

AGRICULTURAL DEVELOPMENT

Donald Nkrumah, PhD/MBA

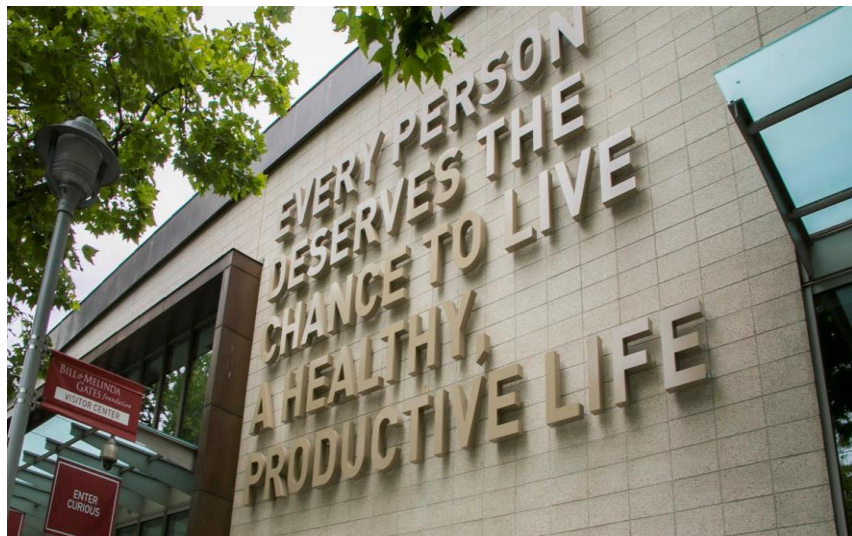
July-27, 2017



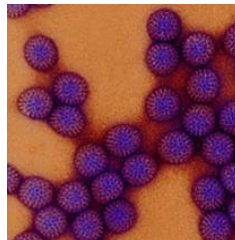
BILL & MELINDA
GATES foundation

LIVESTOCK BIOTECH IN INCLUSIVE AGRICULTURAL TRANSFORMATION

BILL & MELINDA GATES FOUNDATION



1998



Bill and Melinda read about rotavirus.

2000



Foundation Officially Created

2006



Warren Buffett gives BH stock

2008



Bill joins Melinda at the foundation

GLOBAL DEVELOPMENT:

Delivering health and development solutions

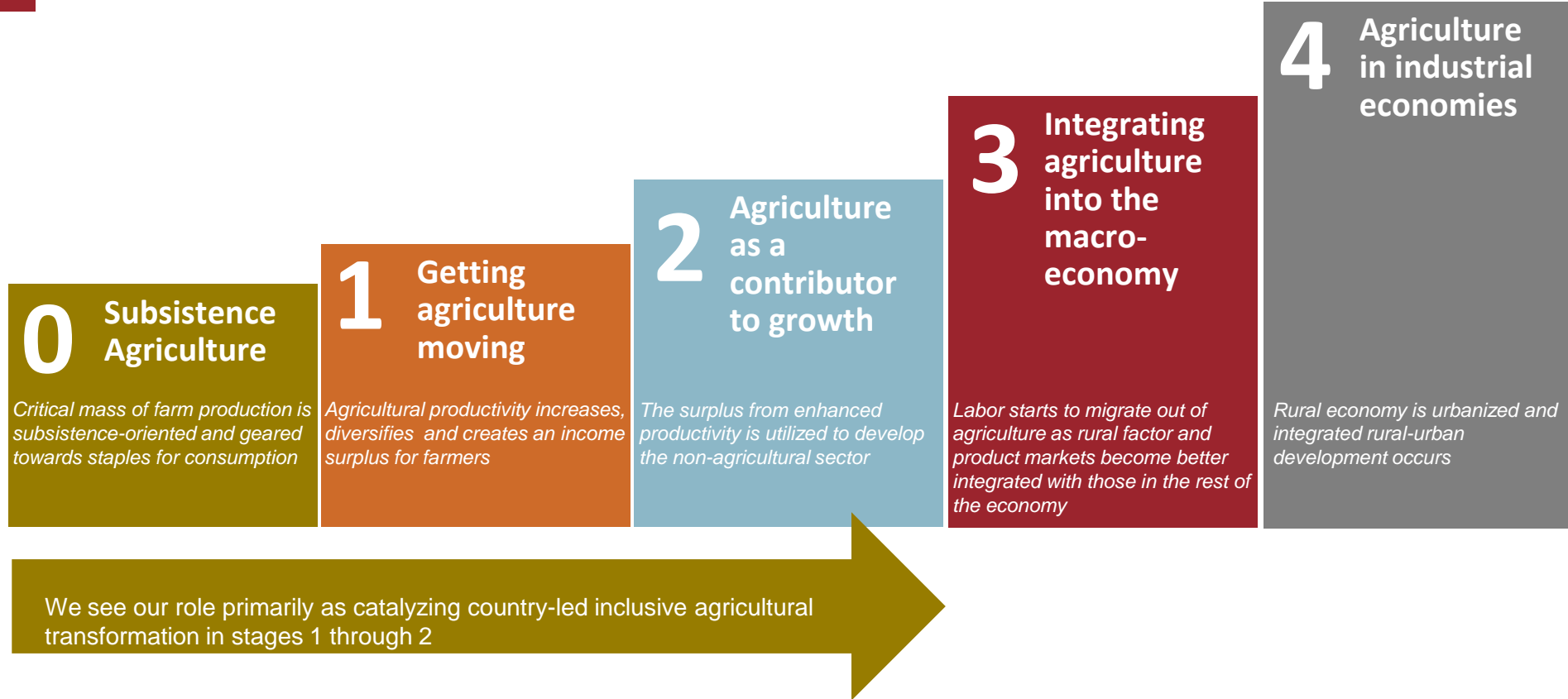
- **Agricultural Development**
- Financial Services for the Poor
- Water, Sanitation, and Hygiene
- Gender Equality
- Maternal, Neonatal, and Child Health
- Family Planning
- Nutrition
- Polio Eradication

