VET TECH
Empowering Livestock Health

Empowering Livestock Economies
Through Health Innovation and Technology

Economic and socioeconomic impact of animal diseases

- Bouda VOSOUGH AHMADI, FAO
- 2-3 of December 2025, Riyadh

وزارة البيئة والمياه والزراعة
Ministry of Environment Water & Agriculture
Kingdom of Saudi Arabia المملكة العربية السعودية

TAFS forum

البرنامج الوطني لتطوير قطاع الثروة الحيوانية والسمكية
NATIONAL LIVESTOCK & FISHERIES D. P.

THE VIEW ESSAY

WORLD

The real reason we fail to feed those in need

BY DAVID BEASLEY

FOOD IS THE DIFFERENCE BETWEEN LIFE AND DEATH. Everyone knows this. But it's also the difference between stability and instability, union and division, and peace and war. I have had a front-row seat to some of the worst recent humanitarian crises—from Yemen and Syria to Afghanistan and Gaza—and this has been true, time and time again.

I've sat face-to-face with mothers who've told me, "My son didn't want to join ISIS or al-Qaeda, but he had to feed his little girl." These are families who don't want to leave home, but will do what any mother or father would to feed their children, even if it means risking everything.

The power of food is simple to understand, yet the systems around it are anything but. When famine strikes, we rightfully react. Emergency aid is activated. Millions of dollars are deployed. But repeatedly, the cycle starts afresh. We fail because we treat famine in isolation from its interconnected crises.

We have enough funds, and enough food, to feed the world. The real reason humanitarian efforts keep failing is because decisionmakers profit from short-term solutions at the cost of addressing the root causes of inequality and food insecurity.

Women in line for food aid at a camp for the

to feed themselves and their families. These are people entering direct conflict zones for the chance of obtaining

themselves obsolete. This is not a result of insufficient supply; we produce more food per person than at any

If we simply continue to distribute food, we will be doing that for the next thousand years

By David Beasley, former executive director of the UN World Food Programme

Students participate in an Operation Outbreak

HEALTH

A LOSING GAME

IN SIMULATIONS ACROSS THE COUNTRY, STUDENTS ARE PROVING WE AREN'T READY FOR THE NEXT PANDEMIC

BY DOMINIQUE MOSBERGEN/OREM, UTAH

ON A FRIDAY MORNING IN OCTOBER, ABOUT 100 high school and college students gathered in a Utah ballroom to play a game. Some students were assigned specific roles and given costumes to wear. "Government officials" slung ties over their T-shirts; "store clerks" sported aprons; and a trio of "journalists" wore fedoras and carried fake microphones.

Kambree Carlile, 16, played a "health care worker" and was given full protective gear to wear, including goggles and gloves. As students started getting "sick" with a mysterious and deadly pathogen, panic surged, Carlile says. "It wasn't a real scenario, but people still got very frantic," she says.

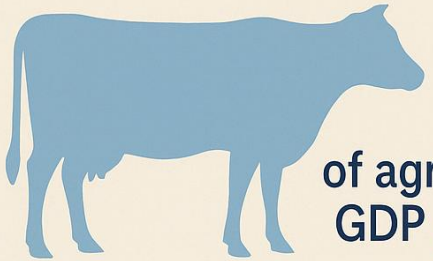
Students thronged the health care and public-health stations for advice and vaccines, ignoring calls by workers to socially distance. One "infected" student ran around, intentionally coughing on people, causing panic.

One of the "journalists," 17-year-old Kenadi

By Dominique Mosbergen, OREM Utah

Global Livestock:
A $1.8 Trillion Industry Under Threat

1.3 billion people depend on livestock for livelihoods

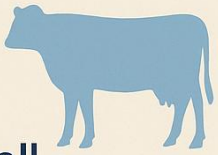


60% of agricultural GDP globally

$1.8 trillion USD (2022)

million smallholders directly supported

400 million small holders directly supported



In East Asia and the Pacific, animal-sourced foods contribute **3–36% of dietary energy** and **10–71% of dietary protein**, varying by country.

In Mongolia, over **70% of protein intake** comes from animal-based food. These foods are rich in iron, zinc, and vitamin B12.

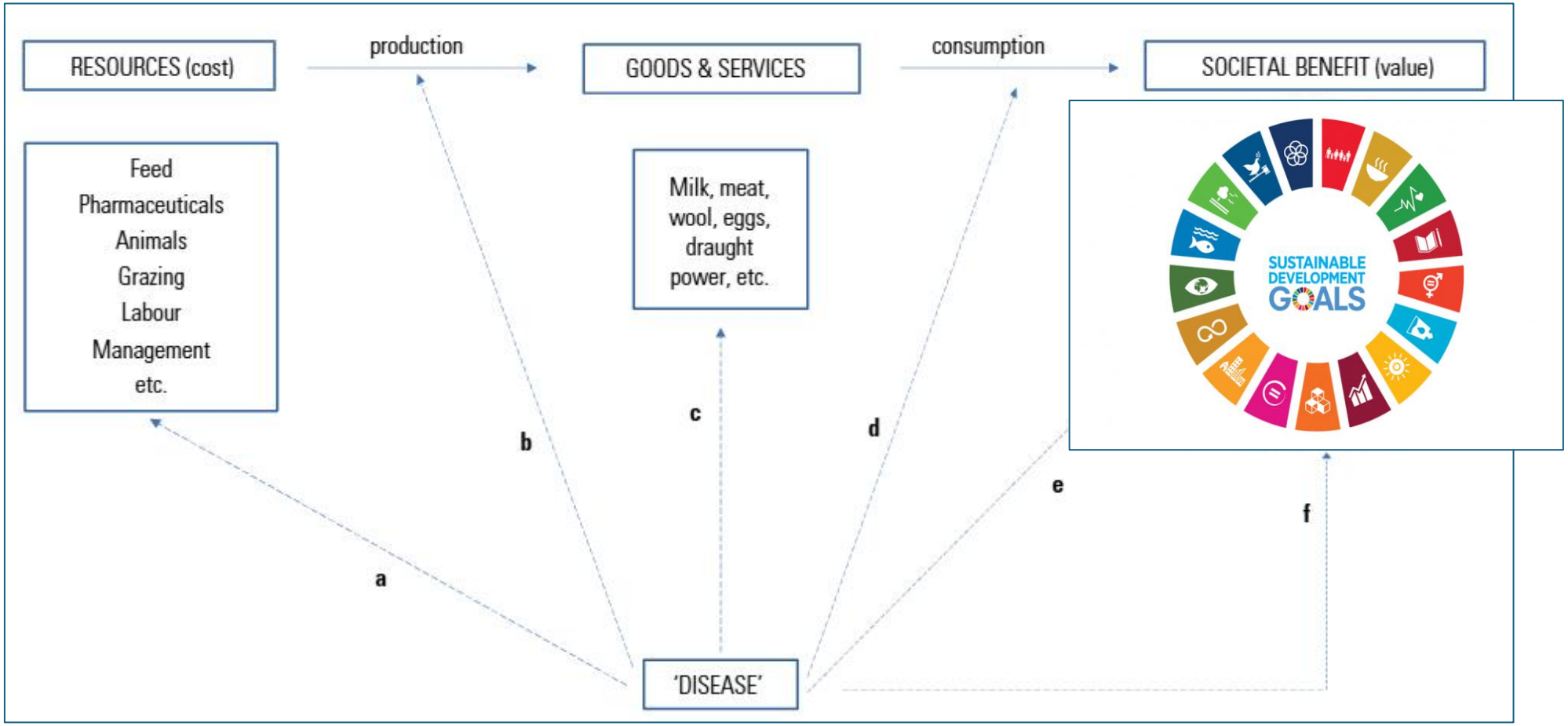
Animal Health: A Foundation for Global Security

Animal health is a fundamental building block of:

- Global food security
- Public health
- Rural livelihoods
- Environmental security
- Sustainable genetic resources & biodiversity

It directly impacts productivity of animal production systems, food security, and rural economies.

Livestock production is an economic process

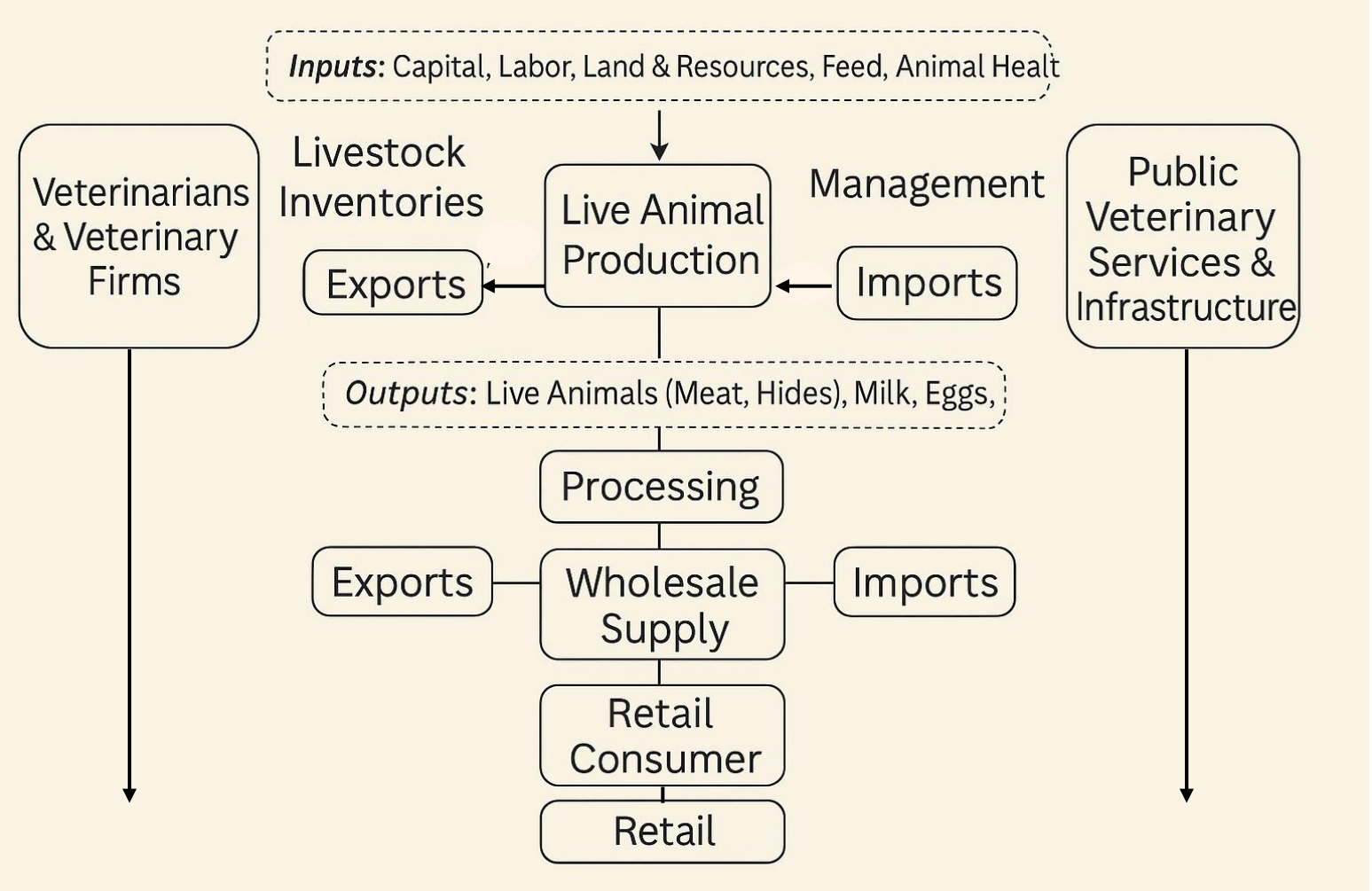


Adapted from Huntington et al (2021) and McInerney (1996)

