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AGRILINKS




Commercialization Opportunities for Orange Fleshed Sweet Potato: Kenya, Malawi and South Africa

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Aviva Kutnick, USAID Bureau for Food Security

Aviva Kutnick is a USAID Foreign Service Officer currently serving as the Private Sector Engagement Division Chief in USAID's Bureau for Food Security Office of Market and Partnership Innovations. She joined USAID in 2008 after serving tours in Georgia and Tajikistan. Aviva also serves on the donor steering committee for AgResults. She began her career in international development as a Peace Corps Volunteer in Uzbekistan. Ms. Kutnick holds a double Masters degree in Economics and International Relations from Johns Hopkins School of Advanced International Studies (SAIS) and an undergraduate degree from the University of Maryland.

CJ Fonzi, Dalberg

CJ Fonzi is Dalberg's Rwanda Office Director. His experience spans a broad range of development issues including impact investing, agriculture and SME finance and support. Over the last seven years at Dalberg, CJ has supported public, private and social sector clients with strategies, investment analyses and impact assessments. CJ joined Dalberg from the Global Impact Investing Network (GIIN) where he was part of the founding team. He holds an MBA from Cornell University with a concentration in Sustainable Global Enterprise and a BS with high honors from Rensselaer Polytechnic Institute in information technology.

Carlijn Nouwen, Dalberg

Carlijn Nouwen is a partner with Dalberg Advisors in Johannesburg. She leads Dalberg's Inclusive Business Expertise area and co-leads Dalberg's Inclusive Industrialization work. She has led numerous projects for USAID's ISP program across Africa, including deal sourcing, feasibility studies and facilitation. With CJ, she co-led the piece of work with ISP and CIP to identify commercialization opportunities for Orange Fleshed Sweet Potato in Kenya, Malawi and South Africa. Before joining Dalberg in South Africa six years ago, Carlijn spent 7 years at McKinsey & Company in the Netherlands.

Orange Fleshed Sweet Potato "OFSP"

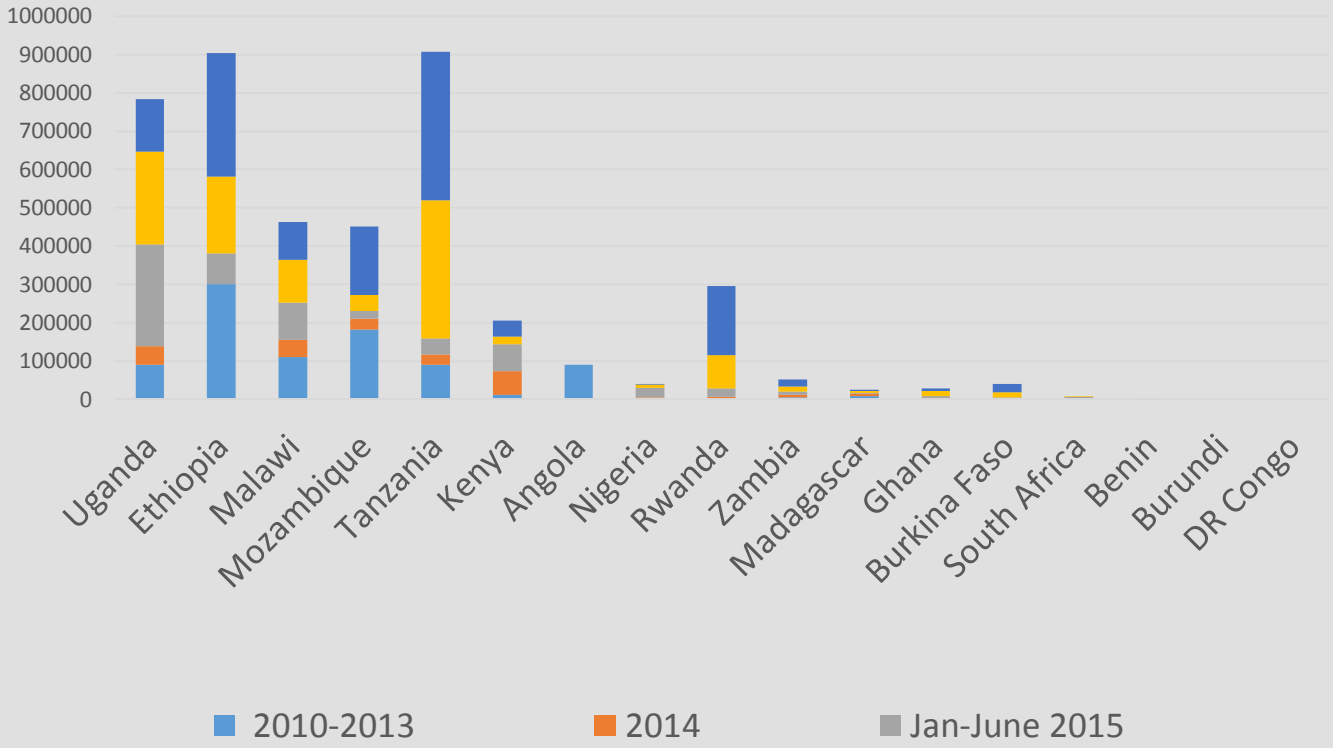
Vitamin-A deficiency is critical to address to achieve food security objectives, particularly among expecting mothers and children under five years of age

These bio-fortified orange varieties are sweeter, easy to grow, and are more nutritious

Sweet potatoes are widely consumed across Africa are especially important as related to recurring risks and resilience

Big question: how to sustainably scale OFSP into the food system in Africa

Orange Fleshed Sweet Potato throughout Africa



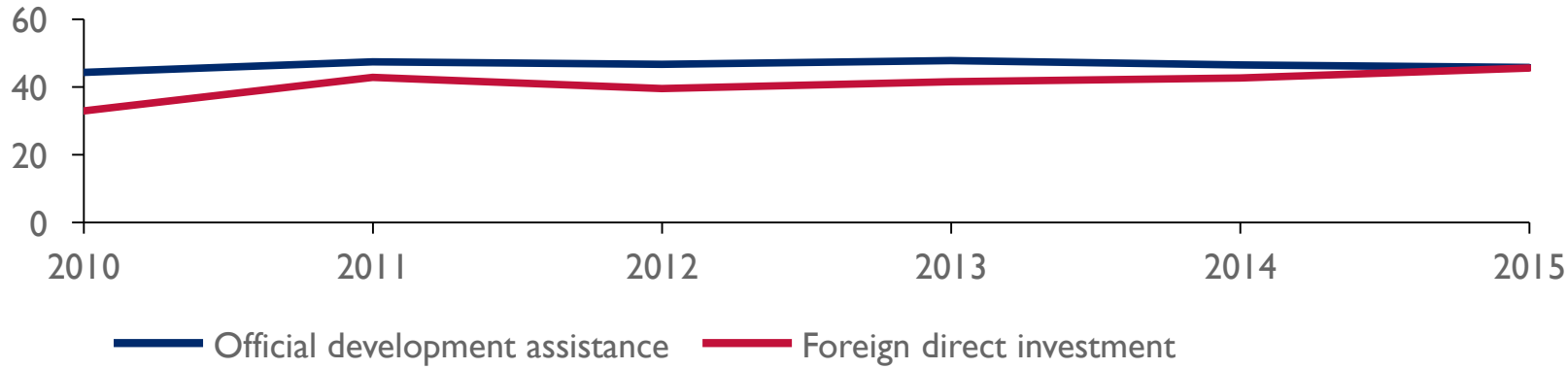
- Public sector dissemination programs and farmer-to-farmer diffusion have reached more than 5 million households in the past 10 years, according to the International Potato Center
- Markets are emerging as a driver of adoption in some contexts

Commercialization offers opportunities to crowd in private sector resources for the benefit of farmers and families

Commercial investment in Africa is as large as development assistance and its growing

Net official development assistance and foreign direct investment in Sub Saharan Africa

Billions USD (current)



With this trend in mind USAID seeks to uncover opportunities to **catalyze commercial investment to accelerate food security and increase farmer incomes**

Using **enterprise-driven approaches** to identify investment opportunities, mobilize private capital, and prepare markets for private sector investment

A commercialization approach is not appropriate in all cases, a viable business model at scale must be possible; we recognize the need for public sector support and that leveraging commercial investment where possible is not only a market based sustainable approach, but also frees public resources to places where commercialization is not yet viable

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The USAID Investment Support Program is a technical assistance mechanism

ISP has six components under which there are a range of services to meet the needs of the Missions and Operating Units. For more information please contact Janet Lawson (jlawson@usaid.gov).