GLOBAL HEALTH:

Discovering and developing affordable vaccines, drugs, and diagnostics

- Enteric and Diarrheal Diseases
- HIV
- Malaria
- Neglected Infectious Diseases
- Pneumonia
- Tuberculosis

THEORY OF INCLUSIVE AGRICULTURAL TRANSFORMATION



COUNTRY-LED INCLUSIVE AGRICULTURAL TRANSFORMATION

productivity ||| income growth ||| better household nutrition ||| economic empowerment of women

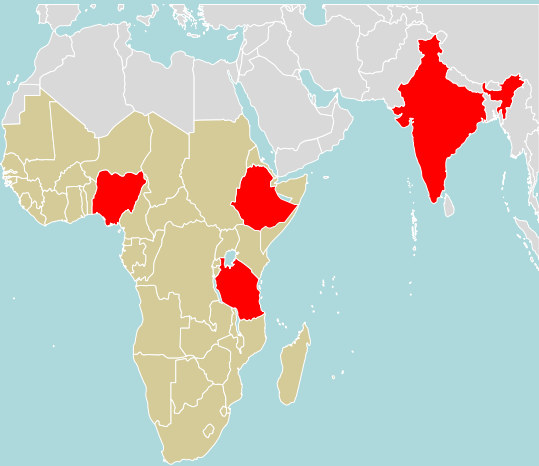
Focus Countries

Africa

- Nigeria (country presence)
- Ethiopia (country presence)
- Tanzania

South Asia

India (country presence)
Focus states: Uttar Pradesh, Bihar, Odisha



Cereals Sm grains/legumes Roots & Tubers



LIVESTOCK IN INCLUSIVE AGRICULTURAL TRANSFORMATION

OVER 700 MILLION POOR (<\$2/DAY) LIVESTOCK KEEPERS IN SSA AND SA.



LIVESTOCK: OFTEN THE MOST IMPORTANT ASSET FOR THE POOR





SMALLHOLDER LIVESTOCK PRODUCTION CONSTRAINTS

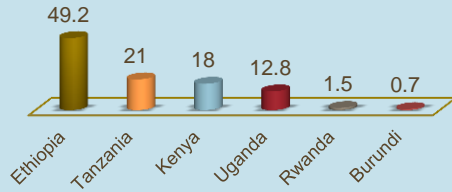
NEGLECTED TROPICAL DISEASES AND PESTS

significant losses to poor livestock keepers

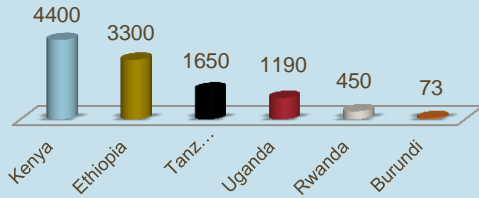
	Disease/Pest	Total Annual SH Loss (Africa)	Total Annual SH Loss (SA)	Total Annual SH Loss	Cattle	Small Ruminants	Poultry
		Millions USD					
High	Endoparasites	3,332	1,659	4,992	✓	✓	✓
	Peste des Petits Ruminants (PPR)	3,611	-	3,611		✓	
	Contagious Bovine Pleuropneumonia (CBPP)	3,274	-	3,274	✓		
	Ectoparasites	1,851	922	2,773	✓	✓	✓
Medium	Foot and Mouth Disease	8,68	573	1,441	✓	✓	
	Trypanosomes ^ξ (T. congolense, T. vivax and T. brucei)	1,166	242	1,409	✓	✓	
	Contagious Caprine Pleuropneumonia (CCPP)	1,027	NA	1,027		✓	
	Newcastle disease [‡]	415	313	728			✓
	Goat Pox and Sheep Pox	479	234	714		✓	
	Brucellosis (B. Abortus, B. Melitensis)*	344	314	659	✓	✓	
Low	Lumpy Skin Disease	487	NA	487	✓		
	Rift Valley Fever (RVF)*	477	NA	477	✓	✓	
	Bovine Tuberculosis (TB)*	201	205	407	✓		
	East Coast Fever [†]	286	NA	286	✓		

