KALRO
Kenya Agricultural & Livestock Research Organization

KCSAP
Kenya Climate Smart Agriculture Project

Inventory of Climate Smart Agriculture Technologies, Innovations and Management Practices for Animal Health Value Chain

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DISCLAIMER

The information presented in this inventory of Technologies, Innovations and Management Practices (TIMPs) book is for advisory use only. Users of this book should seek additional advice from the livestock extension service to fully benefit from the inventory recommendations.

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FOREWARD

Kenya Climate-Smart Agriculture Project (KCSAP) tasked the Kenya Agricultural and Livestock Research Organization (KALRO) with implementation of the project's Component 2 on 'strengthening Climate-Smart Agricultural Research and Seed Systems'. The component activities are geared towards the development, validation, adoption and delivery of context specific Climate Smart Agriculture (CSA Technologies, Innovation and Management Practices (TIMPs). It is responsible for development of sustainable seed production and distribution systems of priority agricultural value chains to enhance availability and access improved seeds, animal breeds and fingerlings by target beneficiaries. Against this background, KALRO and her National Agricultural Research System (NARS) partners have developed, validated and availed CSA TIMPs for dissemination and adoption. This document provides a detailed inventory of TIMPs that have been developed Animal Health issues

Extensive information from research and background data has been used to develop this TIMPs inventory document. To disseminate the TIMPs, a Training of Trainers (ToT) manual has been developed. The design of the manual takes into consideration the delivery system, partners and their roles, duration of training and logical flow of the modules. The training modules have uniform outline that ensures every aspect of the TIMPs are fully covered in a way that the trainees can absorb and relate to. Various delivery methods are deployed and where possible demonstrations and practical work are incorporated to enable the trainees learn by participating in the actual field activities. The use of this TIMPs inventory is expected to contribute to achievement of the envisaged KCSAP Project's Triple Wins of increased productivity, enhanced resilience and reduction of greenhouse gases emissions. Thus, the contents of this TIMPs inventory are to be adopted and used in the dairy, red meat, camels, indigenous chicken ToT Manuals.

Finally, I am greatly indebted to the value chain leaders and all those who participated in the preparation of this inventory of TIMPs. It is expected to herald new ways of delivering training content that will enable realization of project objectives and aspirations.

Eliud K. Kireger, PhD, OGW
Director General, KALRO

PREFACE

The Kenya Climate-Smart Agriculture Project (KCSAP) a Government of Kenya project with support from both the World Bank and Kenya government. The project runs for five years and is implemented in 24 counties, mainly in the arid and semi-arid lands (ASALs) at an approximate cost of KES 25 billion. The project development objective (PDO) is to "increase agricultural productivity and build resilience to climate change risks in the targeted smallholder farming and pastoral communities, and in the event of an Eligible Crisis or Emergency, to provide immediate and effective response." This objective is to be achieved through the implementation of five key components, which are: 1) Upscaling Climate-Smart Agricultural Practices, 2) Strengthening Climate-Smart Agricultural Research and Seed Systems, 3) Supporting Agro-weather, market and Climate, and Advisory Services, 4) Project Coordination and Management and 5) Contingency Emergency Response

Component 1 involves facilitating the empowering of farmers and communities to adopt technologies, innovations and management practices (TIMPs) to achieve the Climate-Smart Agriculture (CSA) triple-wins of: increased productivity, enhanced resilience (adaptation), and reduced Greenhouse gases (GHG) emissions (mitigation). Component 2 is tasked with the responsibility of providing the TIMPs. Therefore, it supports the development, validation, and adoption of context specific CSA TIMPs to target beneficiaries under Component 1 and 3.

To catalyze uptake of TIMPs, Kenya Agricultural and Livestock Research Organization (KALRO) in conjunction with partners in the National Agricultural Research Systems (NARS) and Consultative Group for International Agricultural Research (CGIAR) compiled inventories of TIMPs for the prioritized value chains. The livestock-based value chains are five and include apiculture, indigenous chicken (meat and eggs), dairy (cattle and camel), red meat (cattle, sheep and goats) and aquaculture. Also, there are three cross cutting thematic areas on pastures and fodder, natural resource management, and animal health. The crop-based value chains are 19 and include roots and tubers (cassava, potato), pulses (dry beans, green gram and pigeon peas), vegetables (tomato, onion, indigenous vegetables, kale and cabbage), cereals (sorghum, millet, maize, teff) nuts (Cashew nut), fruits (banana, mango, water melon) and fibre (cotton). The TIMPs have been categorized into those ready for upscaling and those requiring validation. Furthermore, gaps that required further research and development of TIMPs have been identified. Training of Trainers' (ToT) manuals focusing on TIMPs that are ready for upscaling for each of the value chains have been subsequently developed to form the basis of training county extension staff, service providers and lead farmers. Those trained are in turn expected to cascade the training to beneficiaries in the targeted smallholder farming, agro-pastoral and pastoral communities in the 24 project counties of Marsabit, Isiolo, Tana River, Garissa, Wajir, Mandera, West Pokot, Baringo, Laikipia, Machakos, Nyeri, Tharaka Nithi, Lamu, Taita Taveta, Kajiado, Busia, Siaya, Nyandarua, Bomet, Kericho, Kakamega, Uasin Gishu, Elgeyo Marakwet and Kisumu.