VET TECH
Empowering Livestock Health

Vertical supply chains & veterinary services

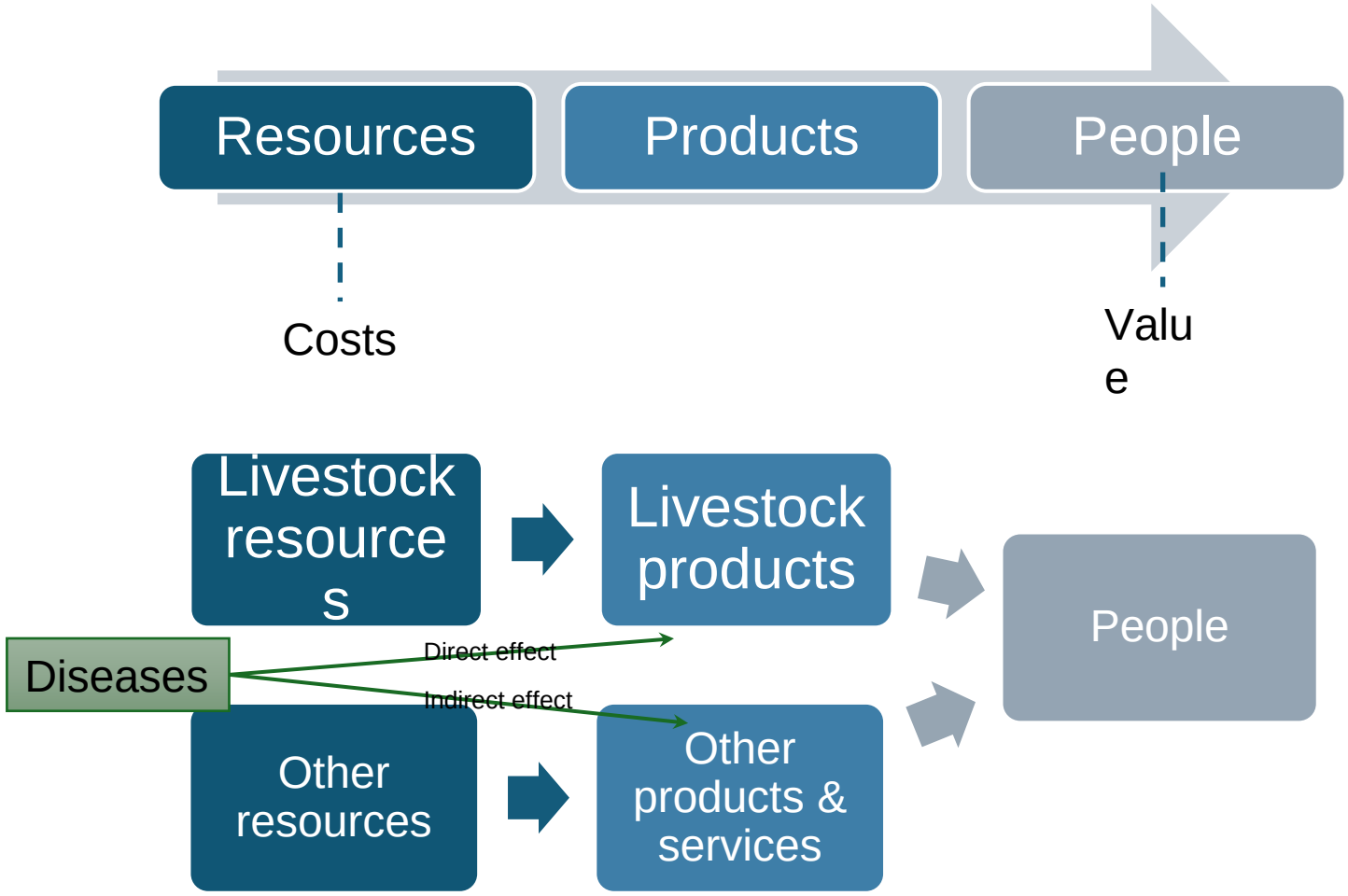
Importance of animal health & veterinary services for vertical supply chain of livestock



Source: Marsh & Pendel (forthcoming)

VET TECH
Empowering Livestock Health

How Disease Creates Economic Losses



Source: Dijkhuizen and Morris, 1997

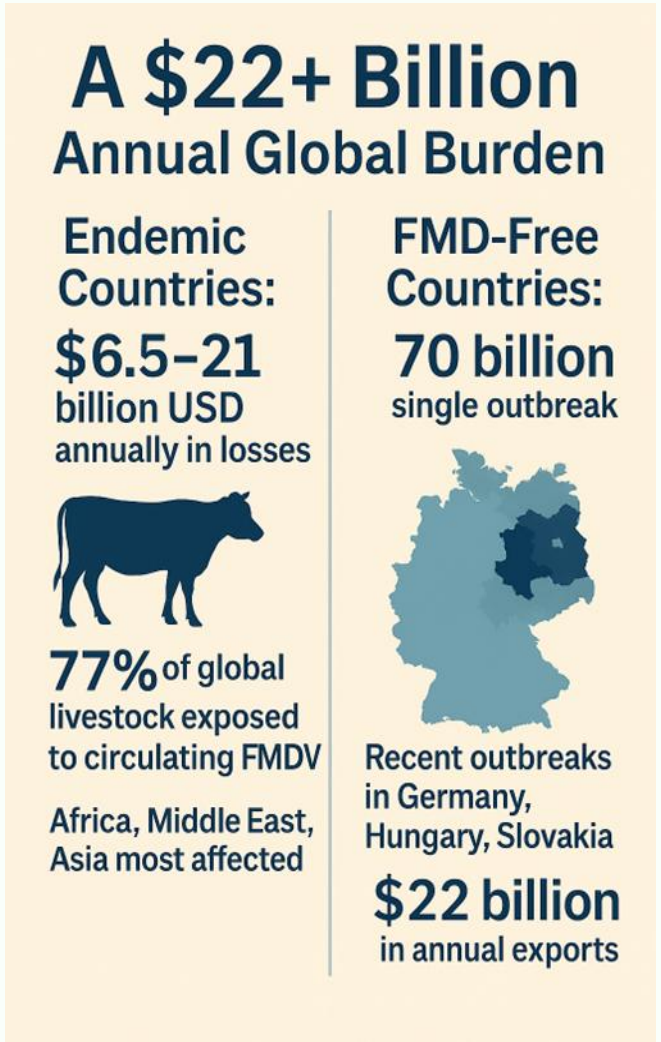
Burden of Transboundary Animal Diseases (TADs)

Endemic and exotic animal diseases have broader societal implications, impacting producers and consumers across the value chain. Transboundary animal diseases (TADs) such as African Swine Fever, Foot-and-Mouth Disease, Peste des petits ruminants, and High Pathogenicity Avian Influenza erode

Foot-and-Mouth Disease

Endemic FMD causes **USD 6.5–21 billion** annually in losses and

Vaccination costs: 6 million livestock culled, **£8 billion total cost**



PPR & HPAI

PPR: **USD 1.2–2.1 billion** annual losses globally

HPAI: US federal payments exceeded USD **1.4 billion** for 2022–2023 outbreak

African Swine Fever

Vietnam: 8,500+ outbreaks by late 2019, nearly 6 million pigs culled (25% of national herd)

Philippines: **USD 194–507 million** in losses during 2020

Recent FMD SAT1 Occurrences

Food and Agriculture Organization of the United Nations

alert

FAO ALERTS COUNTRIES IN NORTH AFRICA, WEST ASIA AND CAUCASUS TO ENHANCE PREPAREDNESS FOR FOOT-AND-MOUTH DISEASE SAT1

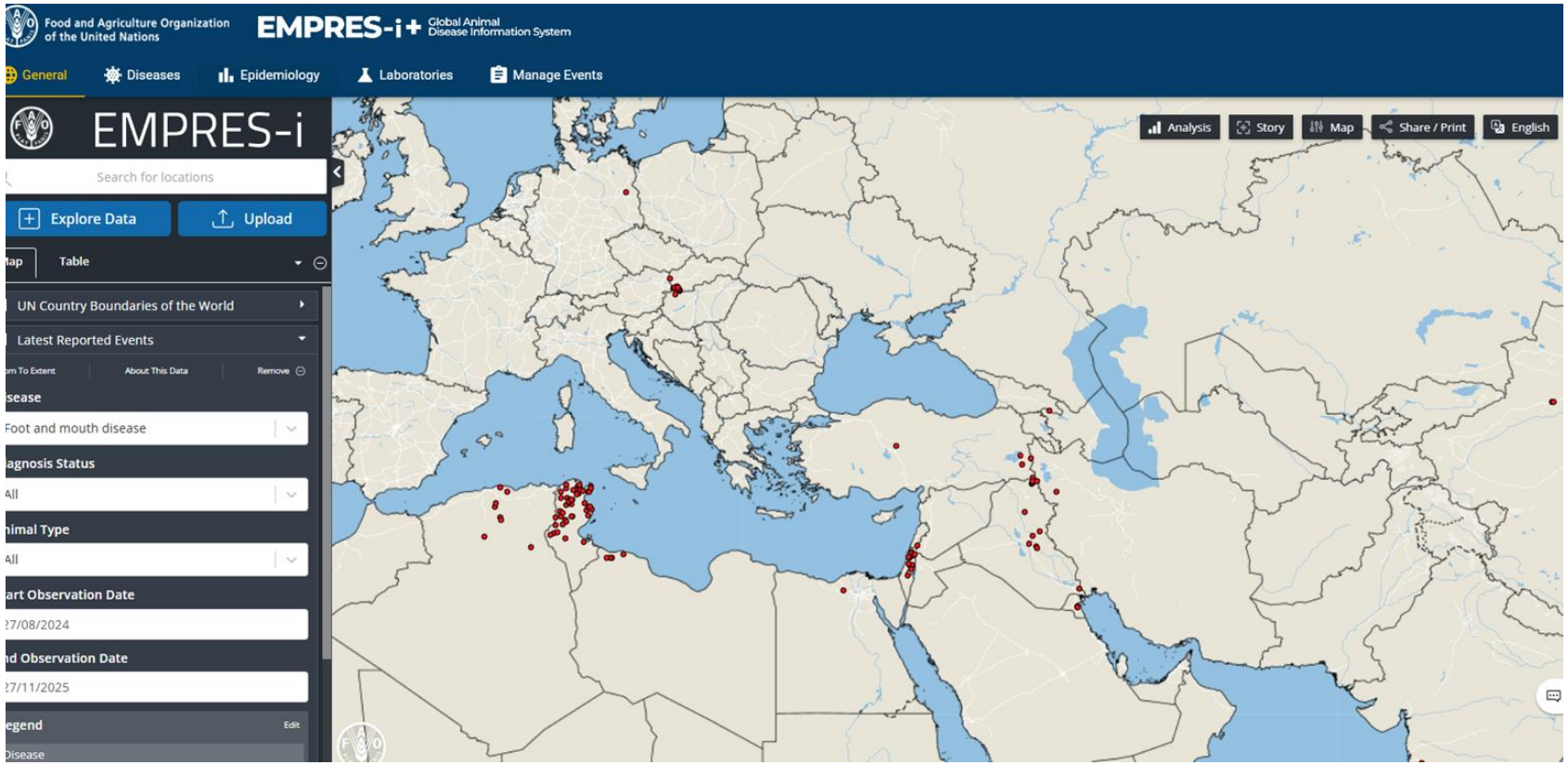
12 November 2025

Key facts:

1. Foot-and-mouth disease (FMD) is a highly contagious viral disease affecting cattle, sheep, goats, pigs and other cloven-hoofed animals. Although not a threat to human health, FMD severely impacts food security, livelihoods, national and international markets.
2. There are seven FMD virus serotypes (A, O, C, SAT1, SAT2, SAT3 and Asia1). Immunity from infection or vaccination is serotype-specific and will not provide protection against the other serotypes.
3. Clinical signs: Affected animals develop fever and blisters/sores on their feet, in the mouth, nose, snout, and teats. Depression, loss of appetite, weight loss, lameness and drop in milk production are observed. Some animals may be subclinically infected, particularly small ruminants. Younger animals may die due to sudden heart failure.
4. Transmission is via the respiratory or oral route. Infected animals shed virus in all excretions and secretions (saliva, urine, faeces, milk). FMD commonly spreads by animal movements, but can also be spread by contaminated clothing, footwear, equipment, vehicles. The virus can survive in the environment and animal products.
5. Diagnosis: In endemic countries, suspected FMD in a newly affected area should be confirmed by a laboratory. Laboratory diagnosis is also required to determine the causative serotype. Appropriate samples for virus confirmation include vesicular fluid or epithelium.
6. Prevention: The front line defence against FMD is robust biosecurity, awareness raising and surveillance. If vaccines are available, it is critical that they are matched to the circulating strains(s).