1. **Investment Identification and Promotion**
2. **Investment Facilitation**
3. **Deepening Financial Sector Engagement in Developing Markets**
4. **Host Government Capacity-Building to Engage Private Sector**
5. **Building Agency Finance and Investment Expertise**
6. **Fostering Developmental Learning and Dialogue**

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Contents

Orange Fleshed Sweet Potato (OFSP) can have a positive impact on farmer incomes, public health and food industry players

Benefits for farmer livelihoods

- **High yield potential** in comparatively **shorter growing seasons**
- **Tolerant to drought** and impoverished soils
- **Higher possible income per hectare** for farmers, if markets accessible

Benefits for consumer health

- **Higher nutritional value** (richer in pro-vitamin A, vitamin C and minerals) than many substitute crops (potatoes and other grains)
- **Lower carbohydrate and glycemic content**, making it suitable for health-conscious consumers
- **Increased food safety** as with recent technology more nutritious elements can be preserved

Benefits for food industry

- In puree form **can offer economically viable and price-stable replacement to wheat flour** for baked products (bread, cookies)
- Given slow increased popularity with high-income consumers (previously a poor man's crop) and in western markets, **can offer high-value, premium consumer base for additional off-take**

Source: Innovation Opportunities in sweet potato production in Kenya; Dalberg analysis

Focus for today is on *investment facilitation* which may require you to think a bit differently

- Uptake and growth of OFSP has been impressive, quite unlike any other crop
- Natural next step is to look at large-scale commercial plays as ‘flywheel’ to spur growth
- USAID’s ISP programme focuses on *investment facilitation*. Nature of investment calls for opportunities for larger SMEs and up – notwithstanding the potential of innovation and viability at smaller scale
- To find opportunities, the ISP team focused on (1) demand, (2) a viable business case for processors and (3) a viable business case for farmers
- We invite you to put on the hat of an *investor* who is expecting a *return on investment* with *acceptable risk* – help yourself and **be tough.** Do the ‘savings’ litmus test
- Because we couldn’t only be tough, we have also identified opportunities that are less commercially viable knowing they may align only to the objectives of ‘impact driven’ anchor buyers

Paths presented in this presentation will vary in scale and attractiveness with a distinction between '*business opportunities*' and '*commercial scale investments*'

	Business opportunity	Commercial scale investment

Definition	• Reflects an opportunity to access a market and operate profitably (i.e., **could a business be run?)**
	• Does not consider
	  • Size of the opportunity
	  • Whether it would be large enough to attract a commercial investor / operator
		Reflects an opportunity that:
		• Operates profitably and
		• Can generate large enough free cash flows to cover the cost of getting involved (i.e., **is it worth investing?)**

Illustrations	Identification of a nascent, niche or locally significant market that can only **access a small number of customers generating, for example, a few hundred thousand dollars of revenue**	A business operating in / a product for a large mass-market that **can generate significant revenues (i.e., millions of dollars) that can justify investor / operator involvement**

Source: Dalberg analysis

OFSP can be transformed into various products for human consumption, for animal feed and for energy production

Uses for OFSP	Sample end-products	Global dynamics around OFSP end-products
Fresh culinary use	Roots in raw, boiled, baked & steamed form	• Main 'competition' is from grain and root substitutes

Processed
Recognizable as sweet potato
	Potato puree, baby food, crisps, juice, some baked goods, some jam	• Big regional variation: Asian countries consume the widest range of OFSP-based end-products
		• No 'standard path' or 'standard end state'
		  • China uses 40% of sweet potato for animal feed, 30% is commercially processed for human consumption and only 20% consumed fresh
		  • In the U.S. the vast majority of OFSP is consumed fresh and consumption has doubled in the last 5 years
		  • In Africa, processing sweet potato is largely limited to boiling, steaming, and baking

Invisibly processed	Yoghurt, some baked goods, some jam	
Non human consumption	Animal feed	• OFSP offers additional applications in animal feed and potentially in biofuel, but all such applications are nascent in Africa
	Biofuels	

Source: Desk research; Dalberg analysis

OFSP processing volumes can be grown in three different ways, each of which has its own advantages and disadvantages

OFSP processing volumes will grow if…	Examples	Challenges
1. Buyers change their habit/ behavior in favor of products containing OFSP in a noticeable way	• Bread containing OFSP (color noticeable at small % already – taste at higher percentages) • Institutional buyers buying OFSP and OFSP products (school lunches, military meals)	• Significant efforts are needed to change consumer behavior, with uncertain results • Cost-conscious nature of buyers drives centralized procurement
2. Producers switch to using OFSP in invisible applications	• Inclusion of OFSP in biscuits at less than 5 – 10% • OFSP as starch in yogurt	• These are niche solutions that may not drive big scale for OFSP • Relative cost savings for producers are likely to be low (since OFSP is only a small part of ingredients) and may not justify the investment
3. Producers who already work with OFSP, include OFSP from Malawi, Kenya or South Africa	• Exporting OFSP puree for further processing in baked goods, baby foods and other products	• High bar on food safety, traceability, quality and consistency of volume and quality may be difficult to meet, especially by smallholders

Target countries grow OFSP mostly for household consumption and some commercialization, whilst industrialization is still nascent

SUBSISTENCE

- Produced **predominantly for on-farm consumption**
- **Where traded, mostly done through local informal** markets at rural levels

COMMERCIALIZATION

- **Produced in small part for formal commercial activity** – either for local markets or exports
- Formally processed for traditional foods, or **used for small scale baking and confectionary**

INDUSTRIALIZATION

- Produced in **large part for formal markets, processing and/or exports**
- Transformed **for wide range of applications** (beyond baking). **Used both visibly and invisibly**

Malawi

Kenya

South Africa

Source: Google images; Hellen Keller International; Dalberg analysis

Per country, we followed a three-step approach with a focus on *demand*, *processor perceptions* and *competitiveness*

1

Assessment of demand and opportunity for OFSP processing

- What is the size of various markets where OFSP could be an input?
- How attractive would OFSP-based bread be, vis-à-vis other options available to commercial actors and consumers?
- **What do processors state as barriers to uptake for OFSP today?**

2

Success factors for realizing identified opportunities

- **If there is a business case for processing OFSP**, what would be required to realize that business case?
- If there is no business case, what elements would need to be addressed to kickstart an eventual case / opportunity?

3

Synthesis and recommendations

- For identified commercial scale investment opportunities, **what investment size would be needed?**
- What additional considerations should be made?

Based on analyses across countries at the start of the study, we focused on including **OFSP in bread, chips, crisps, baby food** and **consumed fresh**

Using OFSP as a partial substitute for wheat in bakery products is a common entry point into OFSP food processing

- An interesting and potentially sizeable opportunity for commercial OFSP use, is to **include OFSP as an ingredient in processed food**

- Within processed foods, **replacing wheat flour in bread is a typical 'first opportunity'** for using OFSP:
  - Doing so has relatively limited technical complexity
  - Bread is often produced by a relatively concentrated processing industry, making it possible to capture a minimally viable scale without having to engage with too many processors

- **The bread market also tends to be the largest opportunity for OFSP** when comparing to other processed food applications
  - 70-80% of all industrial wheat flour produced is for bread baking
  - Use of OFSP ingredients in other products tends to be:
    - A much smaller ingredient – e.g., the percentage of starch in yogurt, which OFSP can be used for, is much smaller than the proportion of wheat in bread that can be replaced by OFSP
    - In a smaller overall market – e.g., the total root volume used as an ingredient for chips or crisps tends to be much smaller than the replaceable wheat volume in bread

- Given the findings above, **understanding processed food consumption and specifically bread consumption in a country is key to understanding the potential for OFSP processing**

Source: interviews; Dalberg analysis

There are compelling supply- and demand-side reasons why OFSP would make a good bread ingredient

Supply-side advantages

Cost savings

- Bakeries can achieve cost savings by substituting wheat with OFSP puree

Price stability

- For the baking industry, **wheat prices can fluctuate from month to month**
- Substituting 50% of wheat with a locally grown product will enhance price stability

Demand-side advantages

Taste and texture

- Taste tests done by researchers suggest that **customers like and accept OFSP bread for its softness, color and taste**
- Use of puree **increases the shelf-life** of the product

Health benefits

- Health-conscious consumers may choose to purchase OFSP puree bread for its **various nutritional benefits**

Source: Desk research; stakeholder interviews; Dalberg analysis

Contents

Kenya

Malawi, Kenya and South Africa present different value chain and market characteristics, driving differences in potential for OFSP commercialization

			
Key market characteristics	• **4M households** • Per-capita bread consumption: **4 kg** • 3-year HH income growth: **-7%**	• **10.8M households** • Per-capita bread consumption: **8 kg** • 3-year HH income growth: **5%**	• **15.5M households** • Per-capita bread consumption: **19 kg** • 3-year HH income growth: **-6%** (middle class growing at 1%)
Key farming characteristics	• Av. farm size: **0.75 ha.** • >90% OFSP produced by smallholder farmers • 2.6% of land under irrigation; w/o irrigation **1 growing season**	• Av. farm size: **0.47 ha.** • >90% OFSP produced by smallholder farmers • 2.9% land under irrigation; w/o irrigation **2 growing seasons**	• Av. farm size: **430+ ha.** • 50% OFSP produced by smallholder farmers • 8.1% land under irrigation; w/o irrigation **1 growing season**
OFSP commercial opportunities	• Main opportunity is increasing consumption of fresh roots • Still some nascent, small-scale business opportunities	• Small commercial investment opportunity in pulp processing; lucrative export potential • Still some opportunity in fresh root market	• Significant value possible in processing • Limited impact potential for smallholder farmers

Source: Desk research; stakeholder interviews; IndexMundi; FAO: Kenya irrigation market: 2015; Agric South Africa; Mail Guardian South Africa; Dalberg analysis

Kenya

In Kenya, sizeable, commercially attractive domestic demand could arise if OFSP puree can sustainably be cheaper than wheat and exports could also be interesting

Opportunity

PROCESSORS	EXPORTERS	PRODUCERS
~ 5M revenue possible in puree processing	**> 50% margin on exports to EU markets**	**~ 225% increase in farmer incomes**
To capture 8% share of bread replacement market	*For exports to UK and the Netherlands*	*By switching from maize to OFSP*

Considerations

PROCESSORS

- Driven by ability to achieve cost savings through reduction in puree production costs and securing partnerships with large bakeries
- Will require investments in scaling up processing to achieve economies of scale

EXPORTERS

- Driven by ability to manage contaminants and spoilage to meet stringent quality standards of EU markets
- Will require investments in capacity-building, fumigation plants and cold-chain-enabled transport

