Better lives through livestock

Research & Innovations against AMR: ILRI's Contribution

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

CGIAR

Health (Animals, People and Ecosystems)

To improve the health of livestock, people, and their shared environments

AoW 1. Innovations and technologies for Animal Health in LMICs

Vaccines: conventional, platforms 3rd generation vaccines development

Diagnostics: low cost, low tech, field deployable

AoW 2: Integrated Livestock diseases control innovations

- **Herd health** (productivity and economic impact)
- **Disease prioritisation, incidence** (eg. ECF, PPR, RVF, CBPP, LSD, ASF, ticks …)
- **Collaborations with private sector –** increased and effective adoption

AoW 3: One Health approach to address EIDs, zoonoses, AMR and ecosystem health

- **Ecosystem health (wildlife)**
- **One Health Units** at community level
- **AMR**
- **Capacity strengthening**
- **Policies**

AoW 4: Innovations for safe and healthy ASFs

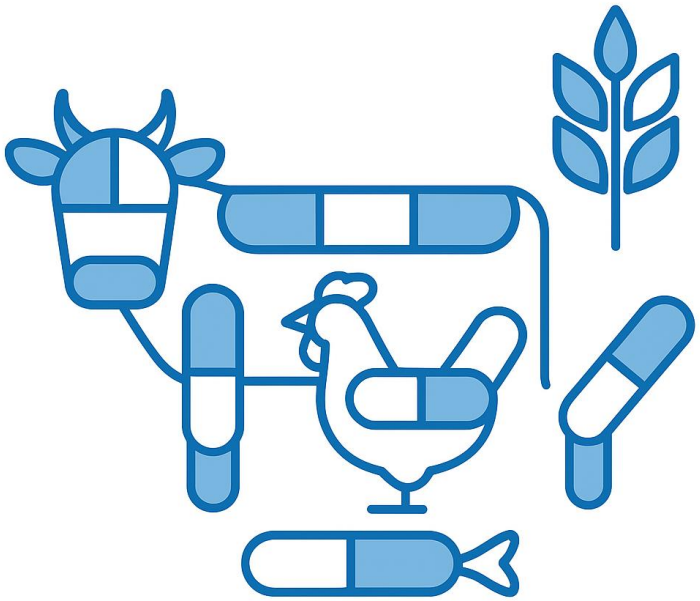
Foster **improved quality safe nutritious diets** through incorporation of ASF from **improved livestock systems** across different settings

Cross-cutting capacities: epidemiology, genomics, digital solutions and health economics

FAO, WHO, UNEP, WOAH, AU-IBAR, RECs, Private sector, NARS, governments, ILRI programs, NGOs,..

We take antimicrobials for granted and underestimate why AMR in Animal Health & Food Systems Matters

Antimicrobials are the **invisible backbone** of animal health and food systems



In LMICs, are often seen as "***quick fixes***"

United Nations

Political Declaration of the High-level Meeting on Antimicrobial Resistance

We, Heads of State and Government and representatives of States and Governments, are assembled at the United Nations on 26 September 2024, in accordance with General Assembly resolution 78/269, to review progress on global, regional and national efforts to tackle antimicrobial resistance, to identify gaps and invest in sustainable solutions to strengthen and accelerate multisectoral progress at all levels, through a One Health approach, with a view to scaling up the global effort to build a healthier world based on equity and leaving no one behind, and in this regard we:

1. Recognize that antimicrobial resistance is one of the most urgent global health threats and development challenges and demands immediate action to safeguard our ability to treat human, animal, and plant diseases, as well as to enhance food safety, food security and nutrition, foster economic development, equity and a healthy environment, and advance the 2030 Agenda for Sustainable Development Goals,

2. Reaffirm that the 2030 Agenda for Sustainable Development offers a framework to ensure healthy lives, and recall commitments to fight malaria, HIV/AIDS, tuberculosis, hepatitis, the Ebola virus disease, neglected tropical diseases and other communicable diseases and epidemics that disproportionately affect developing countries, including by addressing growing antimicrobial resistance while reiterating that antimicrobial resistance challenges the sustainability and effectiveness of the public health response to these and other diseases as well as gains in health and development and the attainment of the 2030 Agenda,

3. Recall that within the broader context of antimicrobial resistance, resistance to antibiotics is a grave global challenge, and that effective, safe and affordable antibiotics are a prerequisite for providing quality, accessible and timely health-care services and are essential for the functioning of all health systems,

4. Recognize that while antimicrobial resistance affects people of all ages, knows no borders and is present in all countries, the burden is largely and disproportionately borne by developing countries and those in vulnerable situations, requiring global solidarity, joint efforts and international cooperation,

"**meaningfully reduce, by 2030**, the quantity of antimicrobials used globally in the agri-food system from the current level"

Antibacterial pipeline

Currently in clinical development
- Human health: 90 (WHO, 2025)
- Veterinary medicine: 0 (difficult to get numbers)