In April 2025, the Food and Agriculture Organization of the United Nations (FAO) recommended enhanced surveillance and biosecurity measures in the Near East and West Asia regions following the detection of foot-and-mouth disease (FMD) virus serotype SAT1 in Iraq with reports in both cattle and water buffaloes. As the SAT1 serotype is exotic to the region, FAO urged the countries to remain vigilant and prepare for the possible incursion of new FMD strains. Since the previous Alert was issued in April, FMD SAT1 has been detected and reported in Kuwait (April, May), Türkiye (April, May, June), Egypt (July) and Azerbaijan (October). In Azerbaijan, the outbreak was detected in its northern area close to the border with Georgia. Unconfirmed reports in the media suggest that FMD SAT1 may also be circulating in other parts of West Asia, with significant impacts reported particularly in the dairy sector. This highlights the urgent need for heightened biosecurity, enhanced surveillance (including prompt submission of samples for laboratory confirmation), and official reporting of results. There are anecdotal reports that preventive SAT1 vaccination has started in some countries, but broader and improved coordinated preparedness efforts, including information sharing and animal movement control, remain essential. Countries in the region are encouraged to share updates with international partners and to seek technical assistance from the World Reference Laboratory for Foot-and-Mouth Disease for virus characterization, vaccine matching, and targeted control measures.

FMD has been a long-standing challenge in West Asia, with multiple serotypes circulating in different countries – primarily serotypes O, A, and Asia 1. Recurrent outbreaks in this region are often linked to transboundary animal movements, informal livestock trade, and inadequate vaccination coverage. While FMD serotypes SAT1, SAT2 and SAT3 are usually confined to sub-Saharan Africa, FMD SAT2 was detected in West Asia in 2022 and now FMD SAT1 has been reported in several countries. These detections are linked to virus strains commonly found in Sub-Saharan Africa. The last reports of widespread circulation of serotype SAT1 in the region were in 1962, with outbreaks reported in Bahrain, the Islamic Republic of Iran, Iraq, Israel, Jordan, Lebanon, the Syrian Arab Republic, and Türkiye.

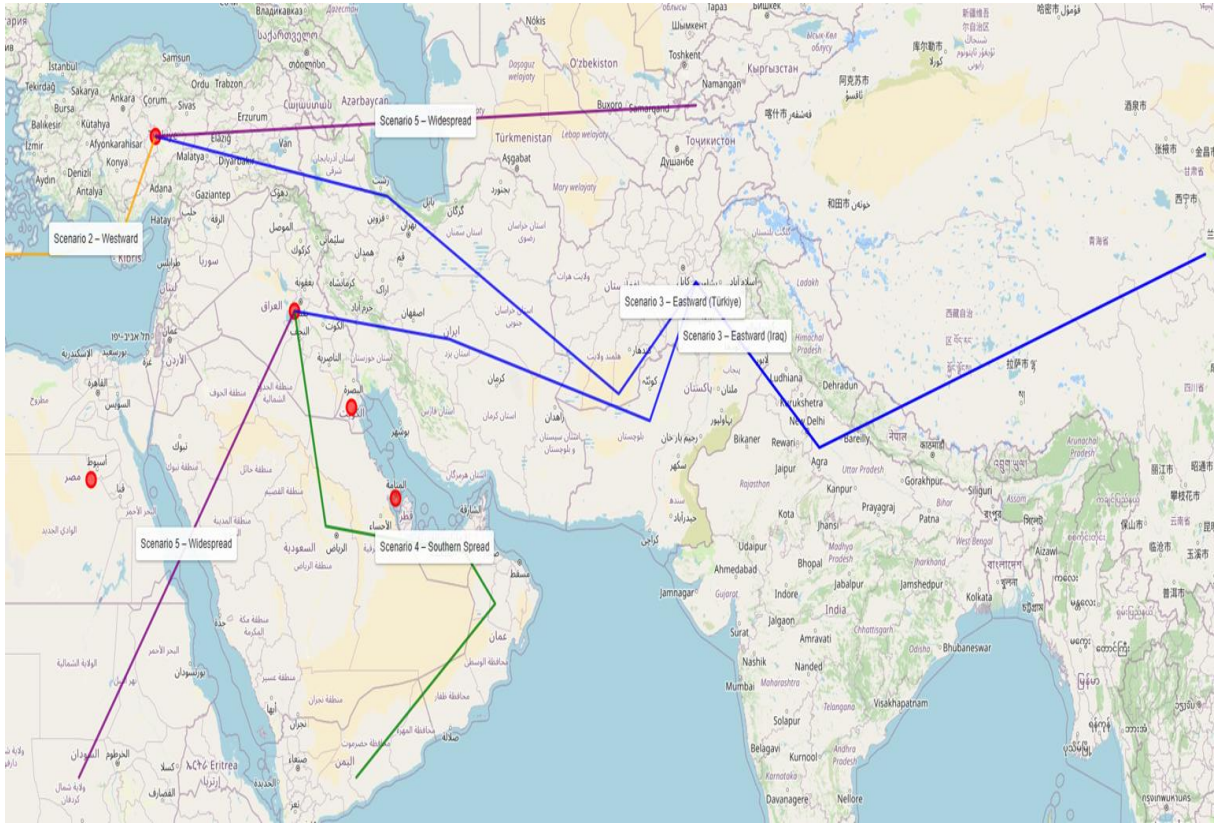


VET TECH
Empowering Livestock Health

Estimated Potential Economic Impact

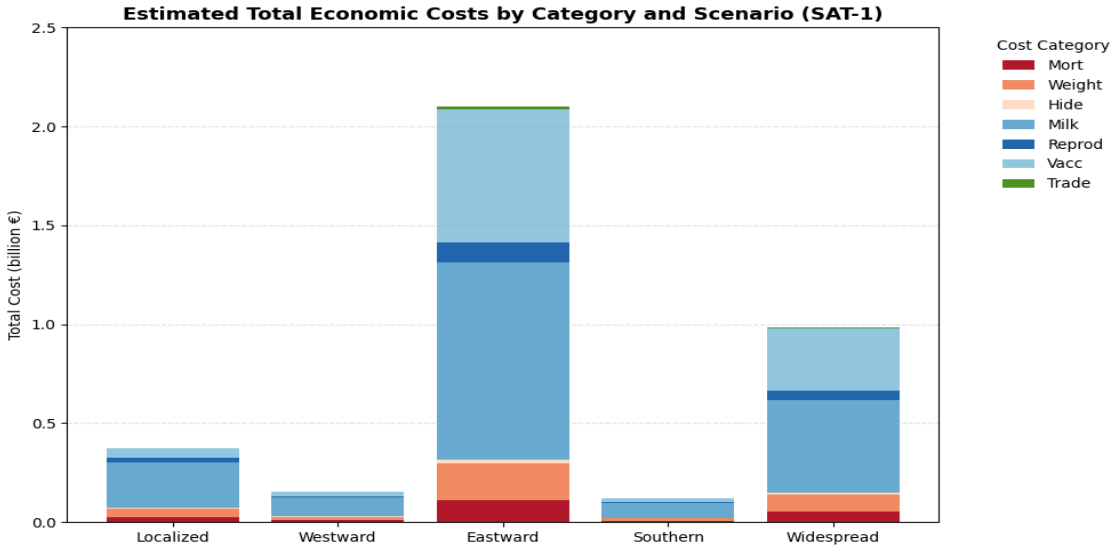
Five spread scenarios:

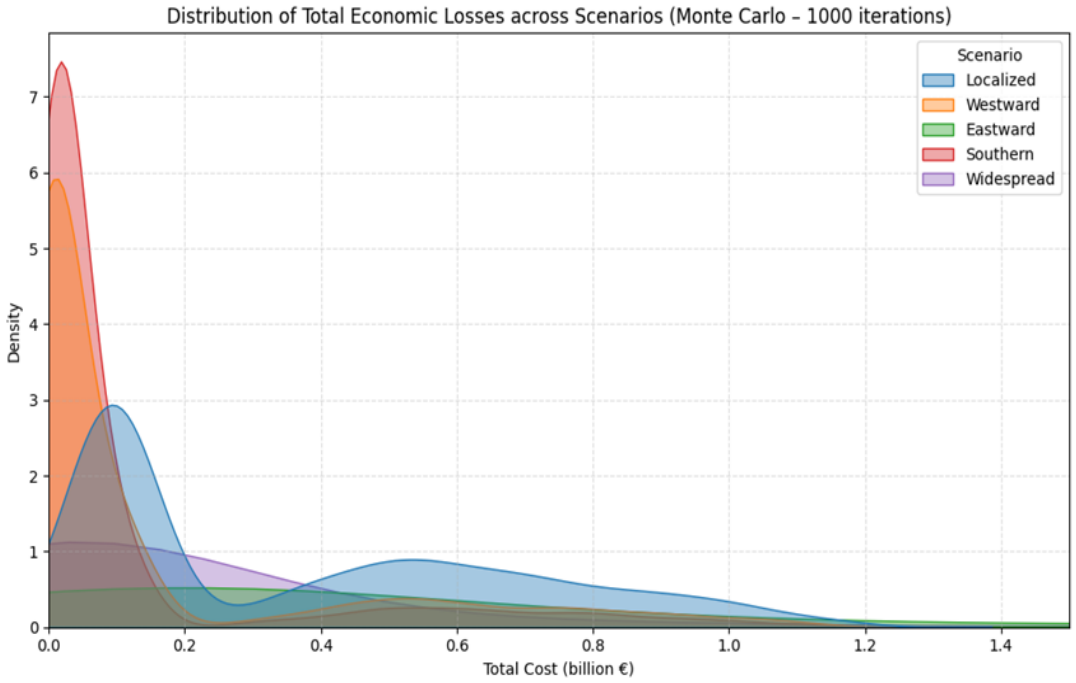
- **Localized:** Confined to Türkiye, Iraq, Kuwait and Bahrain, with containment limited to affected provinces.
- **Westward:** Extension into Cyprus and Greece, resulting in moderate trade-related losses.
- **Eastward:** Progression Iran, Pakistan, Afghanistan, India, China, representing the highest livestock density and dairy value.
- **Southern:** Spread into the Arabian Peninsula (Saudi Arabia, Qatar, UAE, Oman, Yemen, and Egypt), causing a moderate impact on production.
- **Widespread:** Broad regional dissemination across all risk levels.