PRODUCERS

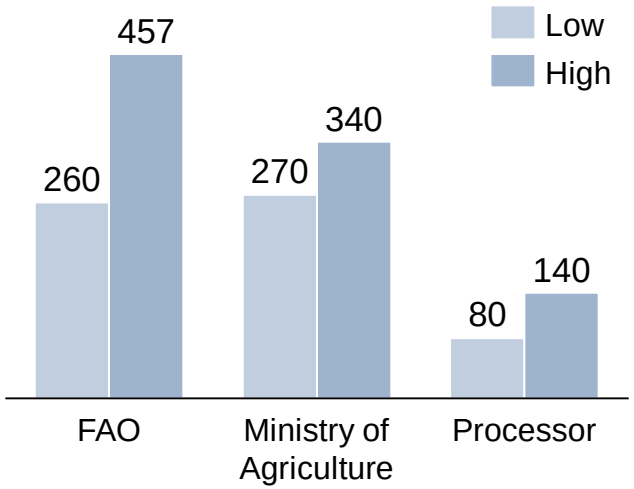
- Driven by ability to command around USD 140 per ton for sweet potatoes across two growing seasons
- Can be supported by donor activity to increase yields and link farmers to markets

Source: Dalberg analysis

At any farmgate price that has been quoted (with sources varying considerably), OFSP offers farmers a significant increase in income over growing maize

Farmgate price for sweet potatoes is hard to pin down across various sources

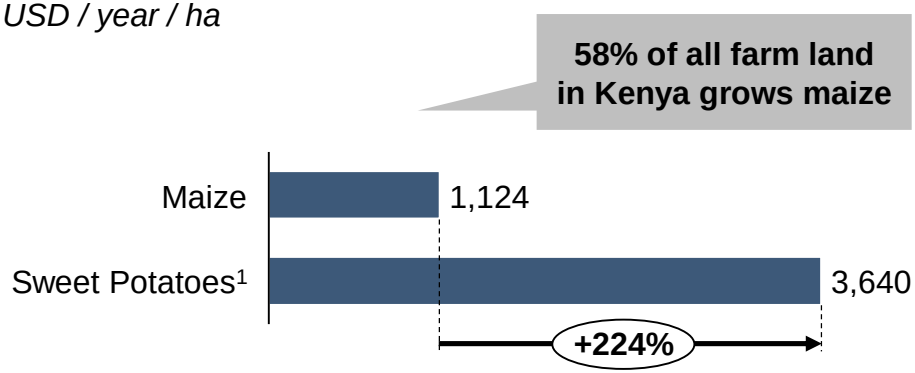
USD / ton



Subsequent analyses use USD 140 – the price paid by the current OFSP processor. Higher farmgate prices would impact the analyses shown

Farmer annual income per crop per hectare with actually realized yields

USD / year / ha



$ 3,640/ ha/ year X 0.47 ha (average landholding) = $1,183 increase of farmers incomes when switching from maize to sweetpotatoes

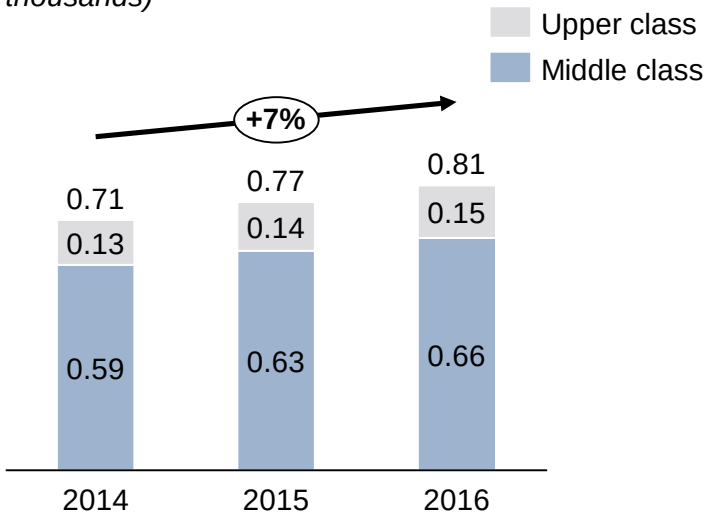
1 Sweetpotato yield used: 13 tons/ha; growing seasons: 2 for Kenya.

Source: FAOstat; USDA.gov; Kenya Ministry of Agriculture; International Potato Center; Dalberg analysis

As the middle class in Kenya grows, total processed food consumption increases, which opens up a potential market for OFSP bread

Class distribution, based on household consumption

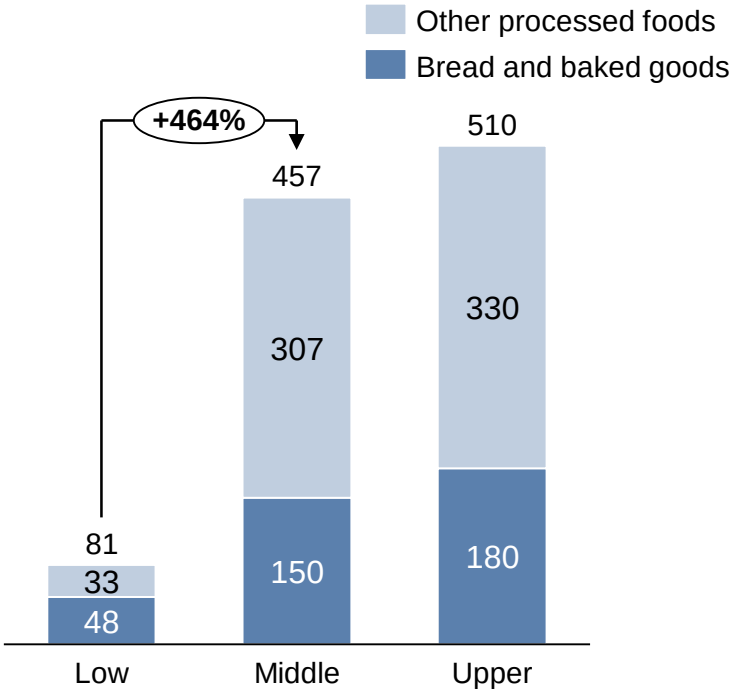
Households by consumption category (in hundreds of thousands)



- While large and growing, the middle and upper classes still represent < 8% of 10.8 million families
- An estimated 45,000 households moved from the lower class into the middle class over this period

Consumption of processed foods by class level

Number of grams per day, 2013



Source: Canback 2016; World Bank 2016; Oxford Business Group (2016) "Bright outlook for Kenya's retail sector"; Olielo (2013) "Food security problems in various income groups in Kenya"; Dalberg analysis

There are compelling supply- and demand-side reasons why OFSP would make a good bread ingredient

RECAP

Supply-side advantages

Cost savings

- Bakeries can achieve cost savings by substituting wheat with OFSP puree

Price stability

- For the baking industry, **wheat prices can fluctuate from month to month**
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Demand-side advantages

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- Taste tests done by researchers suggest that **customers like and accept OFSP bread for its softness, color and taste**
- Use of puree **increases the shelf-life** of the product

Health benefits

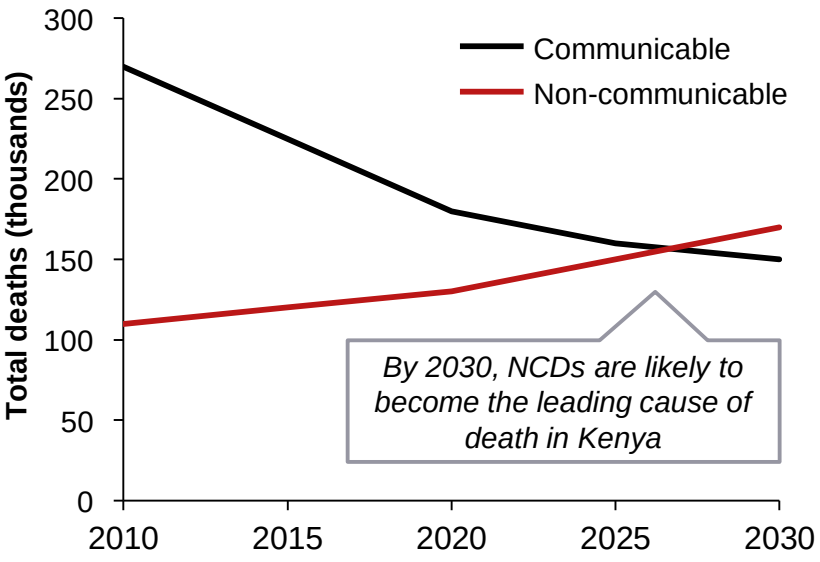
- Health-conscious consumers may choose to purchase OFSP puree bread for its **various nutritional benefits**

Source: Desk research; stakeholder interviews; Dalberg analysis

There is an indication that Kenyans are becoming more health conscious, a trend that is expected to increase and will help strengthen demand for OFSP

Prevalence of lifestyle diseases in Kenya and outlook for NCD[1]

33%	20%	11%
Of women classified as overweight/obese	Of adult Kenyans suffer from hypertension	Of urban adult Kenyans suffer from diabetes



- **Indication that the pendulum is beginning to swing towards healthy behavior**, driven both by **need and by growing availability** of health and lifestyle-improvement brands
- The majority of **brands showcased below were established in the last five years**

Fresh produce aggregators / suppliers

Healthy grocery stores

Healthy processed foods brands

Fitness centers

1 NCD = Non-communicable diseases.

Source: Kenya STEPwise Survey for Non-Communicable Diseases Risk Factors: 2015; company websites; Dalberg analysis

There appears to be a supply-side case for increased production of OFSP bread

Supply-side advantages

Cost savings

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Price stability

- For the baking industry, **wheat prices can fluctuate from month to month**.
- Substituting 50% of wheat with a locally grown product will enhance price stability

Demand-side advantages

Taste and texture

- Taste tests done by researchers suggest that **customers like and accept OFSP bread for its softness, color and taste**
- Moisture in the puree allows for longer shelf life of OFSP-based breads

