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Lessons in Working Towards Global Eradication of Peste des Petits Ruminants (PPR)

Sheep grazing, Georgia. Tinatin Jabanashvili.

December 2, 2020

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SPEAKERS

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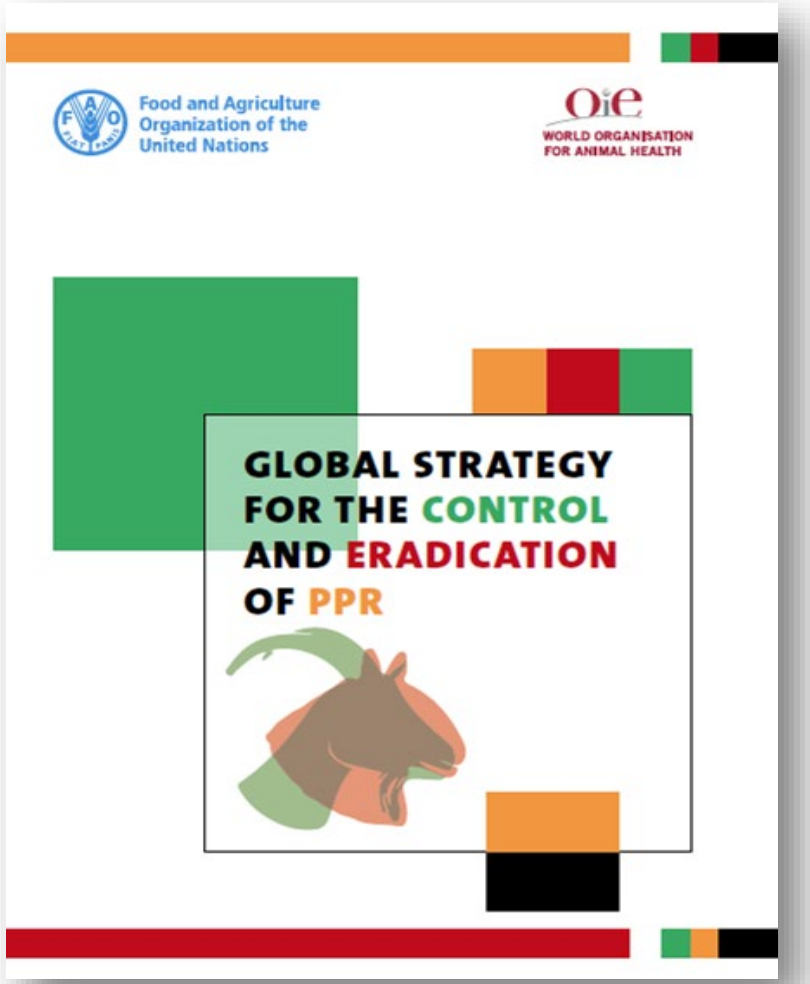
Peste des Petits Ruminants Global Eradication Programme (PPR GEP)

FAO/OIE PPR Secretariat

F Njeumi

Programme coordinator

PPR Control and Eradication Strategy (PPR GCES)



Adopted in **April 2015**

Objectives:

- Eradicate PPR by 2030
- Reinforce Veterinary Services
- Reduce the impact of other major infectious diseases of small ruminants

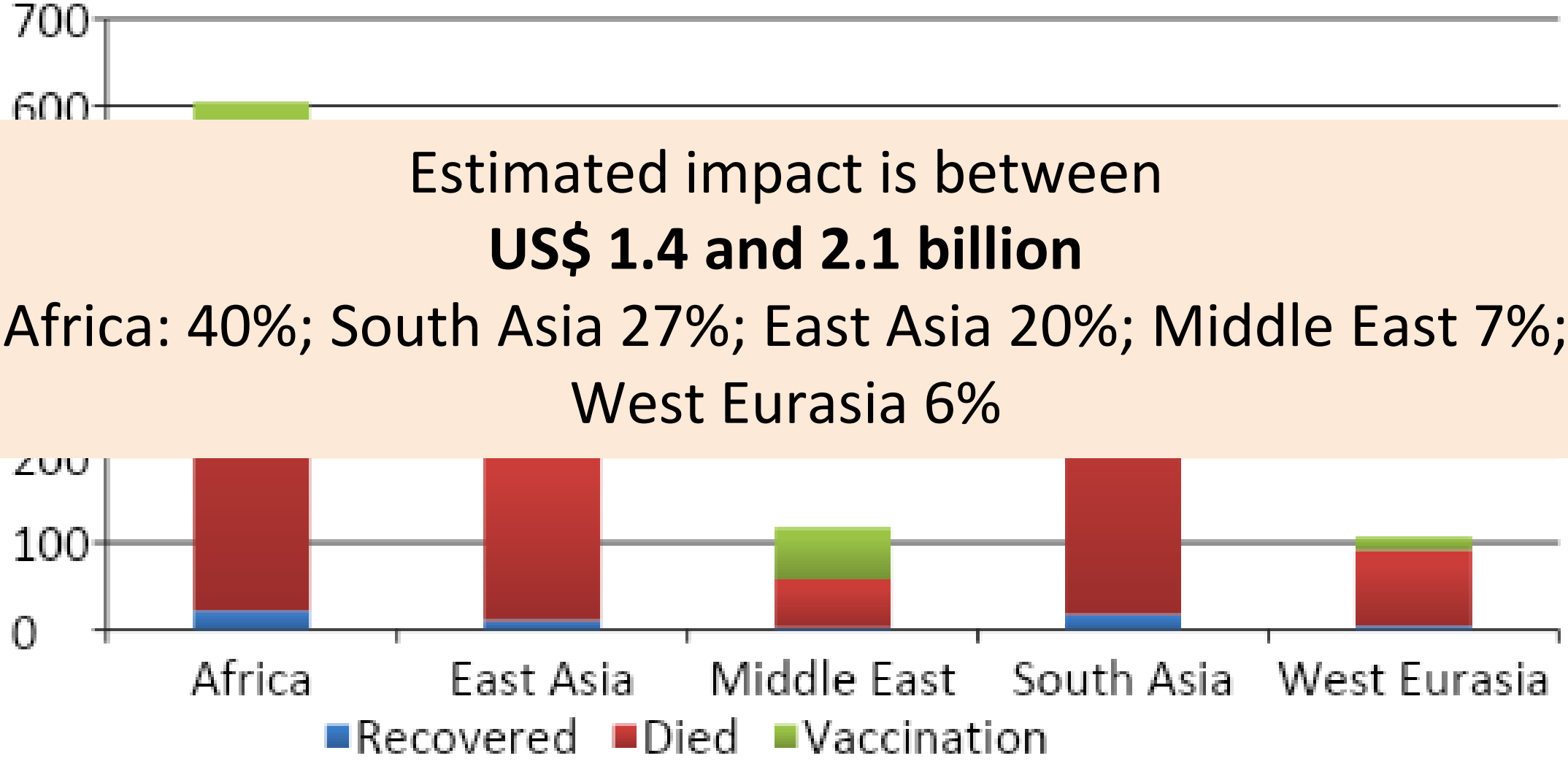
… and then contributing to

- Fighting rural poverty
- Ensuring food security and nutrition
- Strengthening resilience and national economies

… and achieving the **SDGs**.