LOW-PRODUCING COWS, WORSENERD BY CLIMATE CHANGE

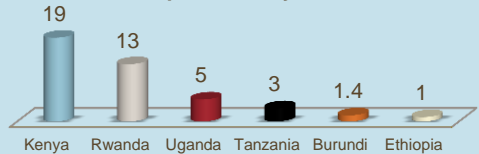
National Cattle Population (Million)



National Milk Production / Year (Million Liters)



% improved dairy cattle

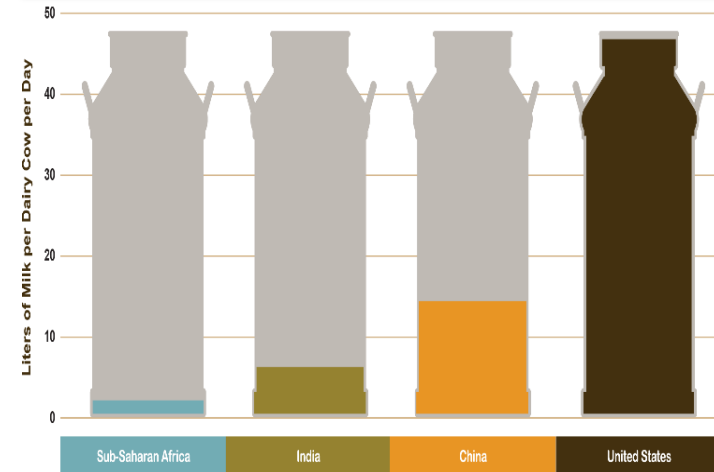


❑ Millions of smallholders in East Africa deliver 60-80% of the milk supply

❑ Total Regional Production = 11.06 Billion

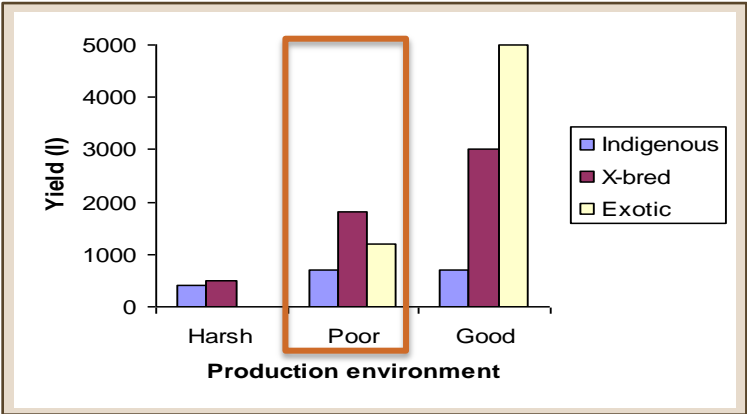
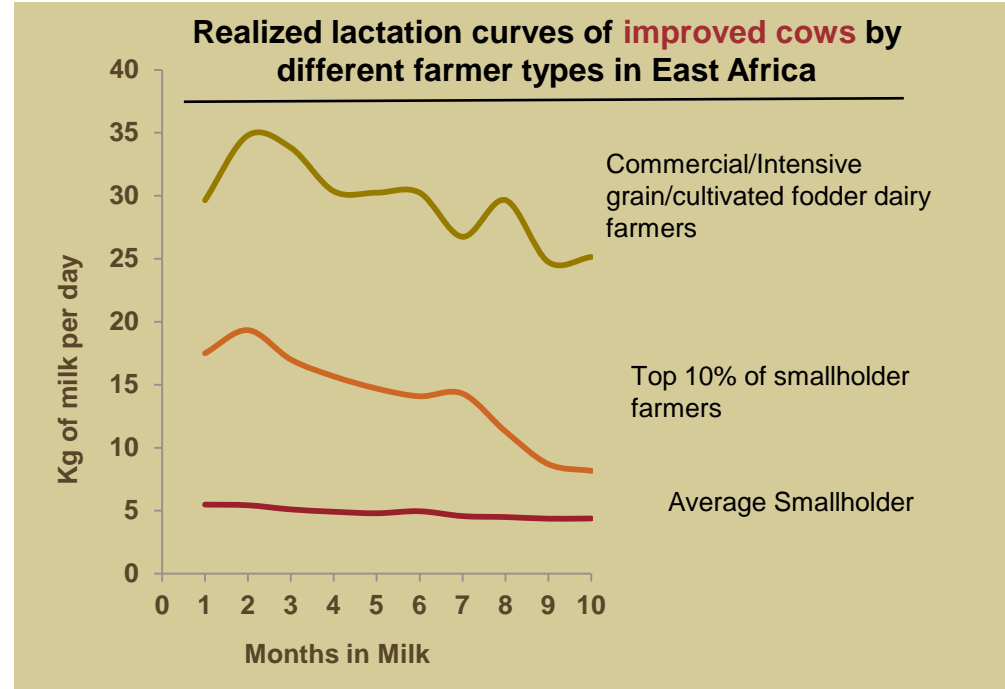
❑ Potential Demand = 48.5 Billion

