Better lives through livestock

Insights from the transformation of dairy in India

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International Livestock Research Institute
With contributions from: Habibar Rahman, Susan MacMillan, Ram Deka, Chris Jones

ICAR lecture series #44 Azadi Ka Amrit Mahotsav
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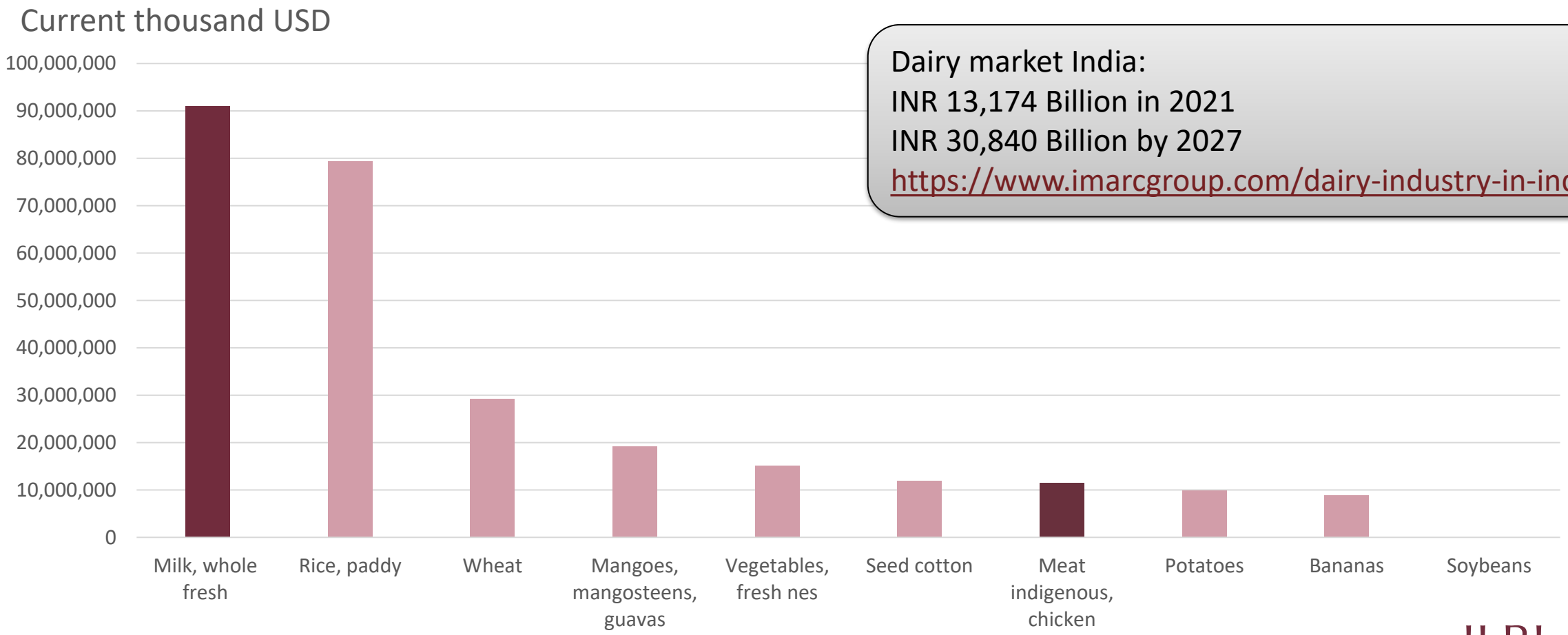
Overview

- Snapshot of India's dairy transformation (photofilm)
- Unpacking Indian dairy trends and context
- Lessons to learn from Indian dairy
- The future of Indian dairy
  - In India
  - And beyond

A snapshot of India’s dairy transformation

Unpacking Indian dairy trends and context

India agricultural commodity values 2018



Dairy market India:
INR 13,174 Billion in 2021
INR 30,840 Billion by 2027
https://www.imarcgroup.com/dairy-industry-in-india

FAOSTAT

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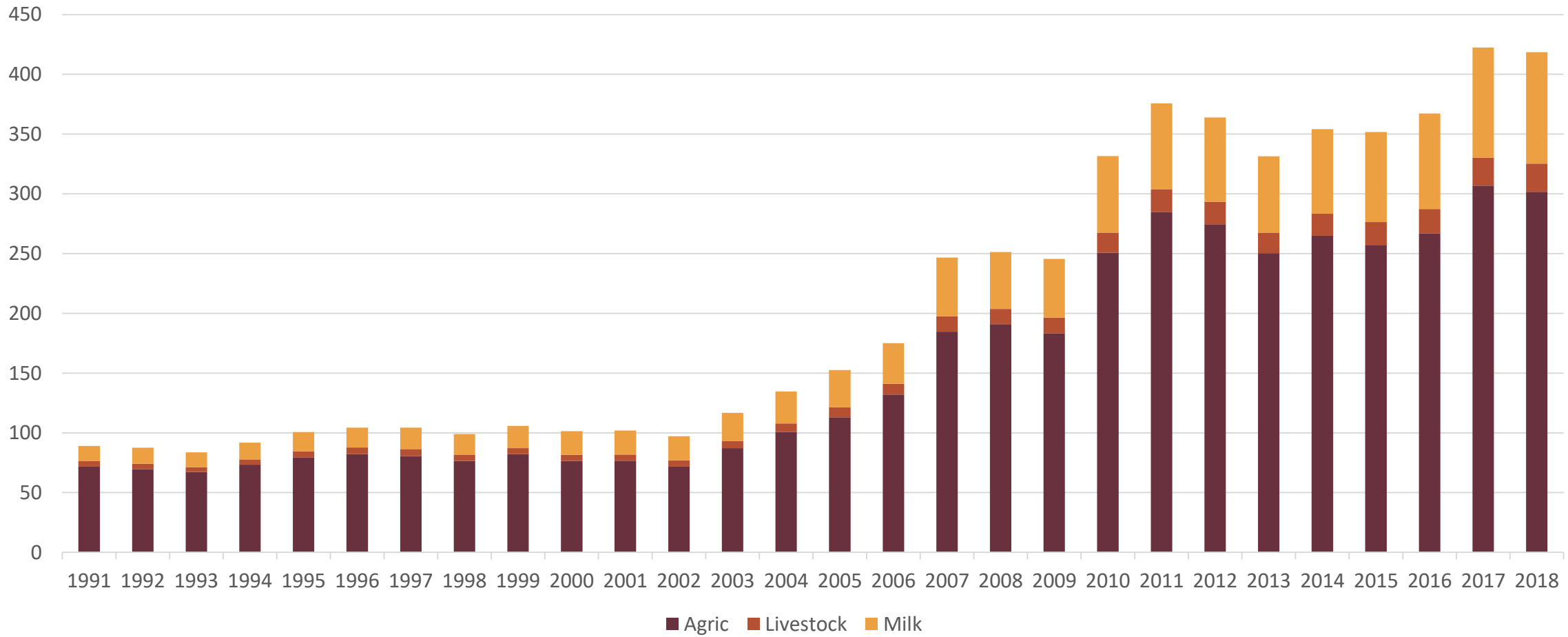
Value of agricultural production USD billion (India)



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2018: milk 80% of the total value of livestock and 22% total value of agriculture

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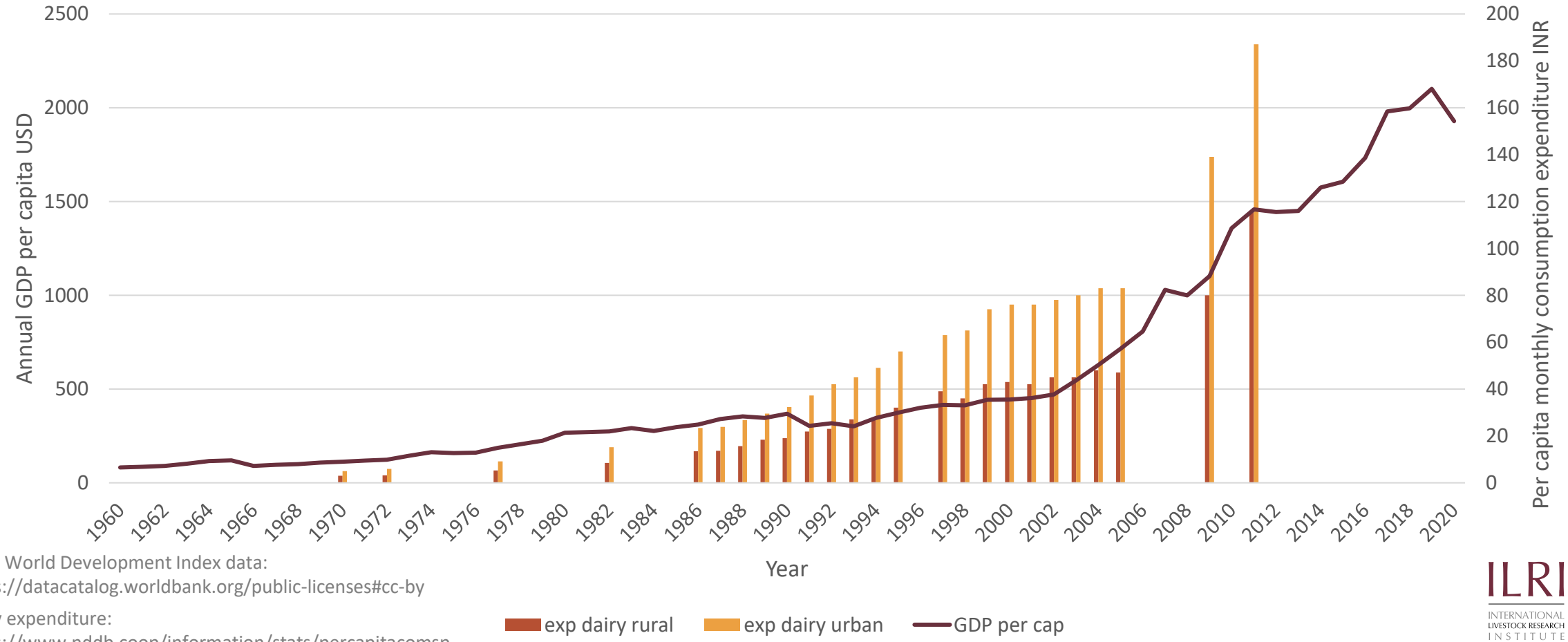
GDP and expenditure on dairy per capita