Estimated global impact of PPR

Estimated impact is between
US$ 1.4 and 2.1 billion
Africa: 40%; South Asia 27%; East Asia 20%; Middle East 7%; West Eurasia 6%



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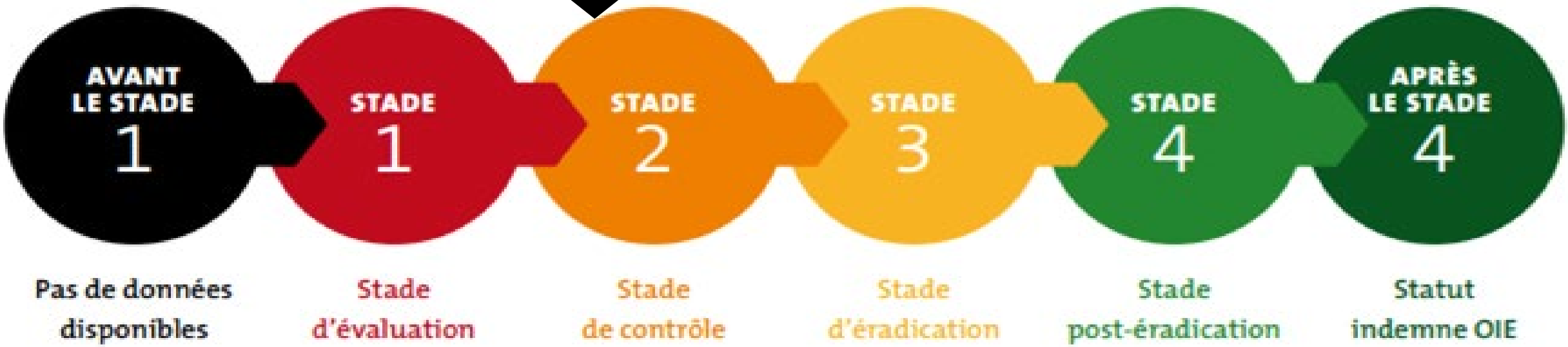
vaccine & vaccination

Live combined vaccine SPV+PPR

Inactivated vaccine PPR

Recombinant vaccine GPV-PPR

Recombinant vaccine NDV-PPR



1.5 billion doses of vaccines need between 2017 and 2021

Overall status to date

- **58 countries** with OIE PPR-free status + 1 son zonal basis (Namibia)

Argentina
Australia
Austria
Belgium
Bolivia
Bosnia and Herzegovina
Botswana
Brazil
Canada
Chile
Chinese Taipei
Colombia
Croatia
Cyprus
Czech Republic
Denmark
Ecuador
Estonia
Eswatini
Finland[26]
France[27]
Germany
Greece
Hungary
Iceland
Ireland
Italy
Korea (Rep. of)
Latvia
Liechtenstein
Lithuania
Luxembourg
Madagascar
Malta
Mauritius
Mexico
New Caledonia
New Zealand
Norway
Paraguay
Peru
Philippines
Poland
Portugal[28]
Romania
Singapore
Slovakia
Slovenia
South Africa
Spain[29]
Sweden
Switzerland
Thailand
The Netherlands
United Kingdom[30]
United States of America[31]
Uruguay

- **79 countries** engaged in the Regional Roadmap:

Stage	1	2	3	4
Number of countries	30	38	5	6

61 Countries at risk of the target 198 countries for freedom by 2030

PPR Vaccine Producers Meeting

- **3rd PPR Vaccine producers held in Amman, Jordan, April 2019**
  - Meeting organized in collaboration with the Veterinary Services of Jordan and JOVAC
  - Adopted recommendations include:
    - Vaccine manufacturers comply with OIE standards
    - Batches of PPR manufactured vaccines be submitted to AU-PANVAC for external quality control and international validation
    - AU-PANVAC strengthen its capacity to meet the increasing demands for international quality control of PPR vaccines
    - FAO and OIE continue their discussions with donors, countries, laboratories and regional organizations in Asia, for the possibility to establish a vaccine quality control laboratory in Asia

Rome meeting in 2017 recommended Temperatures for thermotolerance test

- The vaccines should be placed at any of the three temperature conditions for the determination of thermotolerance i.e. 2-8oC, 25oC or 40oC.
- Rapid evaluation of vaccines by AU-PANVAC to be carried out at 40oC
- All titrations should commence at day zero in the first instance
- Subsequently the titrations should be carried out on days 1, 2, 3, 4 and 5.
- Generally titrations should be carried out at approximately same period everyday
- The period of testing can be extended if there is a need for further information

Storage	Standard cold chain	Room	Field
Temperature	2 – 8° C	25° C	40° C
Period	2 years	10 days	5 days

Main messages

- There are multiple thermostabilization methods that have been applied during the improvement of the traditional vaccine.
- This panel will discuss a few including the method used successfully for the Rinderpest vaccine, which may be referred to by multiple names including the ILRI protocol and Thermovac. Another method discussed today is called Xerovac.

Thank you!

http://www.fao.org/ppr/en/

PPR-Secretariat@fao.org

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Peste des Petits Ruminants (PPR) Vaccine Associate Award

Jeffrey Mariner & Saskia Hendrickx
Feed the Future Innovation Lab for Livestock Systems
Photo credit: FAO, ILRI & LSIL

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MERCY CORPS Tufts UNIVERSITY ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE CGIAR UF IFAS UNIVERSITY of FLORIDA

Introduction to the project

Duration: 4 years (February 2017-February 2021)

Target countries: Uganda (Karamoja region) and Kenya (Turkana and West Pokot county)

Main implementing partners:

- Cummings School of Veterinary Medicine, Tufts University
- Mercy Corps
- Makerere University in Uganda
- Kenya Agricultural and Livestock Research Organization (KALRO)
- National Authorities in Kenya and Uganda

Introduction to the project (2)