Health benefits

- Health-conscious consumers may choose to purchase OFSP puree bread for its **various nutritional benefits**

With reason to believe that OFSP bread can be made less expensively than regular bread, there is a strong supply-side case for increased production

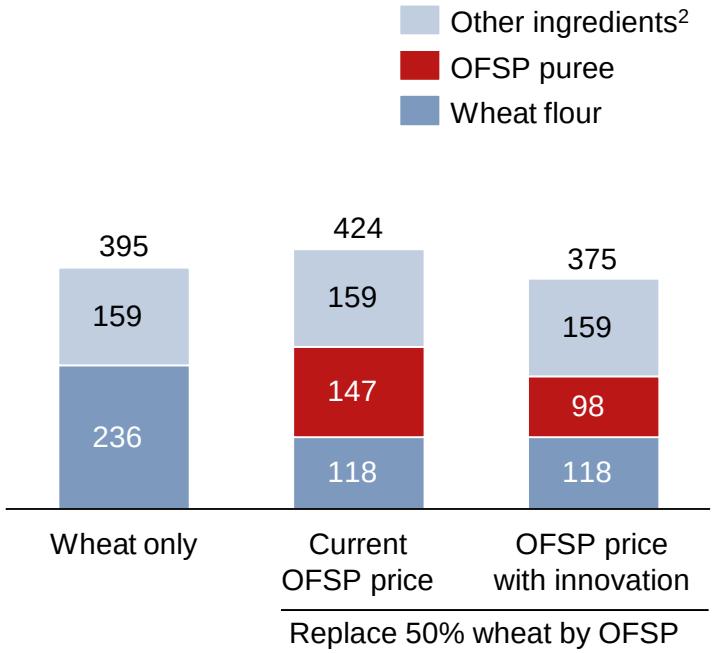
Source: Desk research; stakeholder interviews; Dalberg analysis

Innovations are needed to make OFSP bread. Currently, it slightly more expensive to produce than traditional bread as wheat prices are at a historic low

Process innovations are needed to make OFSP-based bread[1] cheaper to produce than wheat bread

Production costs

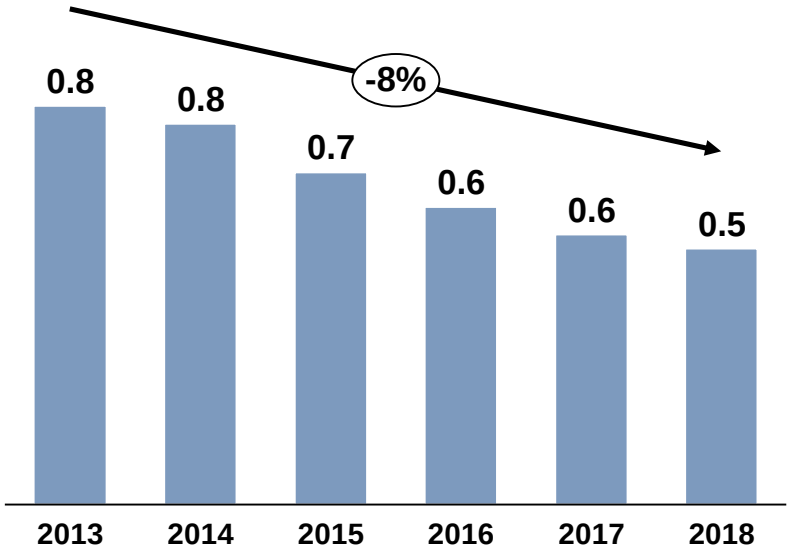
USD per ton of bread



Wheat flour prices are at a historic low, having declined by 8% per year in last 5-6 years: oversupply from imports, increased competition in milling sector and low demand

Wheat flour retail price

USD/ kg, Kenya



1 Ingredient ratios based on recipe for 185gram loaf of bread. Various wholesale pricing websites for input costs. Wholesale wheat assumed 90% of current retail price. The OFSP puree price of USD 0.6/ kg has been set by CIP a couple of years ago.

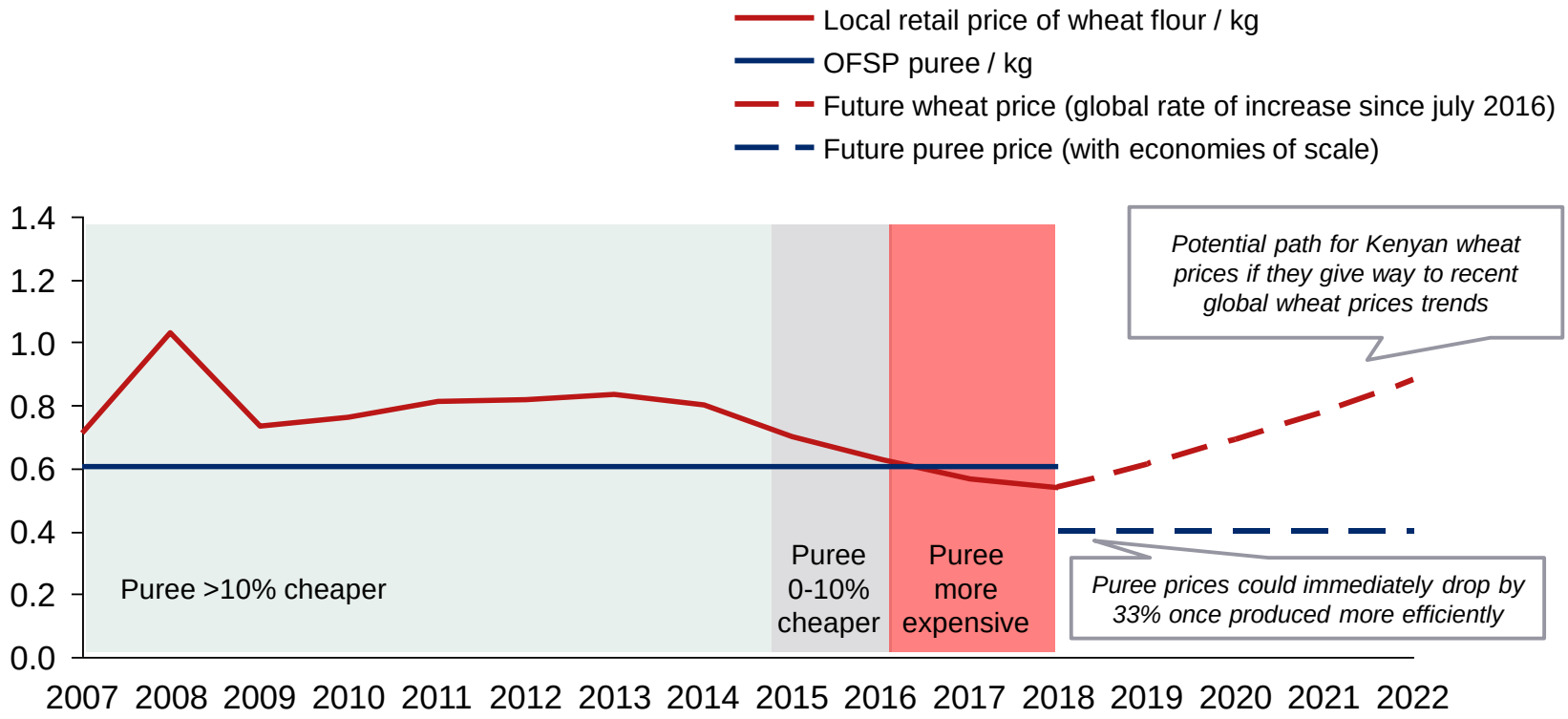
2 It may be possible to reduce other ingredients (sugar, baking agent) when using OFSP; however, sources vary on extent to which this is possible

Source: Kenya Integrated Health Budget Survey: 2015-2016; BusinessDaily (2018) "Wheat flour price falls again on low demand"; Kamal (2013) "Effect of sweetpotato flour of two local varieties on quality of breads"; Dalberg analysis

Concurrently, a recent increase in global wheat prices suggests puree could become considerably competitive against wheat flour in the next few years

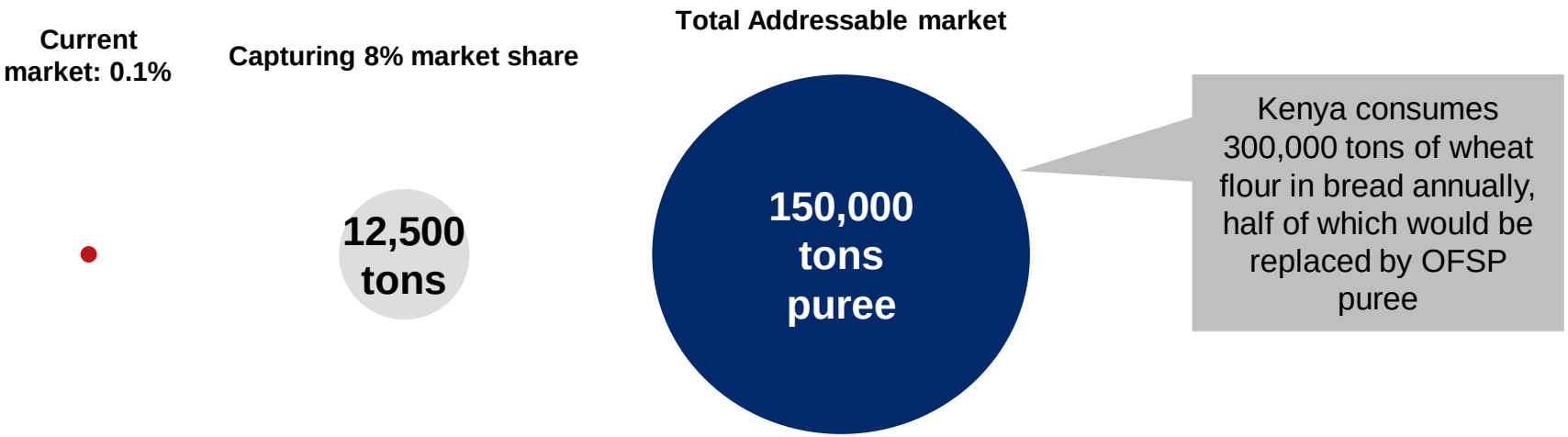
Price competitiveness of OFSP puree vs. wheat flour – Kenya