- The amount spent on dairy increased over 30-fold between 1970 and 2011
- The consumption expenditure shares remained constant: 38% rural, 62% urban



GDP: World Development Index data:
https://datacatalog.worldbank.org/public-licenses#cc-by

Dairy expenditure:
https://www.nddb.coop/information/stats/percapitacomsp

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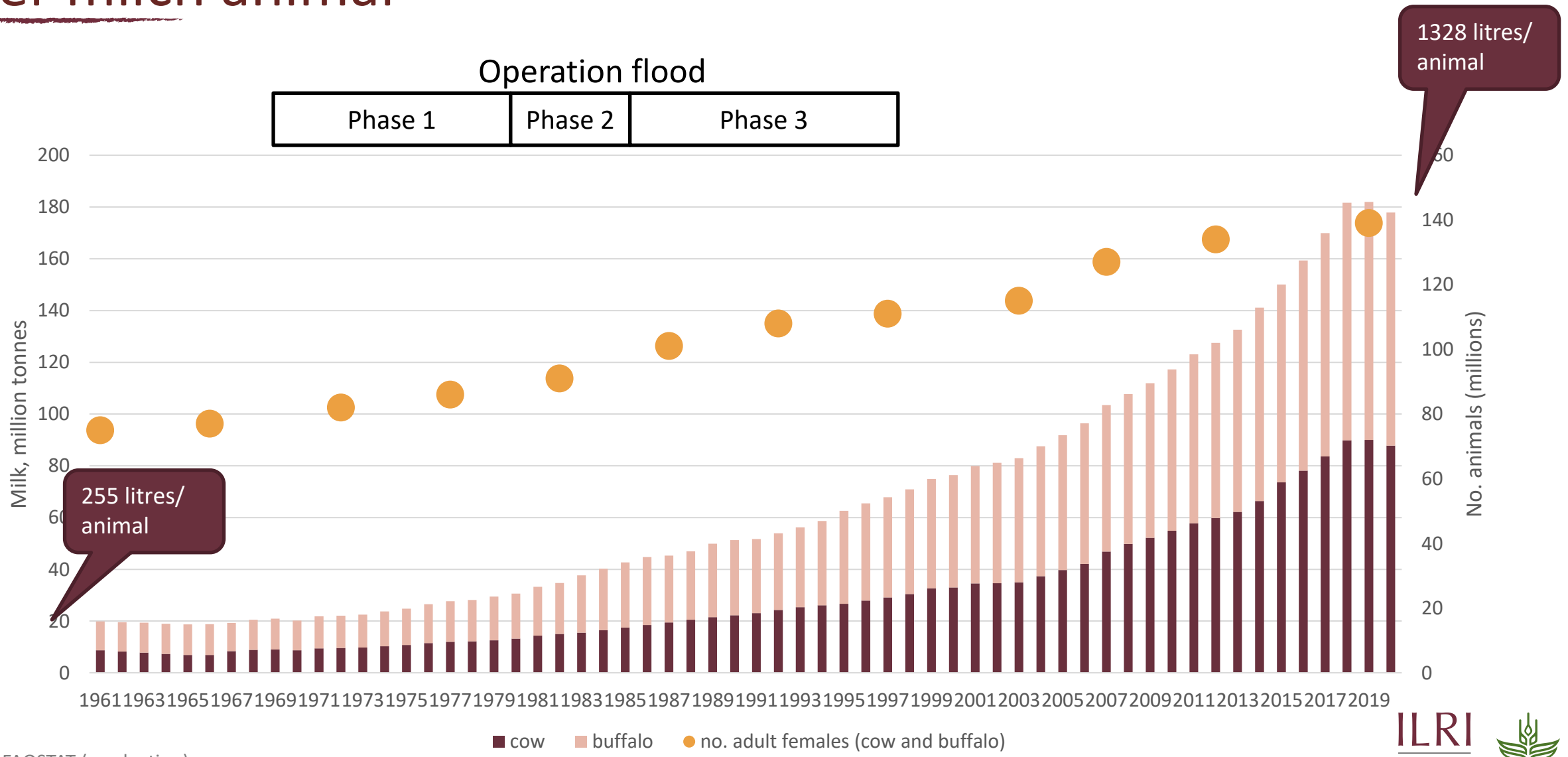
Milk production, million tonnes; increase in productivity per milch animal



Source: FAOSTAT (production)
Animal numbers: NDDB, from Livestock Census data DAHD&F, GoI

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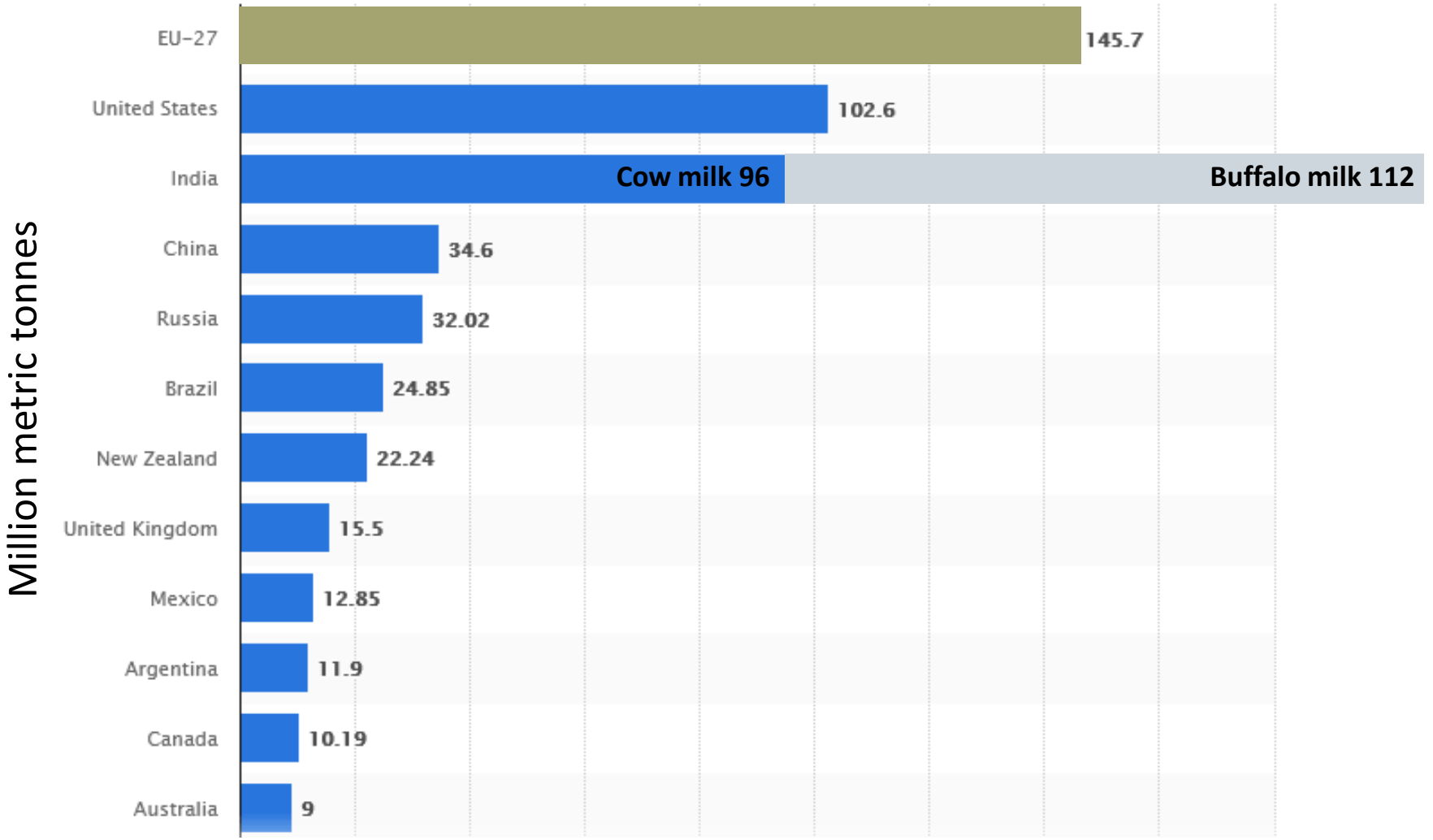
Major producers of cow milk worldwide in 2021