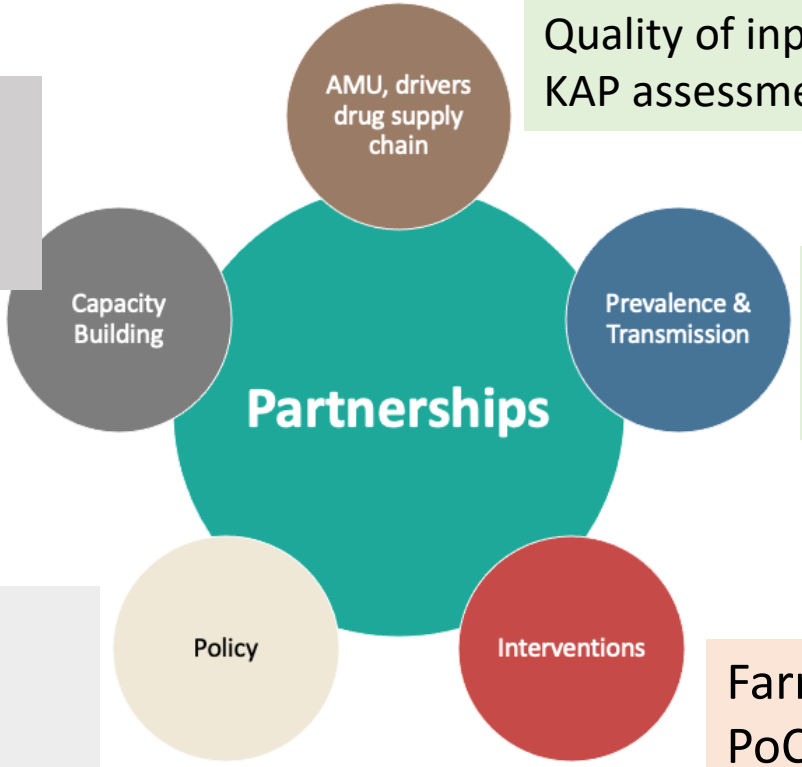
New approvals since 2010 (FDA, US only)
- Human health: 20
- Veterinary medicine: 2 (Tildipirosin and Pradofloxacin)

R&D investment: Global AMR Hub
- Human health: $4.00 billion
- Animal Health: $0.08 billion (50x smaller than human health)
- Plant Health: $0.01 billion

Bottom line: The veterinary toolbox is limited—preservation is critical!

Our AMR Research & Action Portfolio, since 2019

AMR lab diagnostic capacity
AMU & AMR data analysis
Mentorship & Training



Antimicrobial quantification & drivers
Supply chain mapping
Quality of inputs (antimicrobials, day old chicks, vaccines and feed)
KAP assessments- how antimicrobials are prescribed/used

Evidence & Data

Farm resistomes & AMR surveillance
Environmental +climate change
AMR at wildlife-livestock interfaces

Mapping policies & regulations
Animal health Treatment guidelines
Essential Vet. Medicines list
Gender responsiveness

Farm-level & Behaviour change
PoC Diagnostics & (*alternatives to antibiotics)*
Vaccines access and quality

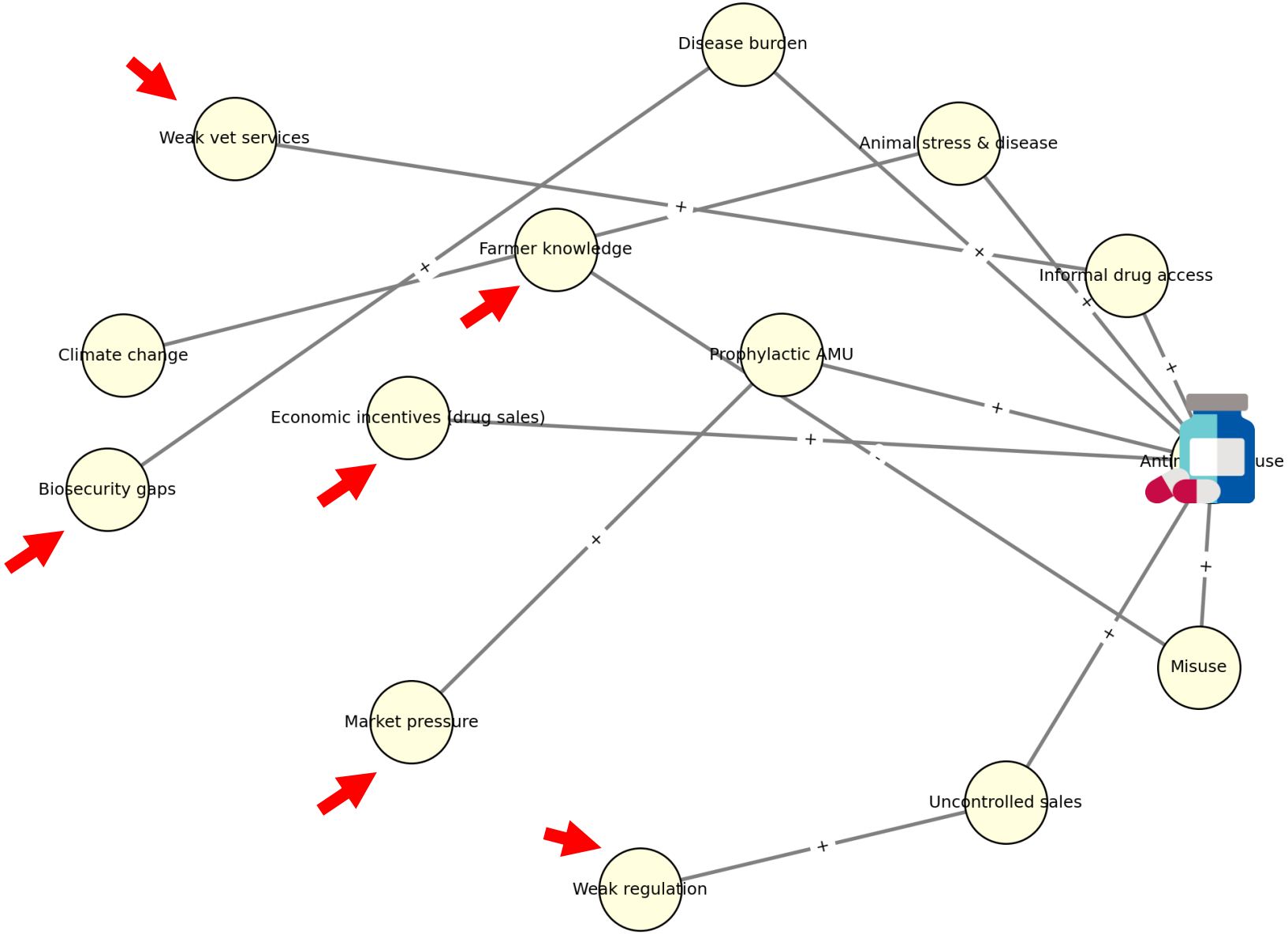
ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE
CGIAR