❑ Estimated Gap = 37.4 Billion



SEASONALITY IN PRODUCTION AND PRODUCTIVITY

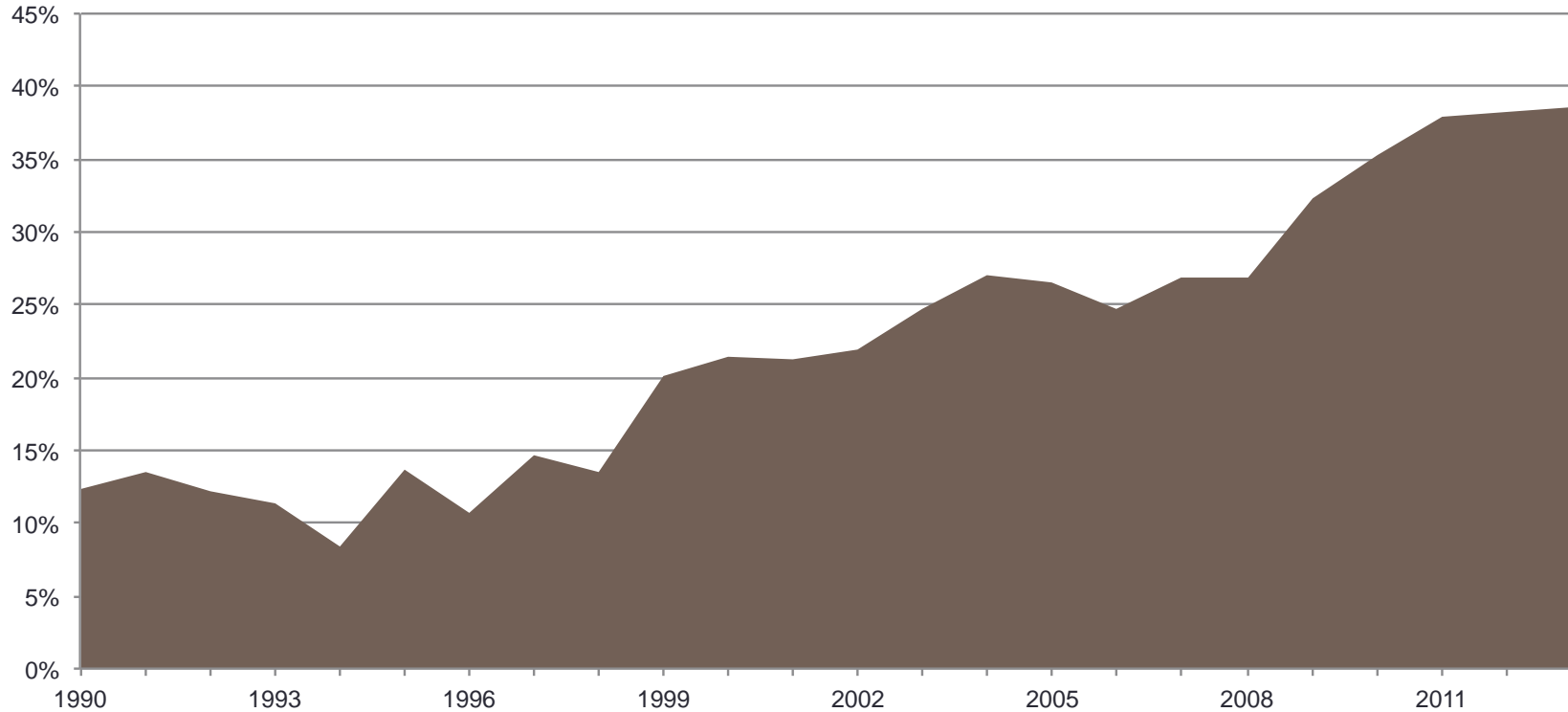
Inadequate feed and fodder in the dry season



Road-side fodder market in Tanzania



THE MIDDLE EAST AND AFRICA ACCOUNT FOR ALMOST 40% OF THE GLOBAL CHICKEN TRADE



LOW-PRODUCING BIRDS, MADE WORSE BY CLIMATE CHANGE



Non-descript Chicken -
African - 20-50



Improved local Horro
(Ethiopia – 80)



Improved local chicken
(Nigeria – 96)