FAOSTAT
https://www.statista.com/statistics/268191/cow-milk-production-worldwide-top-producers/

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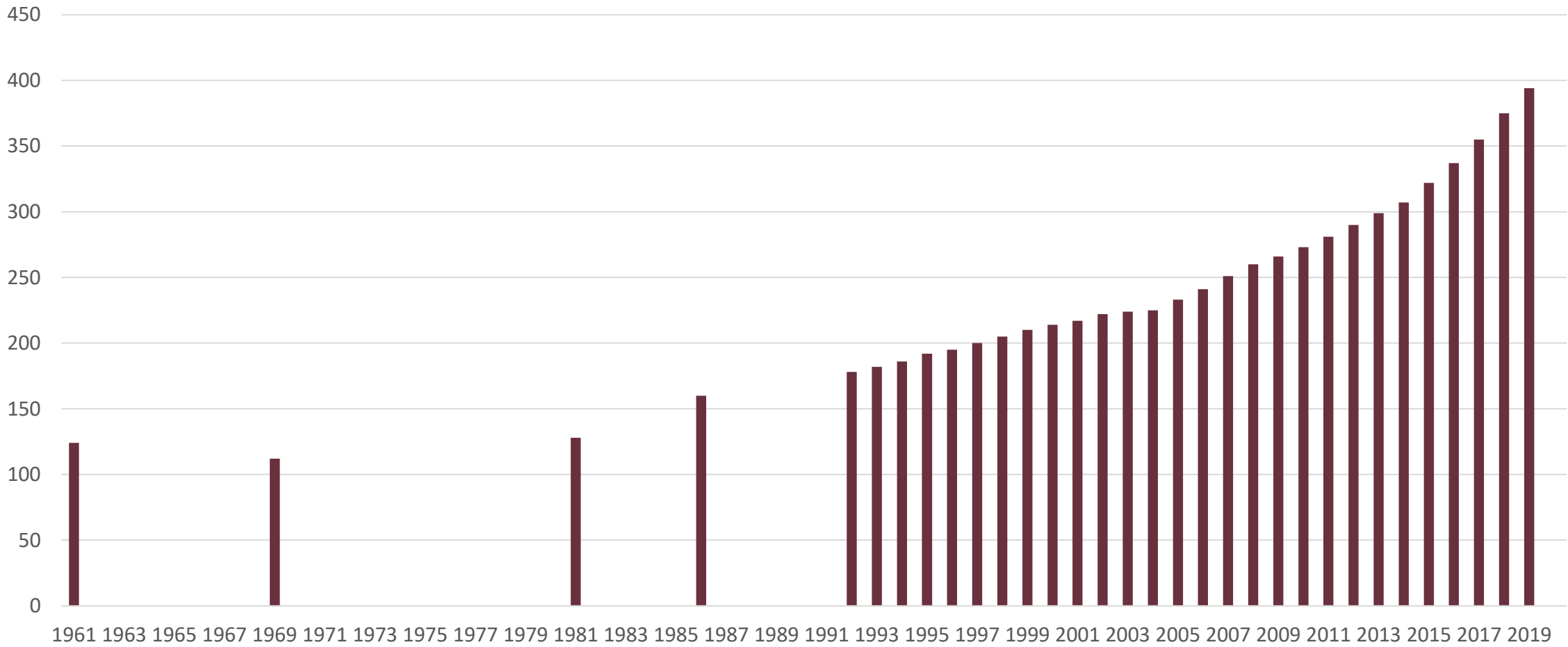
Per capita milk availability g/day (India)



Source: NDDB from Basic Animal Husbandry Statistics, DAHD&F, GoI

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India dairy: import and export

FAOSTAT

Lessons to learn from Indian dairy

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Market pull before technology

1946 Kaira District Cooperative Milk Producers formed

1950 Verghese Kurien joins KDCMPL

1955 Brand Amul founded

1965 NDDB established

1970 to 1996 Operation flood
Ph 1: 1 million farmers
Ph 2: 10 million farmers
Ph 3: 7 million farmers

1973 KDCMPL and Amul subsumed by Gujerat Co-operative Milk Marketing Federation

1974 Mother Dairy established

1991 Delicensing: foreign equity participation up to 51%

1992 Milk and milk products order

1994 Exports decanalized

1995 International Dairy Agreement (WTO), India does not join

1997 India surpasses US as largest milk producer

2000 Export obligations removed under TRIMS

2001 India renegotiates WTO terms

2001 MMPO amended, minimum threshold for registration

2002 Milk shed provision dissolved in MMO

2006 Food safety and standards act passed

2012 Export ban, later revoked

2014 India's milk production surpasses EU

2016 NCDFI e-markets

2019 India does not sign RCEP

Farmer skills + professional management

Research 'in its place':
- With the end in mind
- In context:
- Institutional
- Policy

Adapted from: https://www.theindiaforum.in/article/after-flood

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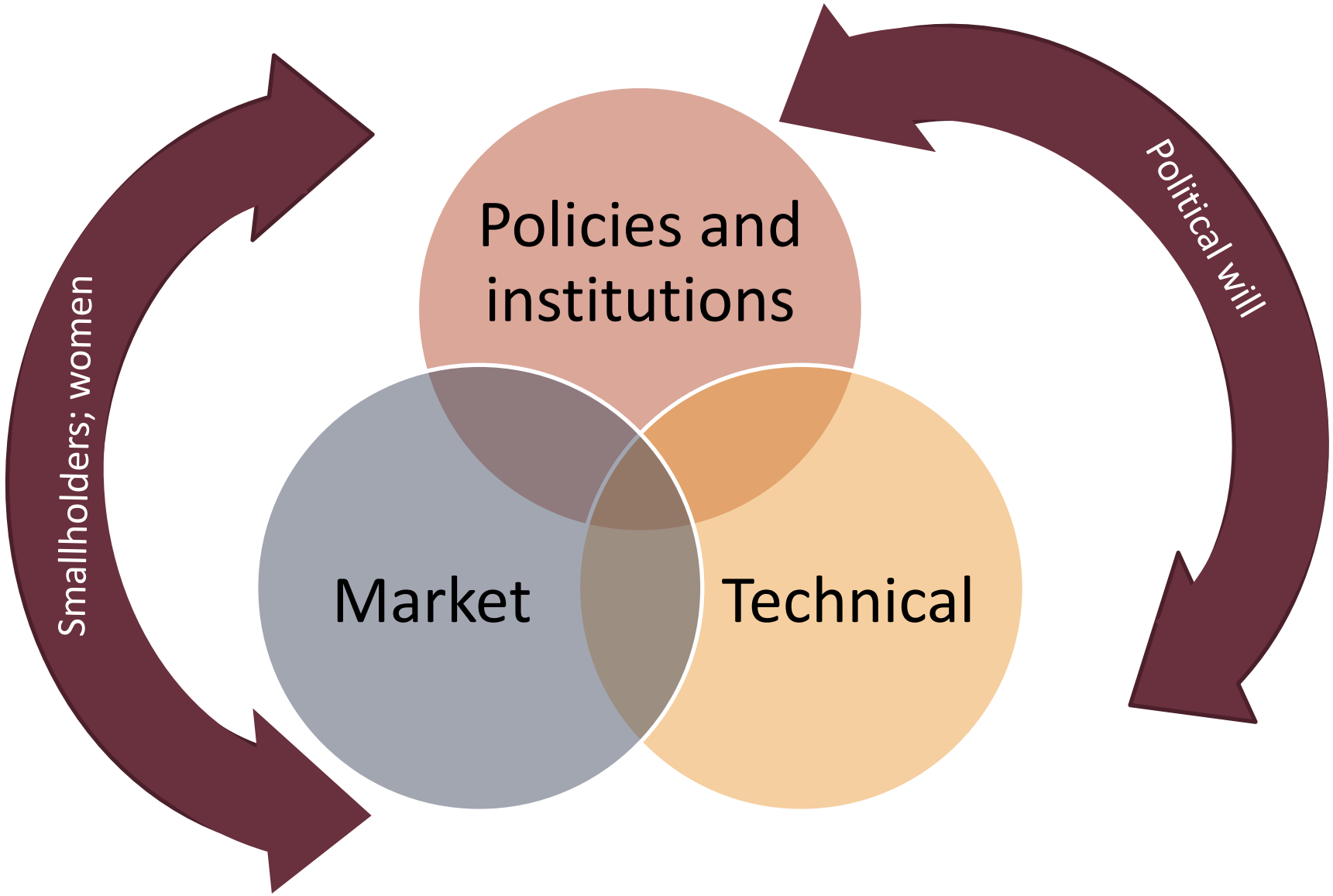
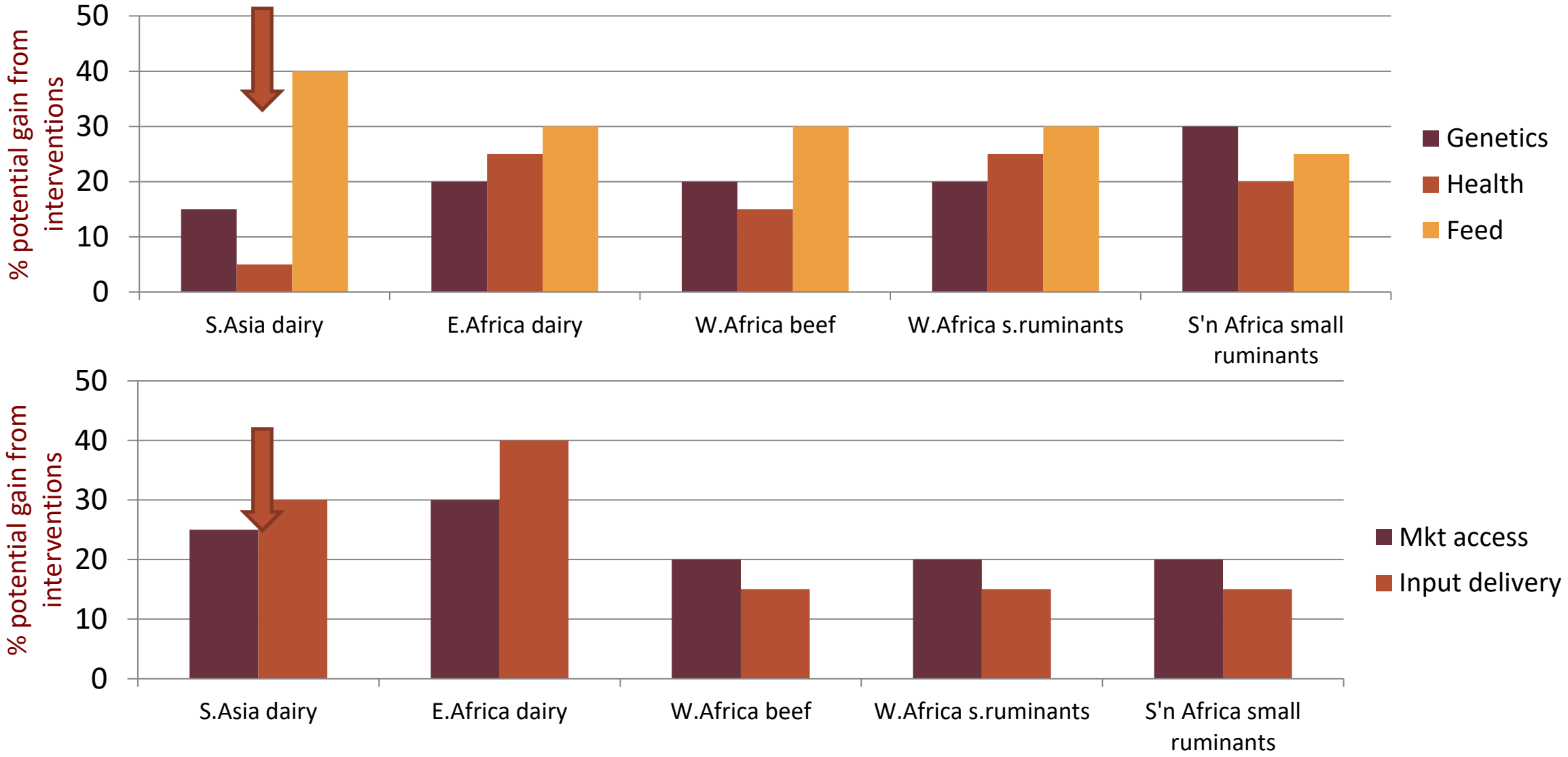