From zero capacity to a regional AST hub supporting African AMR surveillance

- Established a state-of-the-art laboratory supporting different CGIAR centres and labs across Africa and Asia
- Linnet is our resident AST expert (2 months at EDL, Sweden)
- 👩🏾‍🔬 Onsite training in Nairobi
  - ICARS funding: 34 participants from five countries.
  - ILRI funding: two onsite for 17 participants from Eswatini, Uganda, Tanzania, Ethiopia and Kenya.
- 🌍 9 In-country trainings
  - ICARS funding (Zanzibar x 2, Benin, and Namibia).
  - ILRI funding (Burundi, India, Indonesia, Senegal, Rwanda and Ethiopia)
- 💻 13 Webinars (min.20 participants each).
- Supported the Kenyan government during a deadly outbreak. We processed food and water samples (bacterial ID and AST)
- Support the ILRI farm

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE
CGIAR

What are drivers of antimicrobial use on farms?



How many LMICs collect qAMU at the farm-level?

LMICs globally: 9 published studies
In Africa: 5 countries (Cameron, Morocco, Nigeria, Tanzania, Uganda)

Country	Host species	Metric	Study design
Tanzania	Dairy and poultry	(DDDvet) and (UDD)	Cross-sectional
Uganda	Poultry	mg/PCU	Cross-sectional

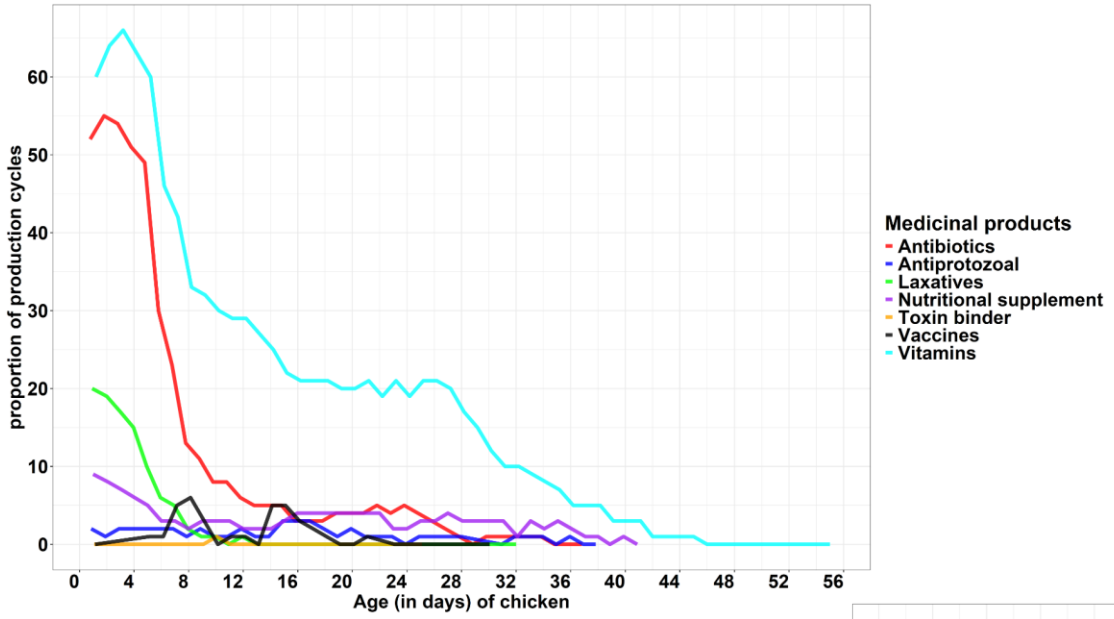
How many published studies have captured longitudinal farm-level data? **0**

… until now

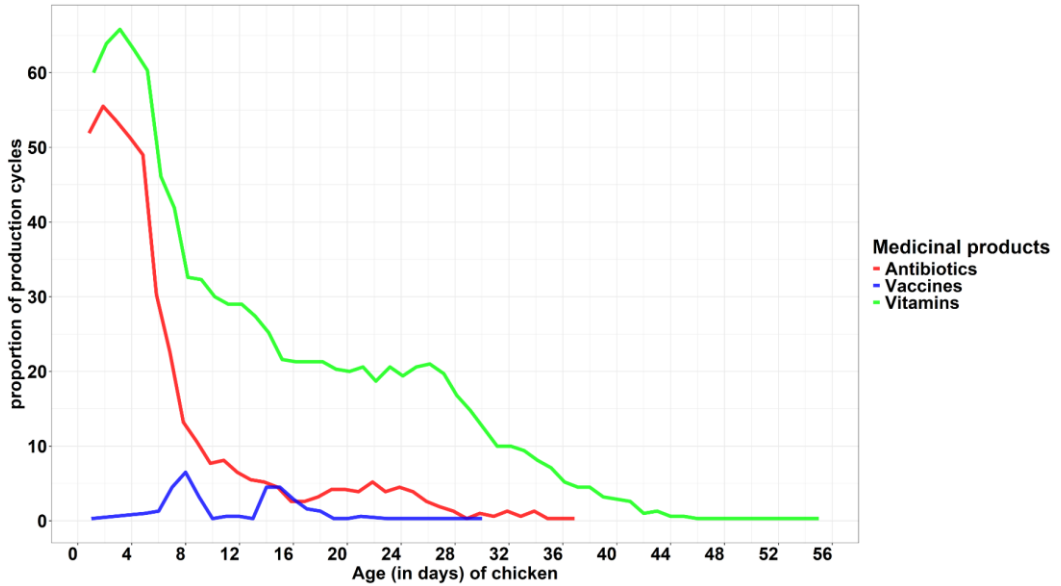
First longitudinal farm-level data! What farmers use and how much?

No. farms	No. cycles
73	1
69	2
64	3
50	4
40	5
14	6

Total cycles
310 cycles/farms



Analyzing wealth of quantitative data!!



