dalberg interviews and analysis, 2019

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Unprocessed beans have the high market share across consumer pathways, and thus hold potential for commercialization

	Features	Primary consumers	Drivers
Processed products	• Processed products include bean flour and pre-cooked beans • Processed beans make up only 1.2% of the market with processors looking to test market demand (see slide 23)	• Middle to upper income households • Smaller segment compared to other markets (see slide 26)	• Convenience through reduced cooking time • Nutritional content and healthier alternative due to growing health consciousness • Palatability of the beans • Lower levels of flatulence
Unprocessed, raw	• Sold unpackaged in large polypropylene bags bags • Major producing regions transport beans to major markets in Dar es Salaam and Arusha	• 75% of rural households consume beans[1] • Communities consume beans as a complimentary to dish to ugali and rice • Average consumption can vary depending on location and culture	• Availability of beans in terms of closest market and in different seasons • Affordability of the beans for rural consumers • Fuels saving through reduced cooking times • Palatability of the beans
On-farm consumption	• Most farmers produce beans for home consumption and only sell the surplus to aggregator or traders • Beans acts as a supplement to maize	• Low income households particularly in rural areas where there is land availability	• Sustenance and ensured ability to provide food for the family at all times

(1) Binagwa P.H, Selian Agricultural Research Institute (SARI) Released Seven Improved Common Bean Varieties, January 2018; Dalberg interviews and analysis, 2019

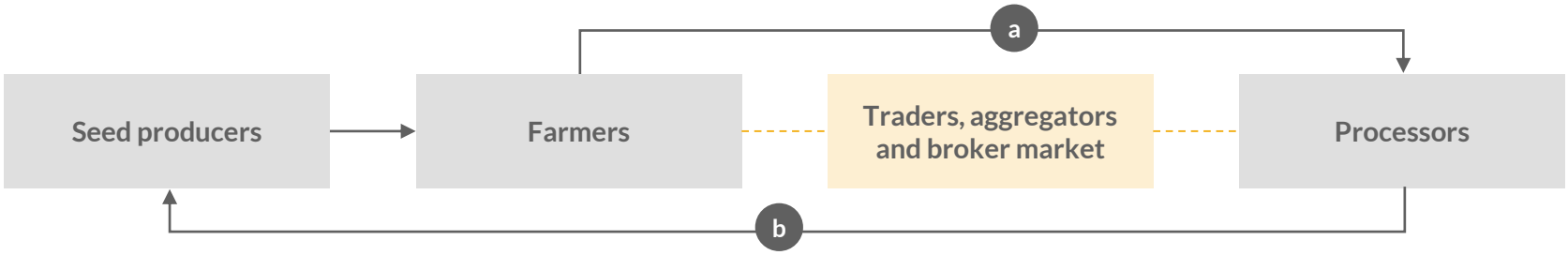
Barriers include limited processed demand and downstream trading in mixed beans in the raw, unprocessed channel

Key barriers	Description
Limited processed demand	**Processed and pre-cooked beans represent just 1.2% of the market in Tanzania, signifying just a small market segment that requires segmented beans.** Consumers do not demand specific bean varieties and are not aware of the potential nutritional benefits of iron beans. The potential to catalyze change in the bean market through a high-end nutritional product is limited.
Trading in mixed beans	**The lack of bean segregation occurs throughout the bean value chain. Beans are mixed at three different stages: planting, post harvest and aggregation.** Mixing occurs as result of a lack of knowledge on the different bean varieties and their individual characteristics. Downstream demand for segregated beans can act as an incentive for value chains actors to separate their beans by variety.

Dalberg interviews and analysis, 2019

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

1 The processed bean market acts as a distinct supply chain that requires high quality segregated beans



- **Mixed beans have different properties, including taste, storage, cooking times and flatulence levels,** presenting a challenge for pre-cooking and processing
- **Processors therefore cannot buy from the mainstream aggregation and trading market**, due to the high risk of mixed beans in a bag, and the additional cost of subsequent separation

a Processors establish relationships with farmers, outgrower networks, and often set up their own production facilities

b They **work with seed processors** to make sure that farmer-outgrowers are using certified and segregated seeds, provided by the seed producers

2 A small market share and lower growth means there is less potential to catalyze change through this segment

- **Processed and pre-cooked beans represent 1.2% of the market**. This is a smaller share than in neighboring countries such as Kenya (10.8%) and Rwanda (10%)[1]
- There are **few bean processors, most of which are small scale,** with little resources to conduct product marketing or help raise consumer awareness. Afco investment and SUGECO are looking to pilot a few products in the market
- Thus, **processed bean products offer limited potential** as a channel to reach large-scale consumers with certified beans, or as a point of market entry to the raw, unprocessed channel where beans are not segregated

