Facilitating Healthier Consumption of Grains – Fortified Whole Grains

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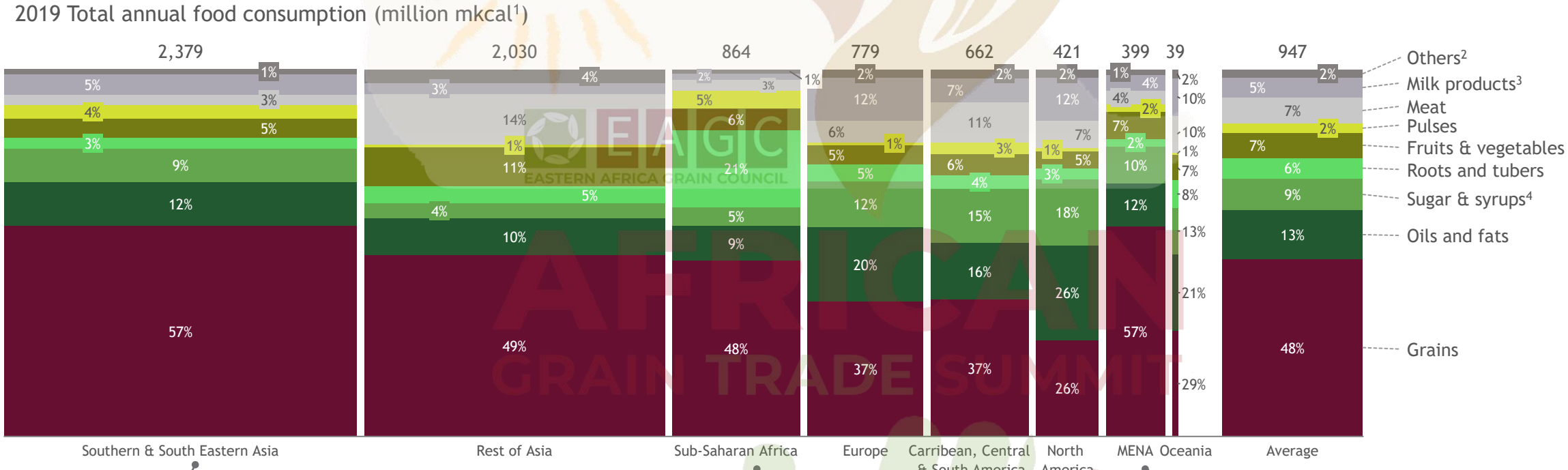
The Rockefeller Foundation

FORTIFIED WHOLE GRAIN ALLIANCE

Grains have been at the heart of food systems since antiquity

Grains account for ~50% of calories and more than 40% of proteins consumed in LMICs



Rice accounts for 58% of grains consumed

Maize accounts for 36% of grains consumed

Wheat accounts for 62% of grains consumed in MENA[5]

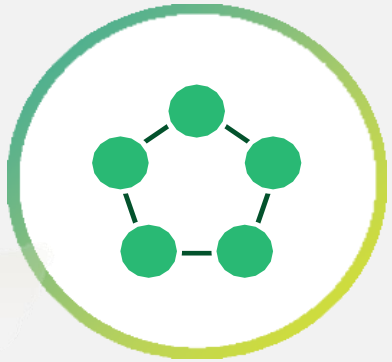
A combination of factors led to the predominant consumption of refined grains since the 19th century

Technology

The advent of the roller mill in Britain led to drastically lower production costs of refined flour and extended shelf life

Consumer Preferences

Refined flour was earlier perceived as a 'cleaner' product and consuming it was seen as a status symbol



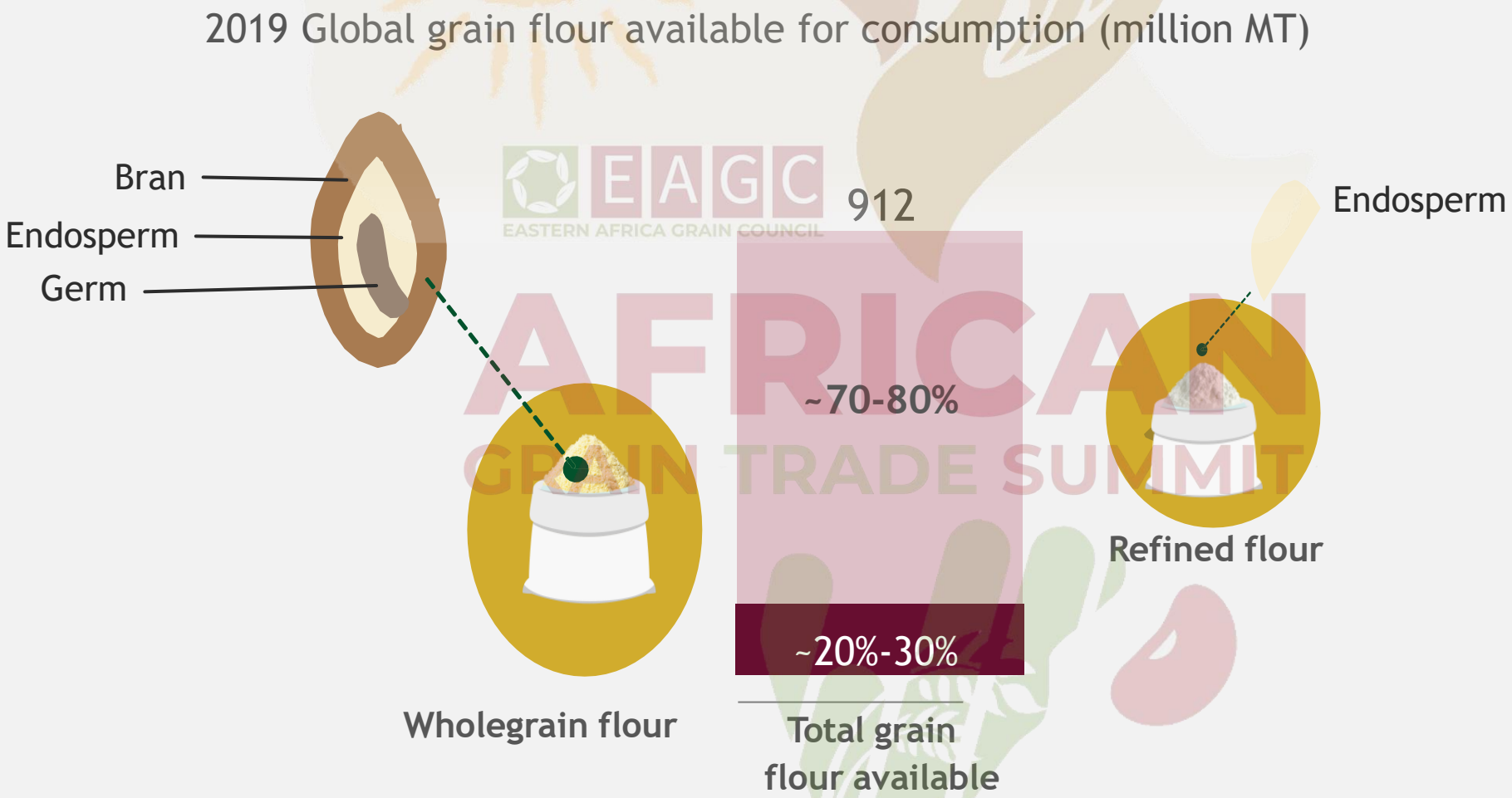
Market Dynamics

The Green Revolution concentrated grain production and consumption on grains which were already mostly consumed in refined form. Byproducts from grain refining became inputs to the animal feed sector