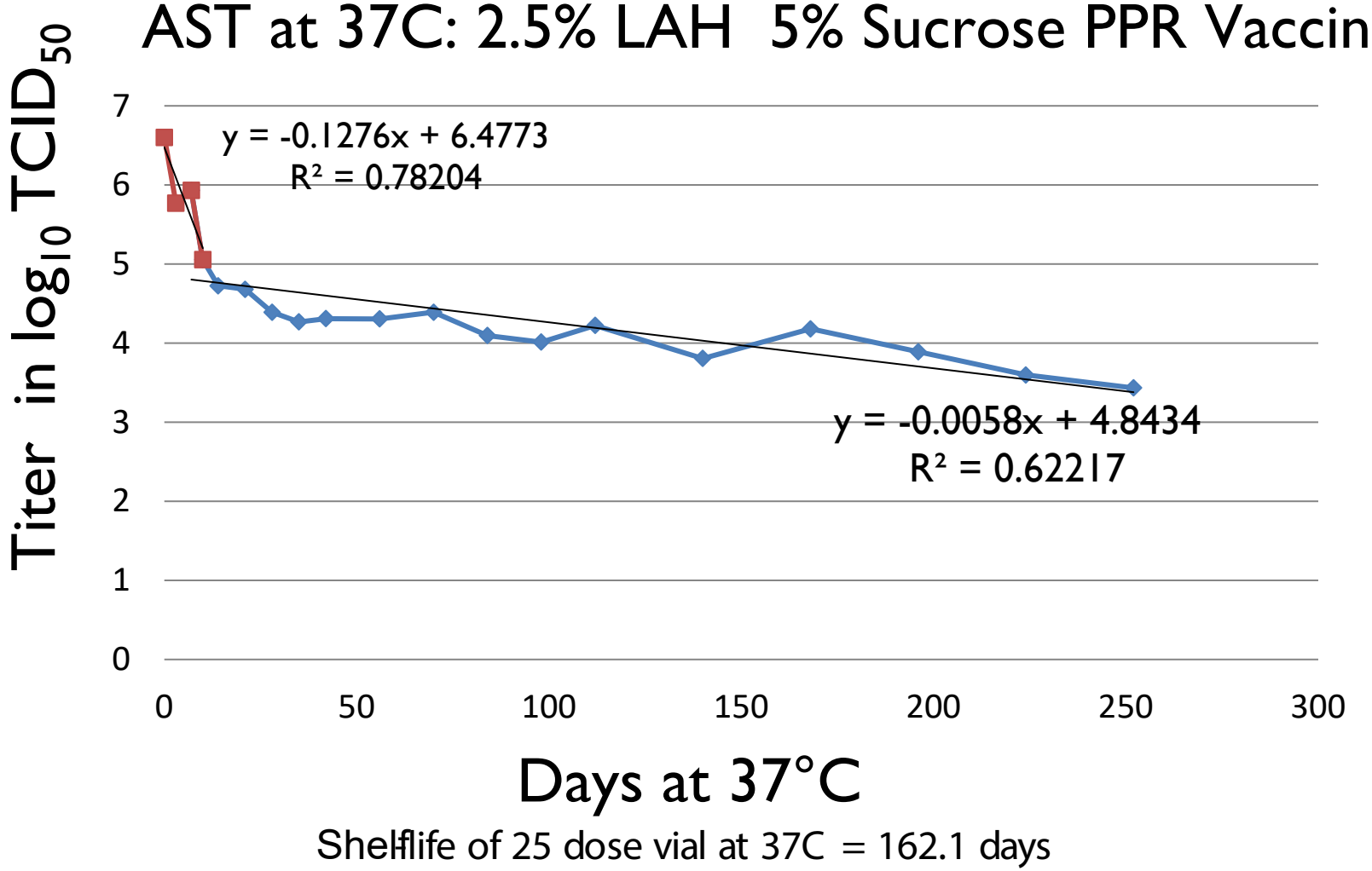
The purpose is to assess innovative approaches to PPR control using a thermostable PPR vaccine and to build capacity to scale the vaccine across a broad region where the disease is endemic.

It will pilot tools and approaches that build on the lessons from rinderpest eradication and measure their impact:

1. Commercial access to thermostable vaccine
2. Appropriate delivery mechanisms based on Public-Private-Community partnership suited to todays environment,
3. Epidemiology assessment using participatory epidemiology, surveillance and genomics to identify critical points in the maintenance of PPR to target interventions to where they will have the greatest impact.

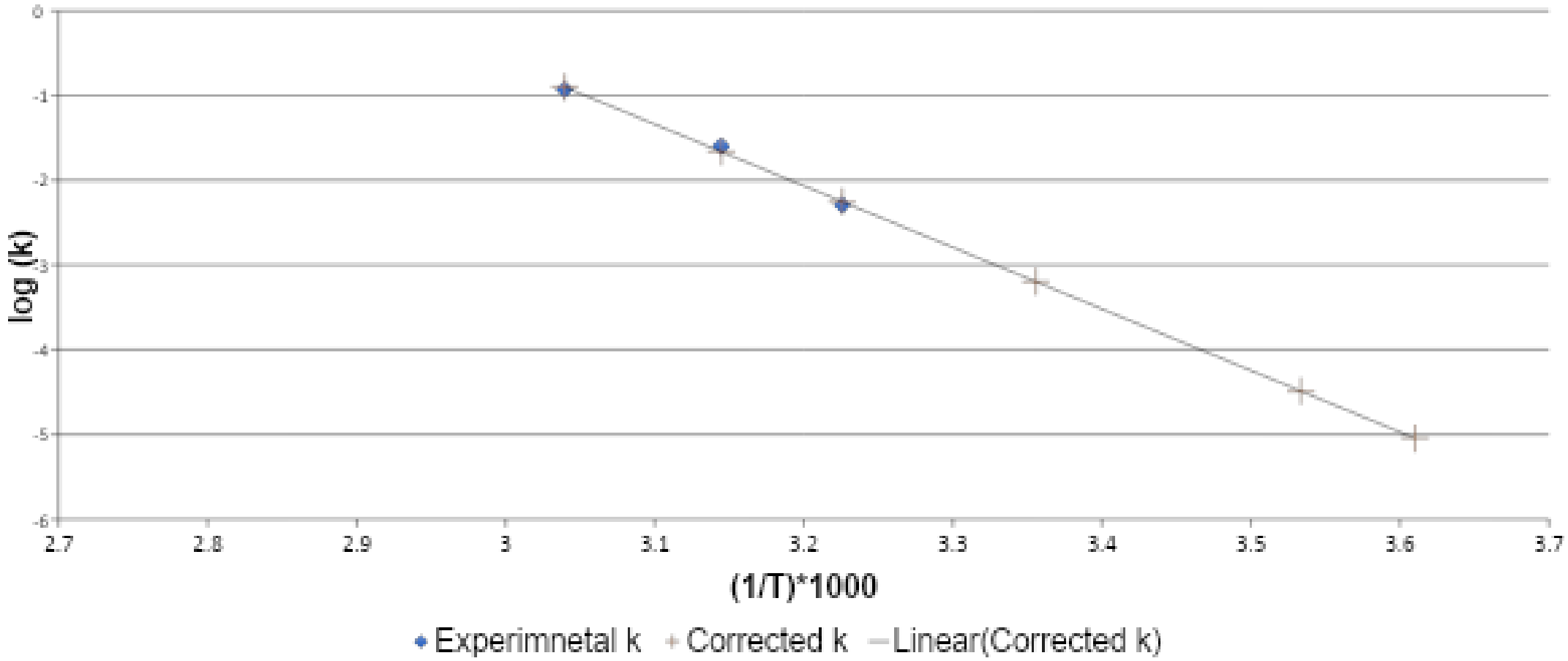
The Vaccine

- The RP Thermovac process has now been applied to Nigeria 75/1 PPR vaccines
- This thermostable PPR vaccine, produced as a practical 25 dose vial, has a shelf life of up to 5 months at 37°C under laboratory conditions
- Suitable for use in the field without a cold chain for up to 30 days
- The Thermovac PPR is now commercially available from Hester Biosciences Nepal in 25, 50 and 100 dose presentations.