(1) USAID, The business case for investing in the processing and canning of common beans in Rwanda, 2012; Dalberg interviews and analysis, 2019

Trading in mixed beans | Without demand for segregated beans, actors along the value chain continue to mix varieties

The lack of bean segregation occurs throughout the bean value chain. Beans are mixed at three different stages: planting, post harvest and aggregation. Mixing occurs as result of a lack of knowledge on the different bean varieties and their individual characteristics. Downstream demand for segregated beans can act as an incentive for value chains actors to separate their beans by variety.

Planting

- Farmers tend to mix their seeds during planting to mitigate the risk of crop failure
- Farmers have no need to segregate bean seeds since a large portion of the beans are for home consumption
- See slide 18 on climbing beans for barriers regarding mixing during planting

Post harvest

- After harvesting, farmers do not separate the different bean varieties. The bean grains are collectively sun dried and stored
- Poor post-harvest management can lead to losses due to the varying characteristics of the bean grains

Aggregation

- Aggregators do not segregate beans sourced from farmers by variety
- Aggregators only sort beans by physical attributes such as color and shape. Examples include red mottled, yellow round and black beans

Dalberg interviews and analysis, 2019; Icons by The Noun Project

Trading in mixed beans | Poor post-harvest handling and lack of variety and quality distinction means that bags contain mixed beans

1 Post-harvest, smallholder farmers lack adequate information, skills and technologies required for appropriate handling, resulting in losses and sale of low-quality produce

- Most **farmers grow a wide variety of beans.** After harvest, farmers do not separate different bean varieties before drying them in the sun
- Different seed varieties have varying **moisture content and shelf life which affects how they need to be handled and stored** post farm
- Drying of beans happens in their homesteads, either on bare earth, mats or sacks. **A lack of awareness on drying thresholds can lead to improper drying or hard shells**
- Improper drying can cause increased susceptibility to pests, mildew and rotting . Hard shells can mean that the beans are hard to cook

> *"Post harvest losses are caused by poor post harvest handling practices. We have launched a national post harvest management strategy… to reduce post-harvest handling by 50% by 2025."*
>
> Jonathan, Department of Nutrition and Food Security, Ministry of Agriculture

- **There are few village-level storage facilities available for pulses**. Government-built village stores that were transferred to village councils are often in need of rehabilitation, misused or mismanaged
- The most **significant losses occur during storage at household level**. Farmers lose an estimated 15-40% of their grains every year[1]

2 In aggregation, trader receive mixed produce from farmers, and similar-looking beans are often confused and mixed together during transport and trading

- Bean types in Tanzania include red mottled, yellow round, black and others. **For each type of bean there are multiple different varieties, and traders cannot always distinguish between them** to separate bags of different varieties or quality
- **Improper handling and transportation of produce increases the risk of mixing different bean varieties,** if they are transported together without clear segregation
- Thus traders both receive and contribute to the issue of **mixed qualities of beans, which hinders the traceability of different bean varieties, including iron beans**

(1) Swiss Agency for Development and Cooperation, Grain post harvest loss prevention, 2013; ITC, Value Chain Roadmap for Pulses 2016-2020, 2015; Jonathan, Department of Nutrition and Food security, Ministry of Agriculture, October 2019; Dalberg interviews and analysis, 2019; Icons by the Noun Project

The school feeding program and retail partnerships could present commercially viable opportunities to scale iron beans

Key Opportunities	Description
School feeding program	**Purchases by school feeding programs could generate the downstream demand required to spur investment and scale throughout the value chain.**[1] This approach could look to work across three groups of stakeholders: *1. School Boards* • The purchasing decision makers are the boards responsible for each school. Interventions could aim to help them understand and recognize biofortified crops, and subsequently include iron beans in school procurement • Working to increase awareness through nutrition information packs, school visits and building relationships will be key *2. School Suppliers* • Working with the registered school suppliers of food could ensure that quality is maintained and mixing of varieties does not occur. These suppliers could act as a focal point for aggregating biofortified crops across districts, specifically for school consumption • Interventions could aim to de-risk the inclusion of iron beans in the aggregation system, potentially through small grants and technical assistance *3. Policy-makers* • See slide 35 Further to school purchases, children can act as agents of change by influencing buying decisions in the home, catalyzing a market effect beyond school purchases and into the mainstream.
Retail partnerships	**Working with downstream retailers is another commercial opportunity. It 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.