Policies and institutions
Market
Technical
Political will
Smallholders; women

Yield gaps remain: technical, market and institutional



Staal, S., Poole, J., Baltenweck, I., Mwacharo, J., Notenbaert, A., Randolph, T., Thorpe, W., Nzuma, J. and Herrero, M. 2009. Targeting strategic investment in livestock development as a vehicle for rural livelihoods. Bill and Melinda Gates Foundation – ILRI Knowledge Generation Project Report. Nairobi, Kenya: ILRI.

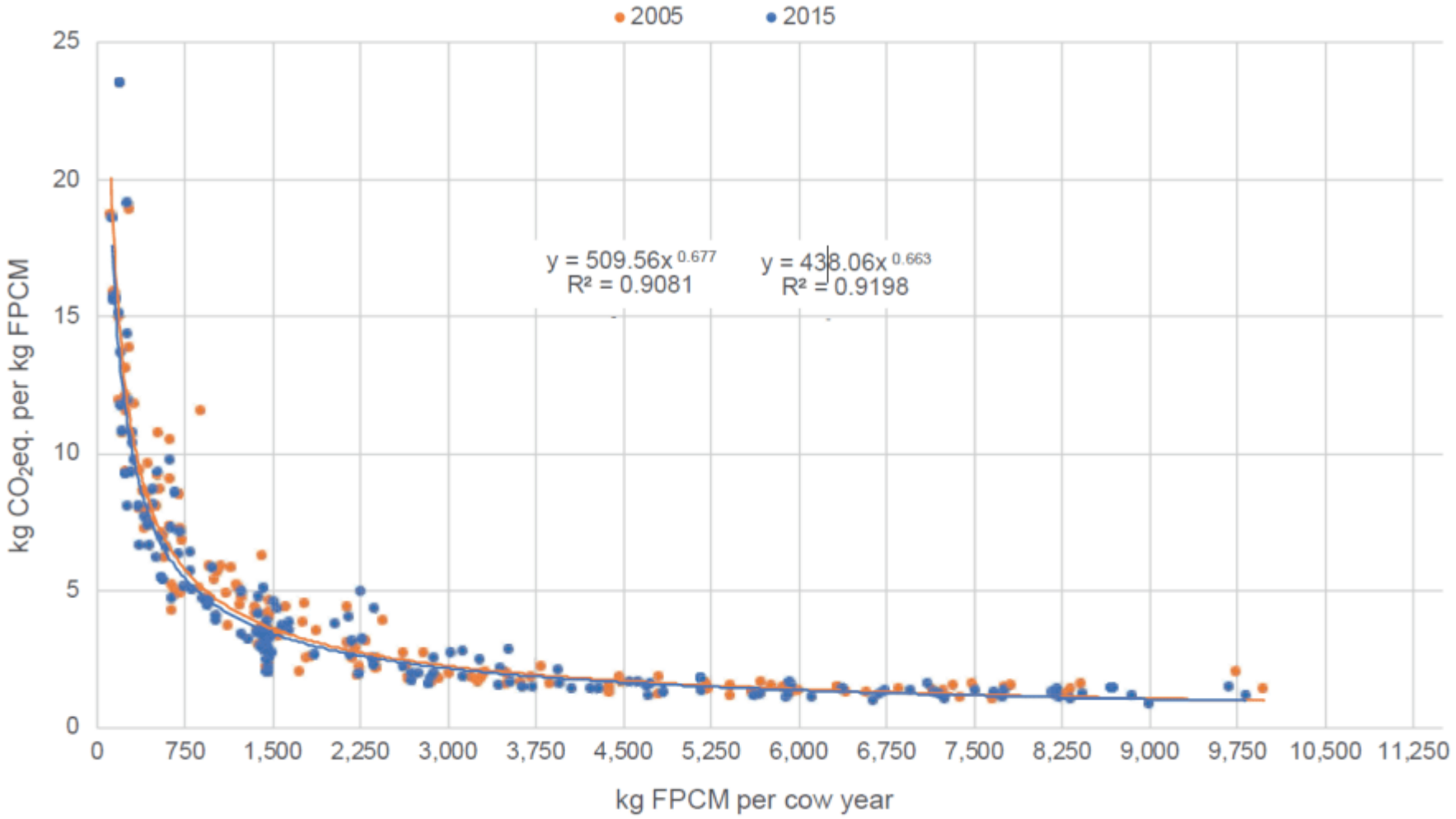
Research elements

- Opportunities—market pull on productivity drivers:
  I. Genetics
  II. Health
  III. Nutrition (feeds)
- Challenges:
  I. Livestock and the environment
  II. One Health:
    I. Zoonotic diseases
    II. Antimicrobial resistance
    III. Food safety
- Market and policy:
  I. National government policies
  II. Livestock master plans

Win-win opportunity

Doubling milk yield through better feeding, genetics and health could reduce India's total methane emissions by 25%

Emission intensity and milk yield



FAO and GDP. 2018. Climate change and the global dairy cattle sector – The role of the dairy sector in a low-carbon future. Rome. 36 pp.