KALRO, having the responsibility of implementing the activities under Component 2, has been instrumental in using its information resources and those of partners and collaborators to come up with the inventories of TIMPs and corresponding ToT manuals. Use of these information resources coupled with the accompanying training and contribution of the other project components will go a long way in enabling KCSAP to meet its development objectives.
The National Project Coordination Unit is grateful to all who participated in the development and production of this Animal Health TIMPs inventory. It is my hope that counties and other users will put this resource to good use as they transform and reorient their agricultural systems

to make them more productive and resilient while minimizing GHG emissions under the new realities of the changing climate.

John Nginyangi
National Project Coordinator
Kenya Climate-Smart Agriculture Project

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ABBREVIATIONS AND ACRONYMS

ASALs	Arid and Semi-Arid Lands
CBPP	Contagious Bovine Pleuropneumonia
CBO	Community Based Organizations
CCPP	Contagious Caprine Pleuropneumonia
DIVA	Differentiate Infected from Vaccinated Animals
DNA	Deoxyribonucleic Acid
DVS	Directorate of Veterinary Services
ECF	East Coast fever
FAO	Food and Agriculture Organization
GALVmed	Global Alliance for Livestock Vaccines and Medicine
ILRI	International Livestock Research Institute
KALRO	Kenya Agricultural and Livestock Research Organization
KCSAP	Kenya Climate Smart Agriculture Project
KenTTEC	Kenya Tsetse and Trypanosmiasis Eradication Council
KEVEVAPI	Kenya Veterinary Vaccines Production Institute
KVB	Kenya Veterinary Board
NACOSTI	National Commission for Science, Technology and Innovation
NGO	Non-Governmental Organization
PANVAC	Pan African Veterinary Vaccine Center
PPR	Peste des Petits ruminants
TIMPs	Technology, Innovation and Management Practices
VIDO	Vaccine and Infectious Disease Organization
VMD	Veterinary Medicines Directorate
VMGs	Vulnerable and marginalized groups
VSRI	Veterinary Science Research Institute

DEFINITION OF TERMS

Technology: This is defined as an output of a research process which is beneficial to the target clientele (mainly farmers, pastoralists, agro-pastoralists and fisher folk for KCSAP's case), can be commercialized and can be patented under intellectual property rights (IPR) arrangements. It consists of research outputs such as tools, equipment, genetic materials, breeds, farming and herding practices, gathering practices, laboratory techniques, models etc.

Management practice: This is defined as recommendation(s) on practice(s) that is/are considered necessary for a technology to achieve its optimum output. These include, for instance, different agronomic and practices (seeding rates, fertilizer application rates, spatial arrangements, planting period, land preparation, watering regimes, etc.), protection methods, for crops; and feed rations, management systems, disease control methods, etc. for animal breeds. This is therefore important information which is generated through research to accompany the parent technology before it is finally released to users and the technology would be incomplete without this information.

Innovation: This is defined as a modification of an existing technology for an entirely different use from the original intended use. (e.g. fireless cooker modified to be used as a hatchery)

2.0. Summary of Inventory of animal health TIMPs

The inventory process resulted in a total of 17 TIMPs including 13 technologies, 0 innovations and 5 management practices, distributed among the 6 sub-themes, as indicated in Table 1.

Table 1: Summary on number of Animal Health TIMPs

Component	Sub-Theme	Technologies	Innovations	Management Practices
Animal Health	Vaccines	6	0	0
	Diagnostic tests	3	0	0
	Resistant breeds	1	0	0
	Disease control strategies	1	0	4
	Medicated feed supplements	1	0	0
	Biosecurity	1	0	0
Overall Total		**13**	**0**	**4**

3.0 Summary of Status of animal health TIMPs

The inventory process resulted in a total of 8 TIMPs that are ready for up scaling, 8 TIMPs that require validation and 1 TIMPs that require further research in the sub-themes, as indicated in Table 2. Inventory of the TIMPS by category and status is shown in Table 3.