*The potential for this intervention requires further investigation, as it can only be effective as a catalyst for commercialization **if the size of school purchases delivers sufficient volumes to drive demand**. Initial estimates do not suggest significant scale.*[1]

(1) Total school purchases are estimated at 19,000 mt/year (number of school children x average daily consumption x 200 school days per year), which equates to just 1.6% of the total dry beans market. Of this, approximately 30% is the addressable market through boarding school purchases. Dalberg interviews and analysis, 2019

Policy & financing

Barriers in the wider ecosystem include fortification standards, school feeding funds, and the financing gap

- Beyond the specific value chain for iron beans, **there are a number of factors that could support or hinder ability to commercialize**. In this analysis we focus on two: policy, and access to finance. Given the timeframe and ambition of the program, the analysis focuses on aspects of policy and finance that GAIN and HarvestPlus could feasibly influence[1]:
  - Interpretation and delivery of existing policy, rather than creation of new policies / changes to existing policies
  - Access to finance for value chain actors (rather than consumers)*
- In terms of 'policy', the analysis considers multiple types of policy: norms, standards, and regulation. The analysis also looks at difference units of scale e.g. national/federal, regional/state, city level
- **For beans in Tanzania, we see three main barriers in policy and finance**:

Lack of emphasis on biofortification

The government's nutrition policy focuses on fortification, and risks sidelining efforts to commercialize biofortified crops

Limited school feeding funds

Funding required for school meals is often late or entirely lacking. Funding is limited and ownership is split across a number of stakeholders

Financing Gap

Actors across the beans value chain have unmet financing needs which prevent greater market formalisation*

(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:

1. Policy coherence – Do different decisionmakers have clear and aligned visions for how a biofortified system should work?
2. Institutional incentives – Is biofortification a priority or not?
3. Effective coordination – Are the different actors talking with one another? Are there clear platforms for alignment?
4. 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

*Financing needs are not unique to beans

Dalberg interviews & analysis, 2019

Lack of emphasis on biofortification | Focusing on fortification means beans are not considered in nutritional interventions

1 **Tanzania has strong government support for nutrition in policy and legislation, with an emphasis on fortification. However, standards are unclear and the degree of implementation appears patchy**

- **Tanzania has a cross-sector, multi-stakeholder platform for nutritional governance,** consisting of the High Level Steering Committee for nutrition and the Technical Working Group for nutrition, which advocate and mainstream nutrition in government objectives
- **Tanzania has made strides to integrate nutrition in national strategies.** The National Health Policy (2003) and the National Nutrition Strategy (2012) highlight food fortification to improve nutrition
- **In 2011, the government mandated wheat and maize flour fortification** with iron, zinc, vitamin B12 and folic acid, and vegetable oil with vitamin A
- **A lack of capacity and funding of government institutions hampers biofortification adoption, and unequal distribution of funds across districts** leads to varying degrees of nutritional policy implementation

2 **Fortification involves adding supplements during the milling process, which does not apply to the majority of beans sold in the market. As a consequence, beans are side-lined as a potential nutritional intervention**

- The **government plans to expand the application and enforcement of fortification** to include all millers. Fortification adds nutrients to milled products through a powder supplement and can not be added to raw beans
- As only a very small percentage of beans are processed into composite bean flour, **fortification cannot be applied to the majority of bean products**
- **Biofortification definitions, certification and standards are inconsistently applied and implemented**. Labelling standards exist for fortified processed products such as maize and wheat flour, but not for processed biofortified or processed bean products
- The government's **emphasis on fortification risks side-lining the benefits and potential to commercialize iron beans** as a nutritional intervention in Tanzania

BNFB, Tanzania SITAN report; Ministry of Health and Social Welfare, National Nutrition Strategy JULY 2011/12 – JUNE 2015/16; Guardian, Malnutrition in Tanzania: Will food fortification laws work?, 2014; TFNC, Tanzania Landscape Analysis final report, 2012; PO-RALG, Dalberg Interview, October 2019.