Shelflife of 25 dose vial at 37C = 162.1 days

Arrhenius Plot: Degradation Constants for Batch 5 Between 5 to 64C

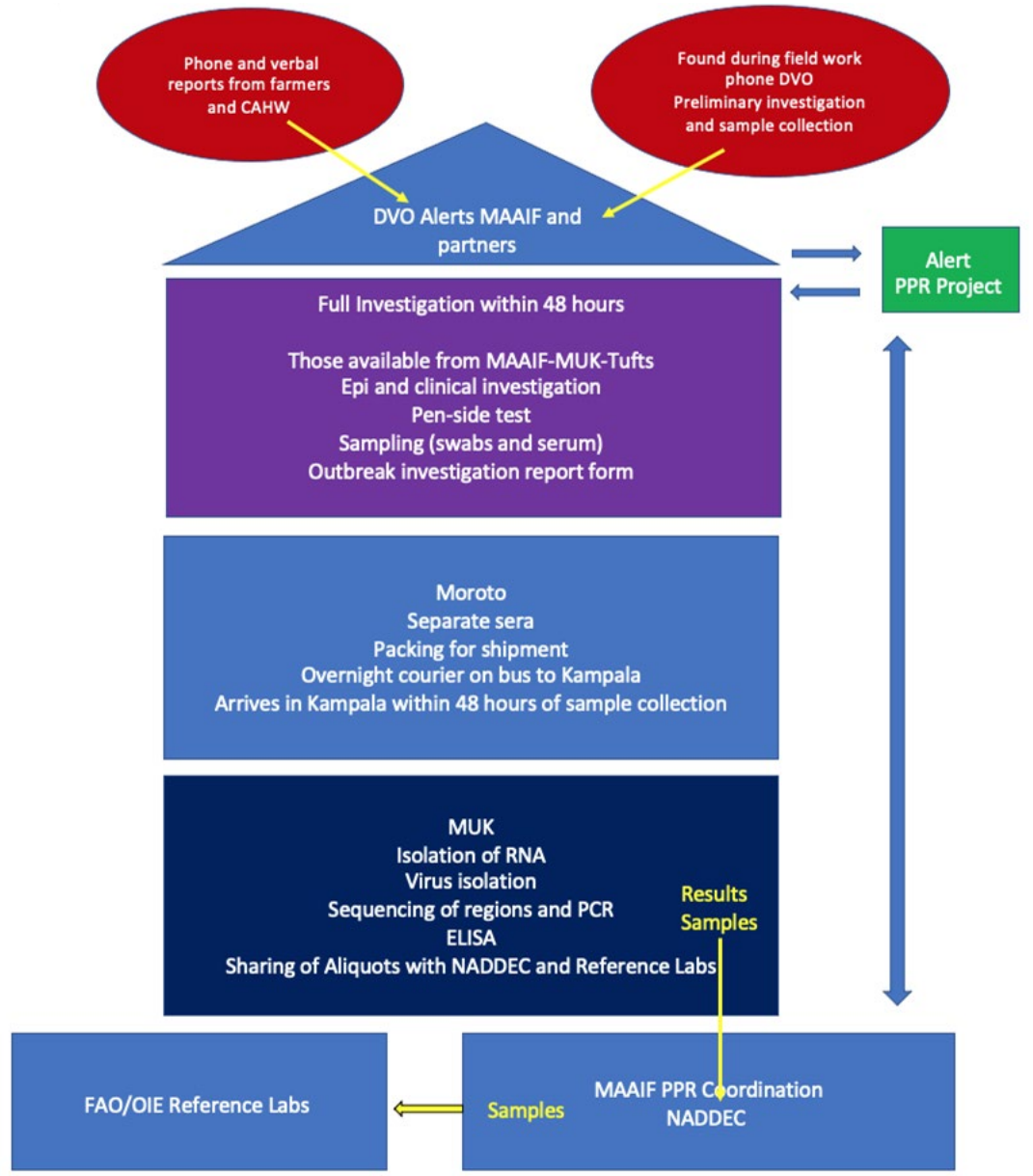


The Business Model

- Designed by dialogue of veterinarians, CAHWs and Kraal Leader
- Private distribution hubs working with CAHWs
  - No cold chain at hub or in field
  - Transport by motorbike
- Incentives to drive coverage
  - Vouchers distribute farmers
  - Farmer pays 100 UGX per head and hands over voucher
  - CAHW turns over voucher to hub and receives additional 150 UGX per head
  - Hub turns in voucher and receives 200 UGX per head
- Public sector and community validate coverage
- Project implements and tests by measuring impact

Epidemiological Targeting

- Syndromic surveillance using SE definitior
  - Disease reporting
  - Participatory surveillance
- Participatory risk mapping
- Serosurveillance and vaccination data
- Genomic analysis
- Targeting plan