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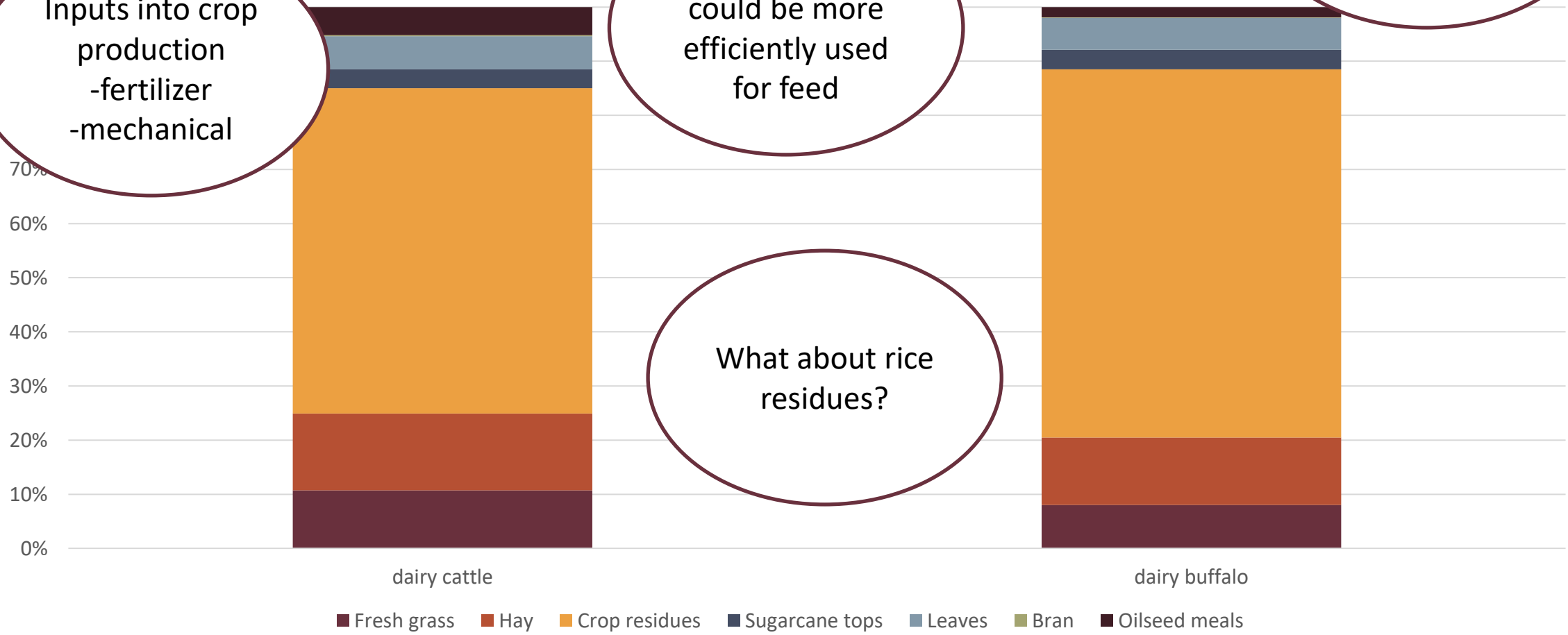
South Asia: regional average feed rations

Are manufacturing by-products being well used for feed?

Inputs into crop production
-fertilizer
-mechanical

Crop residues could be more efficiently used for feed

What about rice residues?



Livestock: On our plates or eating at our table? A new analysis of the feed/food debate
Anne Mottet, Cees de Haan, Alessandra Falcucci, Giuseppe Tempio, Carolyn Opio, Pierre Gerber http://dx.doi.org/10.1016/j.gfs.2017.01.001

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Opportunity: more and better feed options from crop residues

- Small changes in crop residue quality have a significant impact on milk production:
  '. . . a 1% increase in digestibility of sorghum stover fed to dairy cows leads to a 6-8% increase in milk production . . .'

- **Improve feed quality:**
  - Inclusion of feed quality parameters in crop breeding parameters (conventional breeding, genomic selection)
  - Significant increase in crop variety uptake, milk yields

- **Improve feed utilization through processing**
  - By manufacturing feed blocks
  - By leveraging spin-off technologies from 2nd-generation biofuel technologies for deconstructing ligno-cellulosic biomass (2-CCT = 2-Chemical Combination Treatment; developed by ILRI with the Council of Scientific and Industrial Research-Indian Institute of Chemical Technology)

Kristjanson P.M. and Zerbini E. 1999. *Genetic Enhancement of Sorghum and Millet Residues Fed to Ruminants. An* ex ante *assessment of returns to research.* ILRI Impact Assessment Series 2. ILRI (International Livestock Research Institute), Nairobi, Kenya. 52pp.

New cultivars and varieties

India leads by exploiting existing cultivar variations for targeted genetic enhancement

- Developing new dual-purpose cultivars of, e.g., pearl millet, sorghum, groundnut, maize, wheat and rice
  - ICRISAT groundnut variety grown on 160,000 ha
  - Three superior dual-purpose sorghum varieties registered in India
  - Released maize hybrid most popular in India

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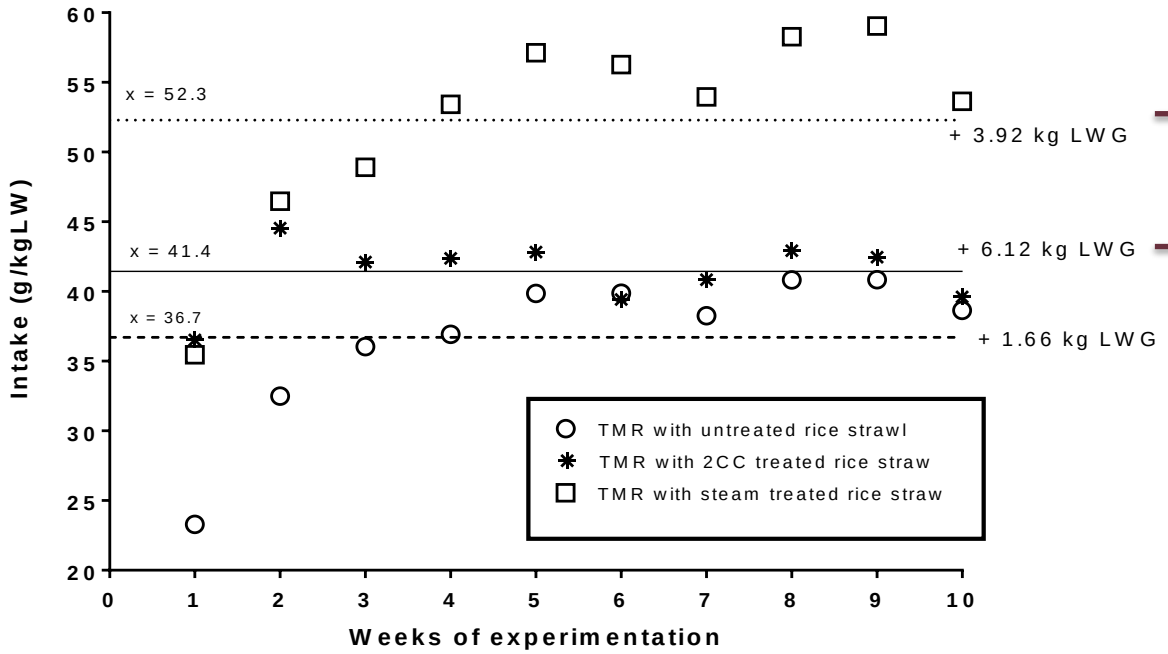
Processing technologies

Use of spin-off technologies from 2nd-generation biofuel technologies can turn crop residues from ‘wastes’ into high-quality concentrates



→ Steam Explosion effect on higher intake

→ 2CCT effect on higher digestibility

2CCT: treatment developed by the Council of Scientific and Industrial Research-Indian Institute of Chemical Technology

Response of sheep fed total mixed rations containing 70% of untreated, 2CCT treated and steam treated rice straw

(Blümmel et al. 2018)

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Would rice straw with a digestibility of more than 60% continue to be burnt?

Wasted inputs

160 million tonnes rice straw
At least 60% burnt producing
7,300 kg CO_2 eq/ha/year

Negative
climate impact

Better residue quality:
Genetic enhancement
and processing, eg
2-CCT treatment

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One Health: ICAR and ILRI research on three key issues at the animal-human health interface

1. Diagnosis: zoonoses (Assam, Bihar, Odisha and Haryana)

Many zoonotic diseases present, varying incidence

Presenting risks to human health, milk productivity and farm economics

2. Diagnosis: antimicrobial resistance (Assam, Haryana and Karnataka)

AMR residues and resistance genes detected

Farmers largely unaware of risks

Solutions to reduce risks

One Health approach at all levels

Strong awareness, motivation, good production practices, vaccination and improved biosecurity

Training/solutions: improve handling, marketing and consumption practices

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One Health: ICAR and ILRI research on three key issues at the animal-human health interface

3. Food safety

- Informal dairy sector critical for nutrition, health and livelihoods
- 97% of milk produced passes through the informal sector
- Essential to improve the quality and safety of milk without jeopardizing livelihoods

Research-based drivers of change:

- Training, monitoring & certification (TMC) of informal market actors
- Consumer awareness building
- Incentive mechanisms
- One Health approach

Improve – not ban – informal markets

- Producers, traders, market agents: improved knowledge, attitude and practices; increased productivity
- Safer milk for about 1.5 million consumers
- Benefits: USD5.6 million, IRR 224%
- New govt and World Bank multi-million dollar project in Assam to scale out to 16 project districts