UNIVERSITY OF COPENHAGEN

vaccines & diagnostics activities

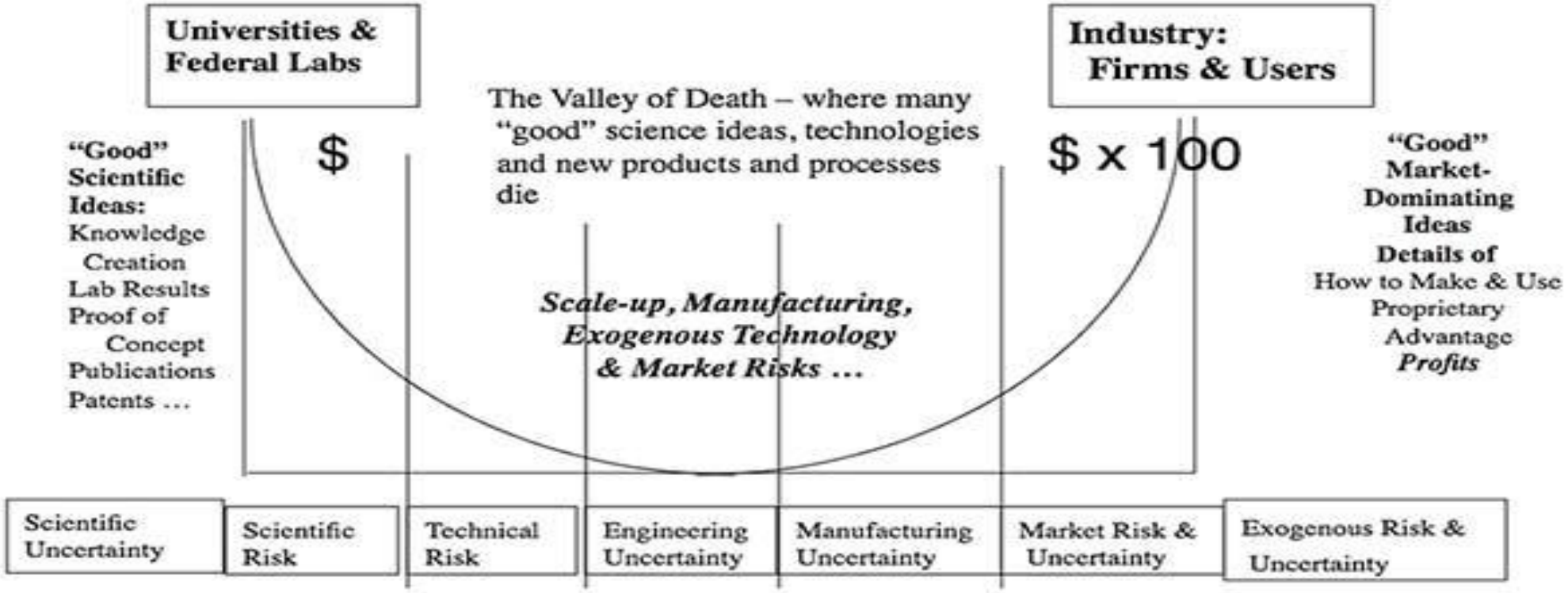
Vaccines:

- **African swine fever (ASF) – swine.**
- **Contagious bovine/caprine pleuropneumonia CBPP / CCPP – ruminants.**
- **East Coast fever (ECF) – cattle.**
- **Peste des petits ruminants (PPR) - small ruminants.**
- **Rift Valley fever (RVF)** – small ruminants, cattle, camels and human.
- **Ticks – *R. appendiculatus*.**

Diagnostics:

- CRISPR/cas based rapid molecular diagnostic tests for tick borne diseases (ECF, Babesia, Anaplasma)
- New partnership with CEVA-Sante Animale-initial focus is diagnostics And surveillance

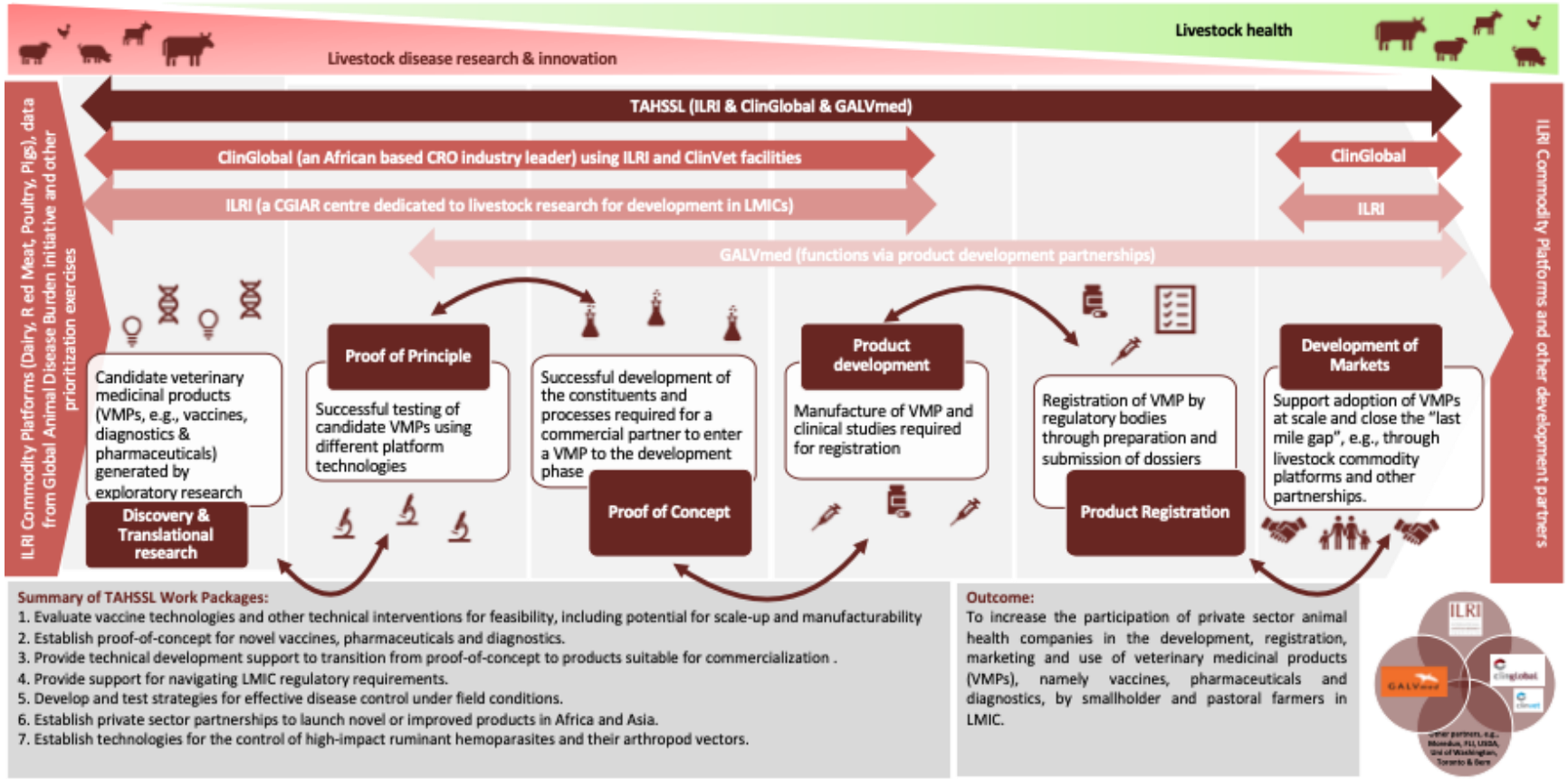
The Valley of Death of new AHPs (Drugs, diagnostics, vaccines)