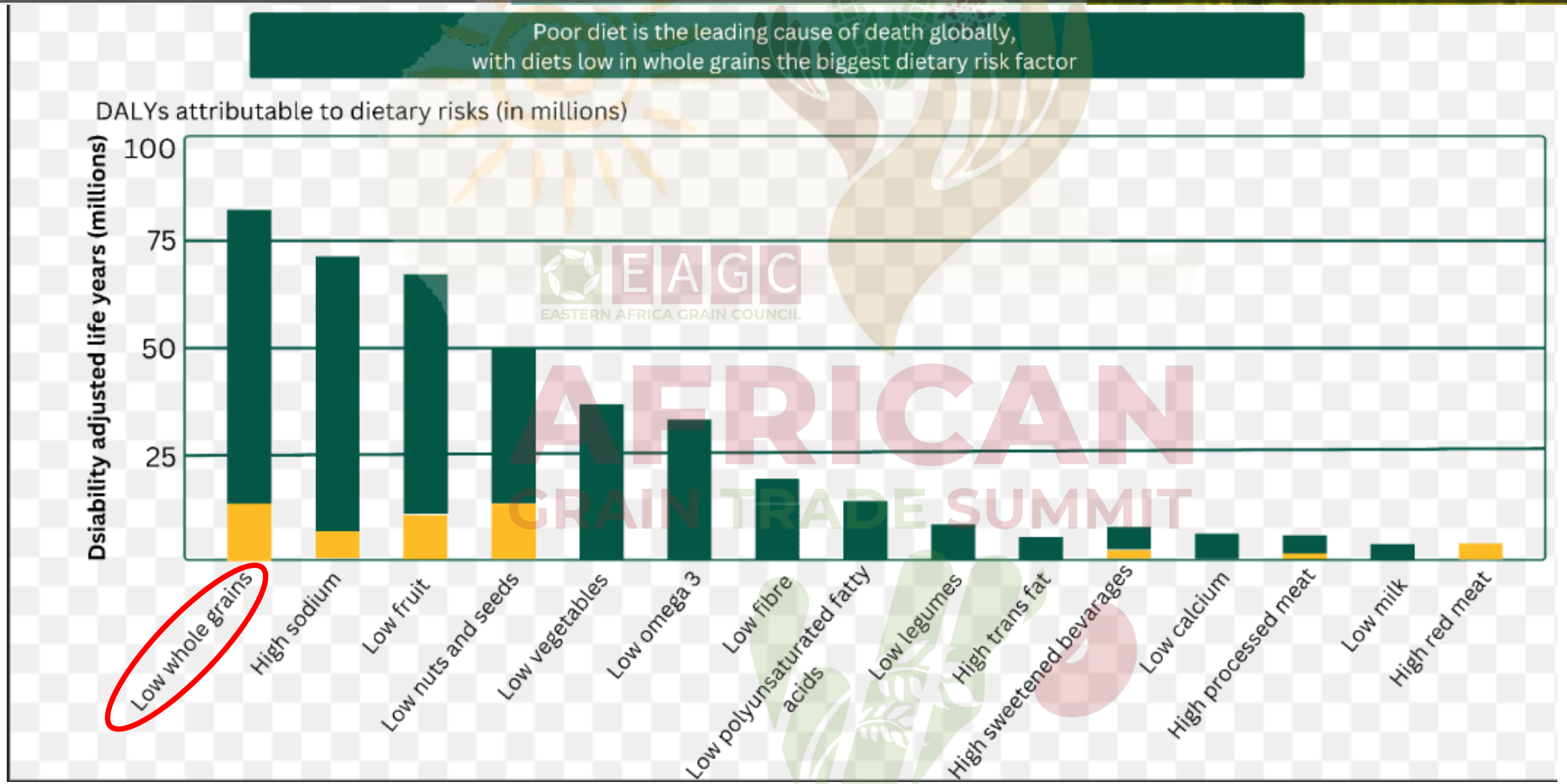
Source: BCG analysis; The Rockefeller Foundation

The dominance of refined grain foods in diets contributes to both undernutrition and obesity

Only 20-30% of grains are consumed as whole



Low consumption of whole grains is the highest dietary risk factor contributing to the global burden of disease

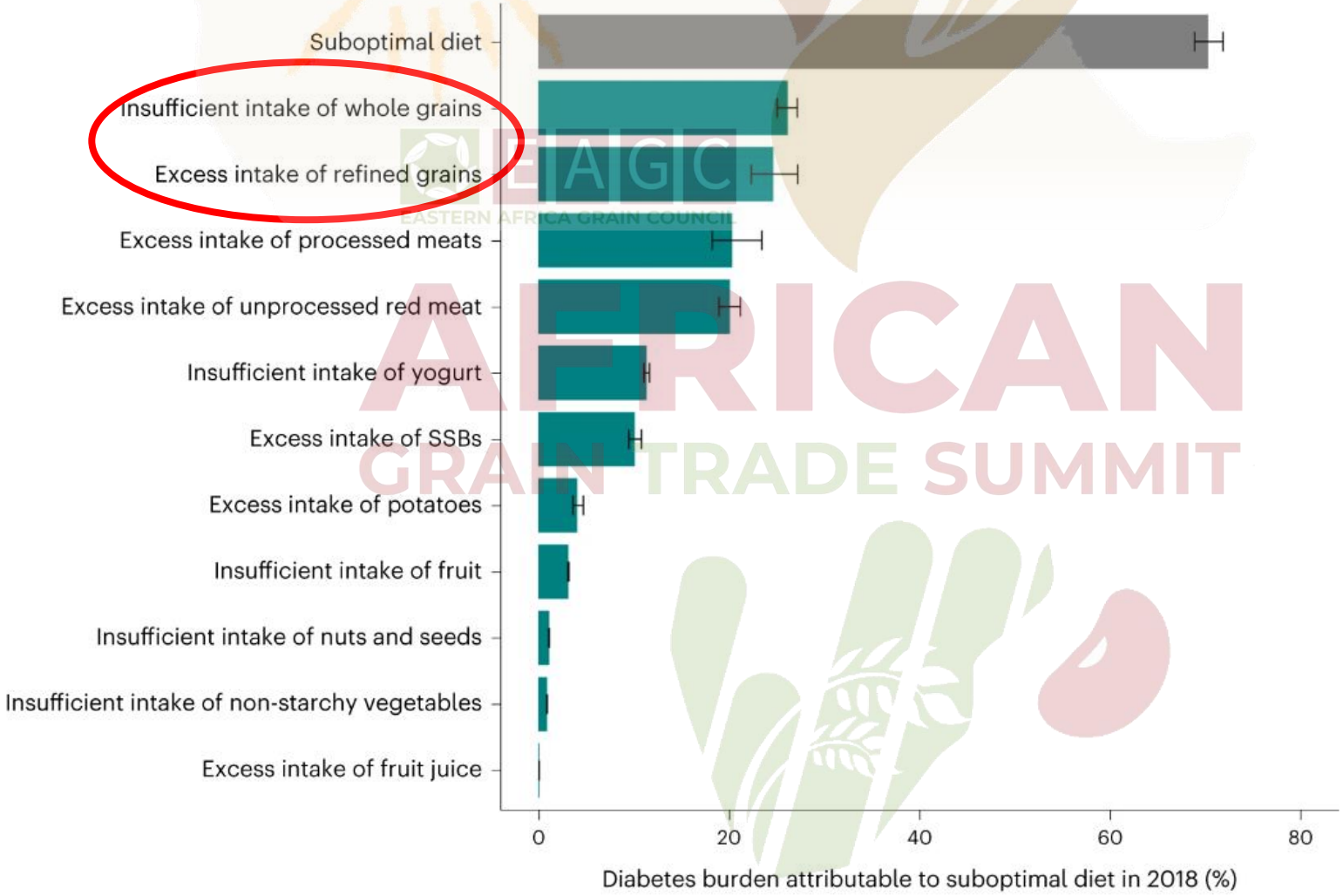


Source: Branca et al. *BMJ* 2019;364:l296

Over ½ of type-2 diabetes cases associated with poor diets are attributable to insufficient whole grain intake & excess intake of refined grains

Fig. 1: The proportional burden of T2D attributable to suboptimal diet jointly and by each individual dietary factor globally in 2018.