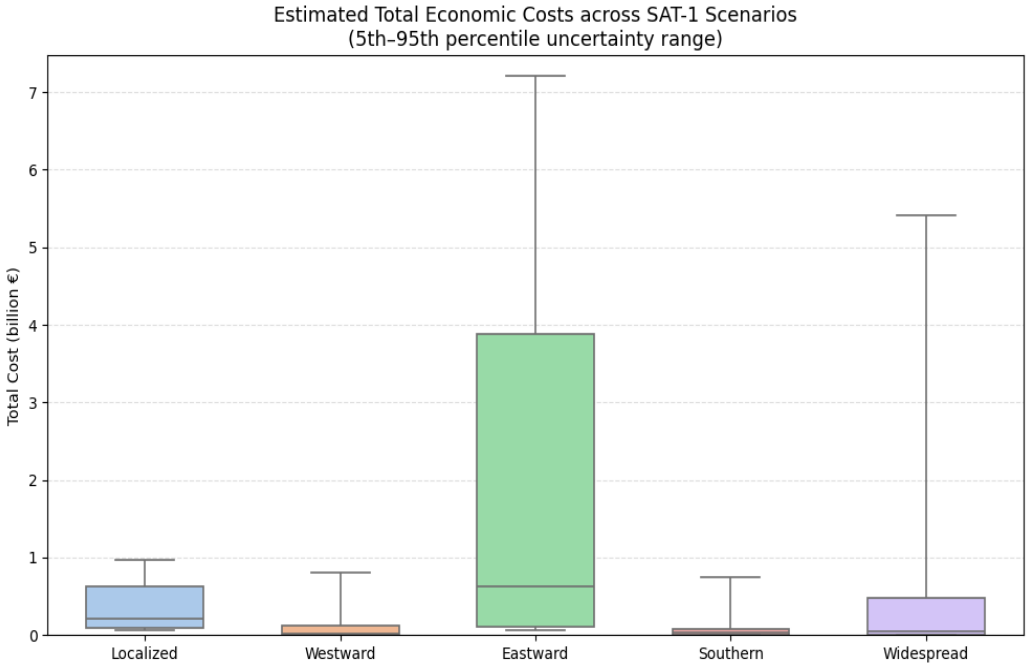


VET TECH
Empowering Livestock Health

- Expect potential losses between **USD 0.4 and 1.9 billion** across modelled scenarios.
- Key losses/costs: milk loss (50-60%), vaccination (20%), trade (10-25%).







TECH
Empowering
Livestock Health

Socioeconomic Impact of HPAI

- **Billions Lost in the Broiler Industry**
  During the 2014-15 HPAI outbreak, broiler sector revenues declined by ≈ **USD 4 billion** due to import restrictions, despite limited direct mortality.

- **Massive Export Losses**
  During the 2022-23 outbreak, US poultry exports fell sharply:
  - Export value dropped by about **60%** under state-level bans
  - Export value dropped by about **16%** under county-level bans

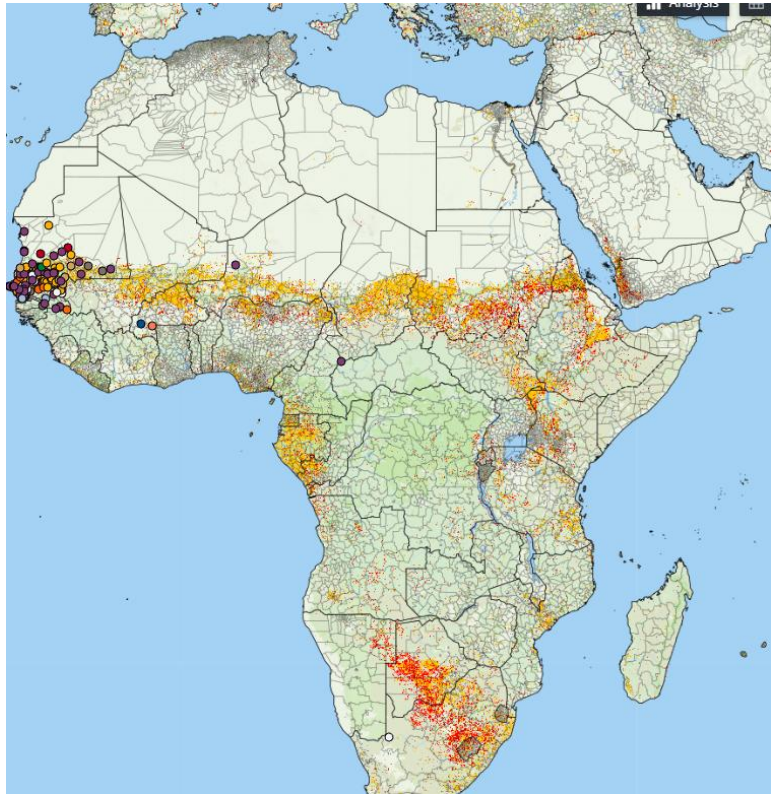
- **Consumer Welfare Losses Through Higher Prices**
  US retail egg prices increased by **~5.3%** during the 2022-23 outbreak, driven by reduced flocks and biological lags in supply recovery.

- **Supply-Chain Distortions**
  Storage volumes, production levels, and export flows were disrupted for months beyond the outbreak, amplifying market losses.

- **Farm-Level Losses in Indonesia (Converted to 2025 USD)**
  Farms lost up to **62.7 million IDR (≈ USD 3,760 in 2025 value)** per production cycle, roughly **twelve times** their normal gross margin.

IVET TECH
Empowering Livestock Health

Potential Impact of RVF

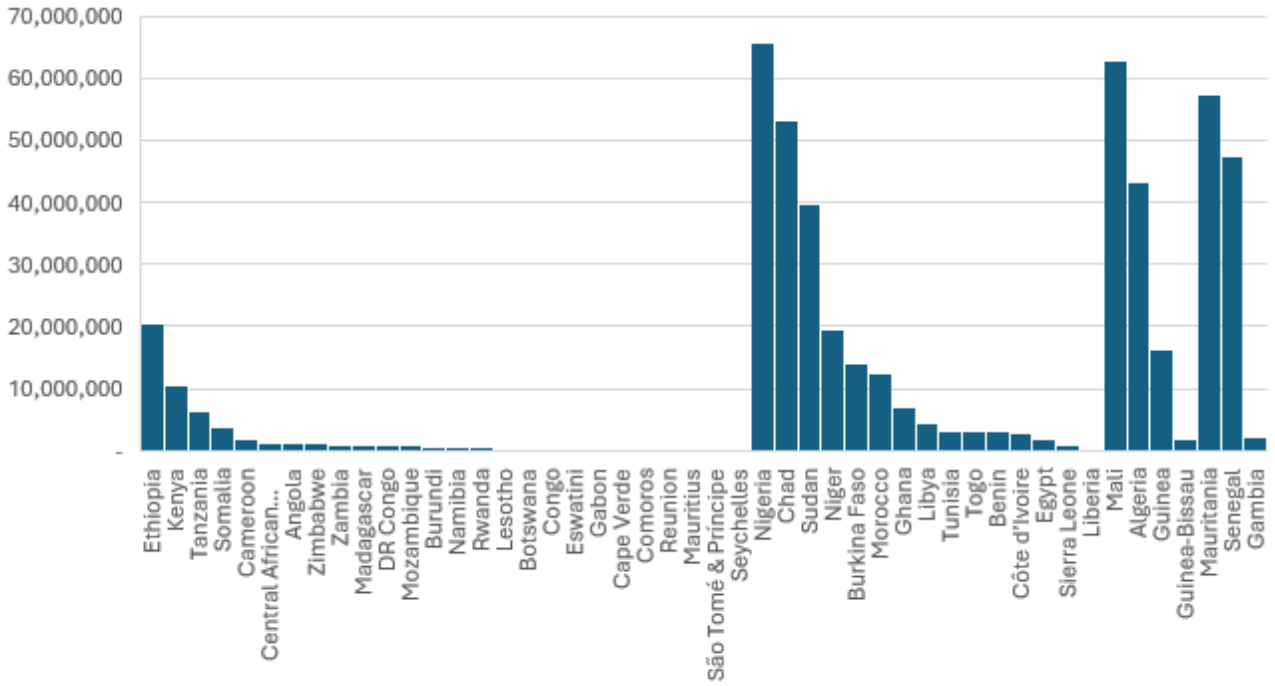


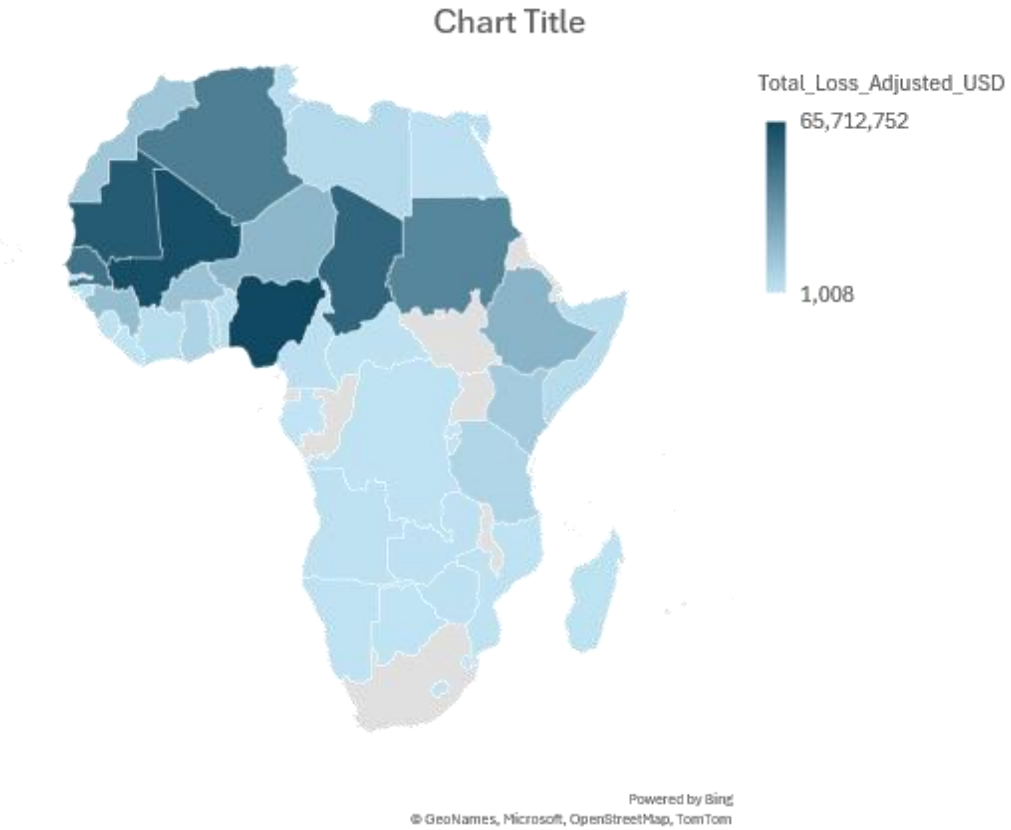
Source: FAO RVF Decision-Support Tool

- Rift Valley fever (RVF) is a mosquito-borne viral haemorrhagic fever that affects animals and humans.
- The virus can persist in dormant mosquito eggs, emerging after heavy rains or flooding.
- Recent extreme weather across West Africa has triggered widespread RVF outbreaks in Mauritania, Senegal and the Gambia.