- The challenge is how to reduce product failure in the valley of death

Source: © Mariann Jelinek, PhD, Professor of Strategy Emerita, College of William and Mary, Williamsburg VA, Star-IDAZ

Transforming Animal Health Solutions & Services in LMIC



THE TAHSSL PARTNERSHIP

- **ClinGlobal:** Capacity and systems to conduct clinical trials at GCP level for both ILRI and external clients.
- **GALVmed:** Regulatory and commercialization capacity linking animal health R&D with market needs
- **ILRI:** Scientific expertise on TAHSSL diseases and world class laboratories and clinical research facilities.

A synergy *that facilitates market driven R&D in partnership with regional and global animal health companies, academia, regional animal health organizations and government authorities.*

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE CGIAR

ILRI's clinical animal research facilities & and contract research-animal capacities

	ABSL2+ barrier facilities	ABSL1 barrier facilities	Conventional facilities	Kapiti Research Station & Wildlife Conservancy
	42	115	175	3,500
	190	295	495	1,600
		40	50	650
	105	240	365	35
	+++	+++	+++	+++

*All animal spaces and caging compliant with **EU** guidelines and requirements*

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

CGIAR

Study capabilities at ILRI's Clinical Facility

- *VICH **GCP** compliant facility*
- ***SANAS** accreditation*








Services	Bovine	Ovine	Caprine	Camelid	Porcine	Poultry	Murine	In vitro
Development of challenge models	X	X	X	X	X	X	X	
Vaccine Efficacy	X	X	X	X	X	X	X	
Immunogenicity	X	X	X	X	X	X	X	
Local tolerance	X	X	X	X	X	X	X	
Pharmacokinetics	X	X	X	X	X	X	X	
Residues	X	X	X	X	X	X		
Parasitology	X	X	X	X	X	X		
Clinical field studies	X	X	X	X	X	X		
Feeding trial	X	X	X	X	X	X		
Enteric methane emissions	X	X	X	X				

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE
CGIAR

LMICs Product profiles should be customized

- Easy to administer
- Highly efficacious
- Annual single dose
- In combination?
- Thermotolerant?
- Cost-effective
- Packaging-smaller packages for SSPs
- Affordable and accessible excipients

The balance between a “good” and a “perfect” Vaccine

- Can it be used together with other interventions?
- Can it be produced at scale with minimal cost?
- Can it reduce withdrawal times?
- Does it induce visible post-vaccinal reactions?
- Can it be accessed when needed?
- Does it demonstrably reduce clinical disease?
- Does it reduce overall cost of disease control?

Outbreak investigation: CBPP treatment

Antibiotics used

Farm 1 (Kajiado) _ Pen strep, Oxytetracycline (10%, 20%, & 30%), Dexamethasone
_Tylosine administered by the CDV which stopped the deaths

Farm 2 (Kajiado) _ Betamox, Oxytetracycline 10% and later 30%

Farm 3 (Kajiado) _Penstrep, Oxytetracycline, Diaminazene Diaceturate, Metaphos (phosphorus and Vit B12 supplement), and Butaphos
_Dewormers

Farm 4 (Marsabit) _ Oxytetracycline 10%, 5%

Farm 5 (Laikipia) _ Oxytetracycline, Butalex, Multivitamin, Dexamethasone

Farm 6 (Isiolo) _ pen strep, antihistamine, multivitamin and, tylosin

- The overall herd mortality rate for CBPP was estimated to be 30%
- CBPP causes high economic losses to farmers through the purchase of drugs and loss of animals
- Self-treatment by farmers is common, at times the vets may inject the first dose and leave drugs with the farmers to continue with subsequent injections.
- One ranch in Laikipia sourced Tulathromycin to successfully treat CBPP

