

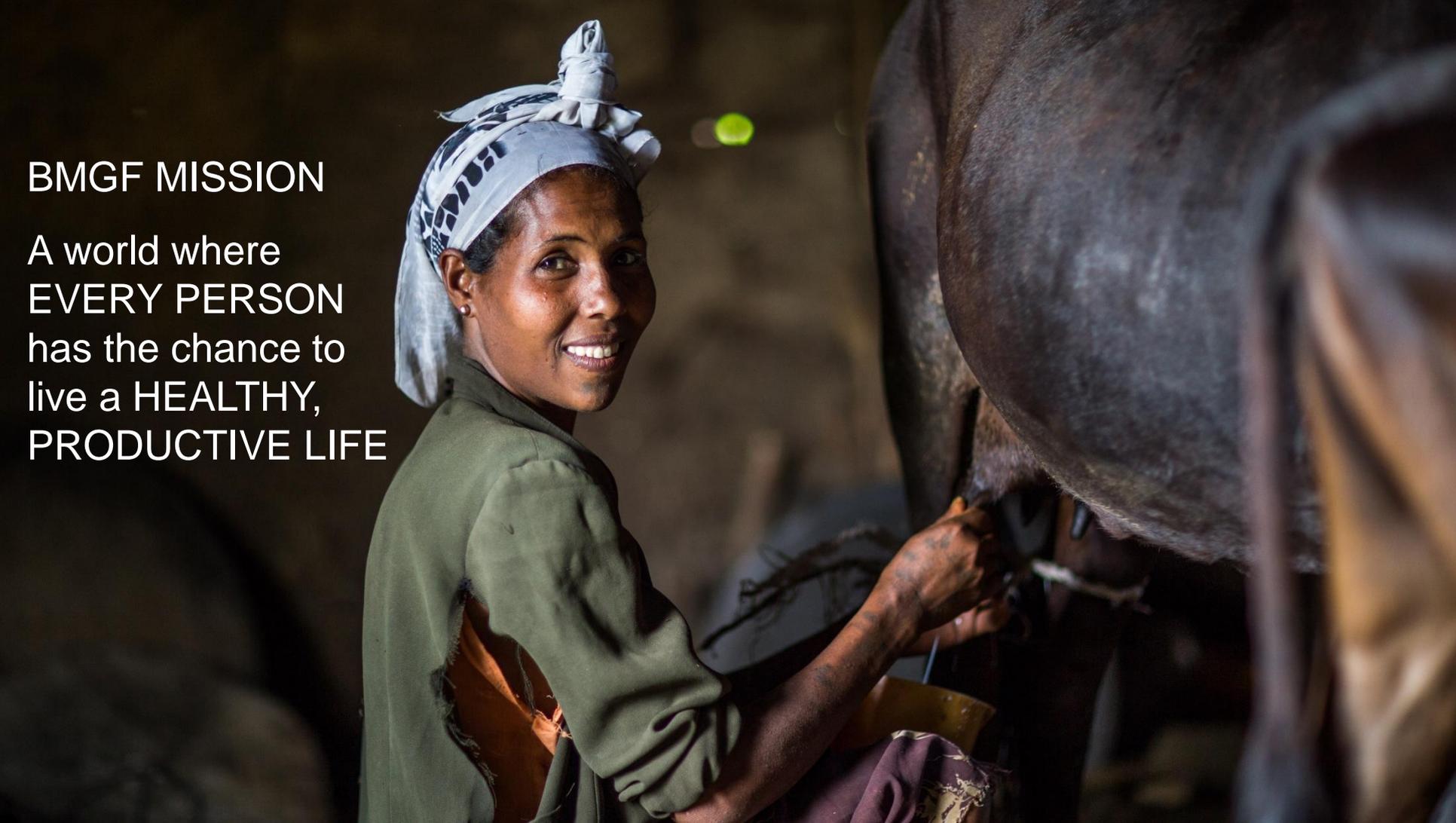


BILL & MELINDA  
GATES *foundation*

# GENOME EDITING CAN HELP ADDRESS GLOBAL NEEDS IN AGRICULTURE

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4<sup>th</sup> International Workshop on Regulatory Approaches for Agricultural Applications of Animal Biotechnologies,  
Sept 12, 2022

A woman with a white headscarf and a green jacket is smiling while milking a dark cow in a dimly lit barn. The scene is captured in a cinematic style with low-key lighting, highlighting the woman's face and the cow's body. The background is dark and out of focus, with a single bright green light source visible.