VET TECH
Empowering Livestock Health

Estimated Potential Impact

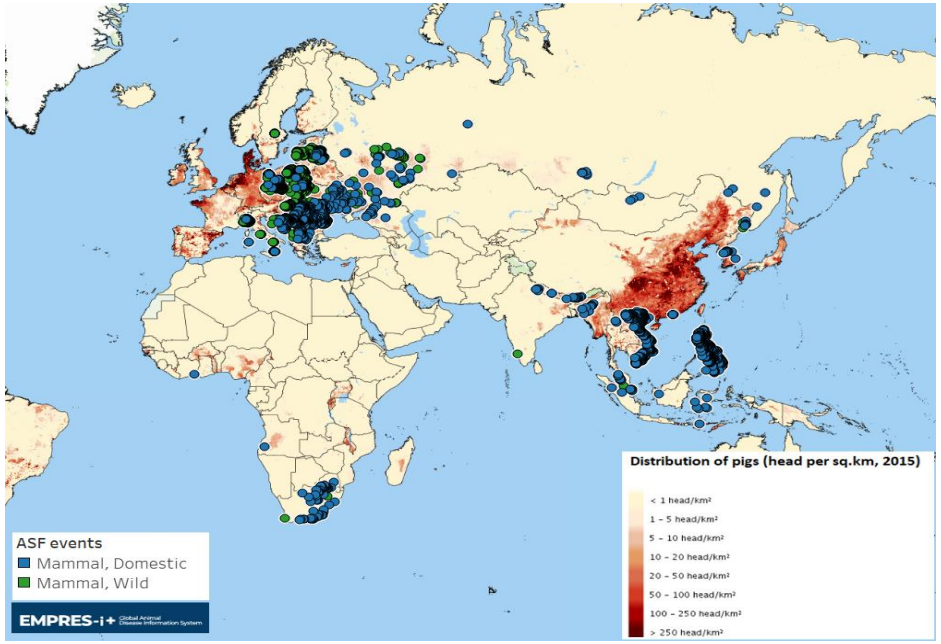


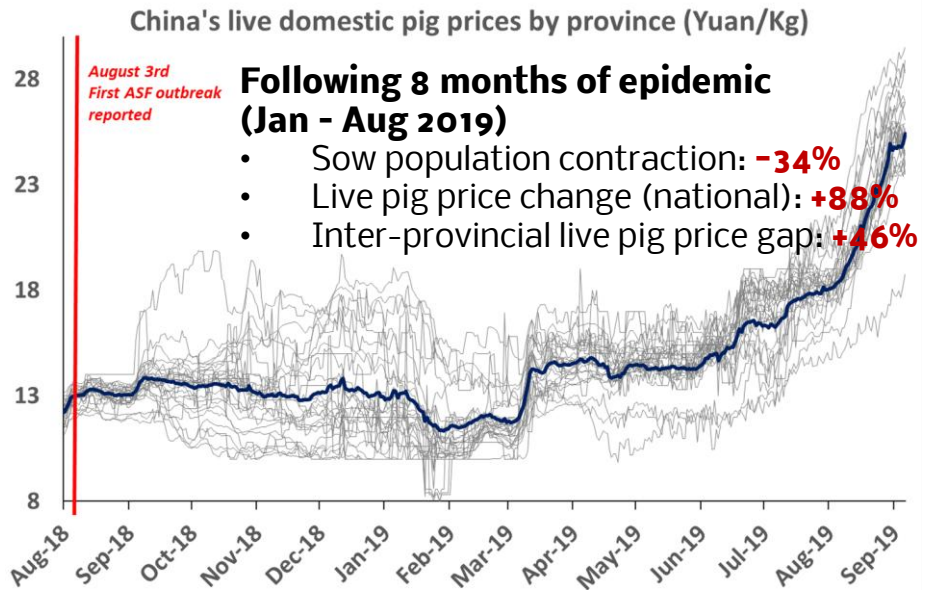


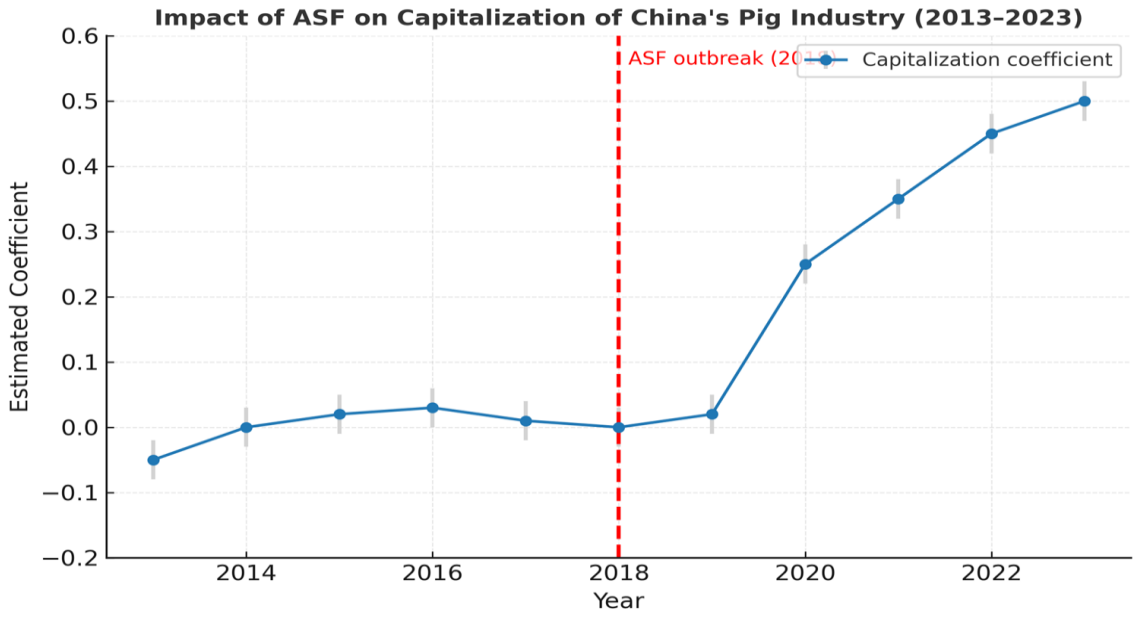
Total estimated potential losses USD 516 Million

VET TECH
Empowering Livestock Health

Impacts of ASF







- The 2018 ASF outbreak transformed part of China's pig industry. The crisis forced a big and rapid restructuring of the sector, accelerating capitalization and consolidation.
- Before ASF, smallholders and large farms followed similar trends. After ASF, only the capitalized sector surged ahead, driven by policy support and industrial clustering.

VET TECH
Empowering Livestock Health

Economic Impact Beyond the Farm Gate

Animal diseases generate considerable **indirect effects** beyond mortality, including reduced milk and meat production, impaired reproductive rates, and **trade restrictions**. These impacts extend to **tourism**, **transport**, and **regional economies**.

Poor animal health leads to **systemic inefficiencies** as valuable resources–feed, water, land, and labour–are wasted when animals fall ill or die prematurely. Investing in TADs prevention and control is a strategic priority for sustainable development.

The Silent Threat: Antimicrobial Resistance (AMR)

Antimicrobial resistance (AMR) introduces a complex aspect to the livestock sector's global relevance. AMR is increasingly restricting treatment options, increasing mortality and morbidity in both animals and humans, and contributing to increased production costs.

$66B

Annual Healthcare Costs

Direct healthcare costs from AMR, potentially rising to $159B by 2050

67%

Increasing Resistance

Countries in East Asia-Pacific reporting increasing resistance trends in E. coli from livestock

73%

Resistant Pathogens

Foodborne pathogens currently resistant to commercially important antimicrobials

Global antimicrobial use could reach 143,481 tons by 2040, representing a 29.5% increase from 2019 baseline. Treatment costs for resistant infections may reach up to USD 55,000 per case.

Environmental Impact and Climate Connection

Livestock systems are affected by and contribute to environmental changes. Poor animal health reduces efficiency in production and increases environmental impact per unit of output. Conversely, healthy animals directly contribute to environmental sustainability.

Better animal health could reduce global GHG emissions by up to **906 million tonnes of CO_2e**, nearly doubling when combined with productivity improvements.

In the European Union, livestock activities account for about **65% of total agricultural greenhouse gas emissions**. Livestock breeding could reduce European livestock GHG emissions by up to 53.5 $MtCO_2e$ by 2029.

Climate Change: Redefining Animal Health

Climate change is exacerbating the distribution and **transmission of vector-borne diseases** such as **liver fluke**, **bluetongue**, and **Rift Valley fever**. Heat stress, modified rainfall patterns, and degraded pastures lessen animal resilience and productivity.

Degraded soils, reduced grazing areas, and water shortages further question the viability of traditional livestock systems. In Mongolia, intense grazing diminishes vegetation cover, accelerates soil exposure, and alters microclimates that threaten pasture resilience.

Improved animal health and management strategies are central to environmental and climate strategy as both mitigation and adaptation measures. Healthier animals result in fewer emissions, reduced waste, and resilient food systems.

Where We Can Go

The rise of technologies such as biotechnology, digital platforms, and data science is radically changing animal health. These advances enhance accuracy, speed, and scale of pathogen identification, facilitating early interventions and more effective resource deployment.

Examples of investing in

- High quality vaccines
- Smarter policies

Using high quality FMD vaccines: dramatic cost reductions in high-risk settings

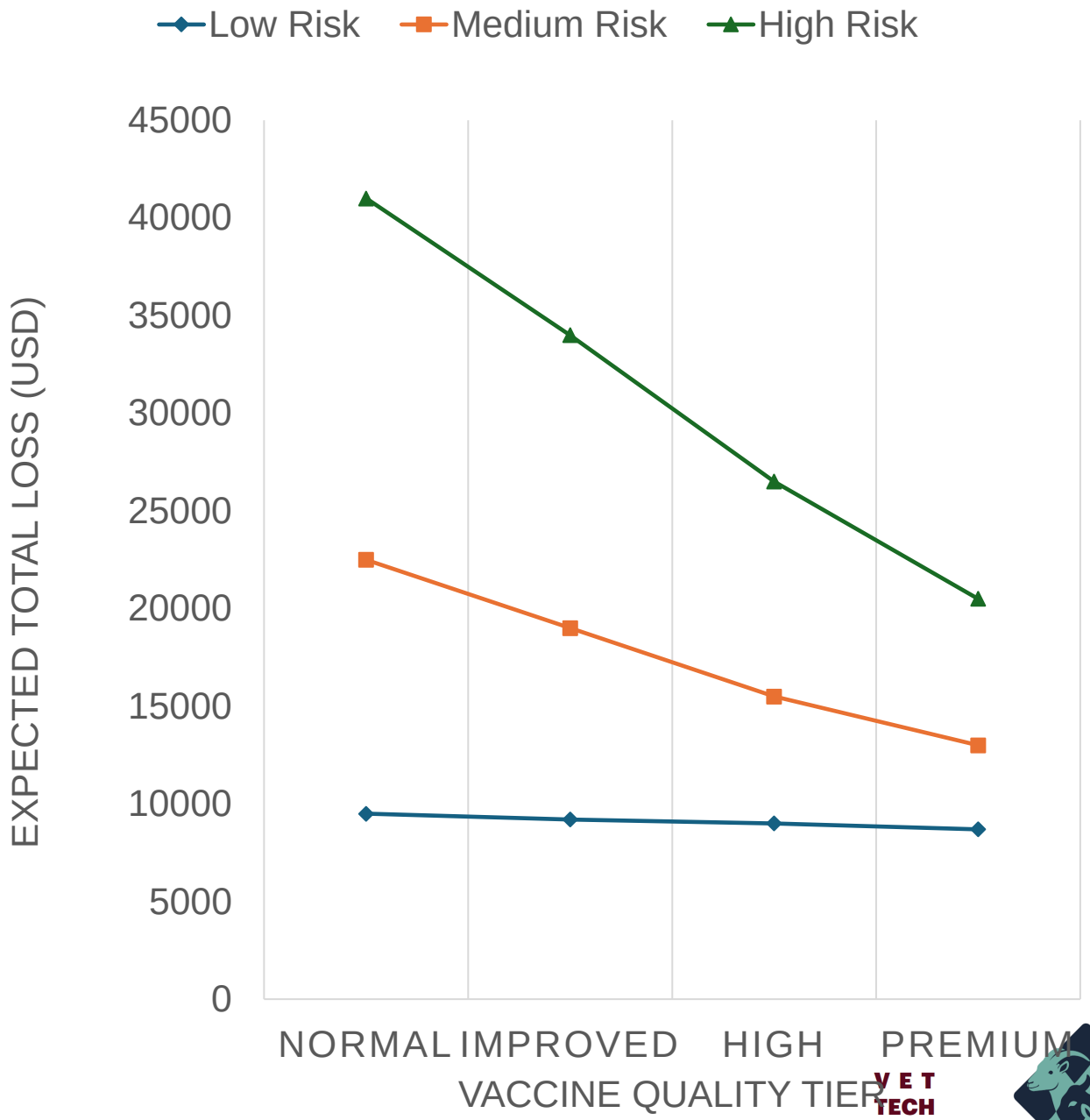
In high-risk contexts where baseline outbreak probability reaches 70%, vaccine quality dramatically influences economic outcomes.