Table 2: Number of TIMPs ready for up scaling, require validation or further research

Component	Sub-Theme	Ready for up scaling	Require validation	Further Research
Animal Health	Vaccines	2	3	1
	Diagnostic tests	1	2	0
	Resistant breeds	0	1	0
	Disease control strategies	4	1	0
	Medicated feed supplements	1	0	0
	Biosecurity	1	0	0
Overall Total		**9**	**7**	**1**

Table 3: Inventory of Animal Health TIMPs by Category and Status

TIMPs Sub-theme	TIMP Title	TIMP Category	Status
4.1 Vaccines	4.1.1 *Theileria parva* Marikebuni East Coast fever (ECF) vaccine	Technology	Ready for up-scaling
	4.1.2 Sub-Unit Contagious Bovine Pleuro-pneumonia vaccine	Technology	Requires field validation
	4.1.3 Thermo-tolerant peste des petits ruminants vaccine	Technology	Requires field validation

TIMPs Sub-theme	TIMP Title	TIMP Category	Status
	4.1.4 Contagious Bovine Pleuro-pneumonia DIVA vaccine	Technology	Requires field validation
	4.1.5 Recombinant HC58 DNA Vaccine	Technology	Require further research
	4.1.6 Avivax 12-Thermostable Newcastle disease vaccine	Technology	Ready for up-scaling
4.2. Diagnostic tests	4.2.1 pH-based mastitis kit	Technology	Requires field validation
	4.2.2 Latex Agglutination diagnostic test for Contagious Caprine Pleuro-pneumonia	Technology	Ready for up-scaling
	4.2.3 Protein tagged latex agglutination test for Contagious Bovine Pleuro-pneumonia	Technology	Requires field validation
4.3 Resistant breeds	4.3.1 Trypanotolerant Orma Boran Cattle	Technology	Require further research
4.4 Disease control strategies	4.4.1 Integrated helminth control	Management practice	Ready for scaling/capacity building required
	4.4.2 Integrated Control Strategy for Camel Surra	Management practice	Ready for up scaling
	4.4.3 Push-pull Tsetse fly control	Technology	Require field validation
	4.4.4 Oral hydration in camels	Management practice	Ready for up-scaling
	4.4.5 Mastitis control practices	Management practice	Ready for up-scaling
4.5 Medicated feed supplements	4.5.1 Medicated Molasses Urea Mineral blocks (MUMBs)	Technology	Ready for up-scaling
4.6. Biosecurity	4.6.1 Improved Biosecurity practices on poultry farms	Management practice	Ready for up-scaling

4.0 Detailed description of animal health TIMPS

4.1. Vaccines

4.1.1 TIMP name	***Theileria parva* Marikebuni East Coast Fever (ECF) vaccine**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Loss of animals due to high mortality rates associated with East coast fever (ECF) in dairy and beef cattle reduces productivity
What is it? (TIMP description)	This is a vaccine that confers life-long protection against ECF. It is formulated from live cocktail of *Theileria parva* Marikebuni parasites. The vaccine is used in combination with 30% oxytetracycline antibiotic to prevent parasites from causing clinical disease. The vaccine is administered by trained personnel Animals immunized with this vaccine require minimal tick control.  ***Retrieving ECF vaccine vials from a liquid nitrogen tank***
Justification	East Coast Fever (ECF), disease is transmitted by ticks and causes high mortality and production losses in cattle. In addition, control of the tick vector through frequent acaricide application and high cost of treatment of ECF infected animals increases cost of veterinary care. The ECF vaccine confers life-long immunity in cattle thereby reducing ECF incidence and cost of acaricide application. Therefore, the vaccine improves the productivity of cattle and decreases acaricide-associated pollution of the environment as well as resistance to acaricides and residues in meat and milk.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy and beef farmers, Extension agents, Service providers and Researchers

Approaches to be used in dissemination	Hands on training of vaccinators, on-farm trials, field days, shows and exhibitions, mass media and digital platforms
Critical/essential factors for successful promotion	• Availability of trained vaccinators • Sensitization of the cattle keepers about the advantages of the vaccine in controlling ECF • Production and supply of quality vaccine • Good records on vaccinated animals to avoid repeated vaccinations
Partners/stakeholders for scaling up and their roles	• Director of Veterinary Services (DVS)- Policy and regulation • Veterinary Medicines Directorate (VMD) – Registration of the vaccine • County Governments – Extension services and vaccine administration • Private veterinary professionals – Vaccine administration • Global Alliance for Livestock Vaccines and Medicine (GALVmed)- Vaccine Promotion • ILRI – Research on the vaccine • NGOs and the private sector- vaccine distribution • Livestock keepers-end user
C: Current situation and future scaling up	
Counties where already promoted if any	Bomet, Kericho, Kakamega, Nyeri, Kisumu, Nyandarua, Narok, Trans Nzoia, Nandi, Uasin Gishu
Counties where TIMP will be up scaled	All dairy and beef producing counties
Challenges in dissemination	• Demand for the vaccine outstrips supply • Fewer number of trained vaccinators • High costs associated with overreliance on liquid nitrogen for vaccine storage • Low shelf life of vaccine at room temperature • Poor vaccine distribution network • Vaccine packaged in doses of 40 and not suitable for smallholder farmers with 3-5 animals
Recommendations for addressing the challenges	• Produce more vaccine doses to meet the demand. • Train more veterinary professionals on vaccine administration-Lobby for incorporation of ECF immunization in animal health training curriculum • Lobby for funds to install liquid nitrogen plants at the KALRO VSRI Muguga • Establish strategic regional vaccine distribution networks in other KALRO livestock institutes/centres • Sensitize cattle farmers on the availability of the vaccine through participatory approaches. • Produce and package vaccine in small dose packs of probably 5 to 10 doses. • Production of promotional materials, use of media in popularizing the vaccine