Drugs used by farmers for CBPP

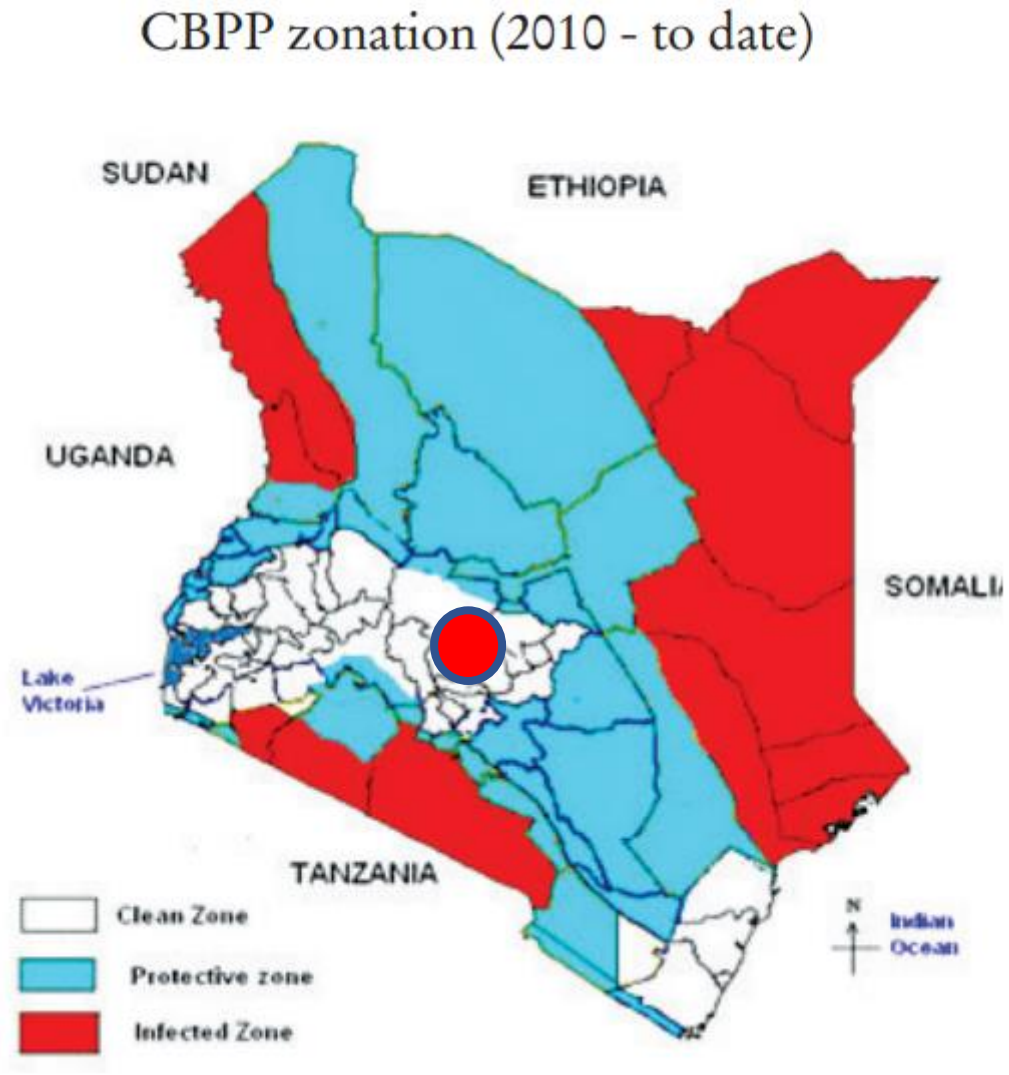
Contagious Bovine Pleuropneumonia in Kenya

The control strategy was based on vaccination and animal movement control in three zones:

- **CBPP clean areas "zone I":** surveillance was carried out in all slaughter facilities accompanied by zoosanitary measures at livestock markets, borders check points and stock routes.

- **Recently infected areas "zone II":** disease surveillance and vaccination in the event of a confirmed outbreak. enforced zoosanitary measures.

- **Endemic areas "zone III":** the strategy was intensive vaccination and zoo-sanitary control measures.



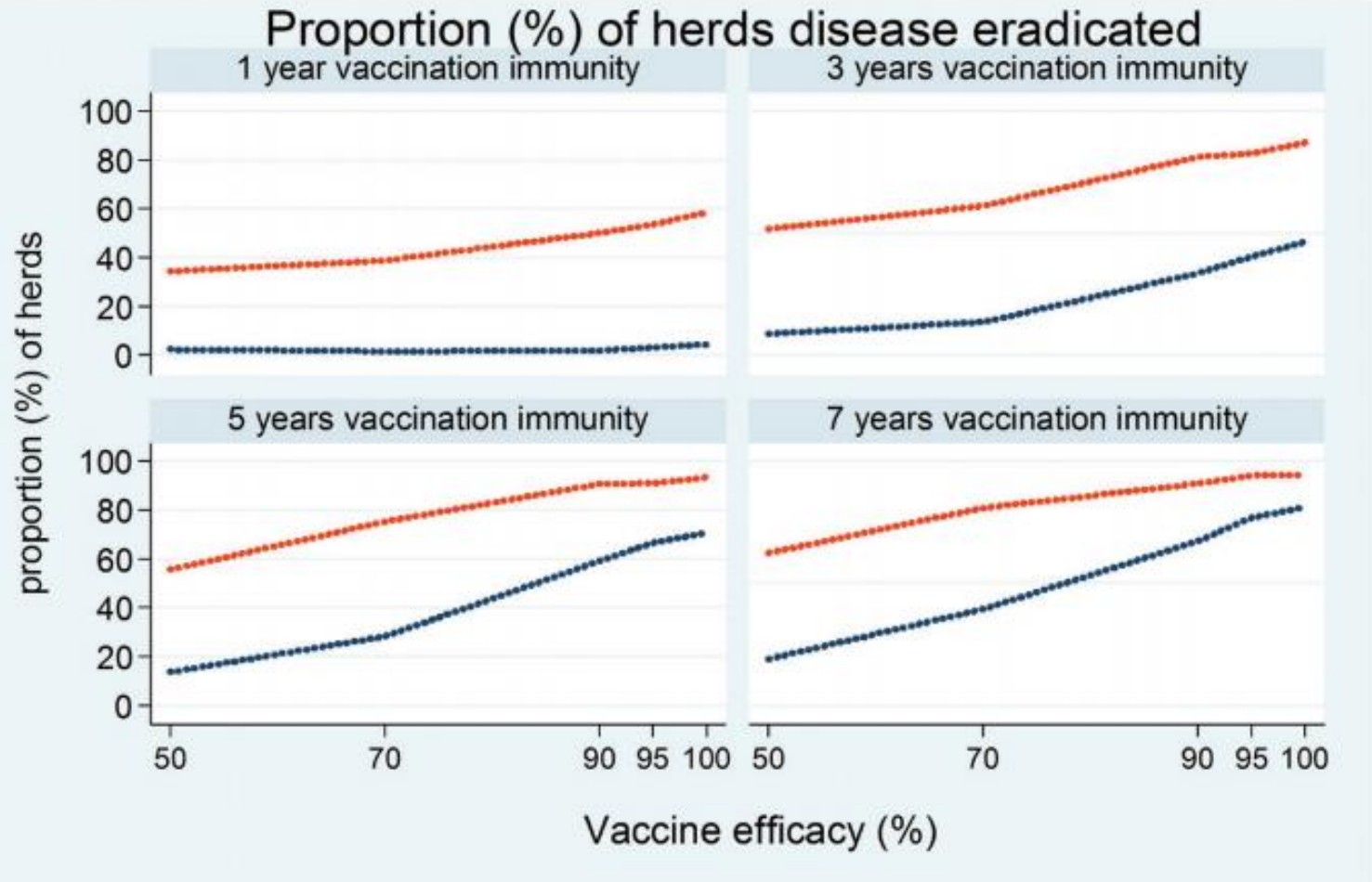
Contagious Bovine Pleuropneumonia: Reality