From: Incident type 2 diabetes attributable to suboptimal diet in 184 countries



Fortified whole grain & whole blend foods make diets much more nutritious

Bran
Fiber-filled outer layer with B vitamins and minerals

Endosperm
Starchy carbohydrate middle layer with some protein

Germ
Nutrient-packed core with B vitamins, vitamin E, phyto-chemicals, and healthy fats

Refined flour

Carbohydrates and some protein

Extraction rate
~70%

Whole grain flour

Vitamins, minerals, proteins, healthy fats, dietary fibers, and bioactive compounds

Carbohydrates and some protein

Extraction rate
~100%

Fortified whole grain flour

Vitamin A | B vitamins
Iron | Zinc

Vitamins, minerals, proteins, healthy fats, dietary fibers, and bioactive compounds

Carbohydrates and some protein

Extraction rate
~100%

Fortified whole blends

+ Nutrients from blending FWG with legumes and other nutrient-dense foods (nuts, seeds, fish powder, etc.)[5]

Vitamin A | B vitamins
Iron | Zinc

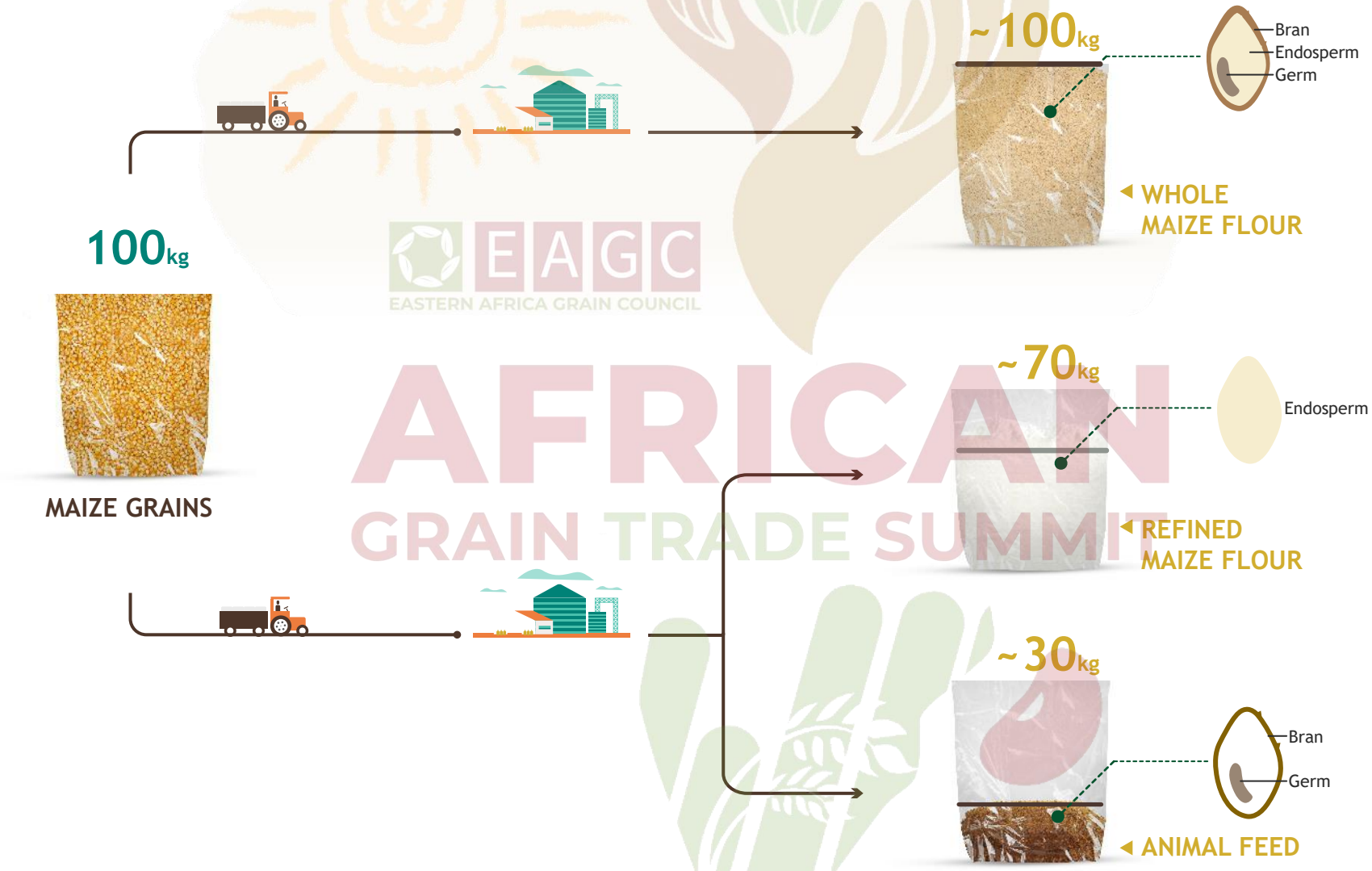
Vitamins, minerals, proteins, healthy fats, dietary fibers, and bioactive compounds