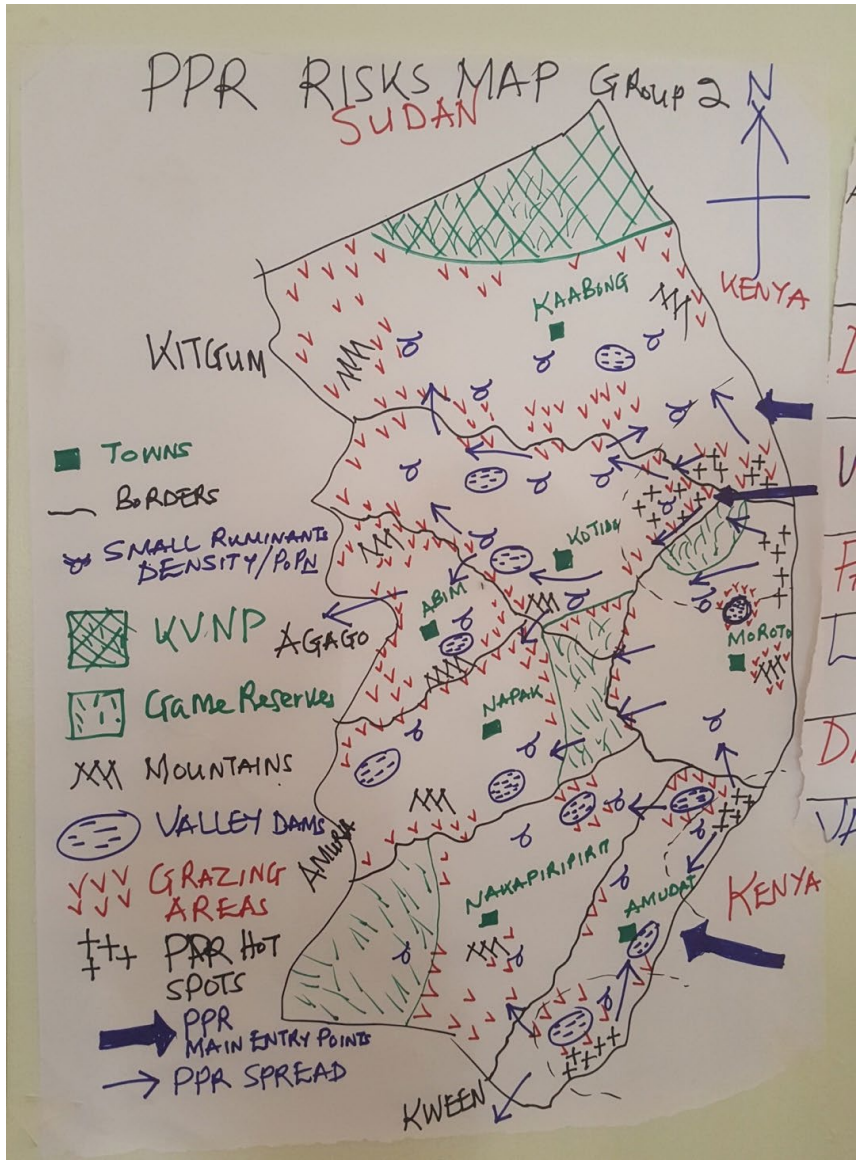


Surveillance Flow Diagram

Risk mapping

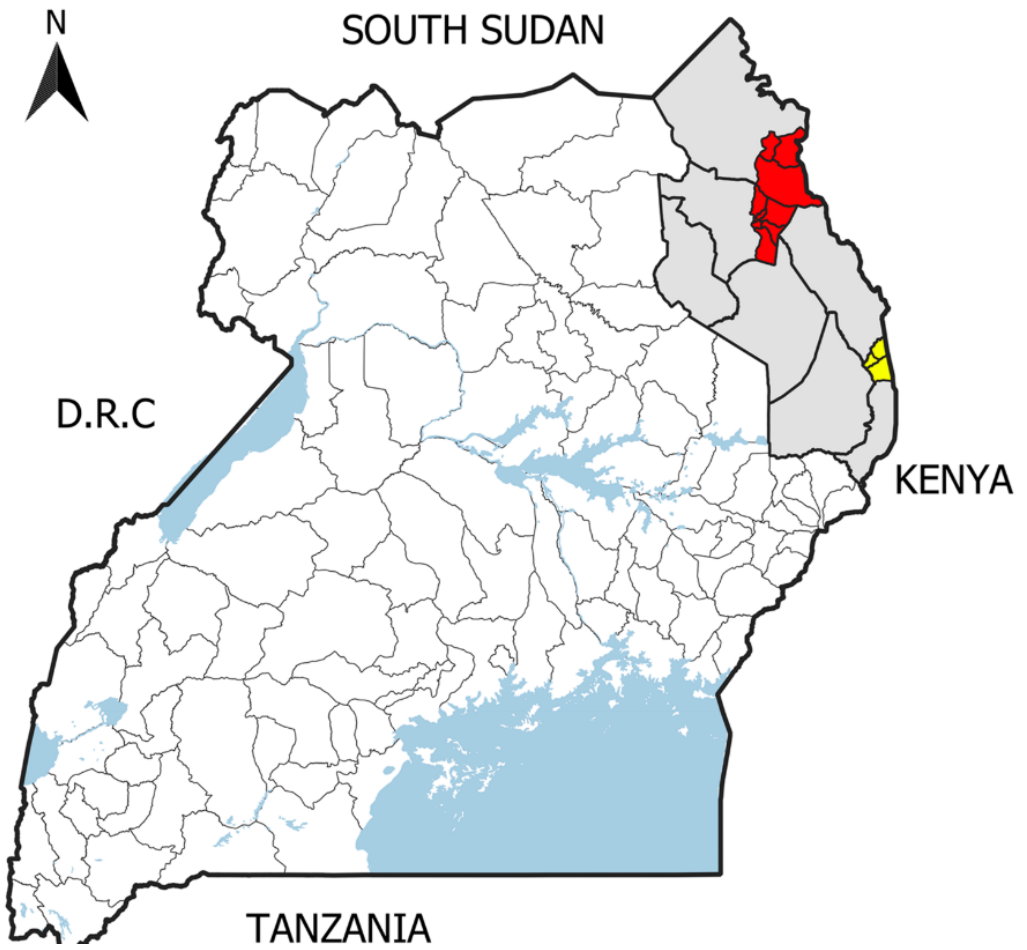
- Focus group of key informants on the ground
- Interactive list risk factors
- Groups map risk factors
  - Like layers in a GIS
- Exam the patterns and areas of intensity of risk