Price in Kenya in USD (historical local prices according to exchange rate on April 29 of each year); 2007 - 2022



Source: Kenya Integrated Health Budget Survey: 2015-2016; BusinessDaily (2018) "Wheat flour price falls again on low demand"; IndexMundi global historical wheat prices; Dalberg analysis

Using OFSP puree in 8% of bread would drive a USD 5 million annual OFSP puree revenue stream and support ~1,380 smallholder farmer livelihoods



Capturing 8% market share seems feasible because:

- OFSP bread has already grown to be 8% at Tuskys (across 10 outlets served)
- There is a cost advantage that may allow for price reductions (or increased marketing push by producers)
- A small health-conscious consumer base will purchase for health reasons
- The distinct flavor profile is favored by some

12,500 X $400 = $5 million

Tons sold | Price per ton | revenue

(12,500 X 1.35) / (13 X .47 X 2) = 1,381

Tons sold | Fresh to puree conversion | Yield | Lot size | seasons | Smallholder farmers supported

Source: Dalberg analysis

Various fundamentals are necessary to develop the market and for processors and investors to reap attractive returns

- Highly achievable
- Moderately achievable
- Not achievable

Fundamentals for market capture	Achievability	Explanations
Initial demonstration of demand	Highly achievable	**Initial demand already demonstrated** through Tuskys and Naivas bakeries: OFSP breads supposedly accounting for 8% of weekly bread sales, selling at a premium. **If price premium is removed, market can be expanded further**
Cost savings for bakers	Moderately achievable	**Achievable, though depends on price of puree**, which at large-scale production would be sensitive to root farm-gate price. Also dependent on price of wheat, but less concerning, as prices likely to follow recent growth
Availability and buy-in from large bakeries with scale	Moderately achievable	Large bakeries catering will be crucial to reaching market beyond Tuskys and Naivas, as three-quarters of households do not shop in supermarkets. **The largest bakery, with 40% share of the national market, could absorb all 8% expected market capture for puree**
Shelf-stable product	Moderately achievable	Moderately achievable; **machinery to do this is available but has a relatively high minimally viable scale.** If costs can be contained, can significantly expand market beyond major urban centers
Continued trends around bread consumption	Highly achievable	Achievable; middle and upper classes still under 10% of all households in Kenya, and a **3x jump in daily consumption of bread (from 48 to 150 grams) is noted as consumers transition up into the middle class**

Source: Kenya Integrated Health Budget Survey: 2015-2016; SupaLoaf Overview; Dalberg analysis

Investment opportunities remain moderately viable in other products, which are either niche or where OFSP is not competitive relative to other inputs

Potato crisps

- The potential for OFSP is **modest and likely unviable**. The OFSP crisps production could **impact 1,000 farmers but would be more expensive** to produce than typical crisps. Likely to be a premium market play

French fries

- Though French fries are a **high-growth market** with urban consumers increasingly consuming, the **commercial opportunity is small,** as the market is restricted largely to urban, high-income areas

Baby food

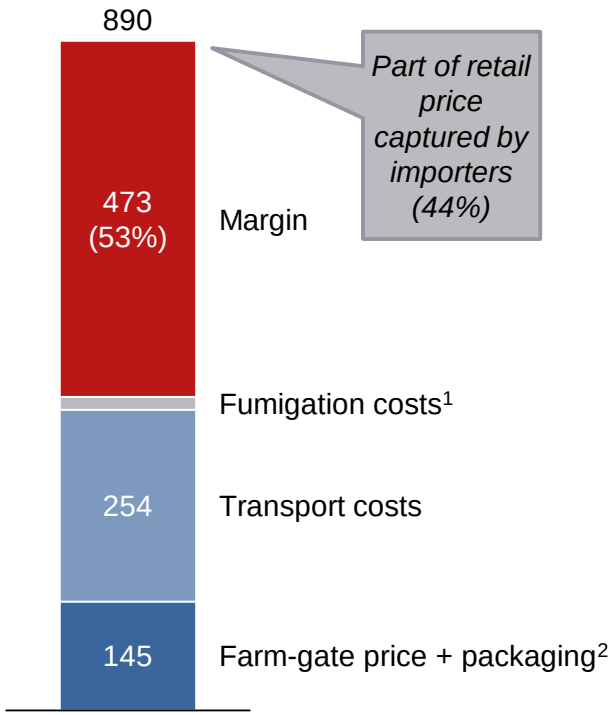
- Baby foods are increasingly seen on supermarket shelves in Kenya, but largely in dry mixes and at high prices (USD 2.25 per kg). **The market is likely restricted to high-income households,** who can still access affordable alternatives

Source: Images (Simplyorganic website, dinnerthendessert, joyfoodsunshine, goodnesspetfood); Dalberg analysis

Kenya may also have an opportunity to export fresh roots to high-value, high-growth European markets where they could earn +50% margin per ton

Landed cost and margins into the EU from Kenya

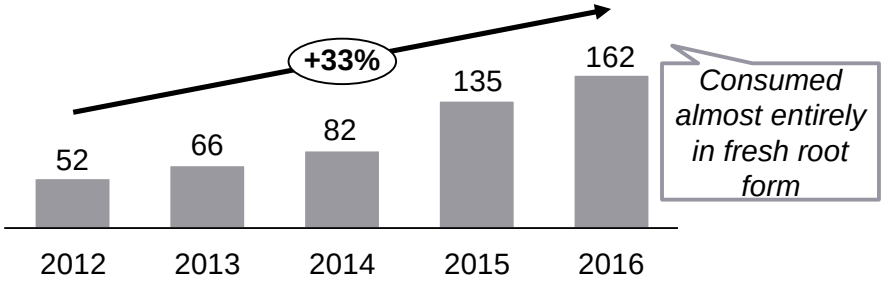
USD per ton sweet potatoes, 2013 (no tariffs)



- **Kenyan sweet potatoes can earn high margins when exported to EU markets,** and have a significant buffer before an increase in farm-gate price could erode the margin (farm-gate price would need to reach USD 600, unprecedented for Kenya)
- **Kenya exports <1% of its production, mainly to Somalia.** It has had a **toehold into the UK, with an export volume of just 2 tons**, but it could export more given the fast-growing market for sweet potatoes, favorable trade agreements with the EU for fresh agricultural products, and attractive economics
- **Areas for exploration to validate the opportunity:** costs of aggregation near farm-gate and for fumigation, preservability of the root during the journey, ability to meet EU quality standards

Imports of sweet potatoes into the UK: 2012-2016

Tons ('000)



1 Fumigation costs are proxy: fumigation costs for grain-based products at USD 0.40/cubic meter

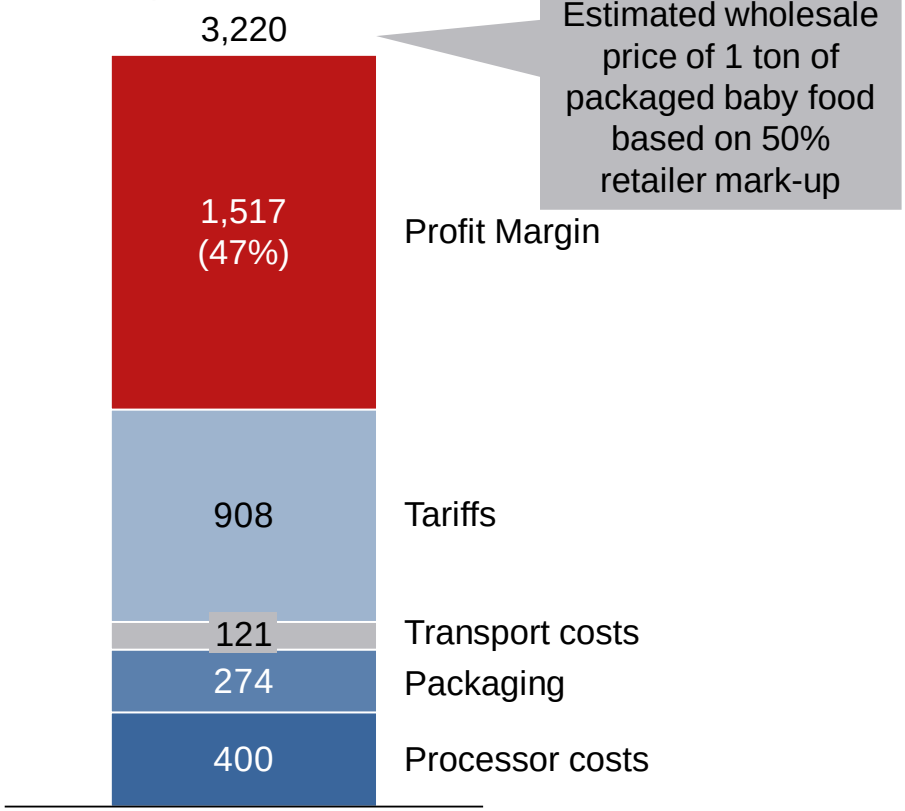
2 Analysis uses USD 140/ ton for root price. Higher farmgate prices would obviously reduce margin