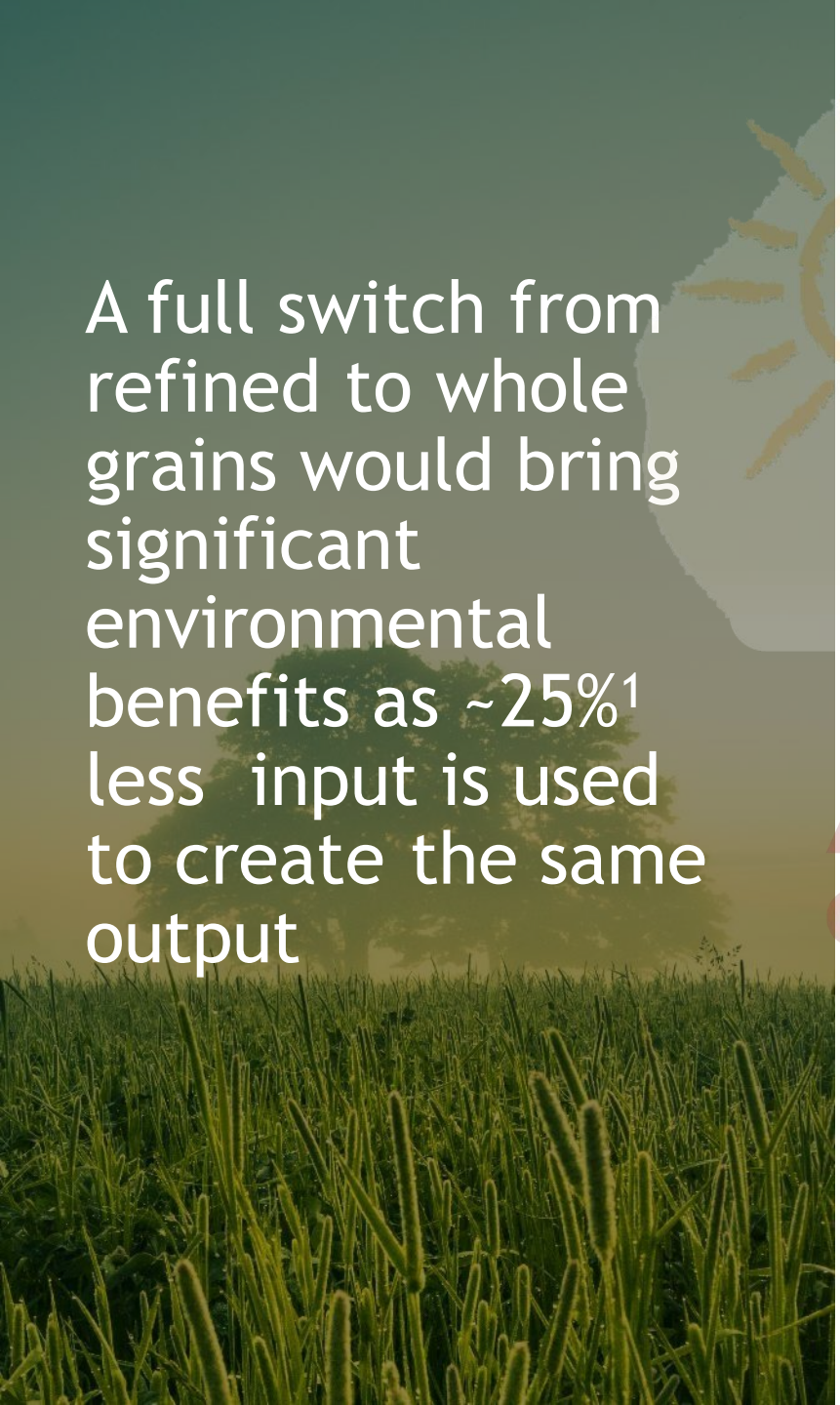
Carbohydrates and some protein

Extraction rate
~100%

Endosperm | Bran & Germ | Fortification Nutrients[4] | Blend Nutrients

Fortified whole grain foods can be a nutrition-positive and budget-neutral substitute to refined and unfortified products





A full switch from refined to whole grains would bring significant environmental benefits as ~25%[1] less input is used to create the same output

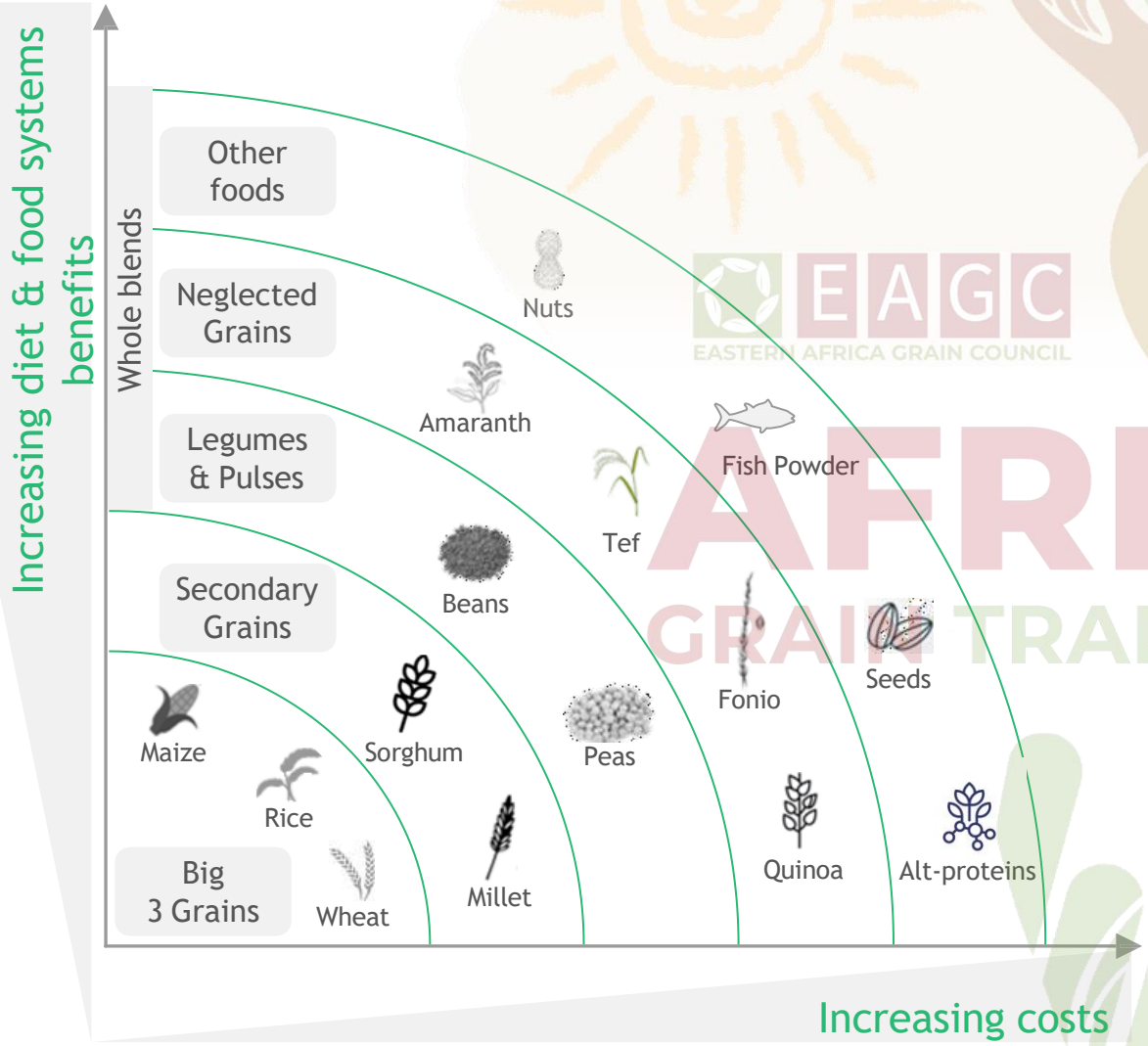
Reduce **freshwater** use for plant crops by 8.6%[2] or 124,000 billion liters, which is the equivalent amount used to grow legumes, roots and tubers

Reduce **cropland** use by 9% or 720k km^2, which is equivalent to twice the size of Germany

Reduce **GHG emissions** from plant crops by 9% or ~450 million Mt of CO2 or the equivalent emissions of the United Kingdom in 2019

Reduce **fertilizer** use by 11.4% or ~8 million Mt nitrogen and phosphorous fertilizers, which is the equivalent amount used to grow nuts, seeds, and sugar crops

Promoting a transition towards fortified whole grains and whole blends is a multi-step journey with increasing food systems benefits



- **Short term** – The transition to FWG and FWB should start by making affordable whole meals of the "Big 3" grains, with gradual incorporation of secondary grains such as sorghum and millet
- **Medium to long term** – Create products blending the "Big 3", sorghum and millet with legumes and pulses, as a start, and neglected grains and other nutrient- dense foods at a later stage

Source: BCG analysis; The Rockefeller Foundation

Why shift from refined to Fortified Whole Grains

5x

more nutritious

2.2x macro-nutrients and 6.1x micro-nutrients compared to refined unfortified flour

$0 [1]

incremental cost

High quality FWG flour produced at the same cost as refined flours

25%

lower environmental footprint

Whole grains can feed more people with less land, water, fertilizer use and GHG emissions

1. Ranges from 20-30%

R&D to extend shelf life - accelerated shelf life achieved of 4.5 months from thermal treatment of maize

University of Pretoria Shelf-life R&D studies

Determining the best ways to optimize the shelf life and nutritional value of FWG maize flour through:

1. Thermal treatment of maize (grain drying and roasting)
2. Addition of antioxidants (e.g., Vitamin E, Citric Acid)
3. Packaging
4. Degradation of phytates
5. Encapsulation of riboflavin

Accelerated shelf-life studies key findings:

- Rates of hydrolytic and oxidative rancidity development slowed down by drying the grain to **11.5%** moisture and below
- Only ugali from **47 days** stored maize meal from maize of **13% moisture** was significant different in aroma and flavour
- Predictive fortified maize whole grain flour shelf life at least **4.5 months** at a mean temperature of 25°C

Reduction in moisture level achieved:

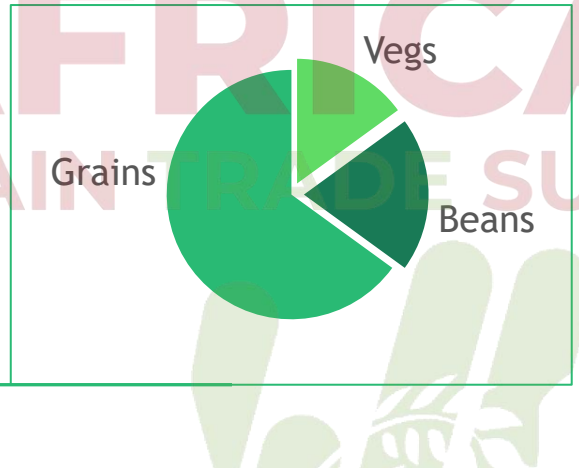
☆ Currently undertaking Real-time Shelf-life Studies with the goal being to get to a shelf life of 6+ months

Source: The Rockefeller Foundation

Shifting from refined flour to fortified whole grain (FWG) flour provides more nutritious school meals at no additional cost

1 FWG is 5X more nutritious

With grains being ~60% of a typical school meal plate in LMICs, changing to FWG makes meals significantly more nutrient-dense



Comparative macro and micronutrient gain when switching from refined to fortified whole maize meal

Gain	Nutrient	Multiple
Macronutrients 2.2X	Proteins	1.2
	Lipids	2.8
	Carbohydrates	0.9
	Fiber	3.8
Micronutrients 6.1X	Iron	4.9
	Zinc	13.6
	Vit. A	2.1
	Thiamin	7.4
	Riboflavin	4.7
	Niacin	1.3
	Pantothenic Acid	12.7
	Folate	2.9
	B12	7.0
	Calcium	3.5
	Copper	1.6
	Magnesium	5.2
	Manganese	8.2
	Phosphorus	4.5
	Potassium	3.5
	Overall 5X	

Source: USDA FoodData Central, WFP Fortified Whole Maize Meal – Eastern Africa Community (EAC) Technical Specification; The Rockefeller Foundation

Pilot study demonstrated the feasibility of a large-scale, budget-neutral shift in school feeding towards FWG foods

Rwanda has successfully piloted this shift and demonstrated its budget-neutrality to school feeding programs

The 18-month pilot program[1] in Rwanda supplied 13,765 schoolchildren in 18 schools with FWG maize meal, demonstrating the potential to

- Produce high quality FWG flour **at the same cost** as refined flours
- **Shift consumer preferences** towards healthier FWG foods
- **Leverage institutional food procurement** to improve diets for the most vulnerable in a **budget-neutral way**

By the end of the pilot …

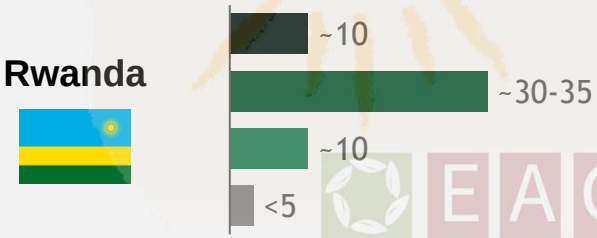
73% **of schoolchildren** were aware of the nutritional benefits of FWG foods

97% **of schoolchildren in Grade 6** preferred wholegrain maize meal to refined equivalent

Annual societal benefits of the switch to FWG in school meals across Rwanda, Ghana and Kenya could reach $250M

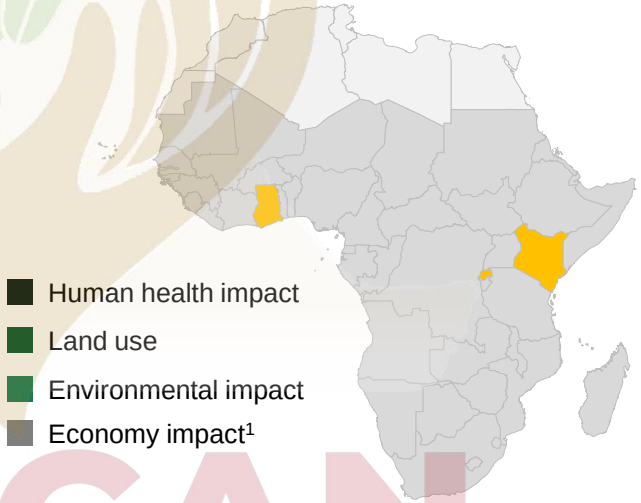
Total annual benefits ~**$50M**

Rwanda



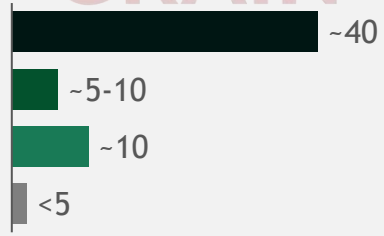
Total students benefited **3.5M**

Estimated grain consumption **~80K MT**



Total annual benefits ~**$60M**

Ghana

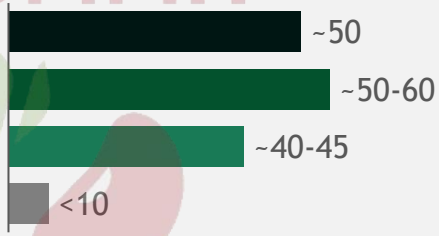


Total students benefited **3.4M**

Estimated grain consumption ~**40K MT**

Total annual benefits ~**$140M**

Kenya



Total students benefited **10M**

Estimated grain consumption ~**300K MT**

Source:McKinsey & Co. True Value of Food Analysis, base case | 1. The estimated economy impact on local millers was minimal and highly preliminary, and is to be refined in further iterations of this work

Focusing on institutional markets in the short term can help drive longer term shifts in consumer markets

Steps to ensure a successful transition to FWG & FWB in public food programs

1

Build awareness about FWG & FWB's importance in diets

Sensitize the school community and the whole population about the benefits of FWG and FWB via nationwide social marketing

2

Switch maize flour procurement for schools to FWG flour

Switch all maize flour procurement to FWG flour (budget-neutrally) to provide the structured demand to enable investment by millers

3

Invest in production economics to increase affordability

Invest in new machinery to efficiently produce FWG to meet national school feeding program's demand and engage local farmers and aggregators to improve quality throughout the value chain

4

Increase distribution networks to enable access to FWG & FWB

Invest in packaging, transportation and storage infrastructure to ensure FWG and FWB is safely, efficiently and sustainably delivered to schools

5

Include FWG & FWB in other government food programs

Provide FWG and FWB in safety nets instead of refined grains and invest in the transition to FWG and FWB for government subsidy programs

Source: The Rockefeller Foundation

After meeting institutional demand, focus should be on scaling production and shifting consumer preferences towards FWG & FWB products

Incremental steps to reach the consumer market with FWG & FWB products

1

Build awareness about FWG & FWB's importance in diets

Sensitize the general public on the social, environmental, economic and nutritional benefits of switching to FWG & FWB by leveraging, for example, social media, creation of pre-cooked options that are easy to serve in retail outlets, and partnerships with chefs and restaurants

2

Invest in R&D for FWG & FWB meals and scale production

Invest in R&D to improve FWG & FWB products in terms of taste, shelf life and shelf stability and scale investments in new machinery to efficiently produce FWG & FWB products