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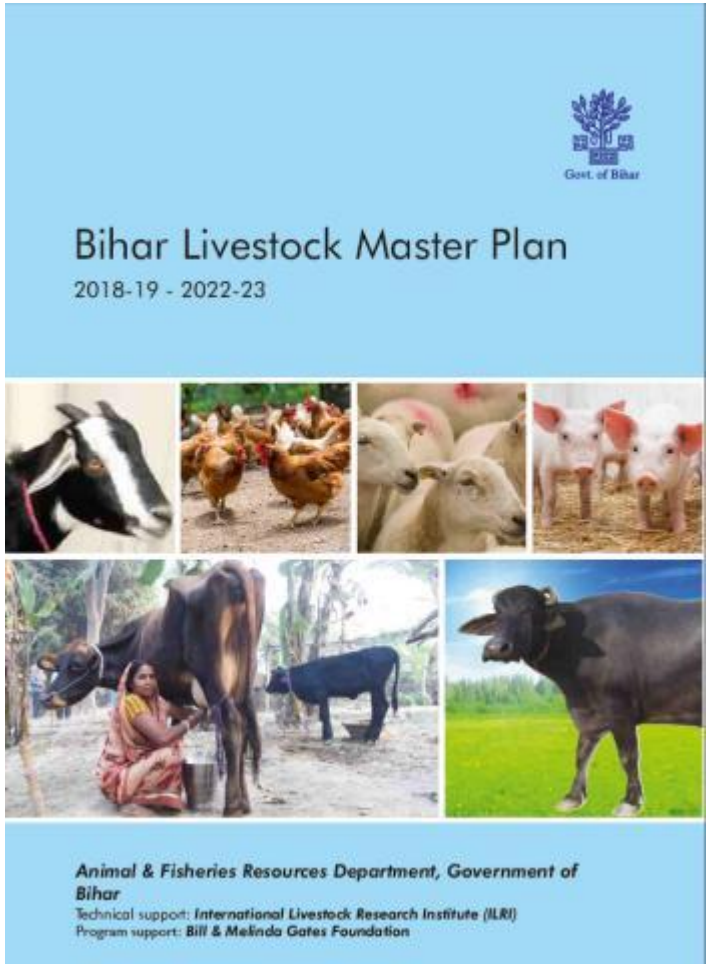
Planning future investments: Livestock master plans for Bihar (complete) and Odisha (under way)



Cow and buffalo dairy—priority

- Technical interventions and investments:
  - Improving feed availability and quality
  - Selection and crossbreeding
- Inclusion of women and marginalized communities in all interventions
- Increased processing of milk and marketing of milk products
- Demand-pull strategy of encouraging more public and private investment in value-adding processing to create assured markets for the additional milk
- Training, price incentives, private investment, AI facilities, feed market options

https://hdl.handle.net/10568/100538

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The future:
Dairy in India and beyond

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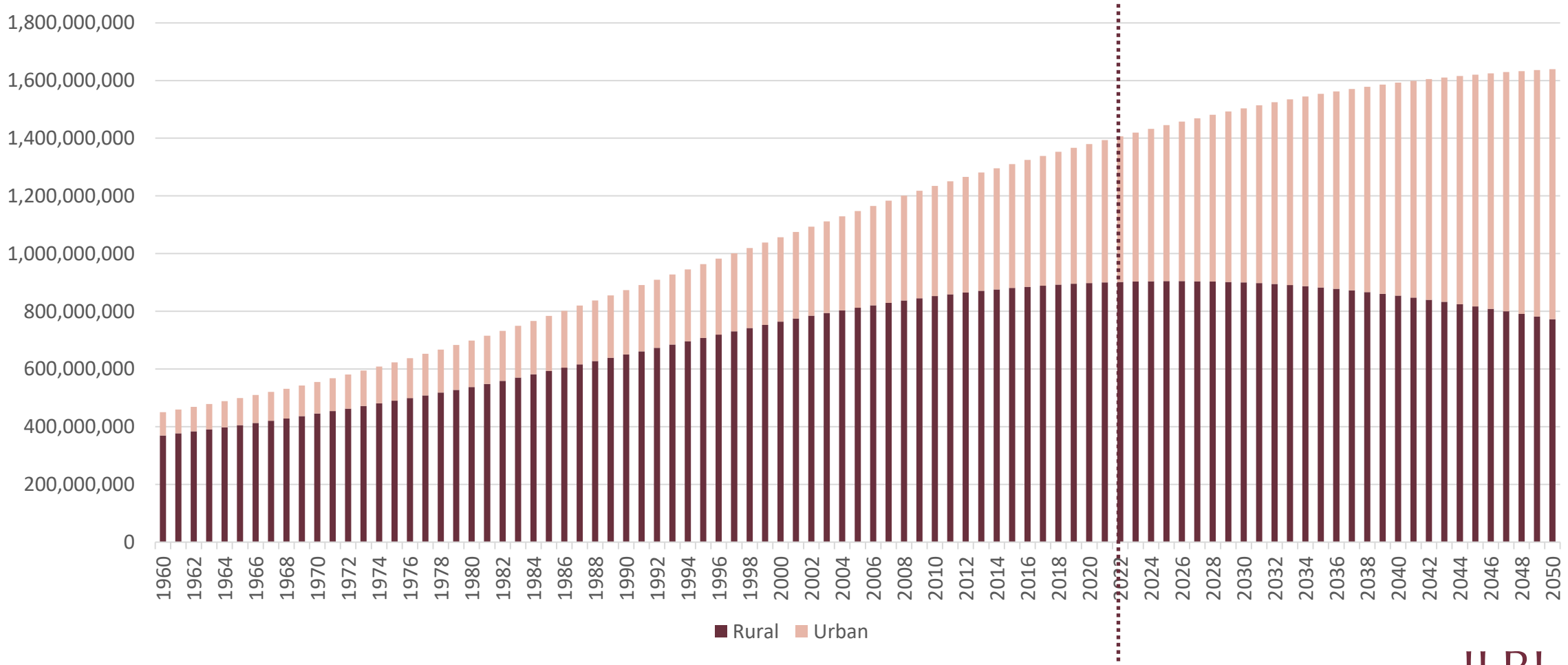
India's population 1961 to 2050: dairy demand continues to grow (more people and more urban dwellers)



https://databank.worldbank.org/source/population-estimates-and-projections#

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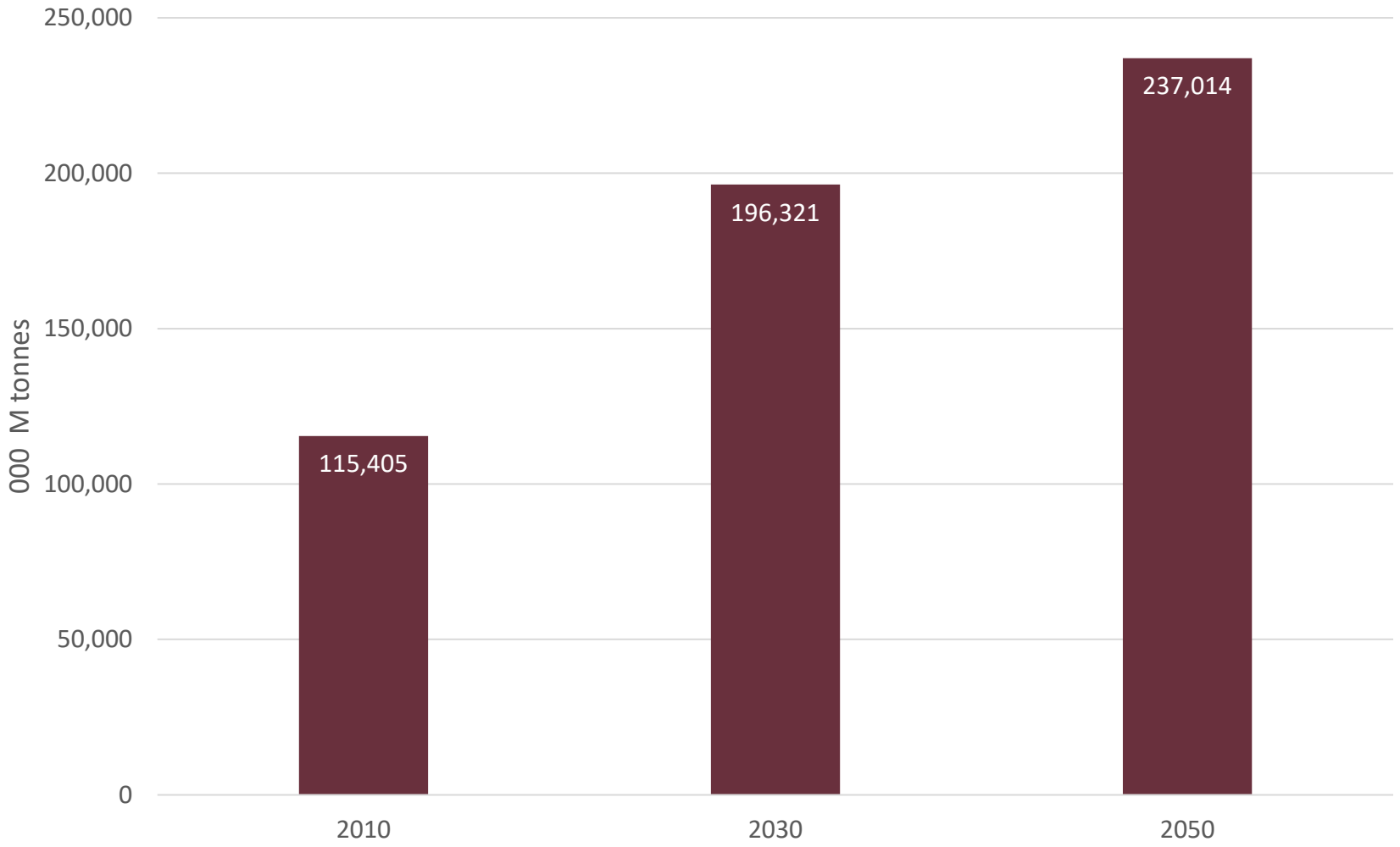
Dairy demand in India