Normal Vaccine:
$1.15 million expected total cost

Baseline scenario with standard quality

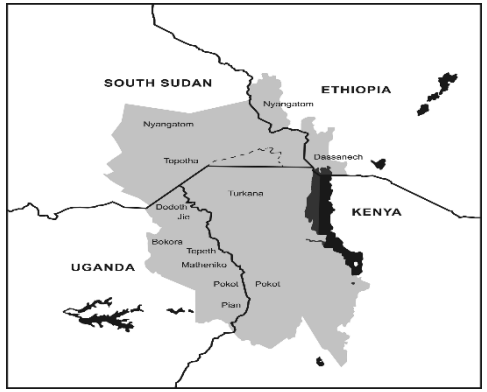
Premium Vaccine:
$0.41 million expected total cost

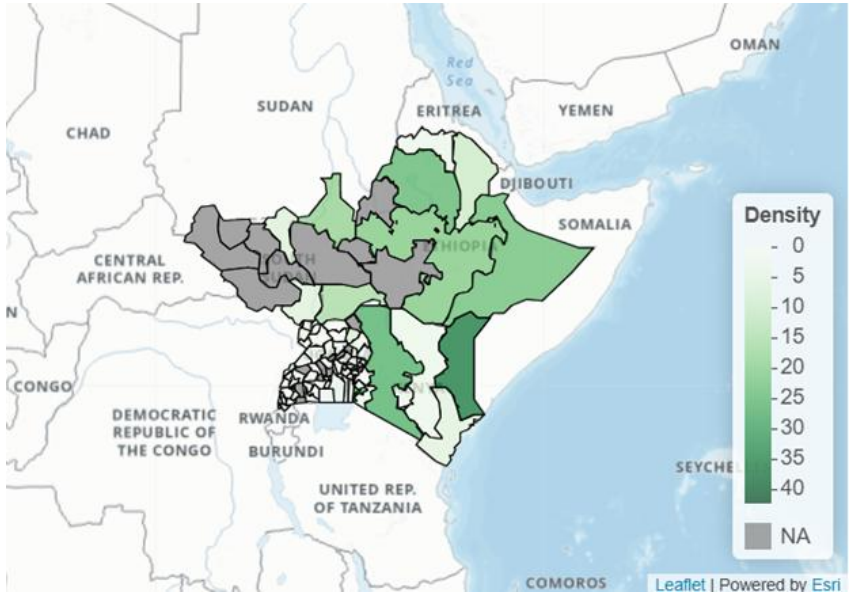
64% reduction in economic losses

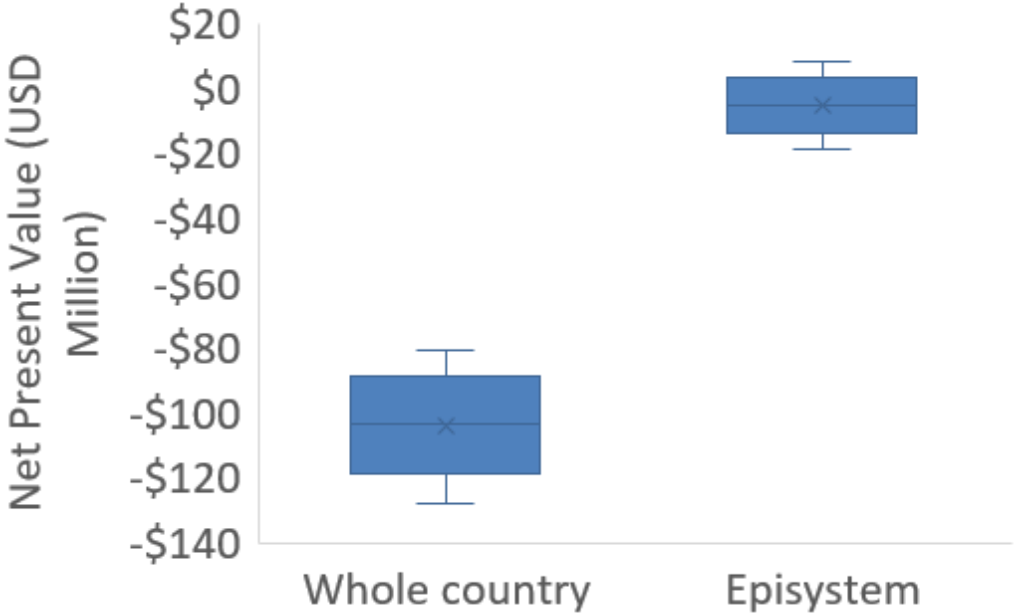


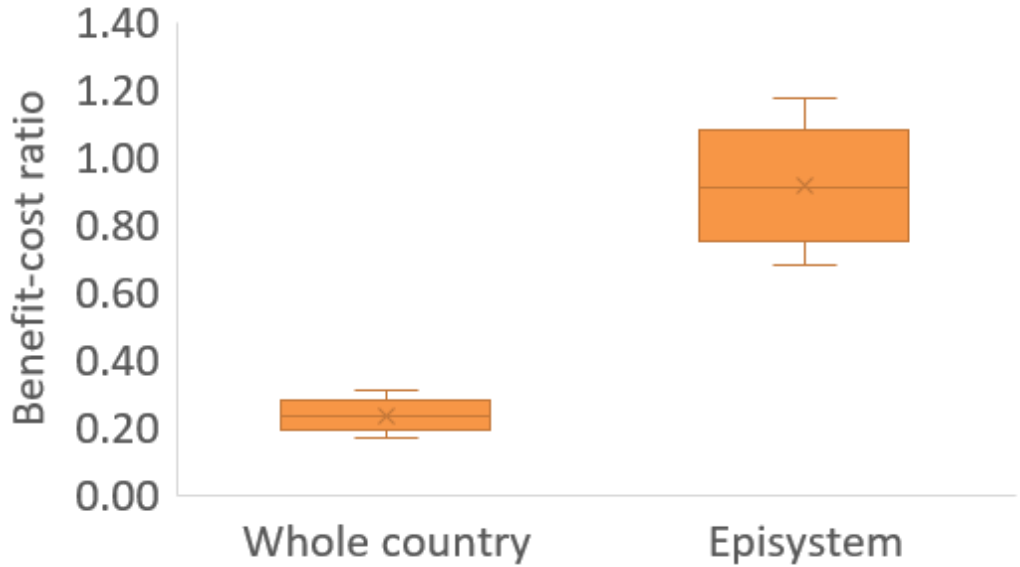
VET TECH
Empowering Livestock Health

Smarter policies: Episystem vaccination vs mass vaccination for PPR



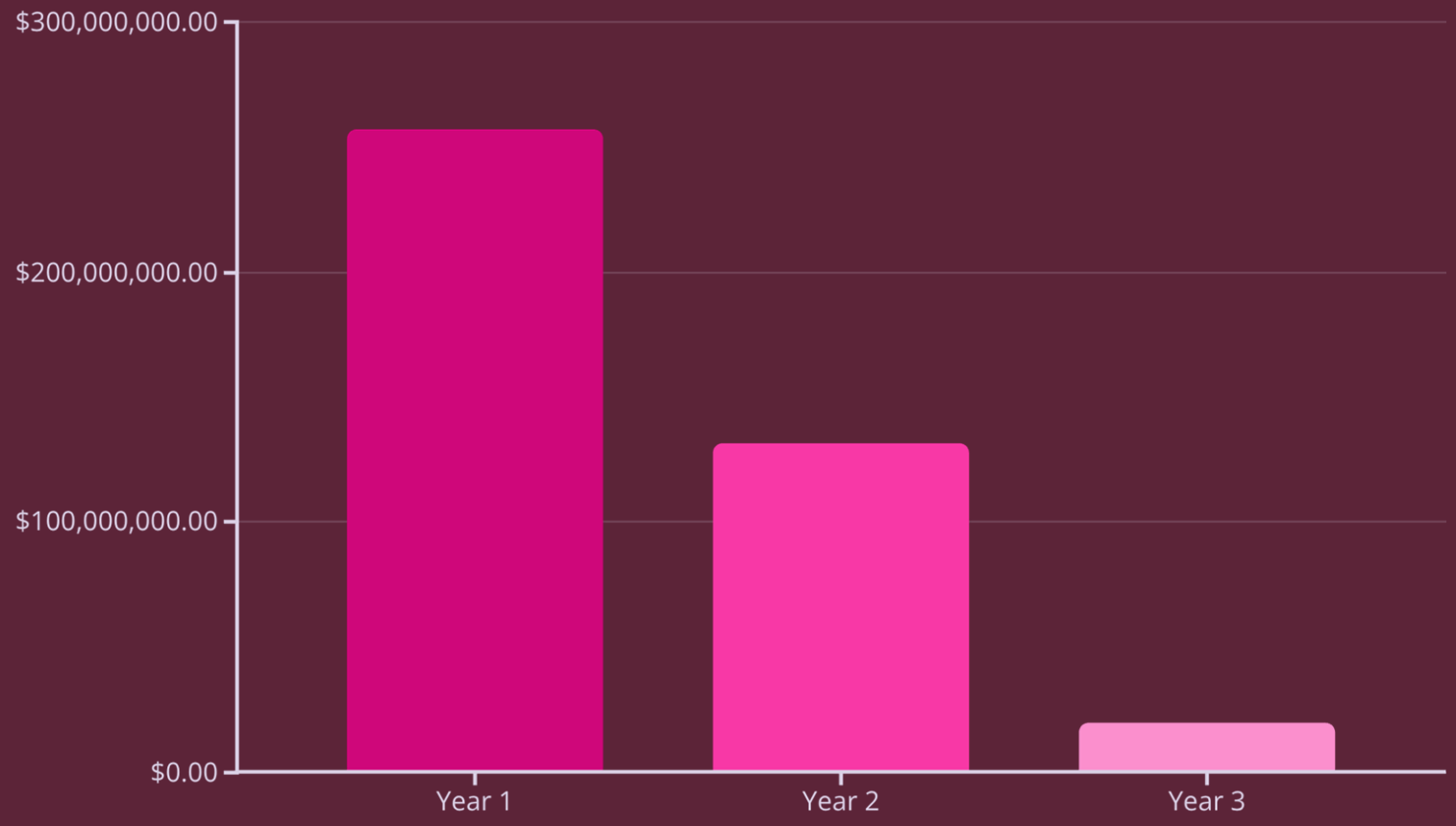






VET TECH
Empowering Livestock Health

Mass Vaccination Strategy Costs



735.7M

Animals Year 1

80% coverage target

375.3M

Newborns Year 2

100% coverage

$408M

Total Cost

Three-year campaign

Targets 42 infected African countries. Year 1 requires 809.3M doses (including 73.6M wasted), Year 2 requires 412.9M doses (37.5M wasted). Cost per animal: $0.35.