Lessons learned in up scaling if any	• There are better returns in vaccinate young animals which will stay longer on the farm • Screening of animals to ensure they are free from *Theileria parva* Marikebuni parasites is necessary before immunization to minimize risk of clinical disease CF • ECF record keeping is important to avoid vaccinating animals that have recovered from infection since they already have life-long immunity • Even with ECF vaccination, relaxed tick control is necessary for the control of other tickborne diseases such as anaplasmosis and babesiosis • The involvement of Counties and NGOs in training of vaccinators has assisted the uptake of ECF vaccine in the control of ECF in cattle • The active involvement of the Kenya Veterinary Board in reviewing and approving content for vaccinator training of veterinary professionals enhances success in ECF vaccinations
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to enhance acceptance of vaccine by beef and dairy cattle keepers • Need of policy to regulate acaricide use following ECF immunization to reduce acaricide overuse and environmental contamination • Need of policy guidelines and regulation on the use of the vaccine to avoid introducing the *Theileria parva* in areas which are free from the parasite • Need for regulation of vaccine pricing to reduce farmer exploitation
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 600 to 800 to cover for the cost of vaccinating one animal (cost of vaccine, antibiotic and vaccinator labour)
Estimated returns	• The use of ECF vaccine saves approximately 80%, of cattle from dying • 50% increase in productivity from healthy livestock • There is likelihood to cost save on acaricides • 50% increase in milk and meat safety following reduction in curative treatments given to cattle • (Immunization reduces losses of KES 9975 per cow per year)
Gender issues and concerns in development, dissemination, adoption and scaling up	• ECF vaccine is administered through injections thus requiring that animals are properly restrained which may not be favourable for women. • Women have limited ability to influence decision-making in their household around vaccination and animal health • Vaccinators go through 3 to 4 days training at the VSRI Muguga which may limit the number of women participants

	• Women have poorer access to markets than men and play a limited role in the commercialization of livestock • Women and youth have limited access to finances necessary to acquire the vaccine • Involvement of women and youth in vaccine distribution may be limited by its requirement for cold chain
Gender related opportunities	• Trained vaccinators are likely to earn an extra income by actively participating in ECF vaccination drives • Knowledgeable women and youth can enter in to the distribution chain for income generation • Organize livestock farmers into groups so that they can vaccinate their animals at the same time • ECF vaccination will enhance livestock production for better food, nutrition and incomes for households
VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited knowledge of vaccine among VMGs who have low access to agricultural information and extension services • VMGs have limited access to credit to acquire the vaccine • Involvement of VMGs in vaccine distribution may be limited by the its cold chain requirement
VMG related opportunities	• VMGs can form common interest groups for collective access of the technology and enter in to the distribution chain for income generation • ECF vaccination will enhance livestock production for better incomes and food and nutrition security for VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• Lanet Beef Research Institute in Nakuru County has significantly reduced cattle mortalities casued by ECF by adopting the use the vaccine. • The success of the Kenya Dairy Farmers Federation (KDFF),one of the distributors of ECF vaccine has vaccinated >25,000 dairy cattle against ECF over the last 5 years • Increased demand for ECF vaccinators training at the VSRI Muguga with about 454 (15 from Uganda and 8 from Rwanda) veterinary professionals already trained to deliver ECF vaccine between 2011 and 2022 • Over 70,000 doses of vaccine sold to various counties between 2012 and 2022
Application guidelines for users	• Ndung'u, S.G., Wesonga, F.D., Olum, M and Maichomo, M (2016). Training manual for veterinary staff immunization against ECF. 64 pages • Vaccines for control of ECF in cattle (Brochure)

	• Tick control after ECF immunization (Brochure) • Important tick-borne diseases in Kenya (Poster) • East Coast Fever (Brochure) - Steps in ECF immunization and post-immunization monitoring (Brochure)
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	The Institute Director KALRO VSRI Muguga North P.O. Box 32 -00902 Kikuyu, Kenya
Lead organization and scientists	KALRO VSRI Muguga, Dr. James Wanjohi, Dr Moses Olum
Partner organizations	GALVmed, KDFF, SIDAI, VetAID, County Governments, DVS and KEVEVAPI

Gaps

i) Evaluate the effects of relaxed acaricide recommendation on sustainable control of other tick-borne diseases e.g. Anaplasmosis, Babesiosis and Cowdriosis.
ii) Develop and promote small dose packs appropriate for use by smallholder dairy farmers.
iii) Validate and make recommendations for use of *Theileria parva* marikebuni ECF vaccine in the pastoral production systems.
iv) Produce a vaccine batch in response to the increased demand for this product.
v) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration.