Source: Impact model predictions under moderate climate change in 2050 with assumption of moderate economic and population growth, with thanks to Dolapo Enahoro (ILRI)

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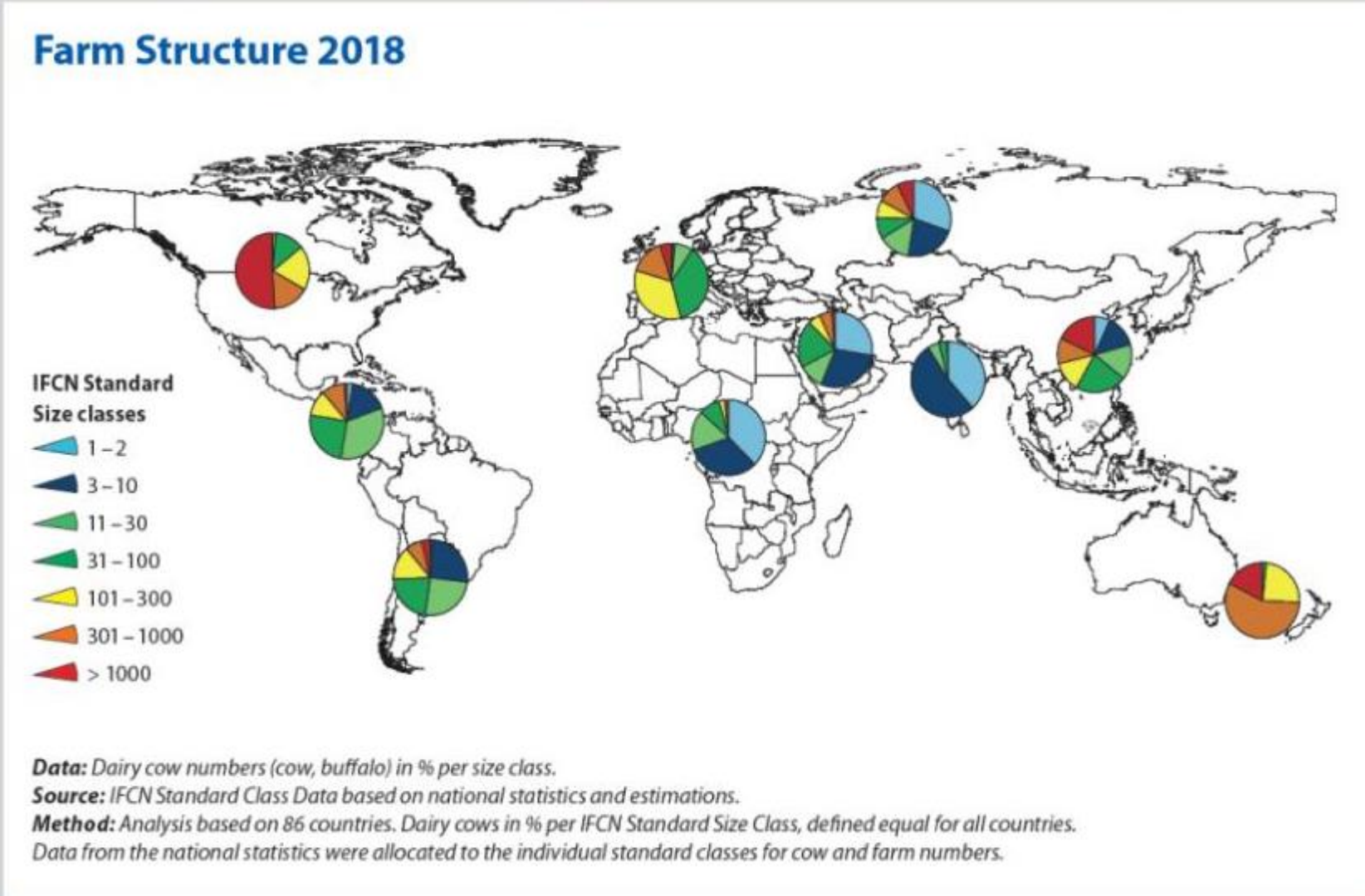
Most dairy farms in India raise fewer than ten animals—but produce 70% of the country's dairy



- Still some 75 million smallholders engaged in dairy sector
- Many women
- Multiple (new) cooperative-type models

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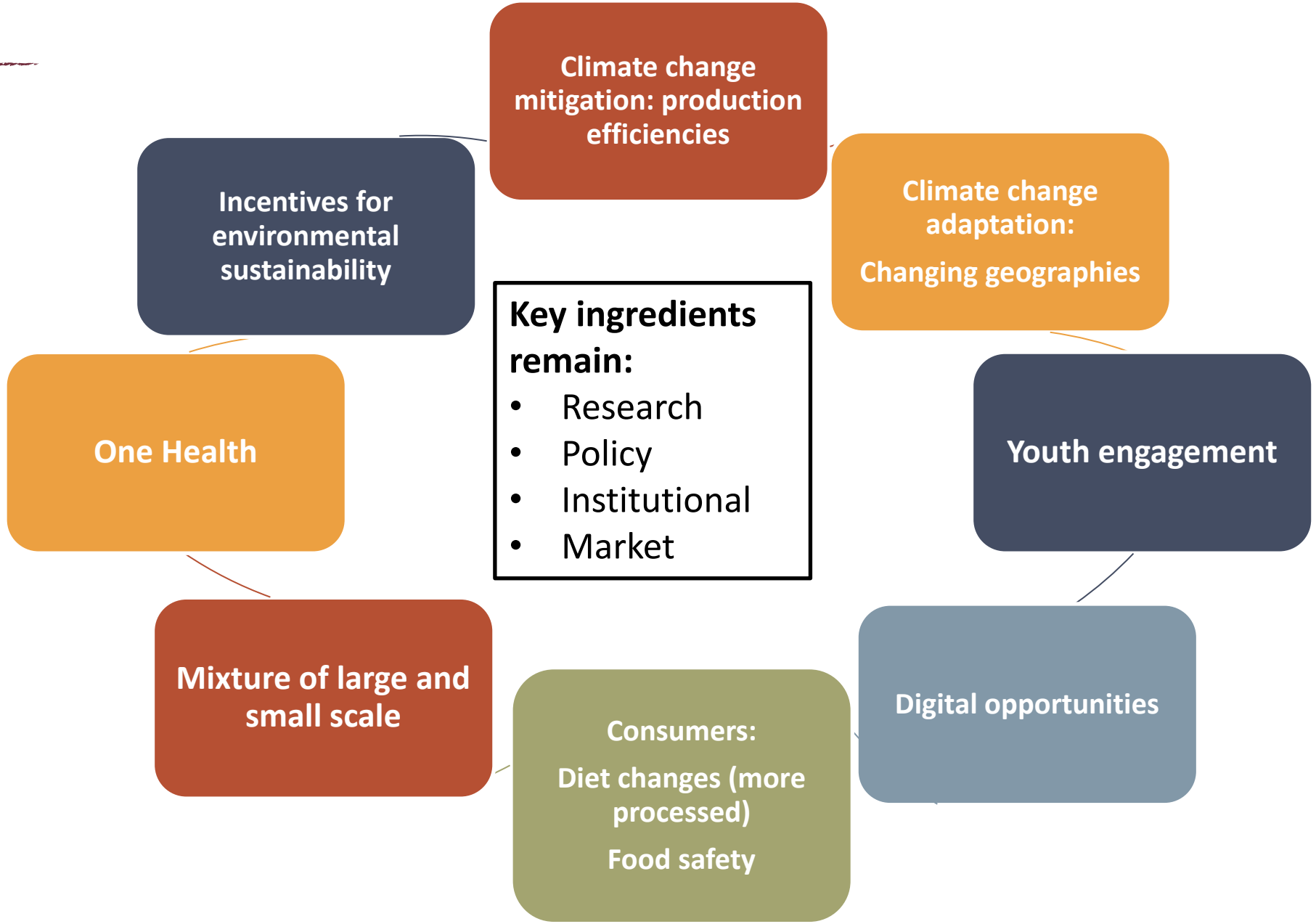
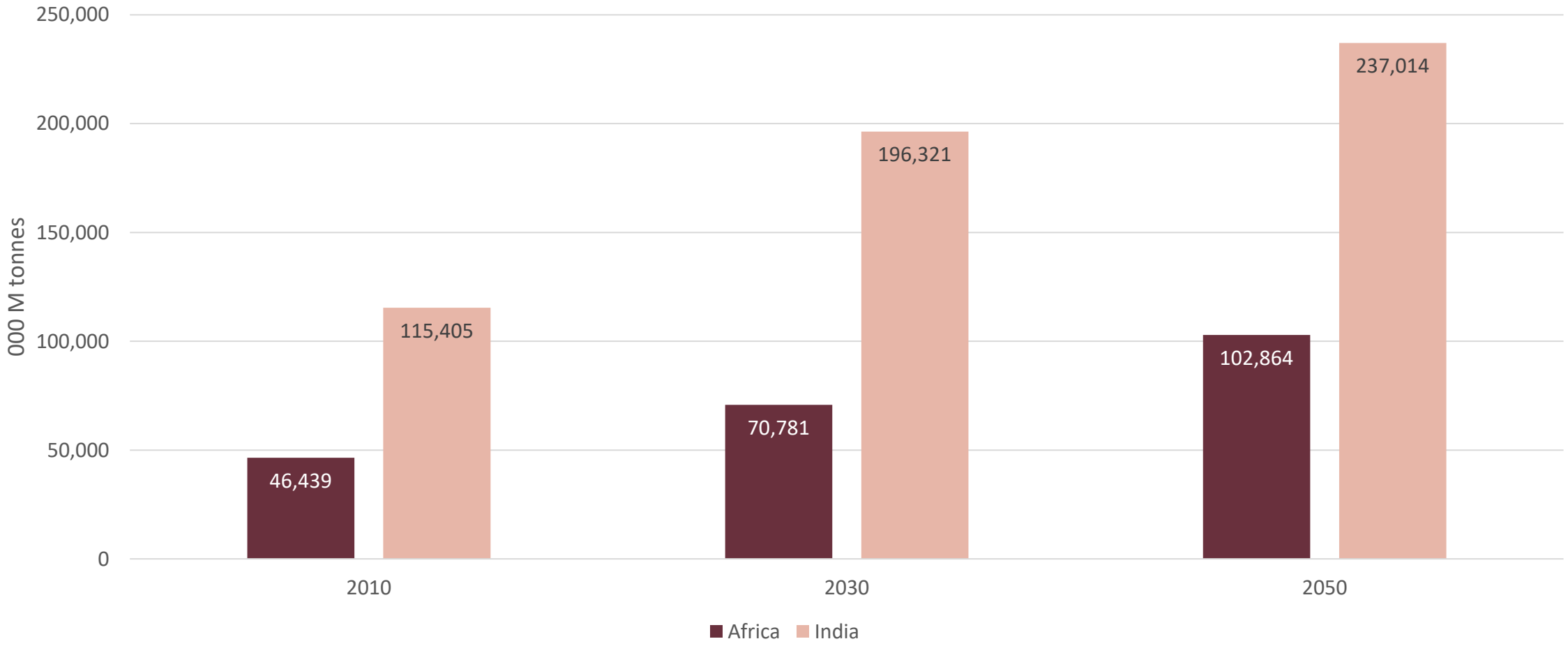
Changing contexts and drivers: the transition continues