PPR Risk Map for Karamoja



Surveillance results

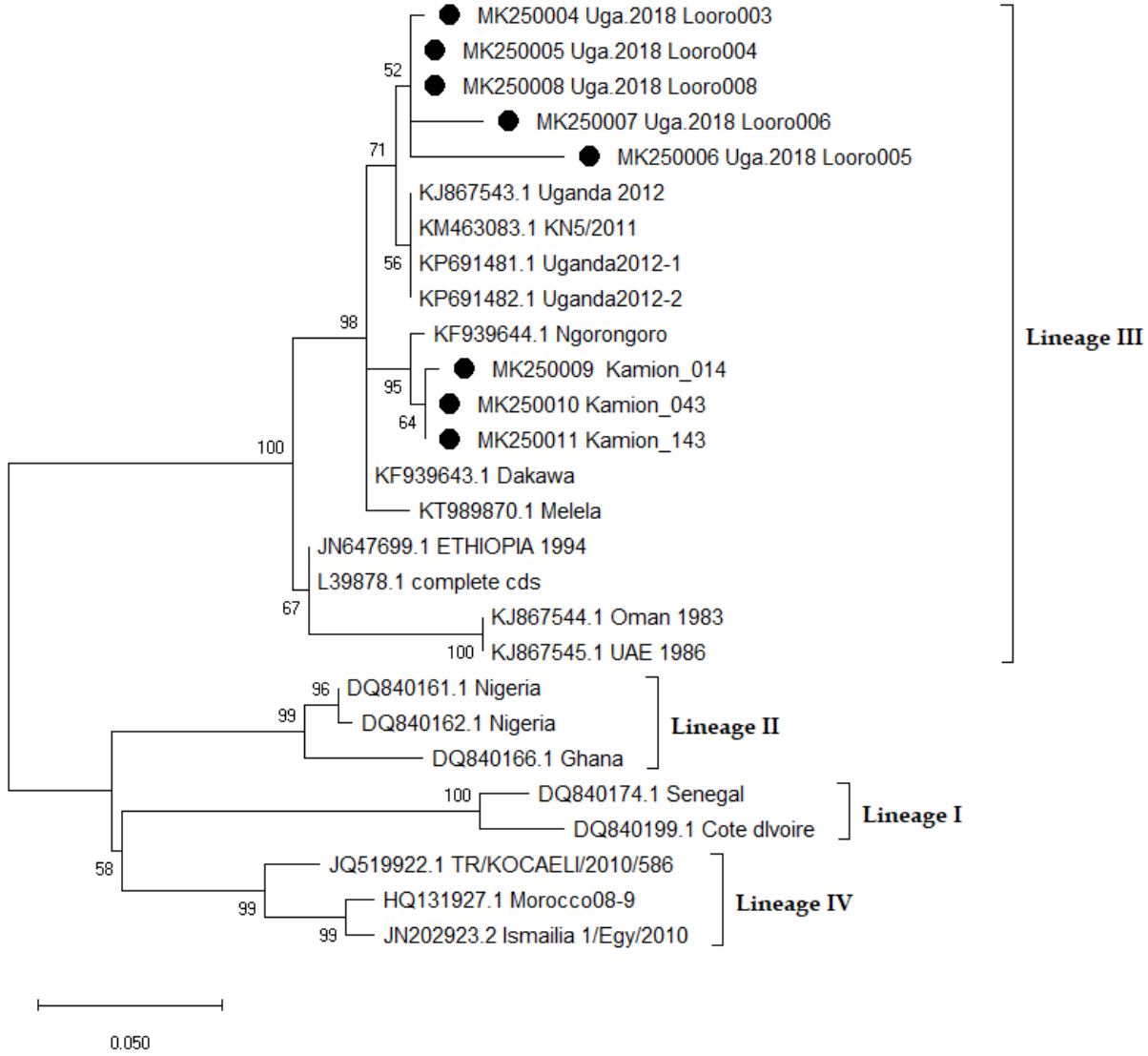
- Since 2018:
  - 3 outbreaks detected in 2018, investigated, sampled, diagnosed and genetically analyzed
- 2 separate genetic clusters more closely related to virus nucleotide sequences from Kenya than to each other
- Separate systems in one pastoral area separated by about 1000-2000 km



Sequencing results

The northern subclade (b) was more closely related to KF939644.1 Ngorogoro than to the southern Karamoja focus.

The southern focus grouped with KM 463083.1 KN5/2011, an isolate from Turkana Kenya, and KP691481.1 Uganda 2012 and KP691482.1 Uganda 2012 which originated from Kotido in 2012 in lineage III subclade a.



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The Future

- PPR Delivery without cold chain in the field
- Up to 30 days shelf life in the field
- Use 30 within days or destroy
- No compliance problems anticipated with the 30-day limit on the use
- A PANVAC Standard for thermostable vaccines used with a reduced cold chain
- Current PANVAC standard insufficient to enable systems that can enhance vaccine access and reduce delivery costs


PAN AFRICAN RINDERPEST
VETERINARY DEPARTMEN
EEC GRANT
06/12/2010

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Production and delivery of thermotolerant vaccine against peste des petits ruminants in the Sahel : case of a successful Public -Private - Partnership in Mali

Michel Dione[1], Cheick Sidibe[2], Oumar Kanta[2], Iddo Dror[1] and Abdou Fall[1]
[1]International Livestock Research Institute, Dakar, Senegal
[2] Central Veterinary Laboratory, Bamako, Mali

Lessons in Working Towards Global Eradication of Peste des Petits Ruminants (PPR)

USAID Webinar, Dec 02, 2020

Photo credit: Michel Dione, ILRI

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CGIAR RESEARCH PROGRAM ON Livestock

ILRI INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

What solutions are available to control PPR?

Current effective vaccines (Nigeria 75/1 and Sungri strains)

- ✔ Vaccines induce long-lived immunity
- ✔ Vaccines are safe

Thermotolerant vaccines (technology available but not used)

- ✔ Advantage for remote and high temperature areas
- ✔ Reduce delivery cost (cold chain)

Test new vaccination strategies

Picture credit: Bryony Jones

How do we produce, test, commercialize and promote wide scale use of the vaccine?

- Many attempts to find ways to stabilize the vaccine for use in areas with high temperatures.

- 2015 – USAID grant to improve productivity of ruminant livestock in Mali for growth in income and food security : FTF MLTSP

- Key Objective: reduce disease burden in ruminant livestock such as PPR through vaccination:
    1. Develop Thermostable PPR vaccine and
    2. Increase vaccination coverages for PPR, CBPP and ovine Pasteurellosis

How do we produce, test, commercialize and promote wide scale use of the vaccine?

Develop a strategic partnership with private sector for technology transfer between:

- ILRI
- Laboratoire Central Vétérinaire, LCV, Mali
- Hester Biosciences Ltd, India

How do we produce, test, commercialize and promote wide scale use of the vaccine?

Recipes of the three PPR vaccines produced at LCV

Designation	LCV classic (Thermolabile)	Xerovac (thermotolerant) ref. *Worrall et al. 2000*	ILRI (thermotolerant) ref. *Mariner et al. 2017*
Vaccine strain	Nigeria 75/1	Nigeria 75/1	Nigeria 75/1
Inoculation / cellular culture	MEM 10% Sérum fœtal 10%	MEM 10% Sérum fœtal 10%	MEM 2% Sérum fœtal 2%
Stabiliser	Trehalose	Trehalose	Hydrolysate de lactalbumine de saccharose
Lyophilisation procedure	36h (Sublimation)	18h (Cryo-dessication)	72h (Sublimation)
Distribution	1ml	1 ml	2ml
Immunizing dose (OIE standard)	$10^{2,50}$ $TCID_{50}$	$10^{2,50}$ $TCID_{50}$	$10^{2,50}$ $TCID_{50}$

How do we produce, test, commercialize and promote wide scale use of the vaccine?

Vaccine Production at LCV

Year	Number of doses			
	ILRI protocol	Challenge	Xerovac protocol	Challenge
2017	219,200	High moisture content	319,000	None
2018	120,000	High moisture content	-	-
2019	240,000	None (Certification PANVAC underway)	-	-

Picture credit: LCV, Bamako, Mali

How do we produce, test, commercialize and promote wide scale use of the vaccine?