VS



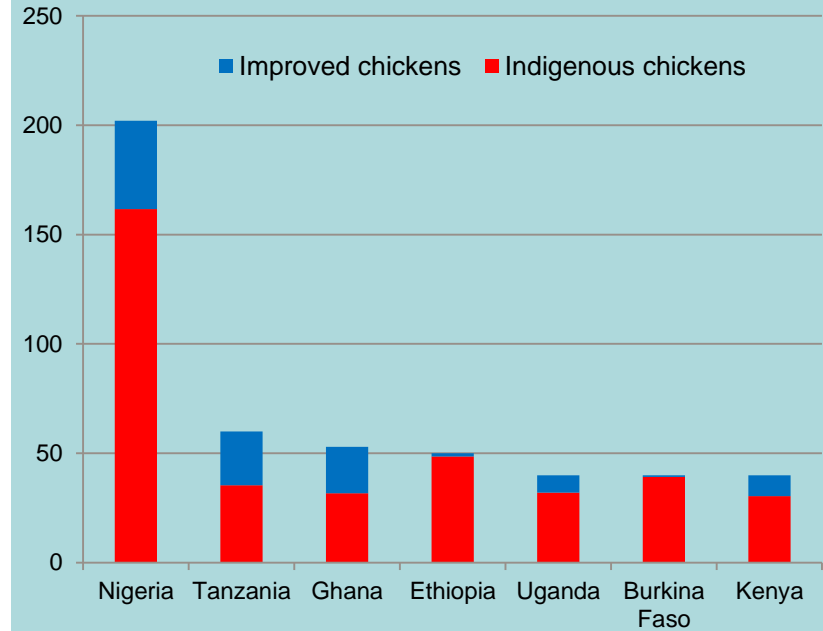
Kuroiler Chicken
India – 180



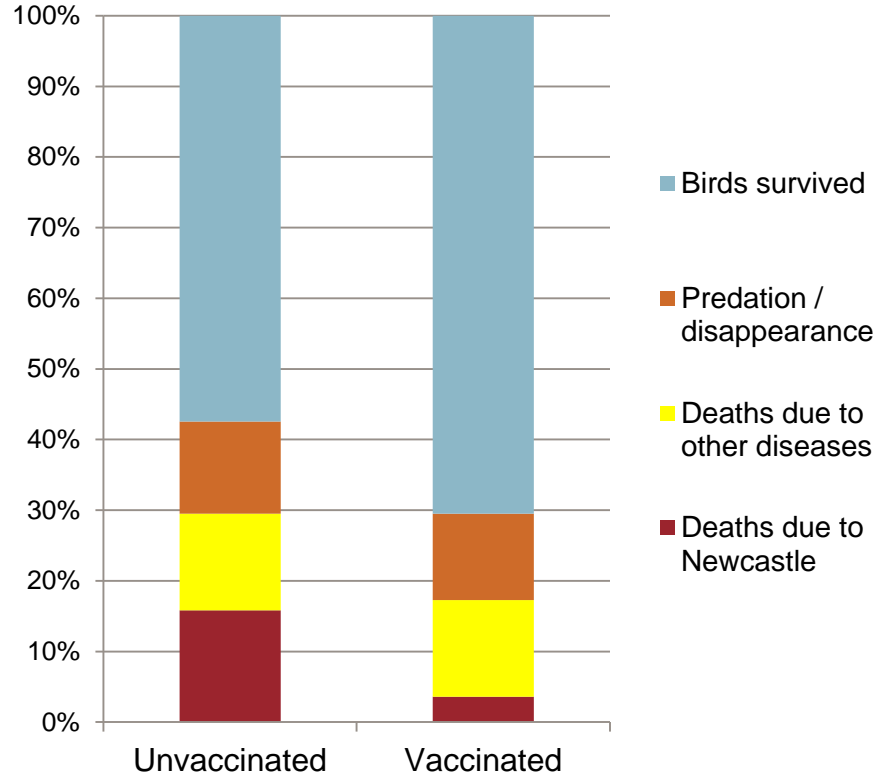
Fayoumi Chicken
Egypt – 146



Koekoek Chicken
South Africa – 204



NEWCASTLE DISEASE ALONE CAN KILL >80% OF CHICKENS



Age	Vaccination
1 day	IB (H120) - beak dipping
1 day	Mareks – subcutaneous injection
7 day	Newcastle (Lasota) – eye drop
10 day	Mareks – subcutaneous injection in the neck
14 day	Gumboro (IBD) – eye drop
3 week	Newcastle-IB – eye drop
4 week	Gumboro (IBD) – water or eye drop
6 week	Fowl pox – wing stab
10 week	Fowl typhoid – injection
Thereafter	Booster doses of Newcastle-IB



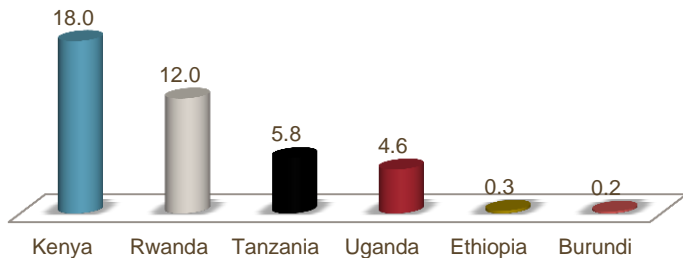
SCALING BIOTECH TO ADDRESS SMALLHOLDER LIVESTOCK CONSTRAINTS

SCALING DOORSTEP AI DELIVERY FOR SMALLHOLDERS

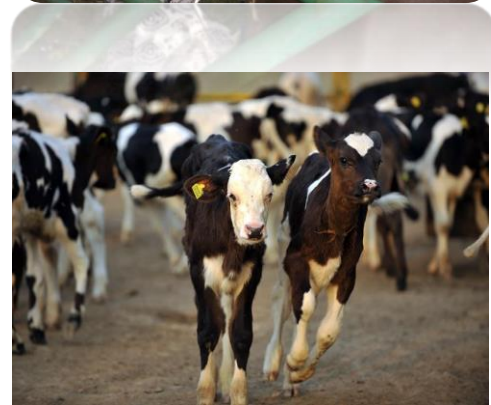
A financially sustainable and effective private doorstep AI delivery system