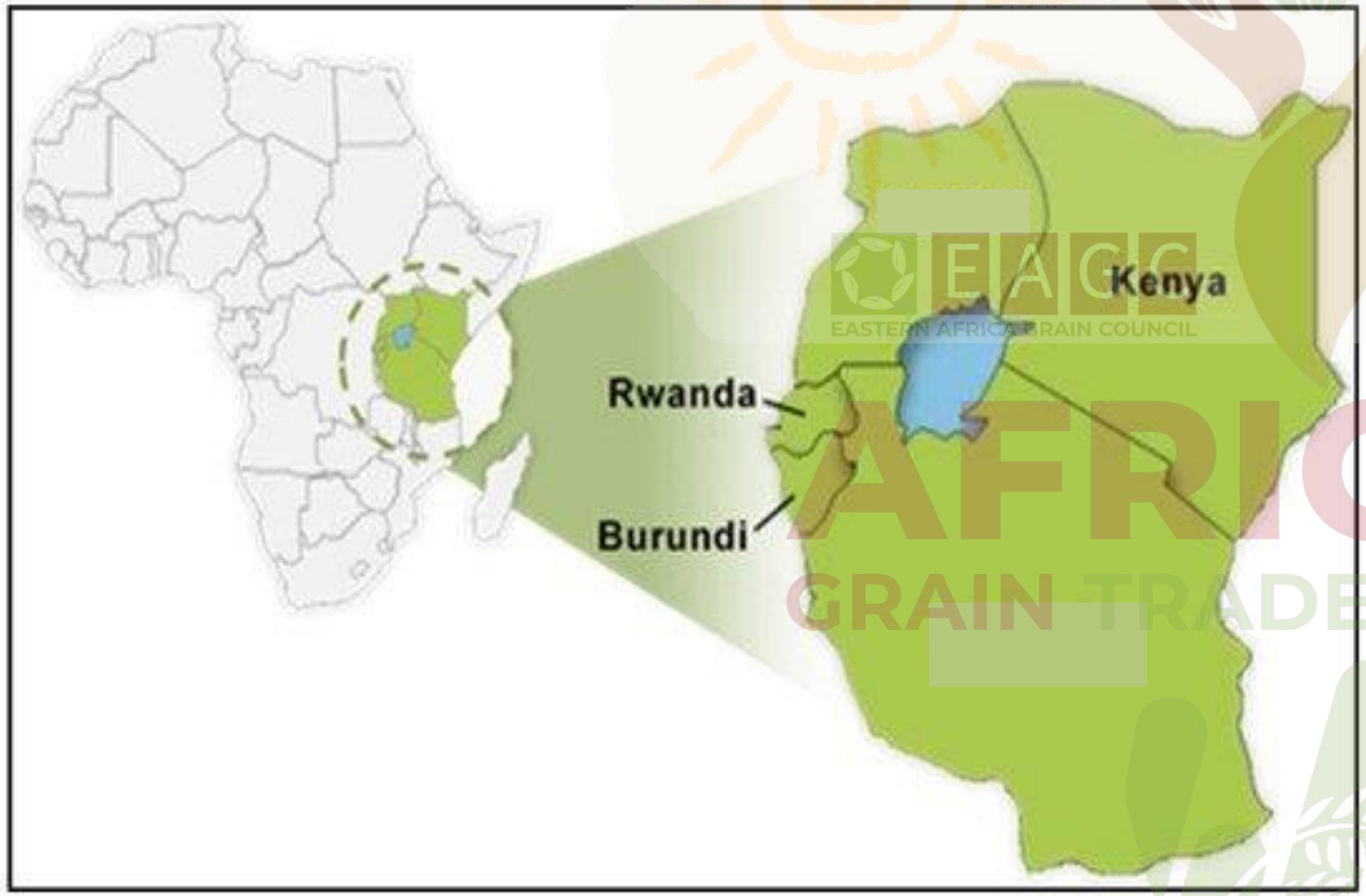
3

Increase distribution networks to reach the consumer market

Build or adapt at scale existing transportation and storage infrastructure to ensure FWG and FWB products are safely, efficiently and sustainably delivered to consumers

Source: The Rockefeller Foundation

Launched & Introduced FWG Foods in school feeding in East Africa with Progress in Rwanda, Burundi and Kenya



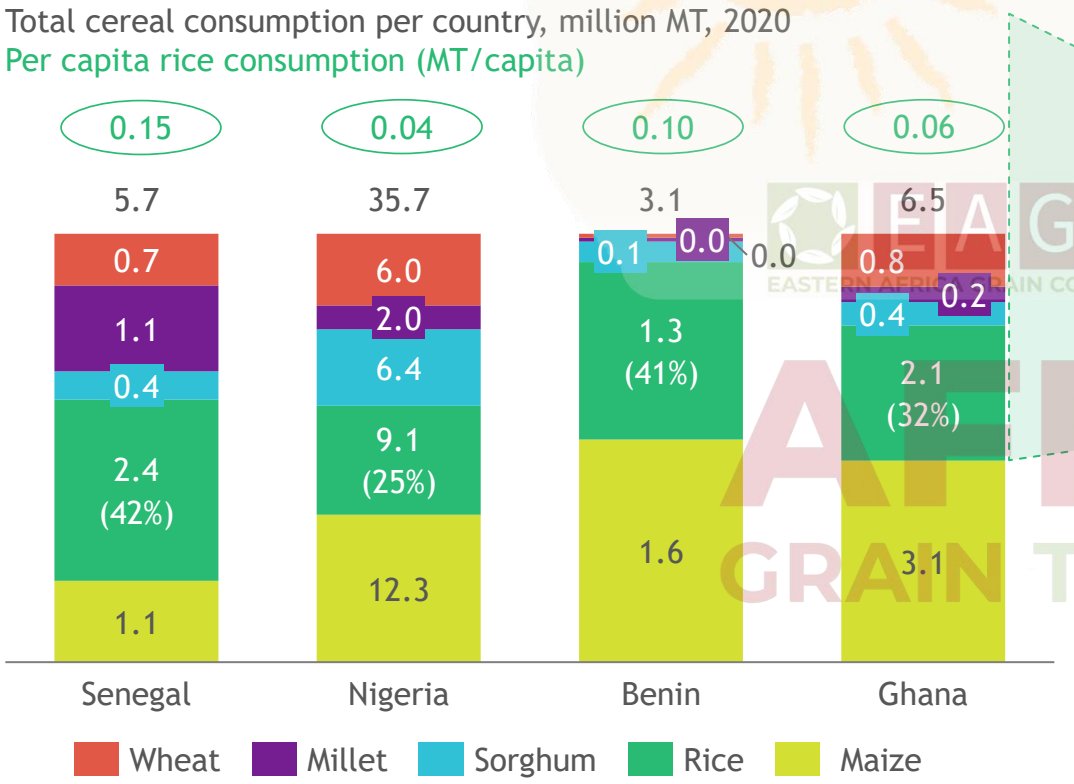
Rwanda
FWG adopted and expanded to 74,000 school children in 81 schools and included in school feeding guidelines