Source: CBI: Ministry of Foreign Affairs (2017) "Exporting fresh sweet potatoes to Europe"; East Africa Online Transport Agency; Sweetpotato density; Institute of Economic Affairs: Kenya Trade Notes; EU Trade Helpdesk; FAOstat; World Development Indicators; Dalberg analysis

There may even be economic value in exporting processed foods to the EU, despite a significant tariff on processed food imports

Example – Sweet Potato Baby food

USD per ton for puree baby foods



Estimated wholesale price of 1 ton of packaged baby food based on 50% retailer mark-up

This opportunity should be tested further by assessing food safety regulations, packaging requirements and transport restrictions for food coming into the EU

Source: World Bank, Amazon, USDA, East Africa Online Transport Agency; http://madb.europa.eu/madb/euTariffs.htm?productCode=2007995089&country=KE

Kenya

To recap: sizeable, commercially attractive domestic demand could arise if OFSP puree can sustainably be cheaper than wheat; exports could also be interesting

RECAP

	PROCESSORS	EXPORTERS	PRODUCERS
Opportunity	~ 5M revenue possible in puree processing *To capture 8% share of bread replacement market*	> 50% margin on exports to EU markets *For exports to UK and the Netherlands*	~ 225% increase in farmer incomes *By switching from maize to OFSP*
Considerations	• Driven by ability to achieve cost savings through reduction in puree production costs and securing partnerships with large bakeries • Will require investments in scaling up processing to achieve economies of scale	• Driven by ability to manage contaminants and spoilage to meet stringent quality standards of EU markets • Will require investments in capacity-building, fumigation plants and cold-chain-enabled transport	• Driven by ability to command around USD 140 per ton for sweet potatoes across two growing seasons • Can be supported by donor activity to increase yields and link farmers to markets

Source: Dalberg analysis

Kenya

To increase incentives for investment in OFSP, there are several challenges in the value chain that USAID could help to smooth out

Key challenges expressed by off-takers

Inconsistent supply

- Leading bakeries have decreased their orders of OFSP puree by 50%, **as supplier could not meet requested quantities**
- **Leading upmarket grocery store routinely out of stock with fresh roots**, though consumers reportedly prefer OFSP over other sweet potatoes available

Costly aggregation

- Given lack of aggregation present in supply chain, **processors have been forced to directly source and transport from large number of smallholders**
- Large distances from production areas to major cities lead to **high transport costs**

Variations in product quality / specifications

- For crisps producers, shape and size of the root matters. **Processors cannot guarantee sufficient supply of the raw material according to their specifications**

High perishability

- Unsterilized OFSP puree requires refrigeration; thus **unstable electricity access outside of Nairobi makes scaling puree use to less urbanized bakeries challenging**

"We started at 500kgs per week but had to scale down to 250 because the supplier didn't have enough."
- **Bakery chain**

"When we cut those large roots with the machine, we lose a lot of flesh. It adds an extra processing step to not lose as much."
- **Crisps processor**

"We only use the puree in Nairobi. It's too expensive to set up freezers in the other regions."
- **Bakery chain**

Source: Stakeholder interviews

To address some of these challenges, USAID and its partners could first help to professionalize OFSP production – improving yields and root quality

Interventions	Actors
Establishing formal relationships to key markets through formal buyer partnerships, establishment of collection points, and guaranteed price floors to help smooth market linkage challenges	• Donor-funded initiatives
Financing equipment to boost yields (e.g., irrigation) and increase root life shelf (low-cost storage facilities)	• Donor subsidy or grants • Financing through local banks and NBFIs
Boosting farmer knowledge and capacity and fostering business-to-business linkages for transfer of technologies and know-how around proper field management, post-harvest handling of the roots, and safety and quality requirements of local and international markets	• Donor-funded NGOs • Government extension services
Increasing availability of clean planting material through multiplication and distribution systems	• Research organizations • Donor-funded studies

Source: Stakeholder interviews; Dalberg analysis

USAID and its partners can also support processors to move into OFSP puree processing by providing financing and or funding supporting activities

Interventions	Rationale	Actors
Boost local processing capacity	• Processors currently operate at small-scale. There is room to grow plant processing capacity (once demand is established) to reduce shortages in supply for current and would-be off-takers. They may also benefit from other capex to support operations	• Private investors • Donor-subsidized start-up costs
Establish production of shelf-stable puree	• A shelf-stable puree would open up markets outside of Nairobi and with small-scale bakeries, as well as extend its applications (could flip the opportunity in the baby food market, for example)	• Research organizations • Donor funding
Establish links with large bakeries[1]	• Large bakery chains that control the market, such as Mini Bakeries whose Supa-Loaf brand captures 45% of the Kenya market should also be prioritized, as they are key to boosting consumer demand for OFSP	• Donor-funded industry groups • Active impact investors

1 For bakeries, either stand-alone or affiliated with supermarkets, hotels, etc.

Source: Desk research; Dalberg analysis

Off-takers in Kenya tended to be experienced, with varying levels of success and interested in using OFSP

Stakeholder interviews in Kenya tended to be "proactively interested", having experimented with OFSP and feeling optimistic about the potential for the market

Typology of processors	Characteristics
Proactively interested processors	• Driven, for variety of reasons, to seek out OFSP processing • Mix of those at verge of starting, those under way, and those who have tried but scaled back
Open to using OFSP if at no risk	• Open to considering OFSP but not strategic priority • Need to see business case confirmed before making decision • Need range of support, including capex, opex and capacity building to engage in OFSP
Not interested	• Other options take priority over OFSP • Mix of those that got burned by cassava experience and conglomerates with very wide range of options

Contents

Malawi, Kenya, and South Africa present different value chain and market characteristics, driving differences in potential for OFSP commercialization

			
Key market characteristics	• **4M households** • Per-capita bread consumption: **4 kg** • 3-year HH income growth: **-7%**	• **10.8M households** • Per-capita bread consumption: **8 kg** • 3-year HH income growth: **5%**	• **15.5M households** • Per-capita bread consumption: **19 kg** • 3-year HH income growth: **-6%** (middle class growing at 1%)
Key farming characteristics	• Av. farm size: **0.75 ha.** • >90% OFSP produced by smallholder farmers • 2.6% of land under irrigation; w/o irrigation **1 growing season**	• Av. farm size: **0.47 ha.** • >90% OFSP produced by smallholder farmers • 2.9% land under irrigation; w/o irrigation **2 growing seasons**	• Av. farm size: **430+ ha.** • 50% OFSP produced by smallholder farmers • 8.1% land under irrigation; w/o irrigation **1 growing season**
OFSP commercial opportunities	• Main opportunity is increasing consumption of fresh roots • Still some nascent, small-scale business opportunities	• Small commercial investment opportunity in pulp processing; lucrative export potential • Still some opportunity in fresh root market	• Significant value possible in processing • Limited impact potential for smallholder farmers

Source: Desk research; stakeholder interviews; IndexMundi; FAO: Kenya irrigation market: 2015; Agric South Africa; Mail Guardian South Africa; Dalberg analysis

Malawi

In Malawi, main potential lies in the fresh root market, and there may be additional niche, localized cases in processing or industrial uses (e.g., biofuels)

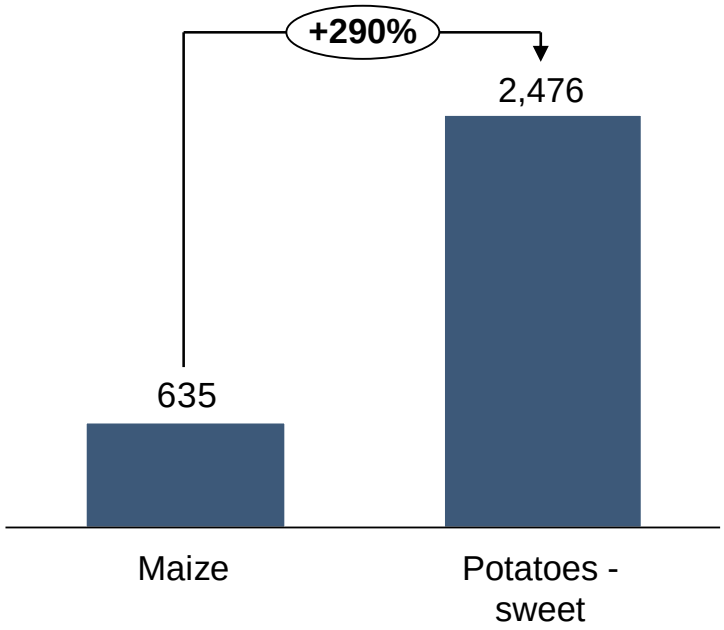
	PROCESSORS	EXPORTERS	PRODUCERS
Opportunity	**Nascent, locally significant market** *Early demonstration of demand at localized level*	**Unviable, given high transport costs** *Uncompetitive infrastructure and farm-gate price*	**3x more annual revenue possible** *By switching from maize to OFSP*
Considerations	• Already some evidence of niche local markets in bread and biscuits sub-sectors • However, currently limited by low consumption of processed foods compared to other countries and significant recent economic downturn	• Limited by land-locked position of Malawi • Would require that OFSP prices reduce by > 30% to be competitive against, for example, South African sweet potatoes	• Notable opportunity for farmers to earn more with OFSP, even at current low yields • Irrigation could boost income potential but would also allow for growing horticulture crops which may be more lucrative

Source: Dalberg analysis

For farmers, sweet potatoes can offer high economic value compared to maize

Farmer annual income per crop per hectare with actually realized yields

USD / year / ha, 2013



- Though maize is the top-grown commodity in Malawi (grown on 60 percent of arable land), **sweet potatoes are significantly more valuable**[1]
- By growing sweet potatoes, instead of maize[2], farmers can quadruple their income