Limited school feeding funds | Funding for meals is unclear, split across stakeholders and often late or entirely lacking

1 **School feeding programs aim to provide children with the sustenance they need for education. However, management of the program is devolved, with unclear funding split across stakeholders**

- **School feeding programs aim to reduce hunger in children from low-income districts** where hunger affects learning in primary and secondary school pupils. **The estimated total beans procurement for school feeding programs is 1.6% (19,000 mt/year) of the total dry beans market**[1]
- While some day schools grow their own food, **the majority of boarding schools procure food from registered school suppliers, who provide maize and beans for the schools**. Decisions on food procurement are made by the school board, who buy in bulk according to school needs
- **School feeding programs are widely funded by government, World Food Program (WFP), and other NGOs**, while some public schools require parents to contribute to some of the food for pupils. There is not one system of funding, although in theory government District Nutrition Officers monitor procurement and spending
- **Schools are allocated a budget** by the government of **1,500 TSH per child.**[2] This limited budget means that nutritional considerations come second to the cost

2 **Funding gaps and delays constrain schools' supply of food, and presents a challenge for the adoption of biofortified crops by school feeding programs**

- **Funding has reduced significantly** since WFP withdrew support, and NGOs often run just short-term projects
- **Government funds are regularly delayed** which means that traders are not paid on time. As a result, **many school suppliers are reluctant to procure for schools**, due to fears or non-payment or significant delays
- **Without adequate funding, schools struggle to pay for school meals**, and may be forced to source poorer quality or smaller quantities of maize, in order to reduce costs
- Funding is a risk regardless of whether schools choose to purchase biofortified crops or analogue varieties**. Solely relying on school procurement as a strategy for commercialization carries a funding risk**

> *"Delayed payments from government causes suppliers to refuse to send food to the schools. A lot of effort is spent trying to convince suppliers to send the food regardless"*
>
> Mary Msungu, Principal Education Officer, PO RALG

(1) Total school purchases are estimated at 19,000 mt/year (number of school children x average daily consumption x 200 school days per year), which equates to 1.6% of the total dry beans market; (2) Mary Msungu, Principle Education Officer. PO RALG, October 2019; Dalberg, PVA Maize Literature Review, 2019; Lukindo, Contribution of School Feeding Programs (SFPs) in Enhancing Pupil's Schooling in Primary Schools in Monduli District, Tanzania, 2018; Icons by The Noun Project

Financing gap | Actors across the bean value chain have unmet financing needs, which prevents greater market formalisation*

	Inputs	Production	Transport & Storage	Milling & processing	Marketing
Existing financial relationship	• Limited evidence on the provision of input credit outside of that provided to SHF by 'nucleus' commercial farms	• Contract financing exists for farmers connected to export orientated value chains • SACCOs provide financial support	• Larger traders connected to formal groups such as export agencies and the WFP are supported to purchase on credit terms • Limited other financial offerings	• Limited warehouse financing exists	• Large buyers such as the WFP and exporters have access to finance and can provide contract terms to producers
Needs and gaps	• Significant need for support on inputs. Use of improved seed varieties and fertilizer significantly below potential • Limited farmer association collectives for beans to negotiate on inputs	• Limited evidence of financial services provided to smallholders for bean production • Access to formal FSPs required for farmers wanting to sell and collect payment from large organisations such as exporters	• Small traders require options for working capital and warehouse receipting in order to meet liquidity requirements	• Warehouse receipting or other forms of liquidity is required to allow SHFs to undertake a hold and sell strategy	• Trade credit facilities for exporters • Working capital finance for smaller sellers operating in informal markets
Estimated required finance	• Agro-dealers on average need $10 per acre for inventory	• Farmers need on average $13 per acre for seed inputs	• Traders / aggregators need $200 per acre to buy produce at farmgate • Wholesalers need $211 per acre to buy produce from traders	• Wholesalers need $42 per acre in working capital to package and clean produce	• Retailers needs $257 per acre in working capital to buy beans

*Financing needs are not unique to beans

International Institute of Tropical Agriculture, 2012; N2Africa, 2013; UNDP; Dalberg interviews and analysis, 2019

Dalberg

We see potential opportunities at the policy-maker level with regard to the school feeding program

Key Opportunities	Description
School feeding program – policy makers	**Purchases by school feeding programs could generate the downstream demand required to spur investment and scale throughout the value chain.** Following on from slide 29, working with policy makers is an essential component in addition to the school board and supplier level. This intervention could look to promote school purchases from a top-down directional point of view, particularly with regard to clear messaging on fortification and biofortification requirements. GAIN and HarvestPlus could co-ordinate with district nutrition officials so that understanding translates into demand, and support government to track and enforce the policy.

Dalberg interviews and analysis, 2019