- **Diagnosis:** took up to 3 months for a section of herd
- **Livestock death:** 400
- **Movement control**: None
- **Control policy**: Unclear

TAHSSL
TRANSFORMING ANIMAL HEALTH

CBPP vaccination as a “stand-alone” intervention

GALVmed Protecting Livestock Improving Human Lives



Proportion of herds where CBPP will be eradicated as a function of:

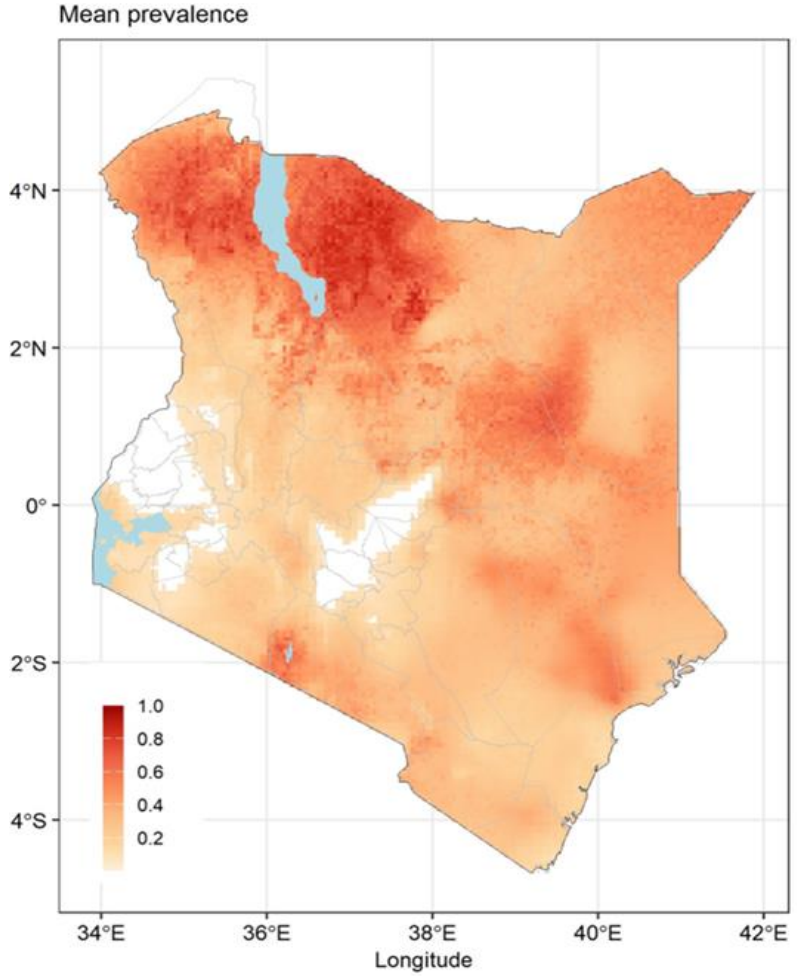
- Vaccine efficacy (50% to 100%)
- In 4 scenarios with DOI ranging from 1 to 7 years

For vaccines to be a truly “stand-alone” intervention, high levels of efficacy >90% and longer duration of immunity will be required.

Single vaccination with T1/44 induced approx. 67% protection. Although, in one study, boost vaccination with T1/44 at 12 months post-primary vaccination rate results in 95% protection.

FAO meeting (2015). The Predicted Impact of CBPP Control Strategies. Jeffrey C. Mariner

The impact of climate change on livestock health, livelihoods, and food security in Kenya; the case of CBPP following 2020-2023 drought



The scale of 1 in the map is the highest prevalence (50%) detected in some areas, while 0.2 is the lowest, and 0 where no positives were found

Map of Kenya showing Predicted seroprevalence of *Mmm*. (2020-2021 data)

Highlights

- The estimated prevalence for CBPP was 30.2%, with the highest risk being in the arid and semi-areas.
- There is a strong negative correlation between rainfall and CBPP cases (RR=2.1)
- The economic impact of CBPP was US$149.27 million (KES 19.2 billion), representing 0.12% of Kenya's GDP.
- The presence of CBPP resulted in a 56.5% reduction in milk consumption in affected households, with 72.1% of households reporting deterioration in children's health.