1 Other roots and tubers may provide as much as or higher value than sweet potatoes – publicly available data need a lot of scrutiny which was applied to OFSP incomes/ yields, number of harvests etc. As a result, comparison to publicly available data on other roots/ tubers facing similar dynamics that distort the data is no longer viable and may result in misleading data

2 The research has not been able to apply a similar scrutiny to maize-driven income; typically, as was the case with sweet potato, the scrutiny drives the income down (as more realistic estimates of yields, number of harvests etc. tend to be lower than formal sources) – hence, despite not having maize data that's checked in more detail, researchers have confidence in the statement that sweet potatoes can bring increased income when compared to maize

Source: FAOstat; USDA.gov; Dalberg analysis

Two key themes kept coming back from off-take interviews: challenges on supply and fragmentation of the value chain, and concern about availability of demand

Challenges with supply, driving need for processor to organize entire value chain

- Farmers do not grow or do not want to grow the OFSP varieties processors need
- Roots are not round enough, or too bumpy, or too large
- Volume, availability and quality are inconsistent
- Genetic variety is too limited, driving vulnerability
- Aggregation in the supply chain is insufficient, forcing processors to deal with/ directly source and transport from large numbers of smallholders
- Seasonality of root availability forces processors to manage lumpy production cycles or to dry / preserve the roots themselves
- Relatedly, there is no availability of quality dried roots, forcing processors to buy and process fresh roots themselves (which takes time and space for drying)
- Root properties (e.g., size, sugar and moisture content) can change during storage, leading to inconsistent results or a need for process adjustments

Weak or unconvincing business case

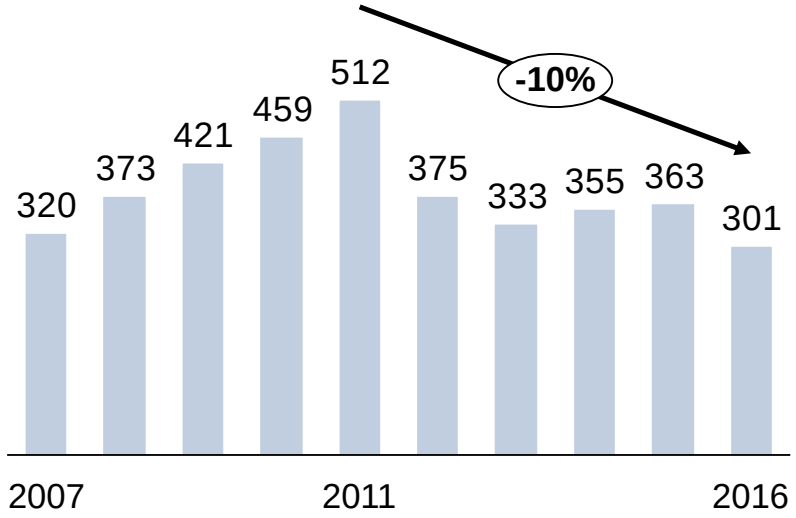
- Processors have a poor understanding of demand, or feel that the demonstrated demand is too low to justify getting involved
- Alternative options are either more attractive or better known to processors
- Processors would need to invest in equipment (which is both a risk and a capital outlay) and in human capital
- Process design to drive uptake by bakeries and processors requires resources, as no two processors are the same (there's no 'one size fits all' solution)
- Many processors have had poor experience with 'similar' cassava case

Source: Stakeholder interviews

On demand side, a key constraint in the processed foods market is the low purchasing power, given declining household incomes and a growing lower class

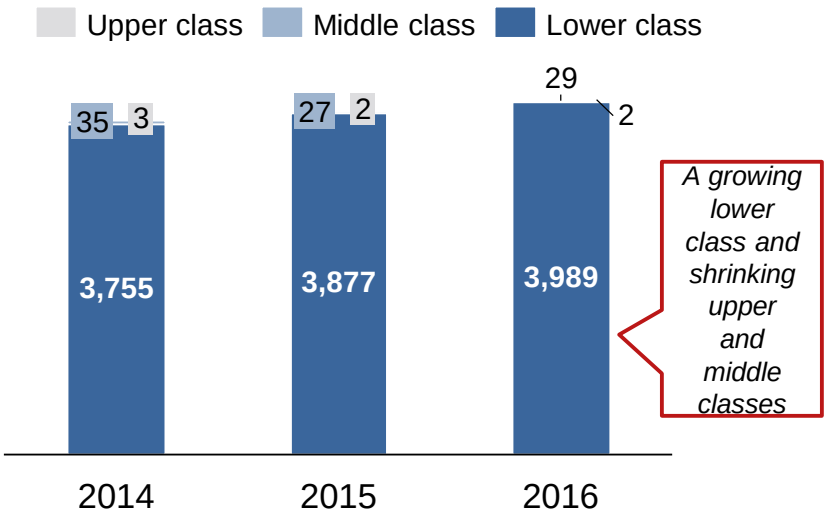
GDP per capita in Malawi

USD



Income distribution – Malawi: 2014-2016

Number of households by class category ('000)



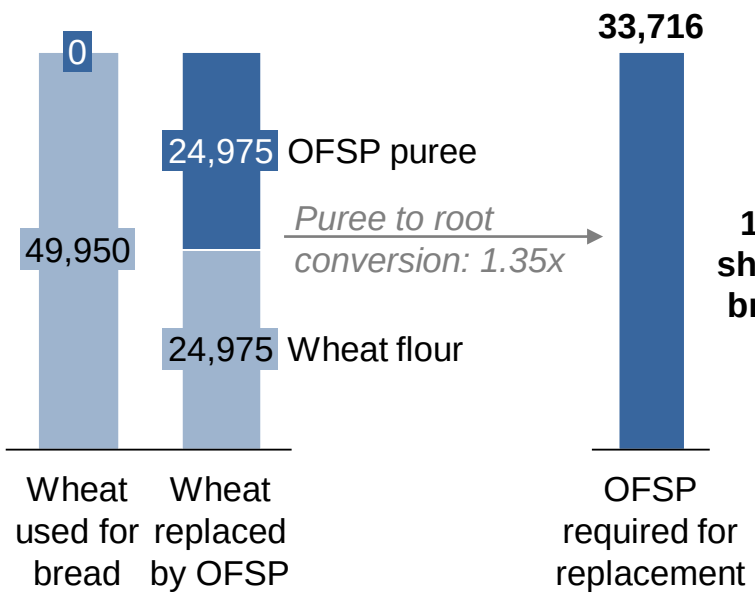
- Consumption of processed foods and bread specifically tends to rise with income and shows a step change when people grow into middle class income levels
- Given low and declining income levels in Malawi, consumption of processed foods and bread is likely to be low and under pressure, negatively impacting opportunities for OFSP processing

Source: World Bank 2016; Canback 2016; Dalberg analysis

Thus, the largest processed market is still small: displacing 50% of wheat flour in 10% of baked goods would represent less than a $1 million annual market

Wheat bread – current market size and opportunity

Tons per year



X

10% market share of OFSP bread market share[1]

=

$999,000
Annual market for OFSP Puree[2]

560
smallholder farmer livelihoods[3]

- **50% of the country's wheat consumption goes via informal retail stores** – excluded here as it's a fragmented, distributed play and would require changing the baking/ cooking habits of a large number of individuals
- **Chips opportunity is tiny – nationally, only 900 tons potatoes/ year** processed commercially into chips

1 Aggressive estimate of market share used to show that puree market is still very small; 2 at $400 per ton of puree estimate by sinnovatek .

3 The unit of 'farmer livelihoods' indicates the number of (smallholder) farmers with an average landholding, that would be required to switch all of their production to OFSP in order to meet this demand. In reality, smallholder farmers almost always multi-crop which would mean a greater number of farmers would be impacted but with for a proportionally smaller portion of their income

Source: World Bank; stakeholder interviews; Dalberg analysis

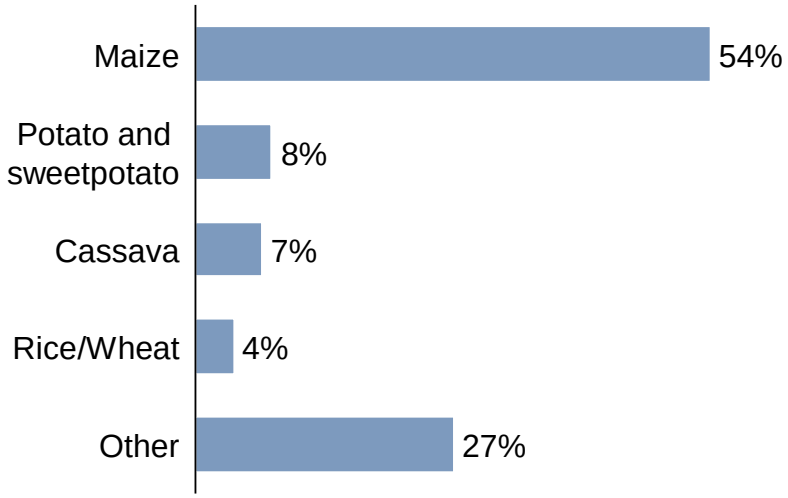
Biggest opportunity for OFSP growth lies in fresh market: people could consume OFSP more frequently and 1.8M non-consumer households could start eating OFSP

There is still **room to increase calorie contribution of the sweet potato relative to maize**, which disproportionally drives household food consumption

And still 49% of rural and 26% of urban Malawian households report **never consuming roots and tubers. This is a 1.8M household opportunity**[1]