Vaccine thermostability profiles

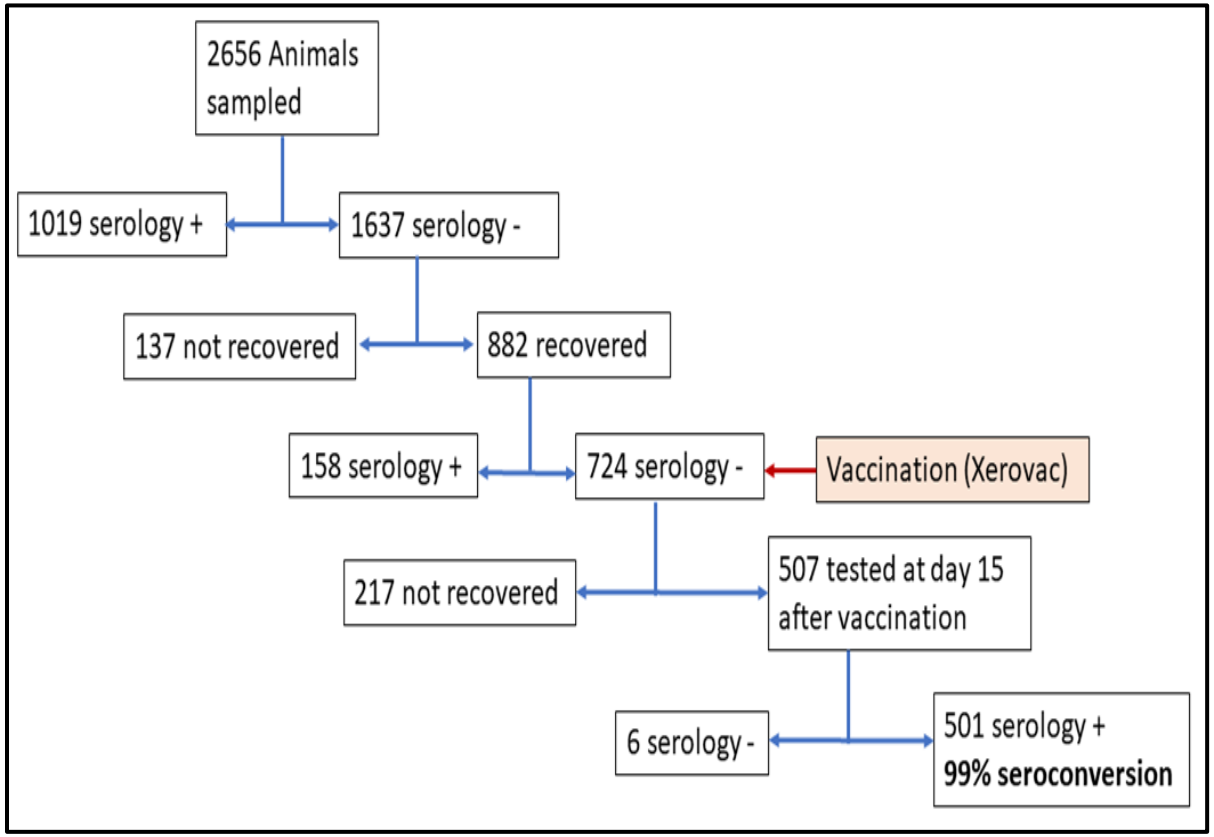
Vaccine	37°C	40°C	45°C
ILRI protocol	More than 7 days	**7 days**	**Less than 48h**
Xerovac protocol	More than 14 days	**14 days**	**10 days**

Picture credit: LCV, Bamako, Mali

How do we produce, test, commercialize and promote wide scale use of the vaccine?

Minimum requirements set (FAO/OIE) for manufacturers to use the term of "Thermotolerant Vaccine" is 40 °C for 5 days (Immunizing dose is $10^{2,5}$ $DITC_{50}$).

How do we produce, test, commercialize and promote wide scale use of the vaccine?



Xerovac vaccine has 99% efficacy in the field;

Field work postponed due to COVID - results pending for ILRI vaccine

How did we manage to increase vaccination coverage for livestock?

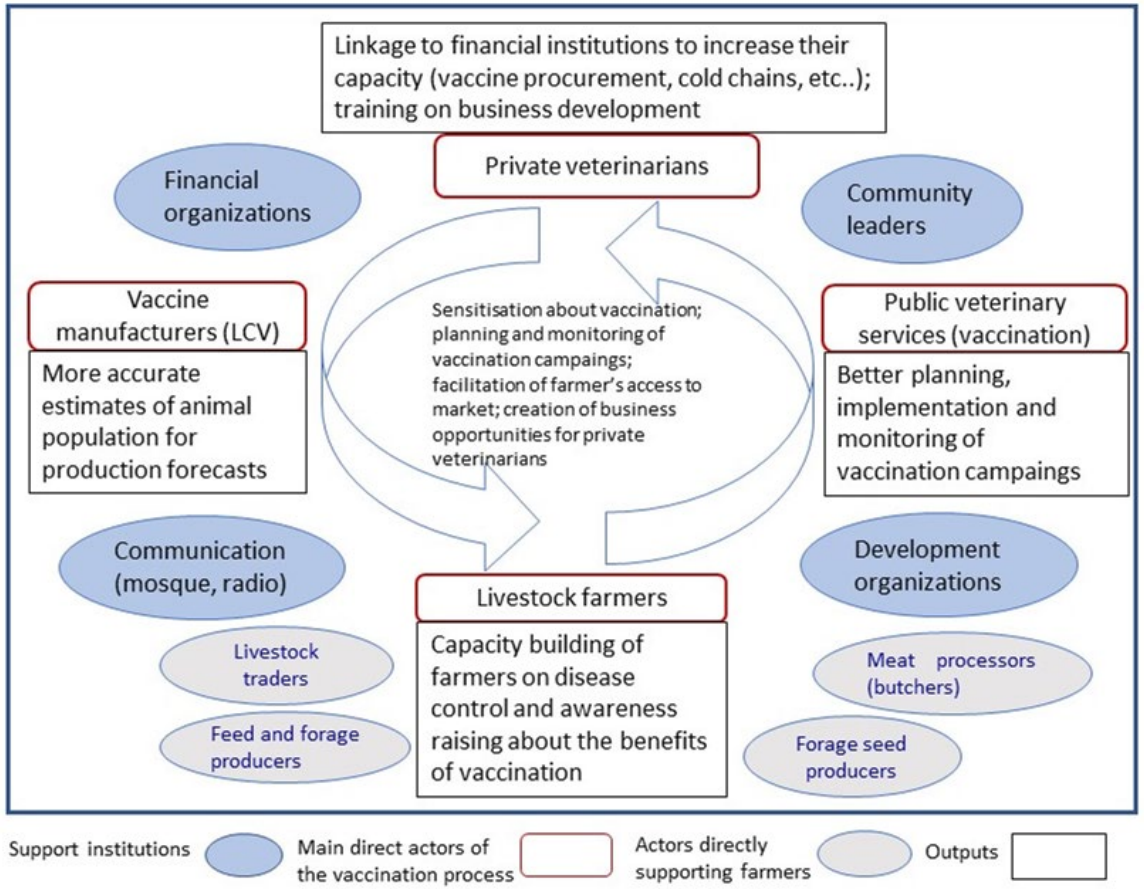
Ex-ante studies: Willingness to Vaccinate and Willingness to Pay for Vaccination

To improve participation of farmers to vaccination

- improve communication on vaccine benefits
- greater price transparency throughout the vaccine production and deployment chain is critical
- timely availability of vaccine tested for viability

How did we manage to increase vaccination coverage for livestock?