Although lower in total, dairy demand in Africa will rise slightly faster than India



Source: Impact model predictions under moderate climate change in 2050 with assumption of moderate economic and population growth, with thanks to Dolapo Enahoro (ILRI)

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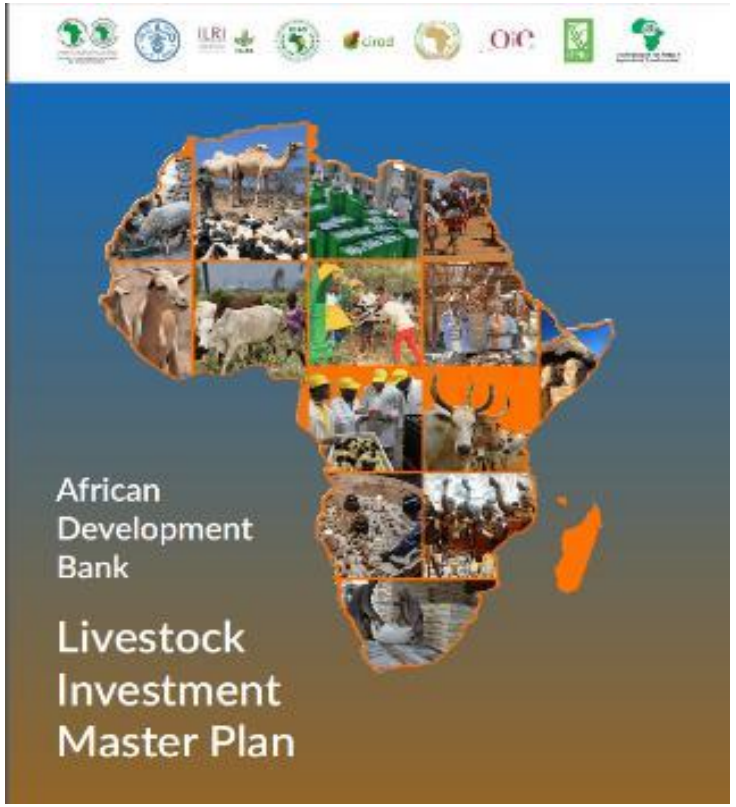
Many other countries face rapid rises in dairy demand: opportunities for South-South learning

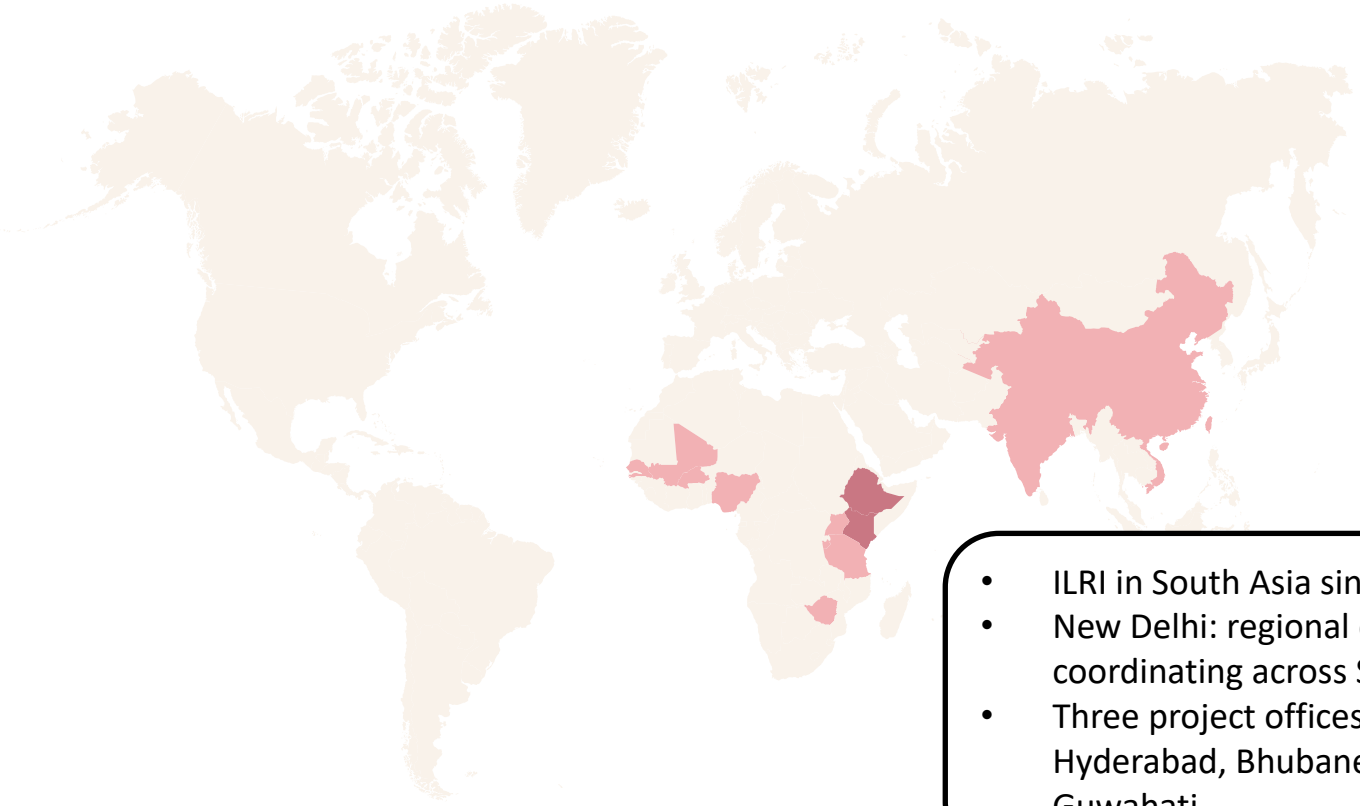
- ✓ Political will
- ✓ Policy and institutional environment
- ✓ Connecting farmers to market (technology 'push' doesn't work)
- ✓ Building dairy industry from its current smallholder base
- ✓ Enabling and improving safe informal markets
- ✓ Technology elements that work for smallholders, women, youth:
  - ✓ improved feed
  - ✓ genetics and AI
  - ✓ animal health
- ✓ Addressing climate challenges (mitigation and adaptation)



International Livestock Research Institute (ILRI): a One CGIAR research centre

ILRI is co-hosted by both the governments of Ethiopia and Kenya, with offices in 8 other countries in Africa (Burking Faso, Burundi, Mali, Nigeria, Senegal, Tanzania, Uganda and Zimbabwe); 4 countries in Asia (China, India, Nepal and Vietnam).

ILRI has approximately **650 permanent staff** (with a gender breakdown of 40% female and 60% male).



- ILRI in South Asia since 2004
- New Delhi: regional office; coordinating across South Asia
- Three project offices in India: Hyderabad, Bhubaneswar and Guwahati

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The International Livestock Research Institute (ILRI) is a non-profit institution helping people in low- and middle-income countries to improve their lives, livelihoods and lands through the animals that remain the backbone of small-scale agriculture and enterprise across the developing world. ILRI belongs to CGIAR, a global research-for-development partnership working for a food-secure future. ILRI's funders, through the CGIAR Trust Fund, and its many partners make ILRI's work possible and its mission a reality. Australian animal scientist and Nobel Laureate Peter Doherty serves as ILRI's patron.

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