4.1.2 TIMP name	**Sub-unit Contagious Bovine Pleuro-pneumonia (CBPP) vaccine**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity of beef cattle due to high incidence of Contagious Bovine Pleuro-pneumonia (CBPP) arising from poor vaccination coverage and the use of the current vaccine which is cold chain dependent.
What is it? (TIMP description)	This technology is a thermo-tolerant protein-based CBPP vaccine that can be kept at room temperature for 14 days. It is produced from traceable proteins extracted from mycoplasma, the causative organism, which when injected in the animal offers sufficient protection from CBPP. It is superior to existing vaccines and safe for sustainable control of CBPP in Kenya and the sub-Sahara Africa region.
Justification	Contagious Bovine Pleuropneumonia is a transboundary disease that lowers productivity and restricts trade along the beef value chain in Kenya. The disease is mainly prevalent in Arid and Semi-

	arid areas (ASALs) which have low electricity coverage to sustain the cold chain system, on which the current vaccines are dependent. Since CBPP impacts significantly on international trade, even the use of the existing vaccine is restricted due to its lack of traceability mechanisms. In addition, the current vaccine can cause adverse reactions and can cause disease in vaccinated animals since it is not fully attenuated. The new subunit CBPP vaccine addresses these limitations in the existing vaccine by being thermo-tolerant and based on traceable protective proteins and is therefore safe for use in the sustainable control of CBPP in Kenya and the sub-Saharan Africa region.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Pastoralists • County Governments • Researchers • Ministry of Agriculture, Livestock, Fisheries and Co-operatives (MoALFC) • Livestock Extension Providers
Approaches to be used in dissemination	• Farmer Field days • Digital platforms • Agricultural Shows and exhibitions • Print and mass media • Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Selection of appropriate adjuvants for formulating the vaccine to minimize adverse reactions • Functional working relations/MOU with KEVEVAPI the veterinary vaccines commercial producer • Incorporation of animal health product regulators (VMD, DVS, NACOSTI, the Kenya Veterinary Board (KVB) into the vaccine development and commercialization process • Registration and patenting of the vaccine
Partners/stakeholders for scaling up and their roles	• Extension Service Providers (Public and private) will offer advice and collect information on the uptake of the vaccine. They will also ensure proper use of the vaccine • County Governments- Promote and create awareness on the advantages of the vaccine • DVS and VMD-Policy and regulation on use of the vaccine • Pastoralists, farmers and farmer groups- will spread information on the vaccine and provide their livestock for vaccination • KALRO-Will train trainers and provide technical backstopping during dissemination of the vaccine • KEVEVAPI- will produce the vaccine and ensure quality assurance and distribution • Vaccine stockists-ensure distribution and availability of the vaccine at the point of use.
C: Current situation and future scaling up	

Counties where already promoted if any	Yet to be determined
Counties where TIMP will be upscaled	ASALs, CSAP Beef VC
Challenges in dissemination	• Inadequate vaccine production capacity at KEVEVAPI • Inadequate knowledge on the use of the vaccine • Inadequate vaccine distribution network • Inadequate vaccine access for individual farmers/pastoralists due to centralized CBPP vaccine use control by DVS
Recommendations for addressing the challenges	• Strengthening the production capacity of KEVEVAPI by lobbying for provision of necessary infrastructure and equipment • Creating awareness and promotion of the vaccine • Capacity building of extension workers on the use of the vaccine • Strengthen Public private partnerships for sustainable distribution of the vaccine • Collaboration with County Governments to enable vaccine access • Lobby for eased DVS control on CBPP vaccine • Encourage formation of community pastoral/farmer groups to increase vaccine accessibility
Lessons learned in up scaling if any	• Working with partners with a competitive advantage will ensure successful development and commercialization of the vaccine
Social, environmental, policy and market conditions necessary for development and up scaling	• Create awareness and promote the use of the subunit vaccine in control of CBPP • Need for policy to guide the incorporation of sub-unit vaccine in CBPP control in Kenya and the region • Need to register the vaccine with the Veterinary Medicine Directorate (VMD) and other regional regulatory bodies for marketing and use of the vaccine in Kenya and the region • There is need to lobby DVS to relax the supervision of vaccinations to allow involvement of private service providers • Need to align use of the subunit CBPP vaccine to government agenda of creating disease free zones
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 300 per animal per year)-2 vaccinations/year
Estimated returns	KES 46,300 per animal from reduction in mortality and reduction in cost of treatment
Gender issues and concerns in development and dissemination, adoption and scaling up	• Vaccine administration is not favourable with women who are not able to restrain the animals during injections • Women have limited ability to influence decision-making in their household around vaccination and animal health • Women and youth may also have limited access to finances to purchase vaccines