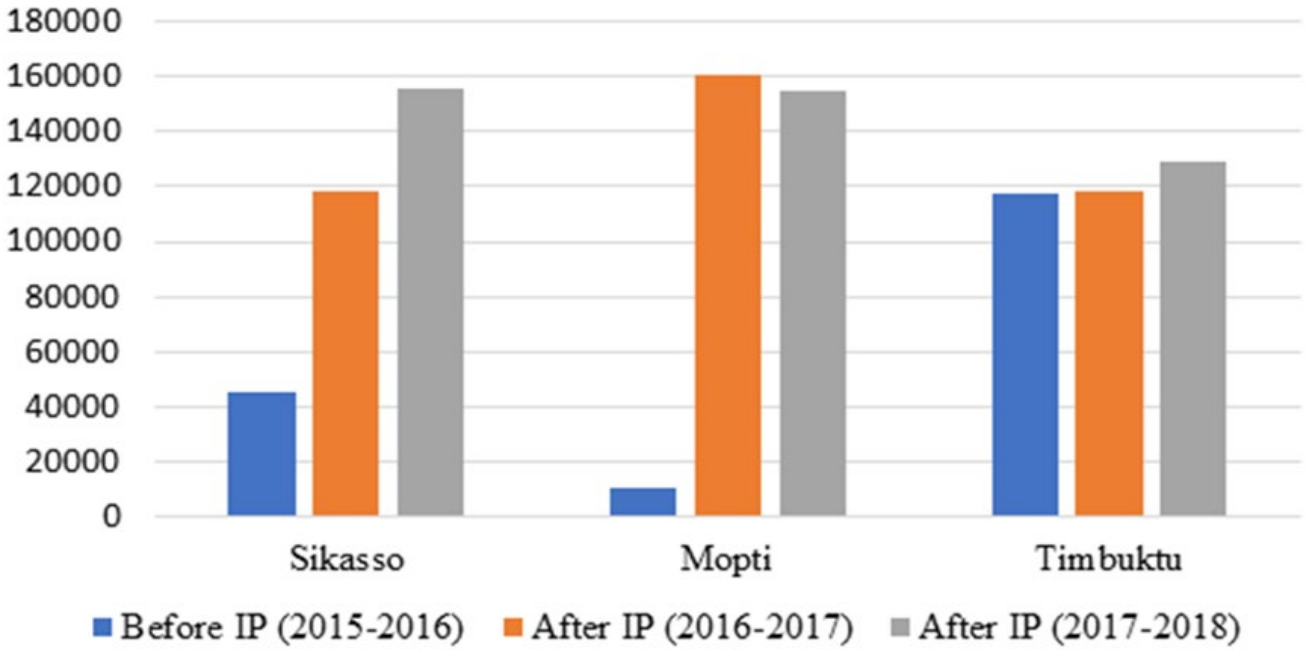
Participatory process through Innovation Platforms



Picture credit: Michel Dione, Sikasso, Mali

How did we manage to increase vaccination coverage for livestock?

Vaccination coverage increased after implementation of Innovation Platforms



In year one only

Sikasso
Seroprevalence before vaccination **57%** (CI95: 54–60%); post-vaccination **70%** (CI95: 67–73%)

Mopti
Before vaccination **51%** (CI95: 47–55%); post-vaccination **57%** (CI85: 53–61%)

What are the next steps?

- External quality control of ILRI protocol-based vaccine (validation of thermostability profiles) by PANVAC
- Completion of small-scale field validations of vaccines
- Development of:
  - ✔ Policy briefs to promote the thermotolerant vaccines
  - ✔ Investigations on cost-benefit analysis of thermostable vaccines
  - ✔ Guidelines for the use of the new PPR thermostable vaccines
  - ✔ Commercialization, investment, and scaling up plan for the new vaccines.

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Partnering for Innovation

INNOVATION

Laura Harwig– Program Director

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Partnering for Innovation builds partnerships with private sector agribusinesses in emerging markets to help them sell products and services to smallholder farmers, who represent a potential market of more than 500 million customers.

Our partner agribusinesses are provided with the investment assistance, expert guidance, and technical support they need to expand into new markets and create a growing and lasting customer base for their agricultural innovations.

Impact to Date (FY 2012 – 2020)

1,713,198
Farmers cultivating 849,064 hectares of land have benefited from partnerships

75
Partnerships in 24 countries through September 2020

133
Technologies and management practices commercialized, with $110,036,515 million in sales of technologies by partners

$104,580,000
In leverage spent by partners to date, $47,112,712 invested by Partnering for Innovation

PARTNERSHIP OVERVIEW: HESTER BIOSCIENCES NEPA

Partnership Period: March 2019 – July 2021

Country: Nepal

Through this partnership, Hester will extend the reach of the Peste des Petits Ruminants (PPR) vaccine to remote areas by commercializing a thermostable formulation, originally developed by Tufts University, that is more easily transported and distributed and will strengthen resilience in farming communities.

Anticipated Results: Hester will produce and distribute 400,000 thermostable vaccine doses, improving the incomes of 100,000 Nepali herders by reducing mortality and morbidity of goats and sheep.

BACKGROUND: HESTER BIOSCIENCES NEPAL

Hester Biosciences Nepal is a subsidiary of the India-based Hester Biosciences Limited, which specializes in large-scale production of veterinary vaccines and growth supplement products.

Since 2011, the company has worked on vaccine production and distribution in Nepal from its state-of-the-art manufacturing facility outside of Kathmandu.

STATUS: THERMOSTABLE PPR VACCINE

Progress

- Hester completed transfer of thermo-stabilization technology, concluded testing, and received a quality certification from the Pan African Veterinary Vaccine Center of the African Union (AU-PANVAC).

- Hester received final regulatory approval in October 2020 to sell its TPPR vaccine in Nepal and internationally.

Next Steps

- Hester now ramping-up production and expects to start selling and distributing its TPPR vaccine in Nepal in December 2020.

CHALLENGES AND OPPORTUNITIES

Challenges:

- Hester's TPPR rollout will introduce the first fee-for-vaccination at the smallholder level in most of the targeted geographies.

Opportunities:

- Hester will launch an awareness campaign to inform farmers in underserved areas about PPR risks and to drive demand for the vaccine in support of the Ministry of Agriculture and Livestock Development.

- Hester stands to play an important role in providing the vaccine in global PPR eradication efforts – an undertaking with vaccine costs estimated at $7.23bn

LOGISTICS AND DISTRIBUTION

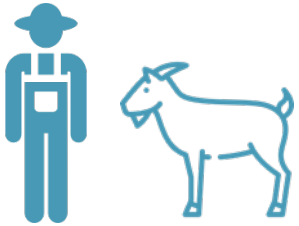
Hester Biosciences
Manufacturing Plant

Super Distributors
(State Level)

Stockists
(District Level)

Rural Retailers
(Sub-District/Block/Village Level)

Vaccinators & Community
Animal Health Workers



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