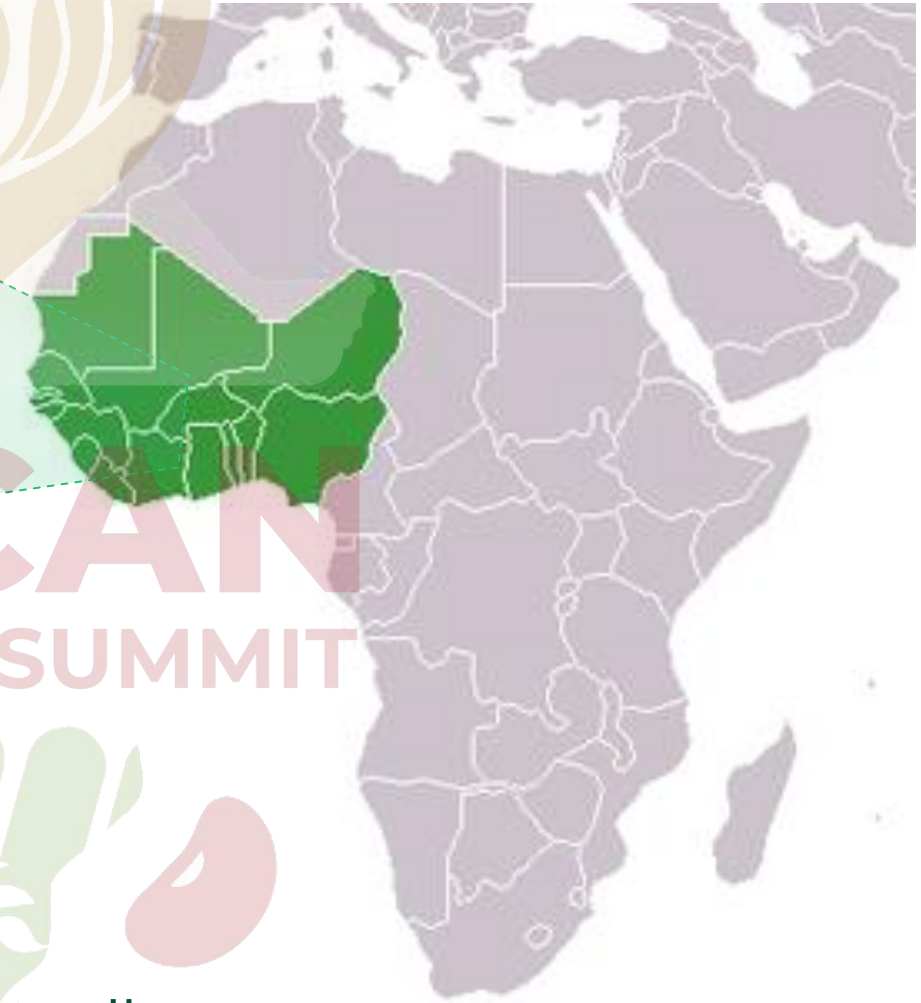
Burundi
School Feeding Program Launched and currently feeding 60,000 students on FWG

Kenya
One county implemented ECD school feeding with FWG Porridge and feeding 40,000 ECD learners and two committed to launch this year. Kenya Posho Millers Program ongoing with 14,000 school children being fed FWG

Source: The Rockefeller Foundation

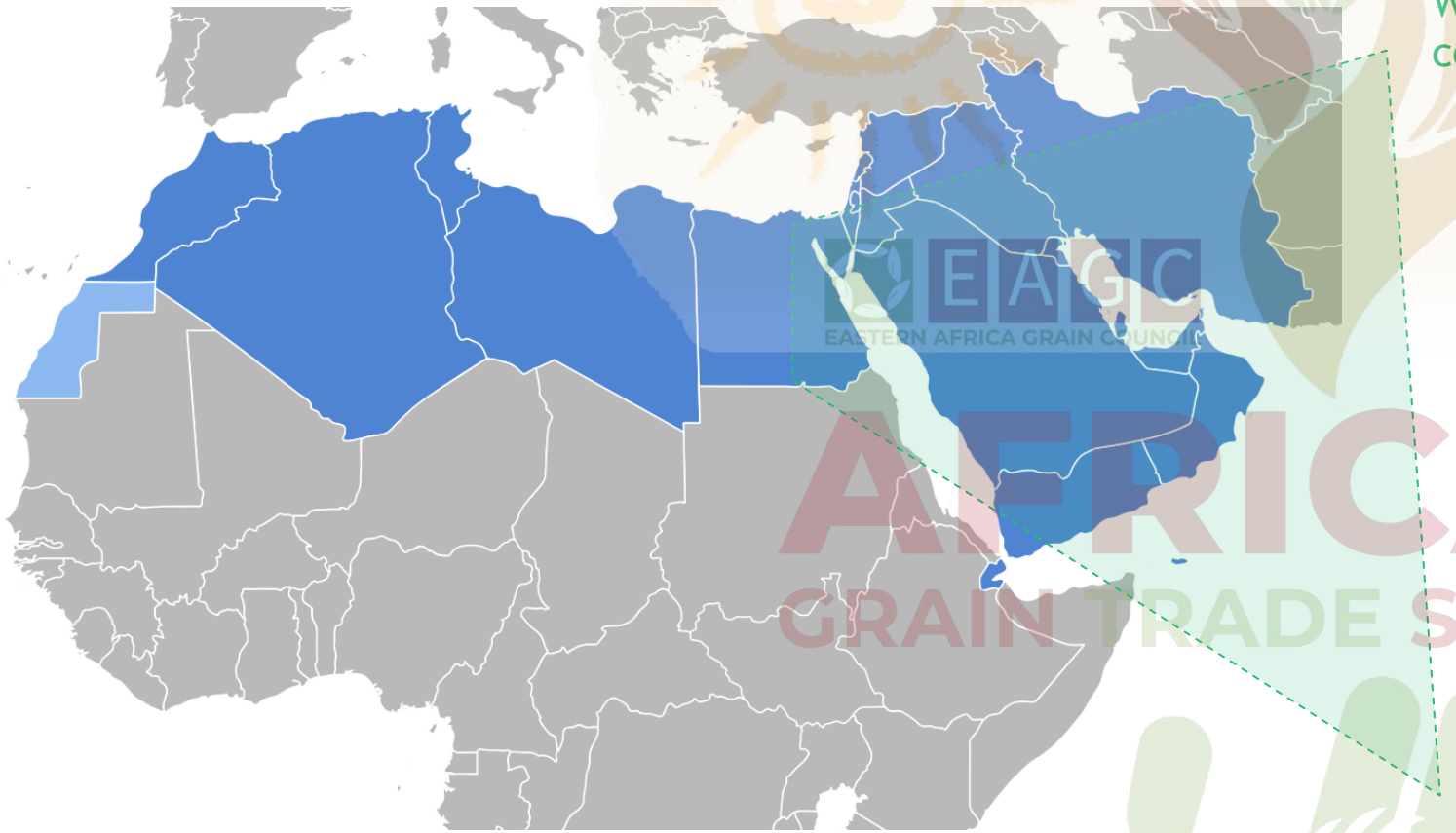
Rice is the second most consumed grain in West Africa and consumption is growing faster than for any other food staple in sub-Saharan Africa



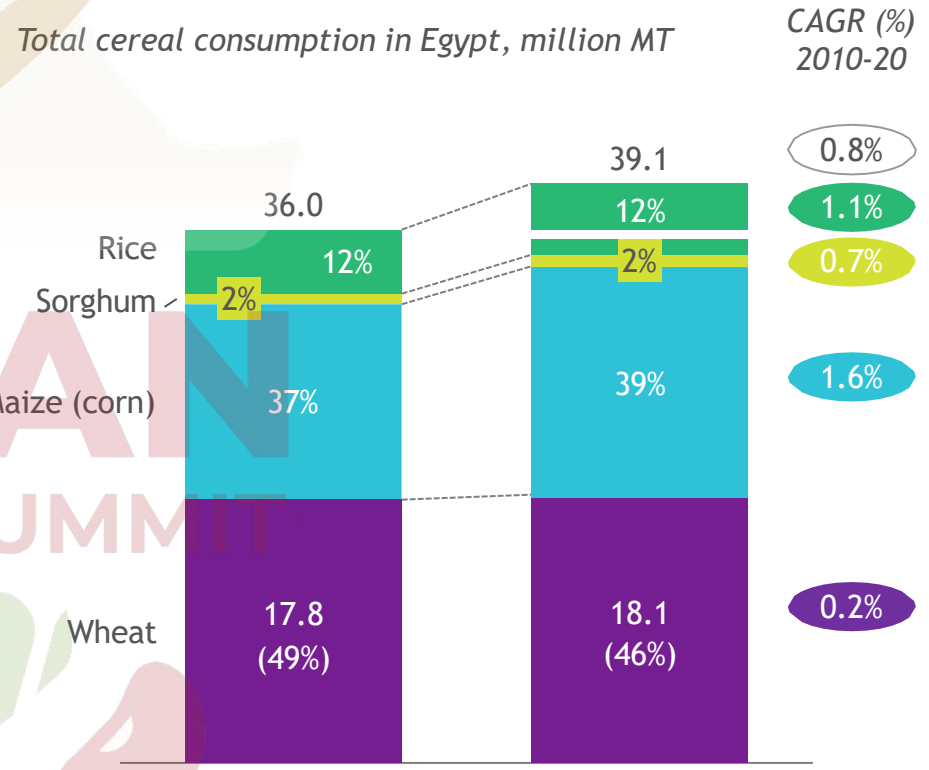


Unpolished (whole grain) rice retains all nutrients naturally present in the grain and costs less to produce than polished rice