	• Women may not be able to attend trainings conducted away from their homes in order for them to become vaccinators • Women and youth have limited access finances necessary to acquire the vaccine • Delivery of the vaccine may require a cold chain which imparts on logistics and costs for youth and women as service providers
Gender related opportunities	• Opportunity for involvement of youth in vaccine delivery • Trained vaccinators are likely to earn an extra income by actively participating in ECF vaccination drives • Knowledgeable women and youth can enter in to the distribution chain for income generation • ECF vaccination will enhance livestock production for better food, nutrition and incomes for households
VMG issues and concerns in dissemination, adoption and scaling up	• VMGs face barriers in accessing resources such as credit to acquire vaccines • VMGs are often excluded from accessing and benefitting from technologies • Delivery of vaccines will require a cold chain which imparts on logistics and costs for VMGs as service providers
VMG related opportunities	• Opportunity for VMG involvement in vaccine distribution networks through creation of incentives • VMGs can form common interest groups for collective access of the technology and enter in to the distribution chain for income generation • ECF vaccination will enhance livestock production for better incomes and food and nutrition security for VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Yet to be documented
Application guidelines for users	To be developed
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	KALRO – VSRI, Muguga North P.O. Box 32 - 00902 Kikuyu, Kenya
Lead organization and scientists	KALRO-VSRI Muguga, Dr Hezron Wesonga
Partner organizations	KEVEVAPI, VIDO Canada, ILRI,

Gaps

i) Assess the effectiveness nebulization and intubation challenge models to achieve infectivity threshold for sub-unit CBPP vaccine to be declared as protective

ii) Validate the sub-unit CBPP vaccine for its efficacy in the control of CBPP in the beef production zones
iii) Determine the cost-benefit of the sub-unit vaccine in the control of CBPP
i) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration

4.1.3 TIMP name	**Thermo-tolerant Peste des Petits Ruminants (PPR) vaccine**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity from increased PPR incidence arising from low vaccination coverage and use of the current vaccine which is cold chain dependent.
What is it? (TIMP description)	This is a live attenuated thermo-tolerant virus vaccine that can be kept at room temperature conditions (20-25^{o}C) for several months; 37^{o}C for 7-14 days). The vaccine is a thermostabilized improvement of currently used Nigerian 75/1 strain PPR vaccine.  ***A goat showing clinical signs of PPR***
Justification	Kenya has embraced the global PPR eradication initiative by 2030. The disease is prevalent in marginalized areas where majority of the small ruminants are found. These areas are low on critical infrastructure including grid power connectivity. Consequently, the use of the existing vaccine which is cold chain dependent is low thus justifying the need for a thermo-tolerant vaccine. The thermo-tolerant vaccine reduces reliance on cold chain during vaccine delivery.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small ruminant keepers, Researchers, DVS, Kenya KEVEVAPI, Pan African Veterinary Vaccine Centre of African Union AU-PANVAC), FAO, Livestock Extension Providers
Approaches to be used in dissemination	On-farm trials, field days, shows and exhibitions, print media, mass media
Critical/essential factors for successful promotion	• Stakeholder participation especially County livestock and veterinary staff, sustainable supply of the vaccine • Meeting the AU/PANVAC quality control standards for thermostable vaccines • Patenting and Registration of the vaccine for local and regional use

	• Functional working relations/MOU with KEVEVAPI the veterinary vaccines commercial producer • Proper working relationships with County Governments • Incorporation of animal health product regulators (VMD, DVS, NACOSTI, the Kenya Veterinary Board (KVB) into the vaccine development and commercialization process
Partners/stakeholders for scaling up and their roles	• KALRO- Technical backstopping during upscaling Research and dissemination • KEVEVAP- Vaccine production and distribution) • DVS- policy and regulation of vaccine use) • County Governments-extension services, awareness creation on vaccine, • Non-Governmental Organizations(NGOs)- Dissemination
C: Current situation and future scaling up	
Counties where already promoted if any	West Pokot and Turkana
Counties where TIMP will be up scaled	Baringo, Garissa, Marsabit Tana River, Isiolo, Laikipia, Elgeyo Marakwet
Challenges in dissemination	• There are likely to be socio-cultural challenges like rustling and transhumance • Inadequate infrastructure for vaccine production at KEVEVAPI • Inadequate vaccine distribution network • Restricted use of the vaccine to DVS and Government entities • Acceptability of the vaccine in Kenya and in the region
Recommendations for addressing the challenges	• Strengthening the production capacity of KEVEVAPI by lobbying for provision of necessary infrastructure and equipment • Creating awareness and promote the vaccine locally and within the region • Strengthen Public private partnerships for sustainable distribution of the vaccine • Lobby for ease of Government restrictions on the access and use of the vaccine to allow the private sector to open vaccine distribution channels • Advocacy for change of socio-cultural practices
Lessons learned in up scaling if any	• The vaccine has a shelf life of up to 14 days under room temperature • Collaborations and partnerships are key for success in vaccine development process. • Involvement of vaccine producer and regulatory institutions such as KEVEVAPI and DVS from initial technology development stages creates a buy-in which is essential during upscaling.
Social, environmental, policy and market conditions necessary for development and up scaling	• Create awareness and promote the use of the thermo-tolerant PPR vaccine • Need for policy to guide the incorporation of thermotolerant PPR vaccine in OIE eradication programme for PPR in Kenya and the region