## BMGF MISSION

A world where  
**EVERY PERSON**  
has the chance to  
live a **HEALTHY,**  
**PRODUCTIVE LIFE**

# AGRICULTURAL DEVELOPMENT: OUR AMBITION



**Catalyze inclusive agricultural transformation** by developing and scaling new products and services that **benefit small scale farmers, empower women, and improve nutrition.**



# COLLABORATIVE PARTNERS

Our work is made possible by a large group of grantees in diverse organizations from government, academia, civil society, private sector. These include:

- National and local governments
- Consultative Group for International Agricultural Research (CGIAR) Centers
- Universities
- International civil society
- Local civil society
- UN Agencies
- Multinational private companies
- Local private companies
- Donor partners



For more information on specific partners, please visit our website at [www.gatesfoundation.org](http://www.gatesfoundation.org).

# WHY LIVESTOCK?

60% of people  
in extreme  
poverty own  
livestock

~30-40%  
of Agricultural  
GDP

50-80%  
of total  
assets

One of the  
best accessible  
sources of  
nutrition

Significant  
opportunity to  
empower  
women

Climate  
mitigation and  
adaptation:  
Critical for food  
and nutritional  
security



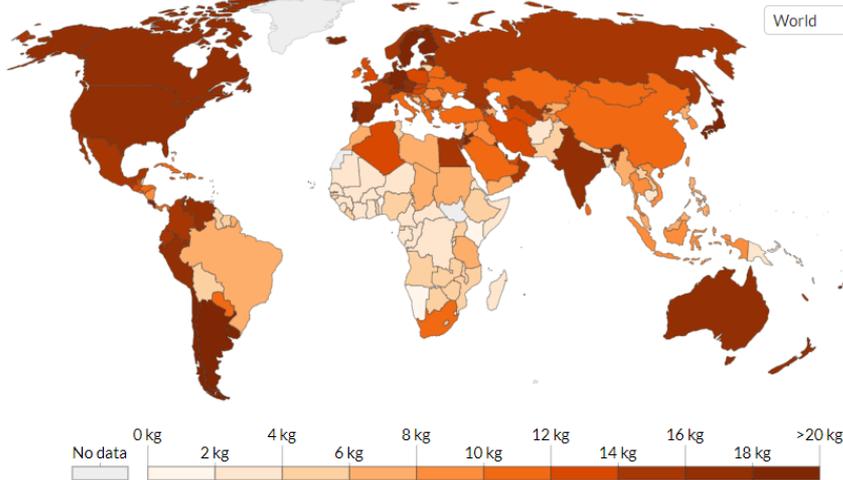
# POULTRY PRODUCTIVITY GAPS LIMIT CURRENT EGG CONSUMPTION

## Eggs per bird, 2018

Annual egg yield per bird, measured in kilograms per animal.

Our World in Data

World



Source: UN Food and Agricultural Organization (FAO)

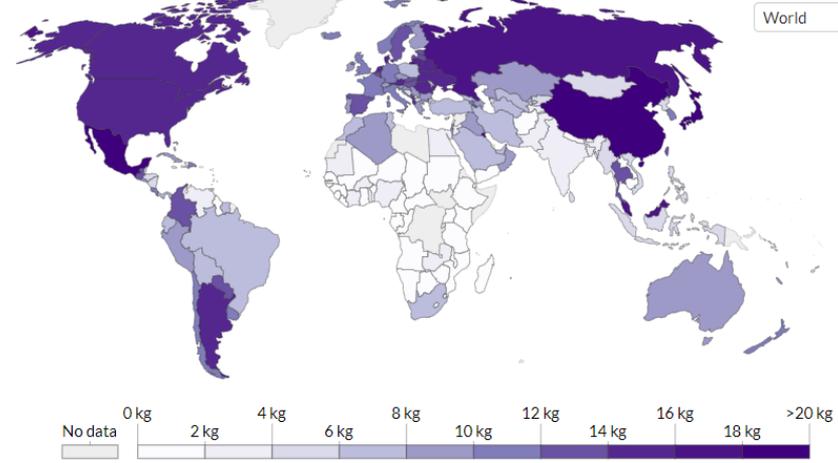
OurWorldInData.org/meat-production • CC BY

## Per capita egg consumption, 2017

Average per capita egg consumption, measured in kilograms per year (in shell weight).