Parameter	Kenya	Ethiopia	Tanzania	Nigeria
National Cattle herd, million	18	54	23	20
Improved dairy herd, million	3.5	0.8	0.7	<0.1
Current productivity, L/cow/d	5.40	1.70	2.00	0.75
Current production, million L/yr	4,500	3,800	1,600	450
Target improved herd, million	5.00	5.00	3.00	1.00
Target productivity, L/cow/d	7.00	8.00	6.00	4.00
Target annual production, million	8,750	10,000	4,500	1,000

Annual AI as % of National Herd



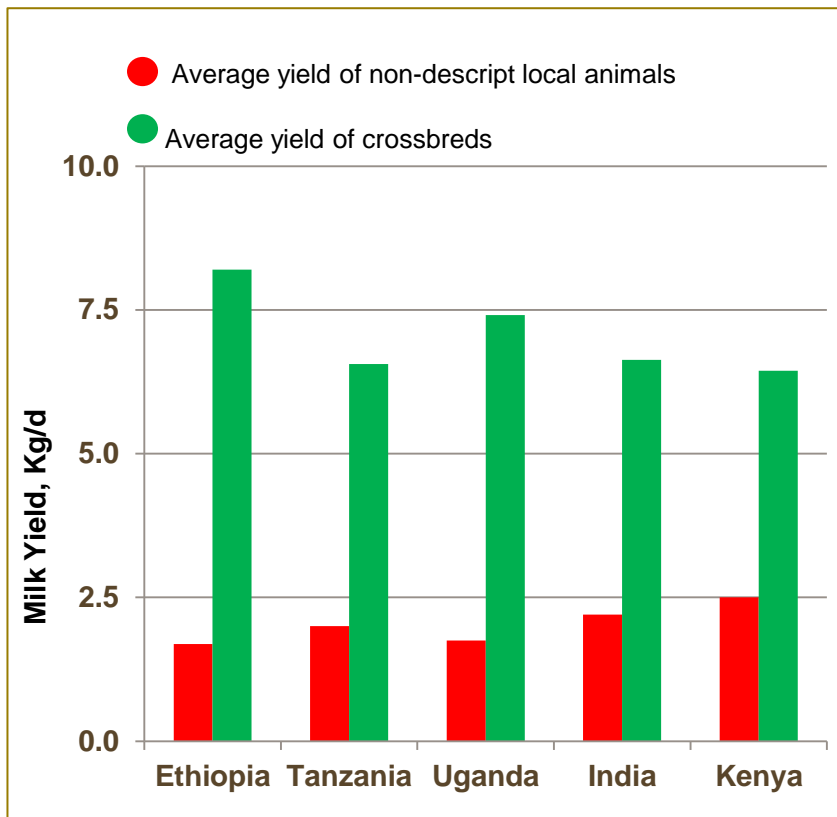
- ❑ 1,000,000 AIs annually
- ❑ Strengthen local capacity for doorstep delivery of reliable AI services
- ❑ Performance-based compensation of ~800 well-trained public and private AI technicians
- ❑ Better logistics for liquid nitrogen supply
- ❑ Appropriate bulls for the production and distribution of quality frozen semen



CROSSBREEDING WORKS.... BUT....



- ❑ High crossbred cow-calf mortality rates in smallholder systems - as high as 40%
- ❑ We don't know what is the ideal exotic blood level that is appropriate for different agro-ecologies – Mortality can be as high as 270% depending on the breed composition.
- ❑ Unwanted traits - The crossbred daughters of some exotic bulls **barely survive and produce** in some agro-ecologies.



- ❑ Establish National Dairy Performance Recording Centres (**DPRCs**) for milk yield, health, and reproduction records
- ❑ ICT platform for analysing information to provide **cow-management training** and timely feedback to farmers --- **iCow System**
- ❑ Combine performance and genomic information for farmers and National AI Center to select better bulls and cows to increase genetic gain

PROCESSOR-LED SMALLHOLDER DAIRY DEVELOPMENT

Targeting Smallholders

- Dairy production has a big impact on household income, nutrition, and employment of women
- >6 million smallholder households in East Africa engaged in dairying
- >95% of local milk supply in Nigeria comes from Fulani women
- women mostly manage the cows; often short-changed on benefiting

Production and Productivity



Processor organizes and supports community-based milk hubs/coops and regional unions



+



Access to technologies

Processor scales and helps farmers finance productivity-enhancing cow-genetics, feed/fodder, & cow-health technologies



Genetics & AI Services



Vet and AH Services



Quality Feed/Fodder



Finance & Training

Quality Milk

Processor strengthens producer hubs/coops to access funds and establish quality milk procurement systems & supply to processing



Milk and Income

Increased production & income for ~3 million dairying households; improved nutrition & empowerment of rural & Fulani women