	• Need to register the vaccine with the Veterinary Medicine Directorate (VMD) and other regional regulatory bodies (AU/PANVAC) for marketing and use of the vaccine in Kenya and the region • There is need to lobby DVS to relax the supervision of vaccinations to allow involvement of private service providers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	One vaccination in an animal's lifetime at estimated cost of KES 35 per animal
Estimated returns	KES 1000 per animal from reduction in PPR mortality, reduction in treatment cost, lowered production losses)
Gender issues and concerns in dissemination, adoption and scaling up	• Low level of vaccination coverage in remote areas could partly be attributed to limited knowledge of vaccine by women as a resulting from their lack of access to agricultural information and extension services • Restraining of animal during immunization may present a challenge to women the vaccine is administered through injections • Women have limited ability to influence decision-making in their household around vaccination and animal health • Limited time and mobility for women to attend extension activities when there are conflicting roles • Women, most of whom are semi-illiterate lack adequate skills on vaccine administration procedure • Women and youth have limited access finances necessary to acquire the vaccine
Gender related opportunities	• Trained vaccinators are likely to earn an extra income by actively participating in vaccination drives • Knowledgeable women and youth can enter in to the distribution chain for income generation • Adoption of vaccine will benefit women and youth who keep small ruminant since there will be less mortalities and increase productivity hence increased income
VMG issues and concerns in dissemination, adoption and scaling up	• Restraining of animals during vaccination may present a challenge to VMGs • Limited knowledge of vaccine among VMGs who have low access to agricultural information and extension services
VMG related opportunities	• VMGs can form common interest groups for collective access of the technology and enter in to the distribution chain for income generation • Vaccine Adoption will lead to increased animal productivity hence increased incomes and improved food and nutrition security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	None at the moment
F: Status of TIMP readiness	Requires validation

(1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	
G: Contacts	
Contacts	KALRO – VSRI, Muguga North P.O. Box 32 - 00902 Kikuyu, Kenya
Lead organization and scientists	KALRO VSRI Muguga-Dr Soi Reuben, Dr Duncan Ithinji KEVEVAPI, Dr. Wachira Jane
Partner organizations	KEVEVAPI, DVS, AU- PANVAC, FAO

Gaps

i) Assess the role of camels and cattle as reservoirs of PPRV
ii) Validate the thermo-tolerant PPR vaccine for use in the control of PPR in small ruminants
iii) Determine the cost-benefit of the thermo-tolerant PPR vaccine in the control of the disease
iv) Develop and utilize PPR outbreak prediction models for enhanced surveillance of the disease
v) Develop guidelines for successful use of the vaccine
vi) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration

4.1.4 TIMP name	**Contagious Bovine Pleuropneumonia DIVA Vaccine**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity from beef cattle due to high incidence of CBPP due to the restricted use of the current vaccine by regulatory bodies because of its traceability issues.
What is it? (TIMP description)	The CBPP DIVA vaccine is live attenuated vaccine (based on *Mycoplasma species* from a Tanzanian outbreak strain T1, 44th passage (T1/44) tagged with a protein marker that is easy to detect and differentiates the vaccinated cattle from the infected ones.
Justification	Contagious Bovine Pleuropneumonia is a transboundary disease that lowers beef production in Kenya. The disease, due to being transboundary, has important consequences on international trade. As such detection of the disease in an area attracts trade barriers and restrictions. This is because of low CBPP vaccination coverage due to restricted use of the current vaccine by regulatory bodies because of its traceability issues. Use the current CBPP vaccine also results in international trade barriers imposition on the beef value chain since it does not allow for differentiation of CBPP vaccinates from naturally infected animals. For this reasons, CBPP vaccinated animals are not differentiated from infected

	animals. The CBPP DIVA vaccine is tagged with a traceable protein and addresses the limitations with the current vaccine in differentiating vaccinated from infected cattle. While offering sufficient protection. The DIVA vaccine therefore enhancing trade while ensuring increased CBPP vaccination coverage.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	• Farmers • Pastoralists • County Governments • Researchers • Ministry of Agriculture, Livestock, Fisheries and Co-operatives (MoALFC) • Livestock Extension providers
Approaches to be used in dissemination	• Farmer Field days • Training of trainers • Digital platforms • Agricultural Shows and exhibitions • Print and mass media • Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Functional working relations/MOU with KEVEVAPI the veterinary vaccines commercial producer • Incorporation of animal health product regulators (VMD, DVS, NACOSTI, the Kenya Veterinary Board (KVB) into the vaccine development and commercialization process • Registration and patenting of the DIVA vaccine • Functional and effective vaccine distribution channels
Partners/stakeholders for scaling up and their roles	• Extension service providers (Public and private) will offer advice and collect information on the uptake of the vaccine. They will also ensure proper use of the vaccine • County Governments- promote and create awareness on the advantages of the vaccine • DVS and VMD-Policy and regulation on use of the vaccine • Pastoralists, farmers and farmer groups- will spread information on the vaccine and provide their livestock for vaccination • KALRO-Will train trainers and provide technical backstopping during dissemination of the vaccine • KEVEVAPI- will produce the vaccine and ensure quality assurance and distribution • Vaccine stockists-ensure distribution and availability of the vaccine at the point of use.
C: Current situation and future scaling up	