Our World in Data

World



Source: UN Food and Agriculture Organization (FAO)

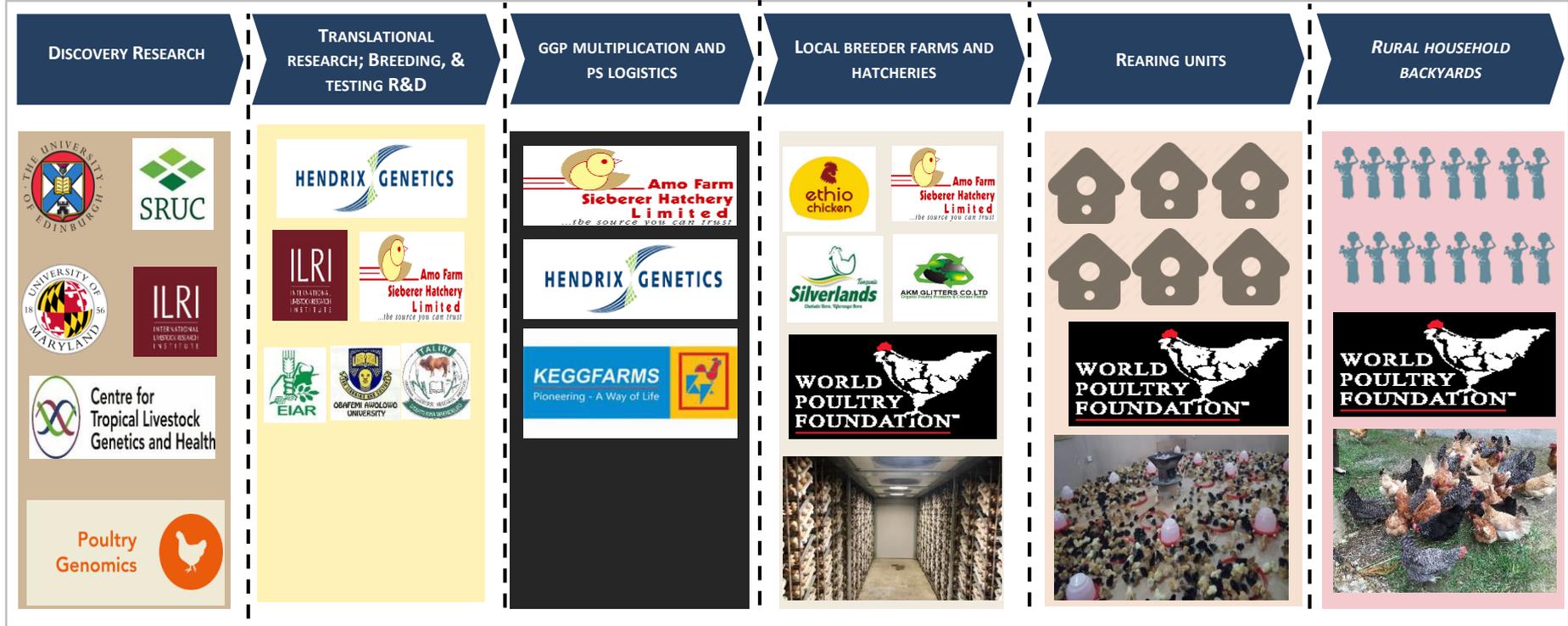
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Note: Data refers to average per capita food supply at the consumer level, but does not correct for any wastages at the household level.

2017 Egg Consumption	Country	Ethiopia	Nigeria	Tanzania	Ghana	South Africa	United States	Africa	World
	Kg/Capita	0.43	2.49	0.35	1.2	6.61	15.57	2.65	9.91

# POULTRY BREEDING FOR SMALL SCALE FARMERS IN SSA

Research and product development to improve **productivity, adaptability, and resilience of local poultry**; Local breeding farms, hatcheries and rearing units provide affordable access to small scale farmers