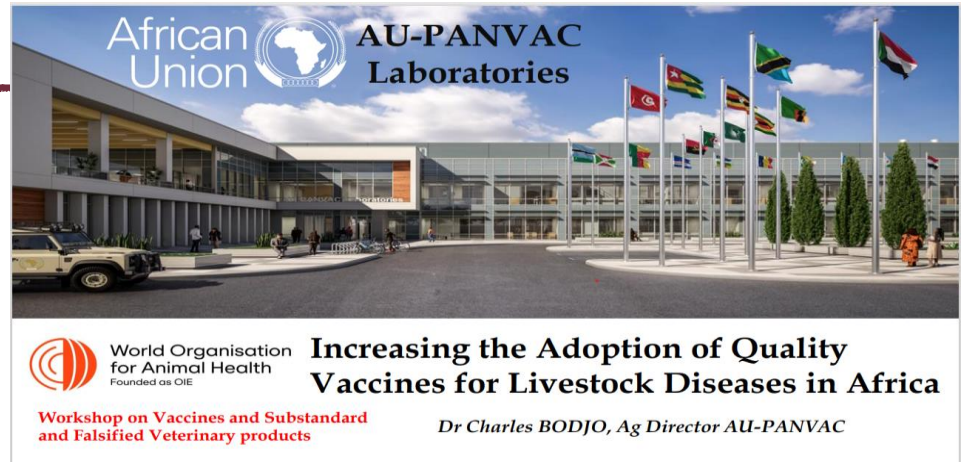
The manuscript for this data is currently in its final stages of preparation

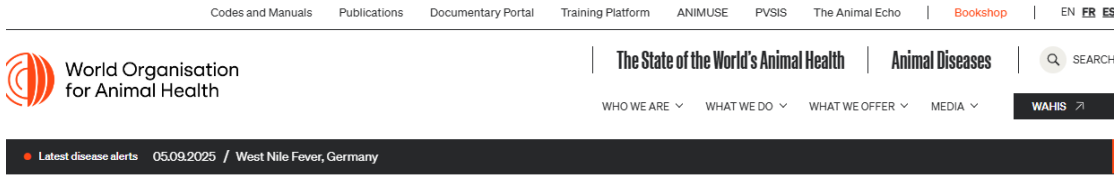
ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE CGIAR

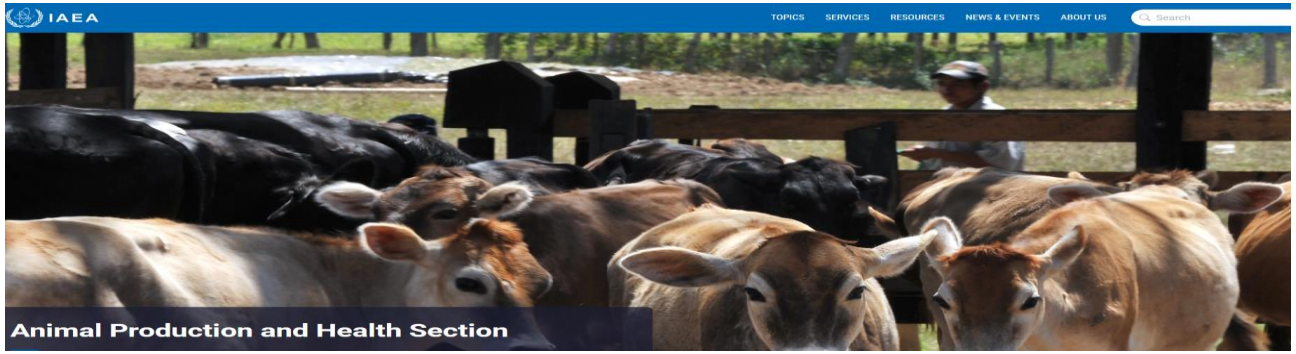
Potential collaboration with WOAH and partners

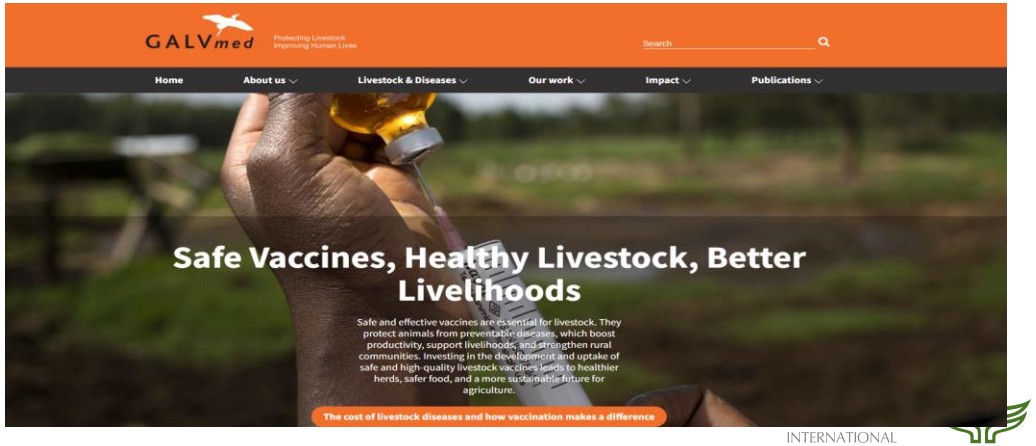
- ILRI is a WOAH Collaborating Centre for One Health
- Diagnostics and Surveillance
- Vaccine quality and pharmacovigilance
- Quantifying hotspots of antimicrobial use
- Identifying resistomes
- VICH GCP standards for Clinical trials for registration

A Robust Regional and International technical ecosystem









INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

CGIAR

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

CGIAR

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.

better lives through livestock

ilri.org