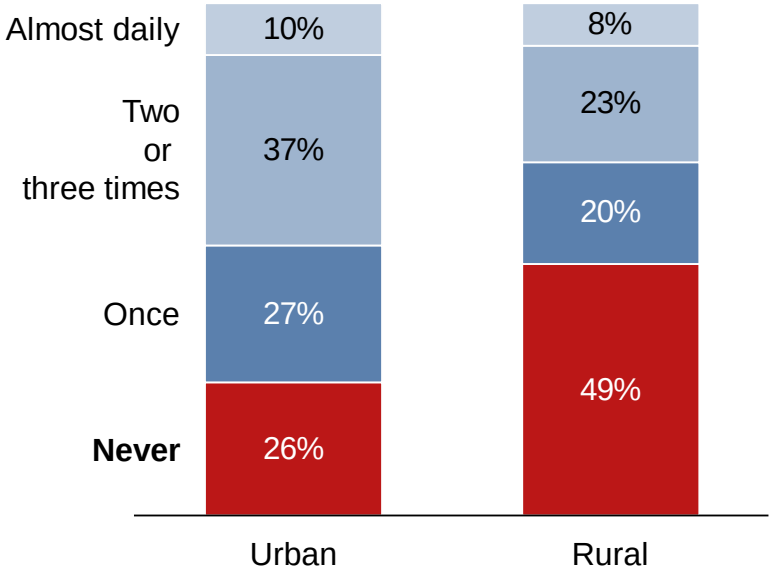
Share of caloric contribution – various crops in Malawi

Share of calories per crop, 2017



Weekly household consumption of roots/ tubers

Share of total households; 2013



1In addition to getting households that never consume roots and tubers to consume OFSP, households already consuming roots and tubers (possibly including OFSP) could eat OFSP more frequently – substituting other roots and tubers. This may be easier to achieve than to 'convert' those not consuming OFSP

Source: Malawi 2014 Welfare Monitory Survey: Ministry of Agriculture; FAOStat; Dalberg analysis

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Source: Desk research; stakeholder interviews; IndexMundi; FAO: Kenya irrigation market: 2015; Agric South Africa; Mail Guardian South Africa; Dalberg analysis

Significant cost savings could be realized for players in the bakery industry, and a lucrative export market is possible

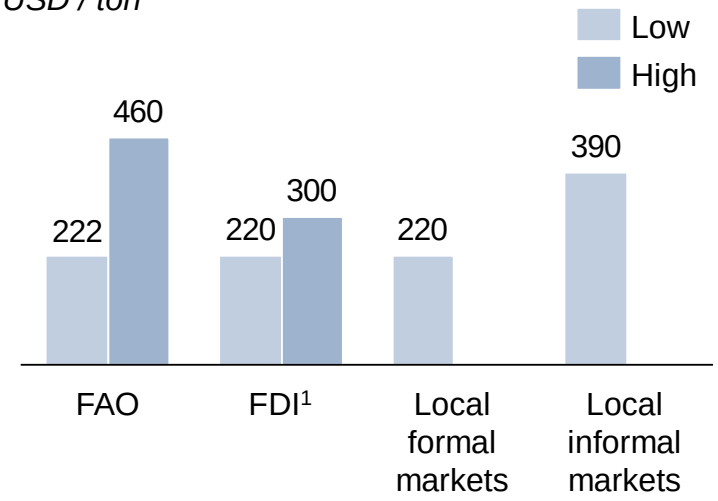
	PROCESSORS	EXPORTERS	PRODUCERS
Opportunity	**10% cost savings for bakeries** *Limited to non-vertically integrated segment*	**>40% margin/ton on fresh roots** *Opportunity to boost exports to markets with double-digit growth*	**>200% additional revenue over maize** *High earning opportunity for farmers*
Considerations	• Cost savings would only be possible in the one-third of the ($1.5 billion) bakery industry that is not vertically integrated • Depends on ability to efficiently produce OFSP puree to be consistently competitive with high local wheat flour prices	• Already demonstrated ability to export to such markets, at c.8,000 tons in 2013 • Areas for further exploration: what factors have kept export volumes at low levels, given access to established high-growth trade markets	• Driven by ability to command average price of USD 230 per ton for sweet potatoes across two growing seasons • Yield levels are also crucial to achieving this revenue gain over maize; the crop would need to become a priority for growers

Source: Dalberg analysis

Sweet potatoes are currently not a major crop in South Africa, but they can be grown efficiently, at higher yield and drive increased income to farmers

Farmgate price for sweet potatoes is hard to pin down across various sources

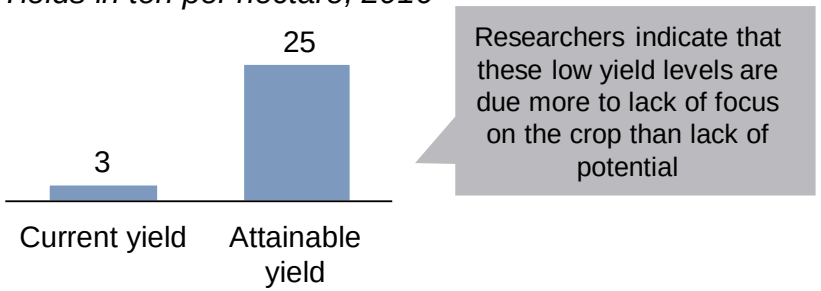
USD / ton



Mean price for sweetpotatoes at 12 formal markets in SA from 2012 and 2016 were between 220/T and 300/T. **Farmer income analysis uses USD 230/T**

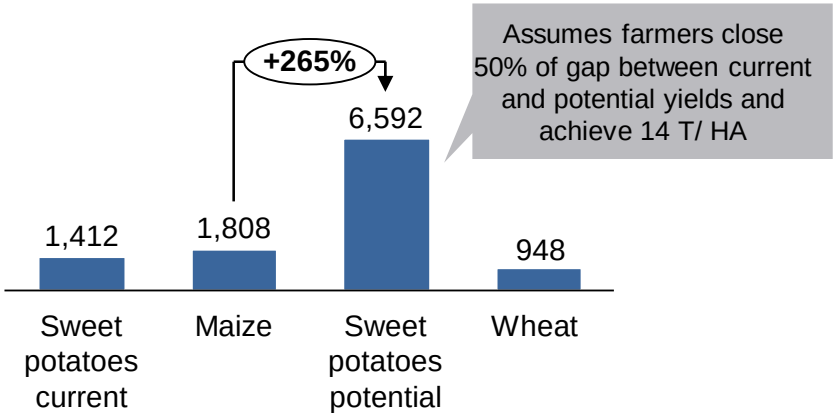
There's a lot of potential to increase yield

Yields in ton per hectare; 2016



Potential for increased farmer income is substantial[2]

Income in USD per hectare per year; 2016



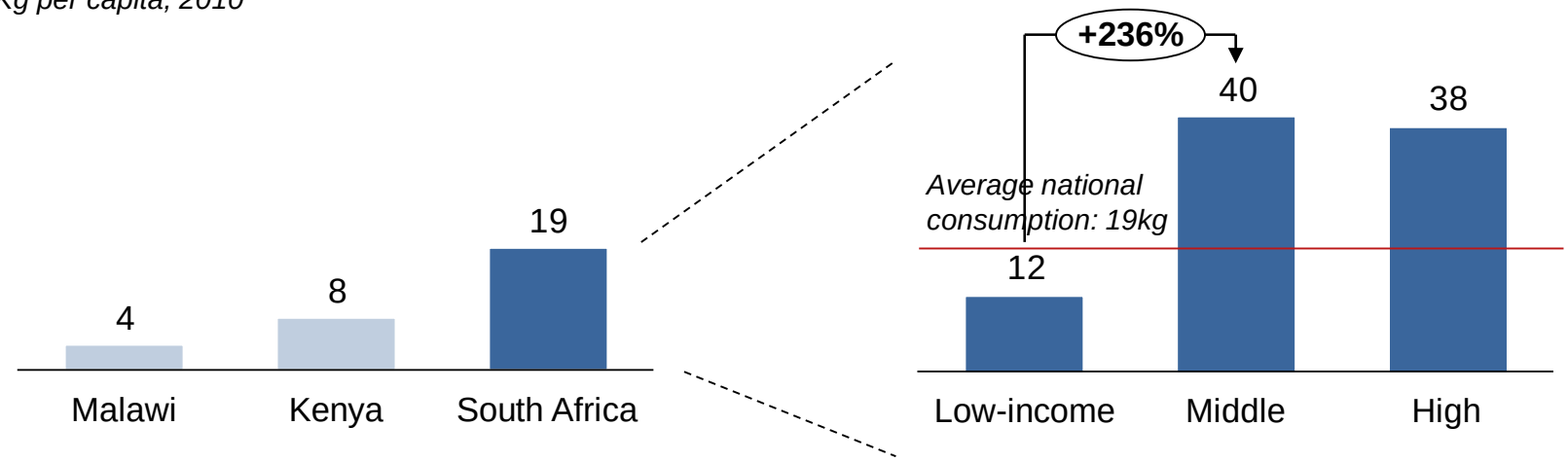
1 FDI: Food Research International.

2 Growing seasons for potatoes, swee tpotatoes, and maize at 2 each; others at 1. Source: FAOstat; South Africa crop calendar; South Africa growing guide for potato; USDA.gov; Laurie (2017): OFSP context for South Africa; Dalberg analysis

Although has many market fundamentals suggesting a case for OFSP, the developmental benefits would be limited

Per-capita consumption of bread

Kg per capita; 2010



- As of 2010, South Africa had an average annual per-capita bread consumption of 19kg, but **low-income households still consume a third less than the national average**
- Overall national consumption of bread is fairly stable, at just 1% growth per year, but **further growth could be restricted by recent macroeconomic downturn**
- Developmental benefits would be **limited to nutritional effects for consumers** as both commercial farmers and processors are predominantly advantaged and high-income and market dynamics don't make SMEs and small farmers viable

Source: World Bank 2010; StatsSA (2015): Living conditions survey 2014/2015; Dalberg analysis

Questions and Answers

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