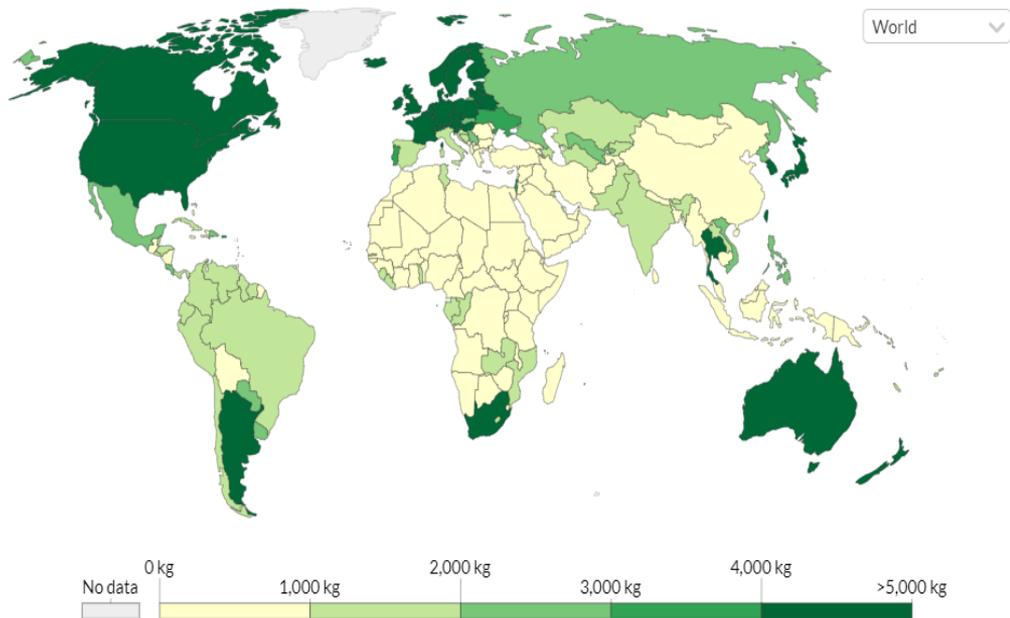




# YIELD GAPS IN DAIRY PRODUCTION

## Milk per animal, 2018

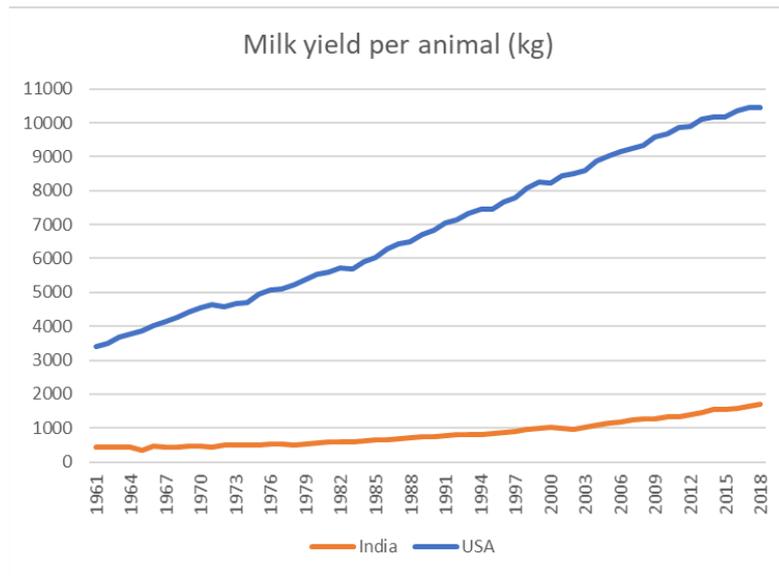
Milk yields are measured as the quantity of milk produced per animal.



Source: UN Food and Agricultural Organization (FAO)  
Note: Data is measured as the weighted-average of production across all milk-bearing livestock.