Episystem Strategy: Targeted Efficiency

$184M

Total Cost

55% reduction vs. mass vaccination

370M

Animals Targeted

44% of continental population

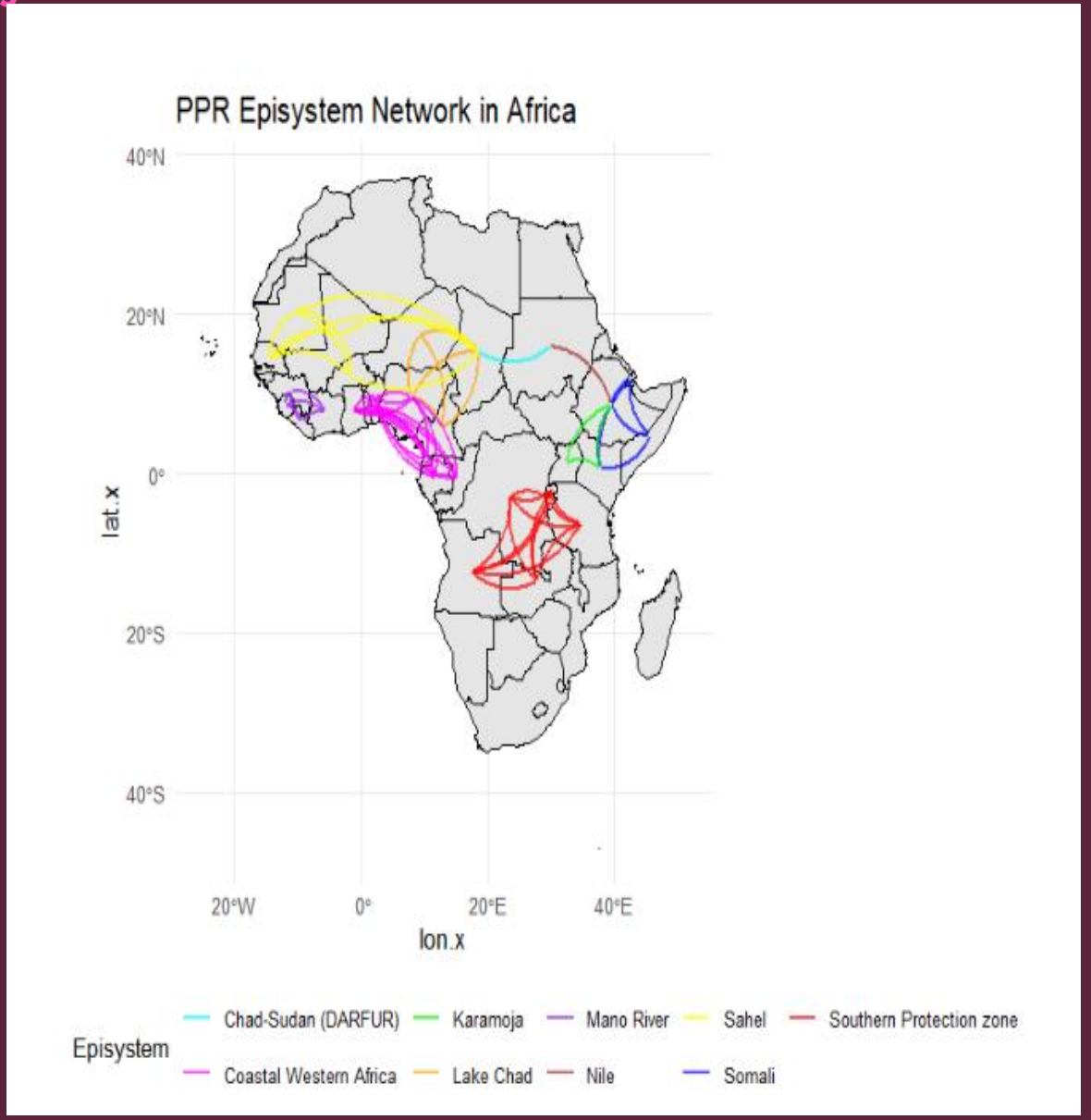
8

Episystems

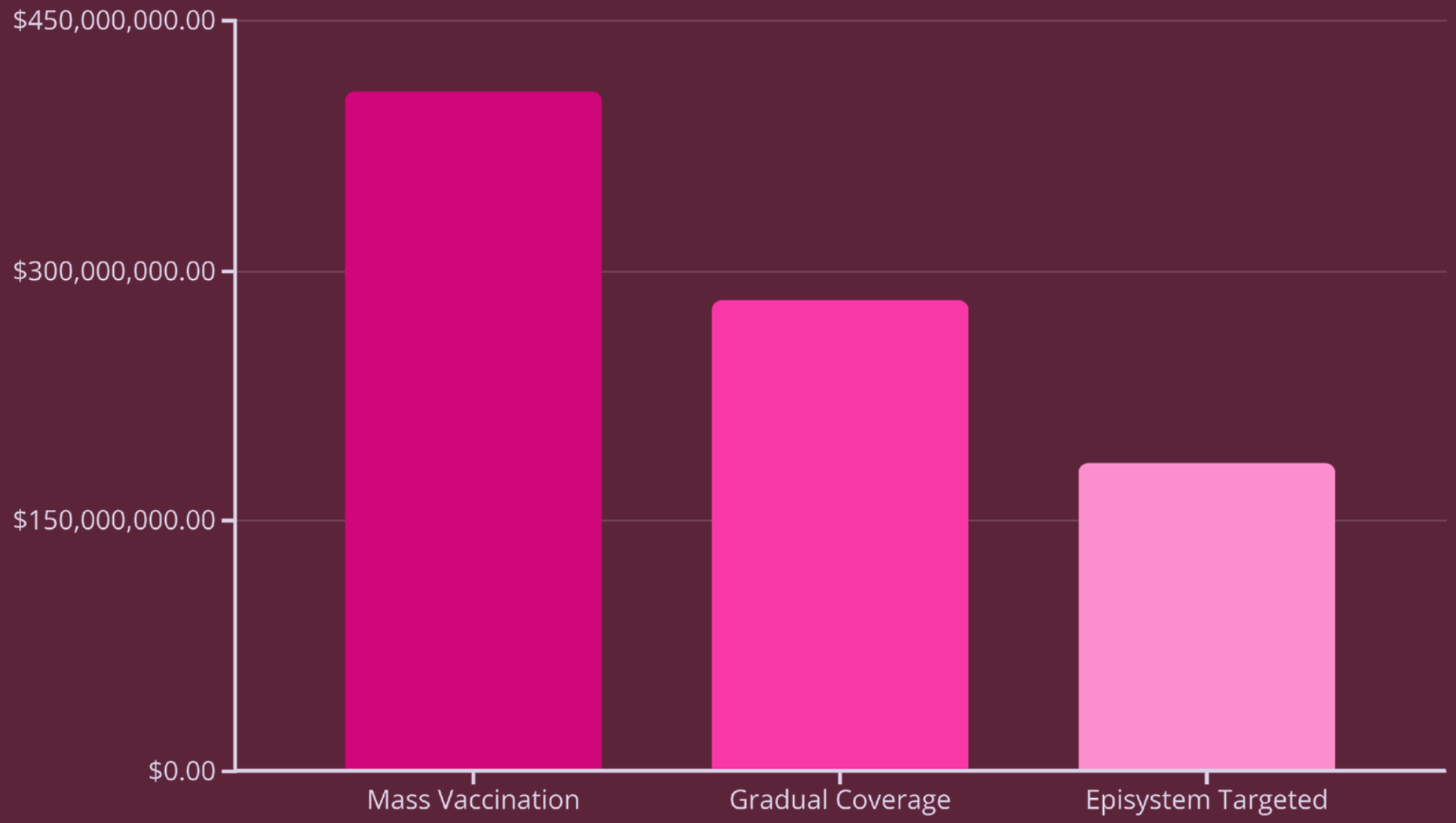
Transboundary high-risk zones

Cost Breakdown

- Year 1: $116.0M
- Year 2: $59.3M
- Year 3: $8.9M



Cost Comparison: Three Pathways



Diagnostic and Surveillance Advances

Rapid Detection Technologies

Technological progress in diagnostic platforms–from point-of-care devices to real-time PCR and portable sequencing–has substantially increased capacity to identify and respond to disease outbreaks.

Rapid laboratory confirmation leads to speedy containment and integrated monitoring systems.

AI-Enhanced Surveillance

Surveillance systems enhanced with AI and machine learning enable detection of emerging disease threats, AMR trends, and food safety incidents weeks before traditional systems.

AI-driven early-warning systems consistently outperform standard methods in early detection, accuracy, and sensitivity.

Digital Health and Precision Agriculture

Digitization allows real-time monitoring of animal health indicators, movement, and environmental variables, transforming disease management and traceability.

Electronic Identification

EID tags greatly enhance disease traceability, enabling rapid animal tracing during outbreaks and significantly reducing duration and geographic scope of diseases.

IoT Sensors

Real-time monitoring of barns with daily data on animal temperature, feeding behaviour, and activity, alerting farmers to early signs of illness or stress.

Blockchain Traceability

Digital systems increase transparency in livestock value chains, assist with food safety assurance, enable rapid recall, and support disease outbreak control.

AI-Enhanced and Community-Based Surveillance

Digital Intelligence

Modern surveillance includes AI, machine learning, and geospatial analytics to analyze huge amounts of data, identify outliers, and use predictive models for outbreak forecasting.

FAO's EMPRES-i+ platform integrates multi-sectoral data including climate, livestock, trade, and land use to detect risk patterns and support forecasting.

Community Participation

Community-owned approaches involve local actors, farmers, paraveterinarians, and community health workers in frontline detection and reporting.

FAO-supported community-based systems have produced alerts within hours of disease detection, surpassing traditional networks in speed and effectiveness.

Expanding Markets and Smallholder Inclusion

Global demand for animal-source products is increasing due to growing population, urbanization, and changing consumer preferences. While this brings economic opportunities, it highlights weaknesses in countries where smallholder production systems predominate.

Smallholder Contribution

Smallholder and backyard producers are critical in global food systems, particularly in low- and middle-income countries, but often lack access to formal veterinary services.

Market Opportunities

Increased demand presents opportunities for market-oriented production, but deficits in veterinary services, biosecurity, and infrastructure hinder disease prevention and market inclusion.

Strategic Investment

Investment in quality vaccines, cold chains, and transport can raise productivity, reduce disease incidence, and create new market possibilities for smallholders.