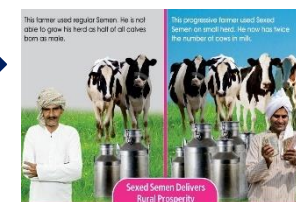
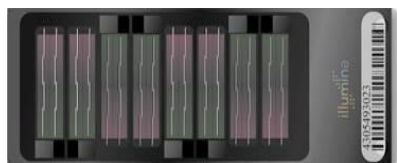
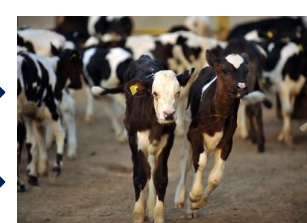
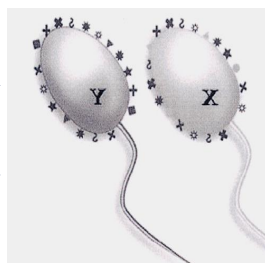
INDIA: BIOTECH TOOLS TO SUPPORT NATIONAL DAIRY PLAN

Targeting smallholders

- ❑ Milk production in India must increase from 156 to >200 billion Liters by 2022 to meet its demand
- ❑ Most of the projected increase must come from ~70 million poor and marginal farmers
- ❑ Smallholders own most of the low-productivity, non-descript cows
- ❑ Multi-state US \$362 million National Dairy Plan (NDP)
- ❑ Traditionally no cow slaughter, thus aggressive selection and culling is impossible

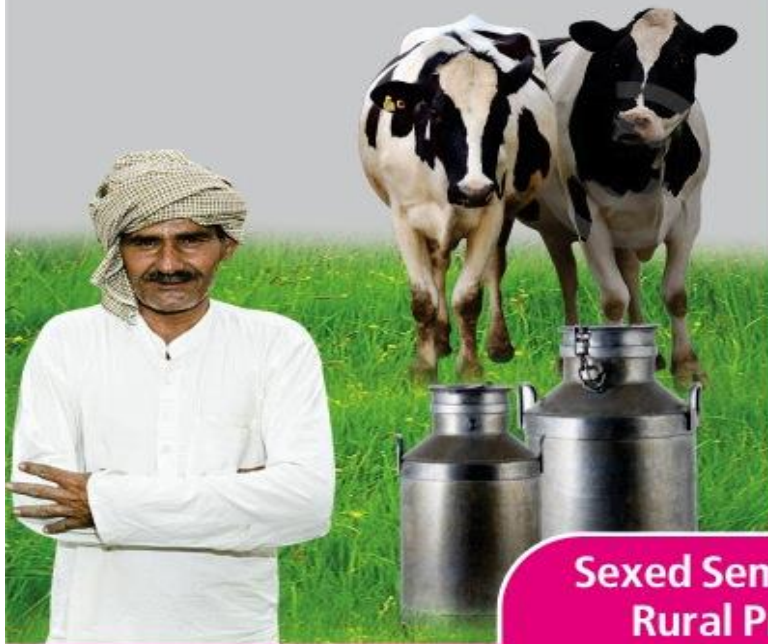
Production and Productivity

Paramter	Value
Adult bovine females (2012), million	133.3
Annual milk production, million MT	155.5
Target annual production (2022), million MT	210
Productivity - crossbred cows, L/d	6.78
Productivity - buffalo cows, L/d	4.9
Productivity - indigenous cows, L/d	2.5
Global ranking on per-cow productivity	59th
Frozen semen production, doses	81
Target frozen semen production, doses	140



THE VALUE OF SORTED SEMEN

This farmer used regular Semen. He is not able to grow his herd as half of all calves born as male.



This progressive farmer used Sexed Semen on small herd. He now has twice the number of cows in milk.



**Sexed Semen Delivers
Rural Prosperity**

FAMILY POULTRY: PRODUCTIVITY, INCOME, NUTRITION, AND EMPOWERING WOMEN (ETHIOPIA, TANZANIA, NIGERIA)

Gender

- 75% - target women brooding agents
- 85% - target women beneficiaries

Integrated delivery model for genetics, vaccines, feed, digital training



For a flock size of ~30 chicks

Farmer invests ~\$75

Gross Revenue = ~\$350

Productivity

	Traditional	Improved
Egg Production	30	150
Market Weight	1.5kg	3.0kg
Time to Market Weight	~250 Days	~120 Days



Nutrition

Target population (number of households that are direct beneficiaries)	10,000,000 rural households
Total beneficiaries in those households:	~60 million
Baseline: estimate that per capita consumption	3.5kg
Endline: 150% increase over baseline	~8.7kg

Assumptions: Target populations have an average rural household size of 6.1 in Tanzania, Household egg consumption Bangladesh increased by 160% (FAO), ILRI survey indicates >80% of households consume more than 30% of the eggs

2016

2021

Scale Hatcheries and Feed mills in TZ



Day Old Chicks

Train and Support Women Brooder Units – ~10,000



20 Day Vaccinated

Train and Support Household Producers (85% women)



Meat and Eggs

Increase flock size to ~30 birds per household for 10 million homes



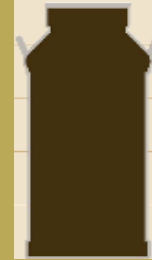


BIOTECH TO INCREASE OR TRANSFORM THE RATE OF LIVESTOCK GENETIC GAIN

100 YEARS OF SUSTAINED GENETIC GAIN SEPARATES AFRICA CATTLE FROM DEVELOPED WORLD DAIRY CATTLE



1,500 L 1900 to 2013 12,000 L



USA



1,000 L 1975 to 2013 4,000 L



BRAZIL



350 L 1972 to 2013 1,200 L



KENYA

DROUGHT TOLERANT MAIZE FOR AFRICA (DTMA)