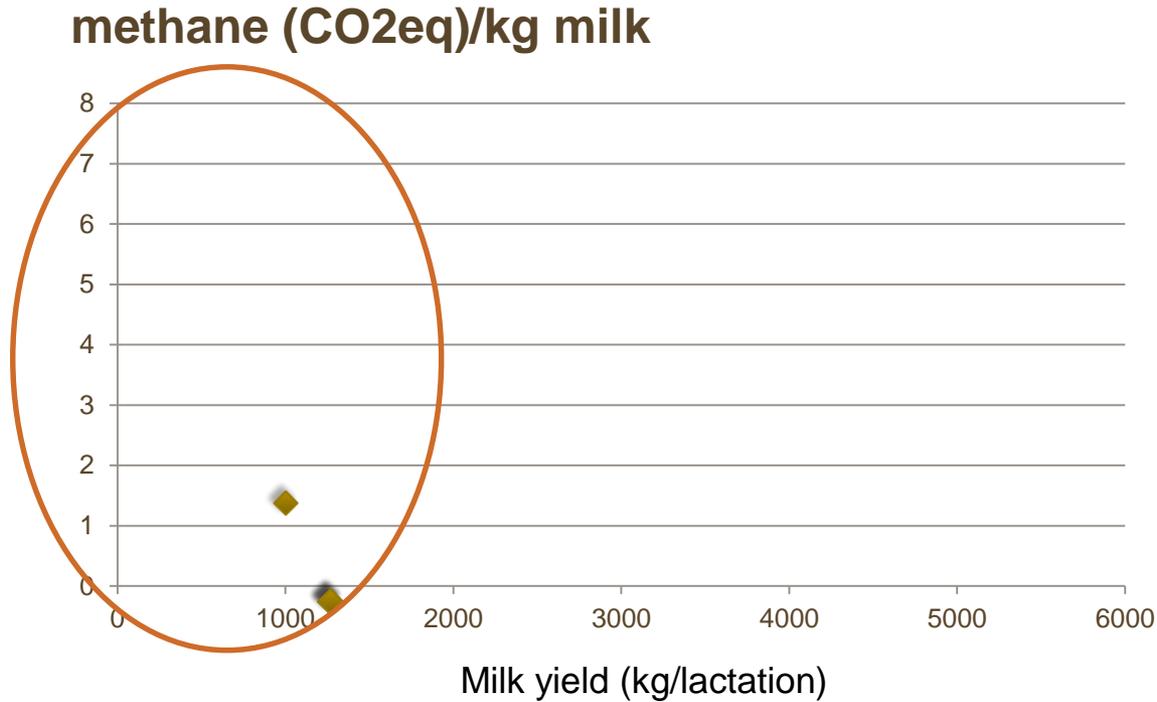
OurWorldInData.org/meat-production • CC BY

## Trend in productivity (1961-2018) India and USA



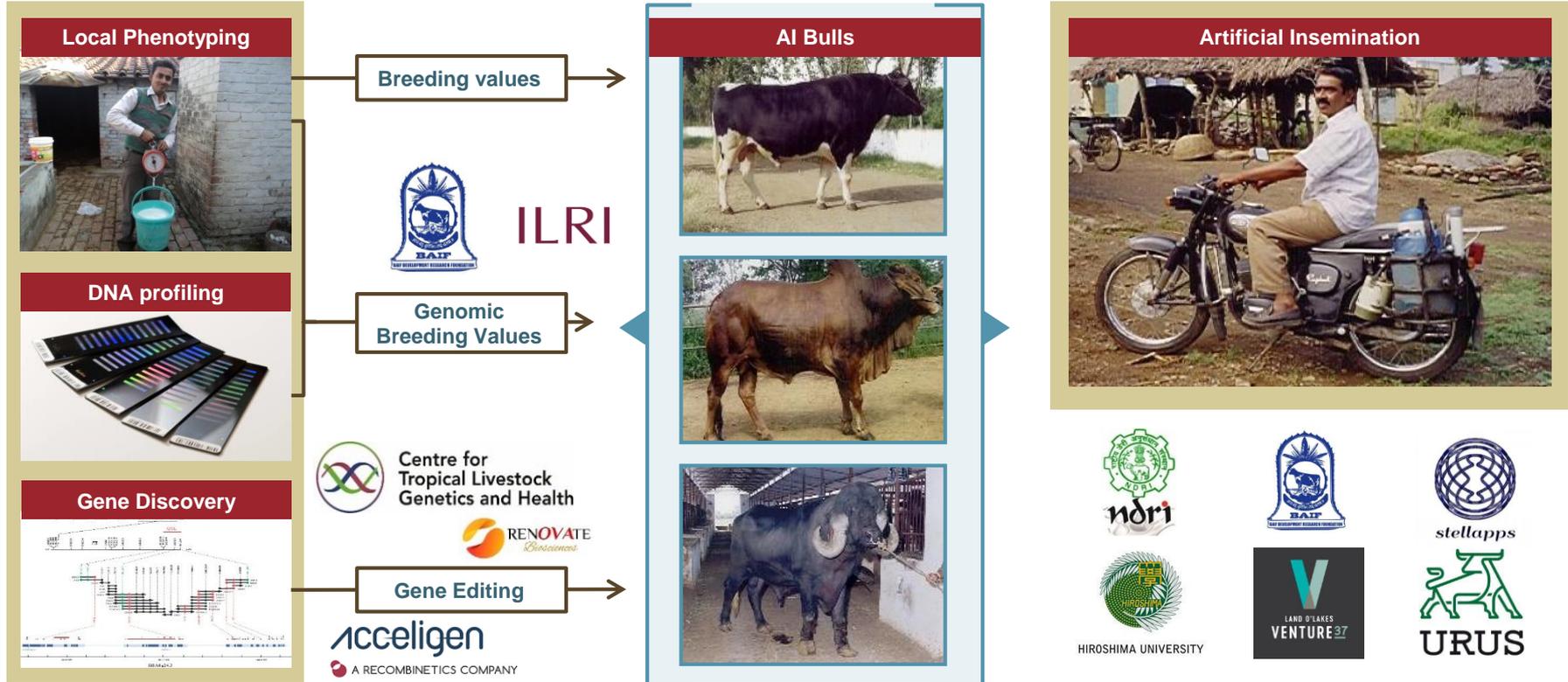
# IMPACT OF MILK YIELD ON FEED EFFICIENCY AND GHG