Decision-Support Tools for Evidence-Based Planning

Operational Tools

- **EuFMDiS model:** Scenario-based simulations for contingency planning and response strategies
- **OutCosT tool:** Estimates economic costs of disease outbreaks, capturing direct and indirect impacts
- **RVF-DST:** Early warning decision support for Rift Valley Fever using habitat modeling
- **VADEMOS:** Vaccine demand estimation model systems to forecast increasing demand for veterinary vaccines

Policy Assessment

- **CAPRI model:** Assesses impacts of policy and natural shocks on land use, emissions, and markets
- **GLEAM:** Evaluates impacts of health interventions on emissions and resource use
- **ROI analyses:** Demonstrates value of integrated One Health systems

Sustainable Financing and Public-Private Partnerships

Longstanding investment shortfalls in animal health undermine surveillance, slow outbreak response, and undermine long-term disease control. As cautioned by Tisdell (1995), "the most costly animal health policy is that of long-term under-investment."

$2B

PPR Eradication Cost

Considerably less than ongoing annual losses from outbreaks

100+

PPP Initiatives

WOAH's PPP database charts over 100 effective partnership models

14:1

Return on Investment

Integrated One Health investments can yield returns as high as 14:1

Public-private partnerships (PPPs) provide a mechanism to bridge investment deficits through pooled resources and efficient delivery. Examples from Ethiopia and Botswana demonstrate how PPPs can scale up access and impact in smallholder systems.

Global Frameworks for Coordinated Action

Several strategic frameworks have been developed to support global initiatives, coordinate national priorities, and promote cross-sectoral cooperation in animal health.

Sustainable Livestock Transformation

FAO's initiative for increased productivity, equity, and environmental sustainability in livestock systems

GF-TADs

Global Framework for Progressive Control of Transboundary Animal Diseases, addressing FMD, PPR, ASF, HPAI, and Rinderpest

Quadripartite

FAO, WOAH, WHO, and UNEP collaboration for integrated One Health governance

The Path Forward: A Call to Action

Global Partnership Programme for

Transboundary Animal Diseases

(GPP-TAD)

Objectives

- **Achieve national, regional and global progress in the prevention and control of TADs** through locally owned, science-based action and enhanced cooperation.

- **Protect animal, human, and ecosystem health and businesses and investments** by improving capacities to monitor and reduce animal disease risks along value chains.

- **Mobilize collective investment** — uniting governments, the private sector, and partners to finance innovation and position TADs management as a global public good.

A new way of working

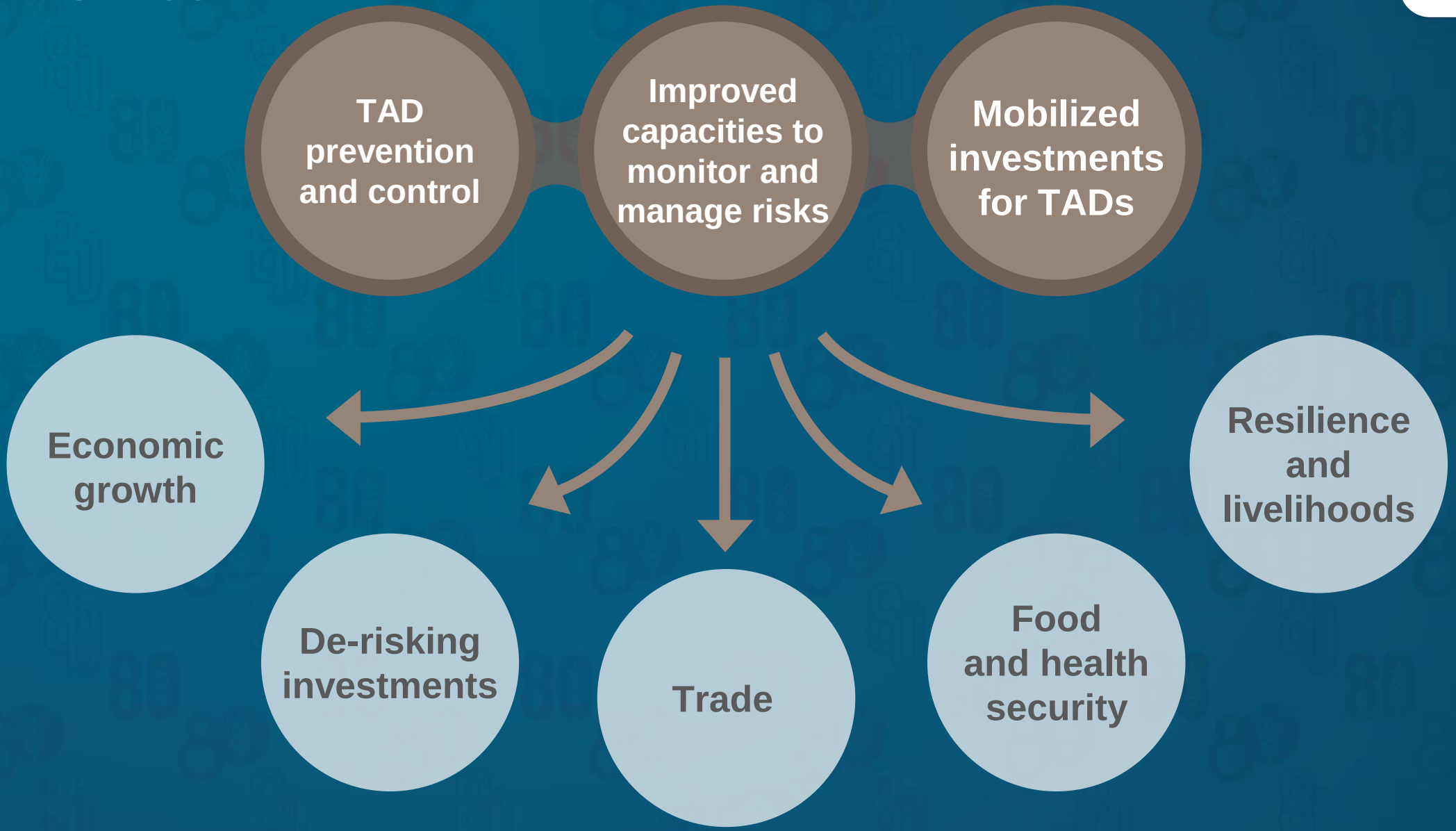
BEFORE:

- Dependent mainly on one single donor
- Donor-driven
- FAO = implementing force
- Disconnected from the private sector and other stakeholders

NEW 4-year programme:

- Country-driven & country context-specific
- Countries implement *(with technical support by FAO and implementing partners)*
- Multi-partners
- In partnership with producers, private sector & financial institutions

Benefits


TAD prevention and control
Improved capacities to monitor and manage risks
Mobilized investments for TADs
Economic growth
De-risking investments
Trade
Food and health security
Resilience and livelihoods

Country-owned, country-led

COUNTRY

REGIONAL

GLOBAL

Center of Excellence *(National Partnership Platforms for TADs)*

REGIONAL HUBS

GLOBAL COORDINATION, INTELLIGENCE, POLICY & CAPACITY

- Country-led implementation
- Early warning, surveillance & lab capacity
- Prevention, preparedness, vaccination & emergency response
- Co-investments & leverage other resources
- Adoption of new technologies & innovations for TADs (Artificial Intelligence)

- Information sharing
- Regional coordination
- Partnerships & Innovation

- Matchmaking
- Provider of last resort *(in crisis)*

Regional Centre of Excellence for Animal Health

Partnership Opportunity Under GPP-TAD

Transboundary animal diseases like Foot-and-Mouth Disease, Highly Pathogenic Avian Influenza, and Rift Valley Fever continue to spread across regions with increasing speed, crossing borders and disrupting trade. FAO's Global Partnership Programme for Transboundary Animal Diseases (GPP-TAD) is a country-led initiative supporting early warning, prevention, stronger laboratories, and coordinated regional action.

Global Partnership Programme for Transboundary Animal Diseases (GPP-TAD)

A customizable service package for FAO's Members and stakeholders

- **Boosts food and health security**
- **De-risks investments and offers protection from shocks and severe impacts on trade, GDP, and livelihoods**

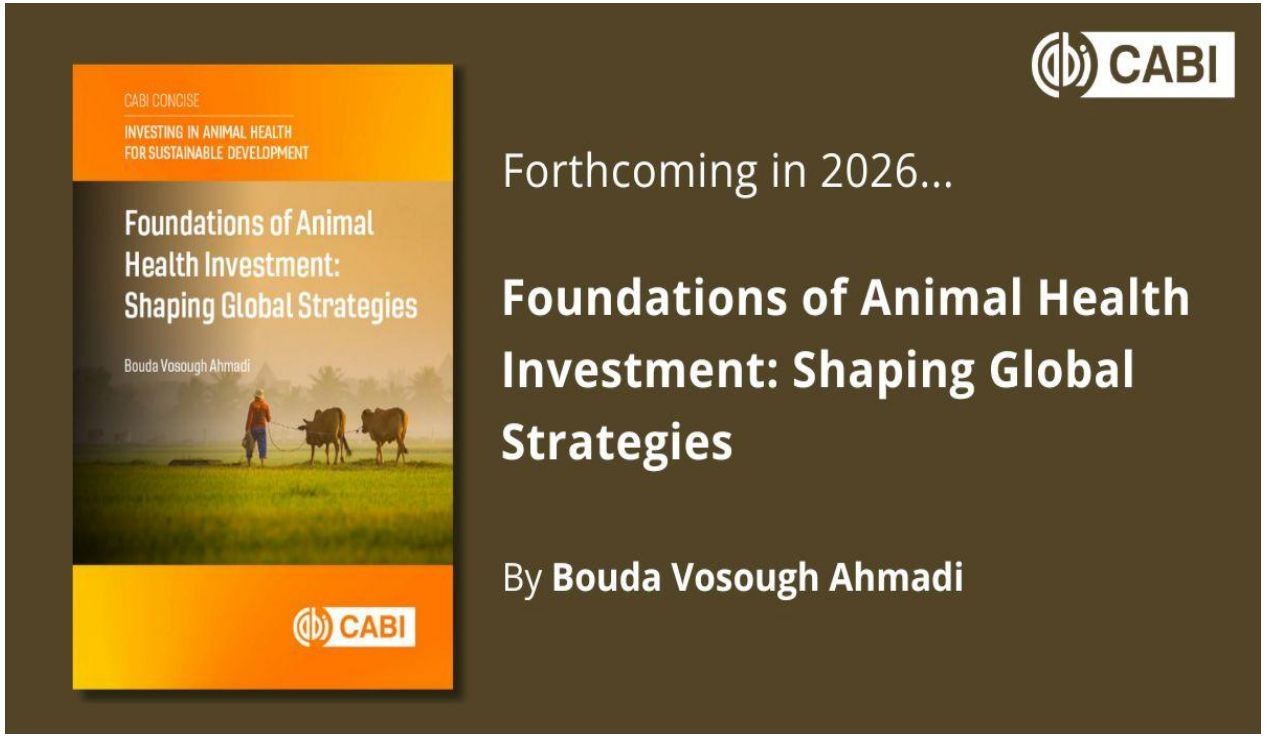
Country-owned and led

Participatory fee structure *(pay to access)*

Private sector engagement & investment

Strategic Capabilities & Future Collaboration

- Epi-Economic & investment insights for stronger animal health systems
- Evidence-based modelling and decision-support tools
- Linking disease impact, ROI, and strategic policy options
- Global experience across regions and sectors
- Upcoming CABI book: Foundations of Investment



VET TECH
Empowering Livestock Health

Thank you!

Bouda.Ahmadi@fao.org
Boudava@gmail.com

VET TECH
Empowering Livestock Health