Wheat consumption in Egypt remains the highest among all grains, with dominance reinforced by government intervention among other factors



Wheat is most consumed grain with ~50% of total consumption



- Egyptians mainly consume government-subsidized baladi bread, which is in refined form and it contributes to >50% of wheat consumption

The Fortified Whole Grain Alliance (FWGA)

FORTIFIED WHOLE GRAIN ALLIANCE

A **coalition of stakeholders that span across the food system,** including nonprofit and private sector partners and members, committed to increasing the global consumption of fortified whole grains (FWG)

Brings together the collective **expertise, resources, operations, funding, visibility, and convening power** of its partners

EAGC EASTERN AFRICA GRAIN COUNCIL

PARTNERS

The Rockefeller Foundation

BCG BOSTON CONSULTING GROUP

dsm-firmenich

gain Global Alliance for Improved Nutrition

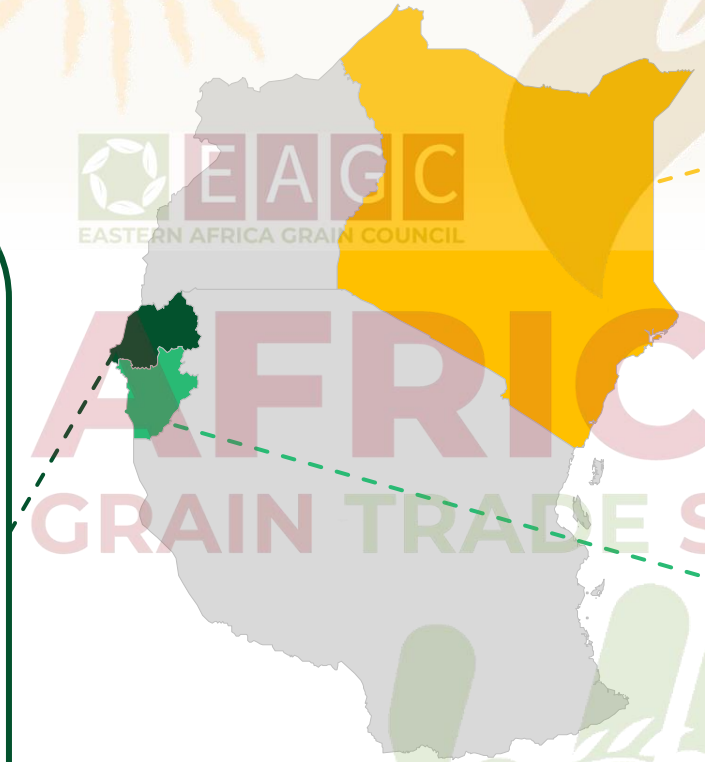
CIMMYT MR International Maize and Wheat Improvement Center

TechnoServe Business Solutions to Poverty ®

capiconic

FWGA provides technical and financial support to millers who are members of the alliance in Kenya, Rwanda and Burundi

Over 50 Miller Members



RWANDA

- ellion INTERNATIONAL
- minimex AFRICA'S FINEST MAIZE PRODUCTS
- MAHWI GRAIN MILLERS
- RWACOF EXPORTS

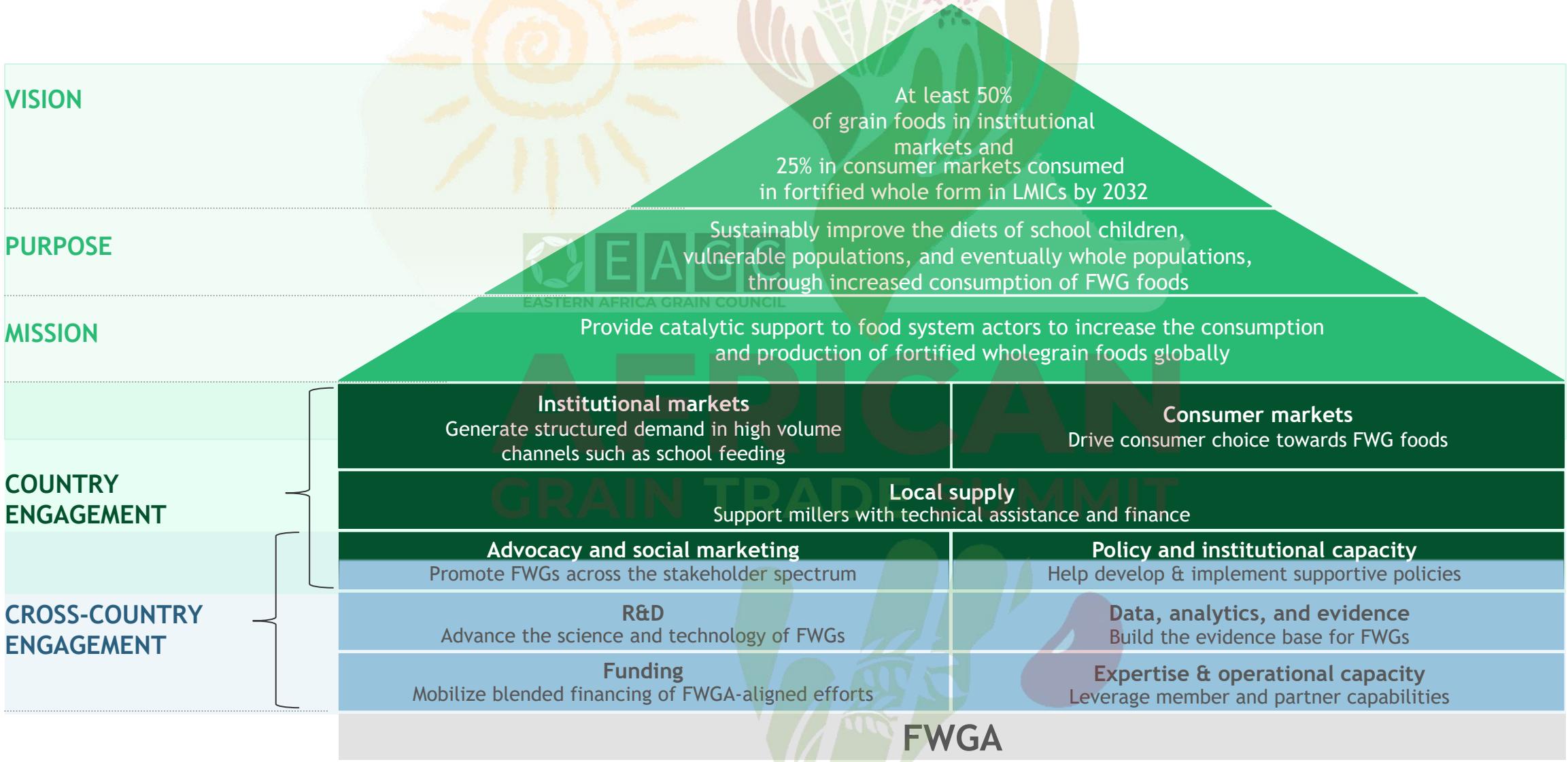
KENYA

- CAPWELL INDUSTRIES MARK OF QUALITY
- SHALEM INVESTMENTS LTD
- +35 micro millers

BURUNDI

- Unikorn
- BURUNDI FORTIFIED FOODS
- FARINE DE QUALITE MINOLACS

FWGA's aim, scope, and engagement strategy

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