FAO 2013, Herrero et al 2013



Largest improvements in low producing animals

# DAIRY BREEDING FOR SMALL SCALE FARMERS IN SSA & SA



# GENE EDITING FOR IMPROVED DAIRY PERFORMANCE IN SSA



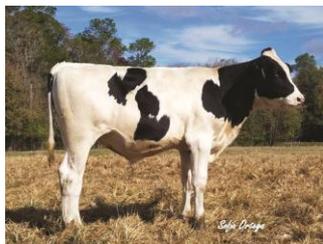
Develop dairy cows that bring sustainable production gains for dairy production systems in SSA



These animals will have “best for tropics” allelic variants delivered through a multiplex gene editing platform.



Best = Improved yield in Gir breed + Improved local adaptation in Holstein



First multi-plex edited Holstein bull calf, born in June 2022

# GENE EDITING FOR IMPROVED LACTATION IN INDIAN BUFFALO



PoC for hypo-allergenic milk  
PoC for increased milk yield and fat composition



Establish a pipeline for efficient multiplex editing in buffalo at ICAR-NDRI in India



Phenotyping for regulatory approval



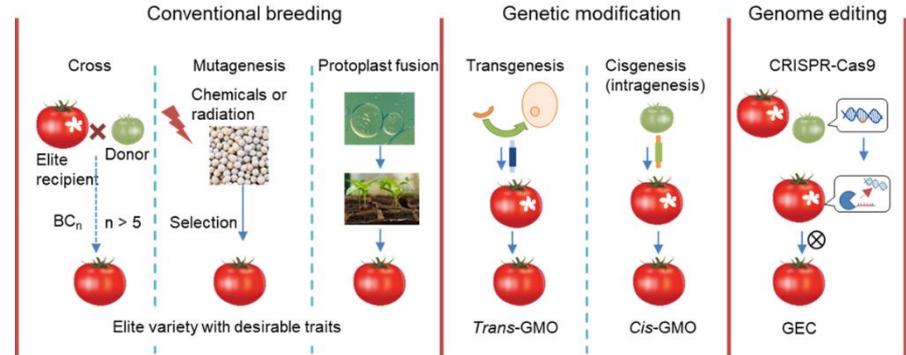
# CONSIDERATIONS FOR APPLYING GENE EDITING

## Technical criteria

- Genetic architecture (major genes?)
- Alternative opportunities
  - genomic selection
  - introgression of the gene variant

## Broad criteria

- Safety for humans, animals and environment
- Chances for regulatory approval
- Impact (value for farmers and food production)
- Access and affordability for farmers in LMIC



# ADVANTAGES OF GENE EDITING

- Locally adapted genetic products (e.g. disease resistance)
- Precise genetic trait development
- Lower costs for development of new genetic products



# CONCLUSIONS

GE products can contribute to meeting the world needs in the 21<sup>st</sup> century

- higher resource efficiency of agriculture and lower GHG emissions
- feed the growing world population with affordable nutritious food
- improve the incomes of farmers in developing countries
- inclusive agricultural transformation in developing countries

Evidence and proper regulations are needed to ensure safety of GE products for

- humans
- environment
- animals

# THANK YOU

Bill Gates, Foreign Affairs 2018:

*Used responsibly, gene editing holds the potential to save millions of lives and empower millions of people to lift themselves out of poverty. It would be a tragedy to pass up the opportunity.*