- ❑ 60 drought tolerant hybrids
- ❑ 57 open pollinated varieties to
- ❑ *Match or exceed the yields of widely sown commercial seed when rains are good*
- ❑ *Yield 20 to 30% more under moderate drought conditions*
- ❑ Possess such desirable traits as
 - resistance to major diseases (e.g. maize streak virus, leaf blight, and gray leaf spot)
 - superior milling and cooking quality



DTMA
The Drought Tolerant
Maize for Africa Initiative

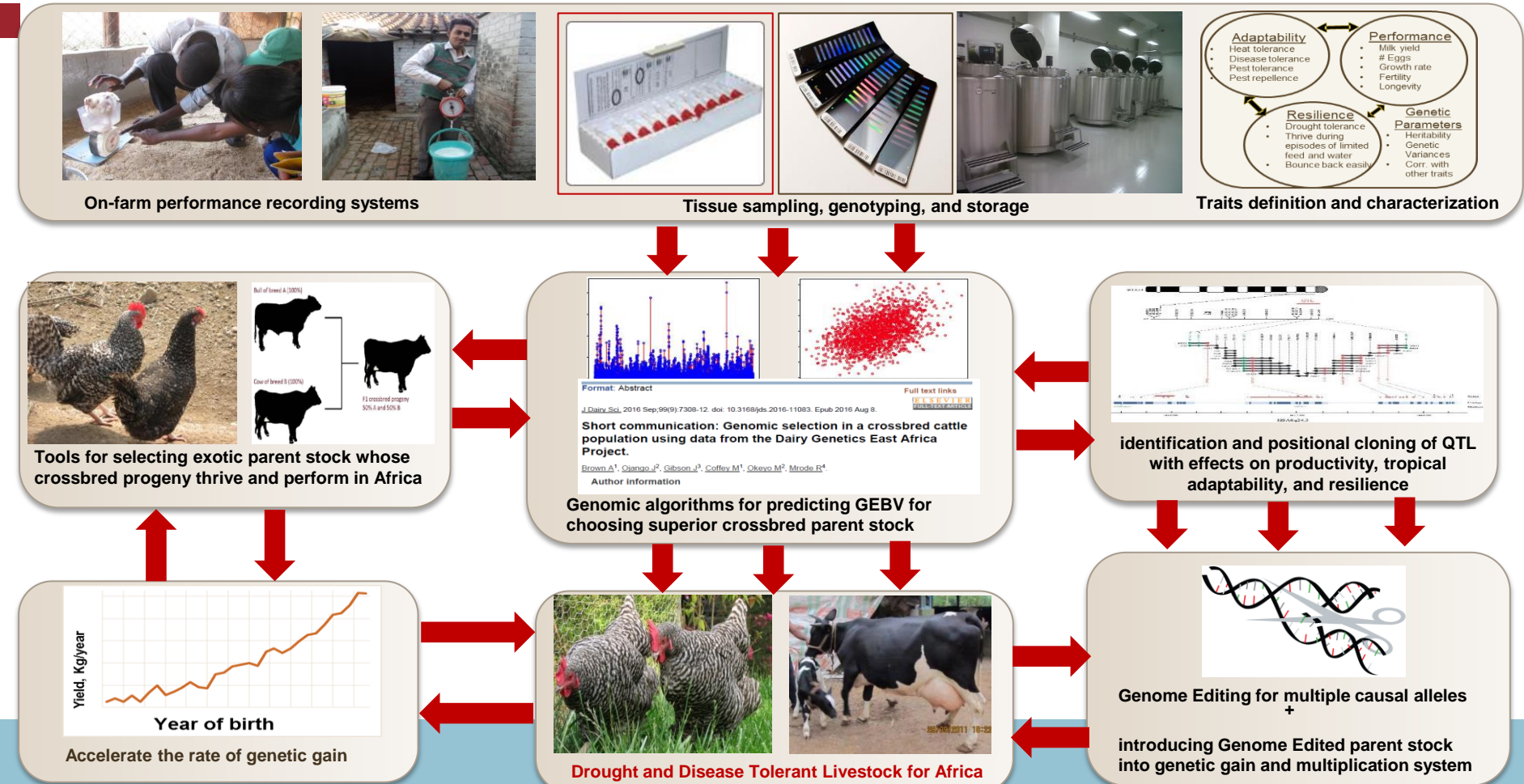


THIS PROJECT FINISHED IN 2015



..... (DTMA) aims to mitigate drought and other constraints to maize production in sub-Saharan Africa, increasing maize yields by **at least one ton per hectare under moderate drought and with a 20 to 30% increase** over farmers' current yields, benefiting 30-40 million people in 13 African countries....

DROUGHT AND DISEASE TOLERANT LIVESTOCK FOR AFRICA (DDTLA)



TOGETHER, WE WILL REACH OUR GOAL
OF RAISING MILLIONS OF FARMING
FAMILIES OUT OF POVERTY