Counties where already promoted if any	None
Counties where TIMP will be up scaled	Baringo, Garissa, Marsabit Tana River, Isiolo, Tharaka Nithi, Taita Taveta, Laikipia, Bomet, Elgeyo Marakwet and Kajiado
Challenges in dissemination	• Inadequate knowledge on the use of the vaccine • Inadequate vaccine distribution network • Inadequate vaccine access for individual farmers/pastoralists due to centralized CBPP vaccine use control by DVS
Recommendations for addressing the challenges	• Creating awareness and promotion of the vaccine • Capacity building of extension workers on the use of the vaccine • Strengthen Public private partnerships for sustainable distribution of the vaccine • Lobby for eased DVS control on CBPP vaccine to allow participation of private partners in vaccine delivery • Encourage formation of community pastoral/farmer groups to increase vaccine accessibility
Lessons learned in up scaling if any	• Working with partners with a competitive advantage will ensure successful development and commercialization of the vaccine • Demonstration of benefits of vaccination will enhance farmer willingness to adopt the vaccine
Social, environmental, policy and market conditions necessary for development and up scaling	• Acceptability of the DIVA vaccine in control of CBPP • Need for policy to guide the incorporation of DIVA vaccine in CBPP control in Kenya and the region • Need to register the vaccine with the Veterinary Medicine Directorate (VMD) and other regional regulatory bodies for its use in Kenya and the region • There is need to lobby DVS to relax the supervision of vaccinations to allow involvement of private service providers • Need to align use of the DIVA vaccine to government agenda of creating CBPP disease free zones
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Approximately KES 500 per animal per year-2 vaccinations/year
Estimated returns	• Approximately KES 26,300 per animal from reduction in mortality, cost of treatment, loss of draft power and loss of trade opportunity due to restrictions
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limitations in information access due to gender inequalities in education • Lower participation of women in vaccine dissemination activities due to cultural barriers

	• Gender inequalities in resources and decision making may limit access to the vaccine • Restraining of animals during vaccination may present a challenge to women • Cultural practices that limit participation of certain gender categories in various aspects beef production including vaccination and distribution of vaccines • Limited time and mobility for women to attend extension activities when there are conflicting roles
Gender related opportunities	• The use of vaccine will increase income and provide household nutrition to the benefit of all • Involvement of trained youth in vaccination for them to earn an extra income by actively participating in vaccination drives • Knowledgeable women and youth can enter in to the distribution chain for income generation
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to their social status VMGs are often excluded from decision making during dissemination of technologies • VMGs face barriers in accessing resources such as credit and information • VMGs are often excluded from accessing and benefitting from technologies • Restraining of animals during vaccination may present a challenge to VMGs • The technology is labour intensive and very technical may require VMGs to hire service providers
VMG related opportunities	• VMGs can form common interest groups for collective access of the technology and enter in to the distribution chain for income generation • Vaccine Adoption will lead to increased animals' productivity hence increased incomes and improved food and nutrition security
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• Yet to be documented
Application guidelines for users	To be developed
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director, Biotechnology Research Institute, KALRO P.O. Box 362-00902 Kikuyu email: director.biori@kalro.org
Lead organization and scientists	KALRO Biotechnology Research Centre, Mwirigi Martin
Partner organizations	DVS, County Governments

Gaps

i) Determine the cost-benefit of using the test in the control of vaccine
ii) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration
iii) On farm validation of the vaccine
iv) Develop guidelines for successful use of the vaccine

4.1.5 TIMP name	**Recombinant HC58 DNA Vaccine**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Productivity losses from the highly pathogenic stomach worm *Haemonchus contortus* in the high potential sheep and goat producing areas of Kenya and increased anthelmintic resistance due to misuse of anthelmintics in the control of *H. contortus*
What is it? (TIMP description)	This is a DNA vaccine against the *Hemonchus contortus* worms in sheep and goats. The vaccine is based on the immune-inducing cysteine protease of *H. contortus* that reduce worm burden by 47%. It is a muscular injectable vaccine requiring a primary and booster vaccination 10 days apart.  ***Goat with bottle neck due to severe haemonchosis***
Justification	*H. contortus* is a highly pathogenic parasite affecting sheep, goats and cattle, causing major losses to the agricultural industry worldwide. Control costs of *H. contortus* and other nematode parasites are estimated to be over KES 600 billion (US$5,000million) annually. Haemonchosis control is so far carried out using chemical anthelmintics and grazing management however, excessive and uncontrolled use of anthelmintic drugs have resulted to emergence of anthelmintic resistant strains of the parasite, toxic residues in the human food chain and environmental pollution. Vaccination is the ultimate, effective and sustainable strategy to controlling this parasite. The recombinant HC58 DNA vaccine has been developed but requires further field testing and up-scaling for adoption.
B: Assessment of dissemination and scaling up/out approaches	

Users of the TIMP	• Small ruminant keepers, • DVS, • KEVEVAPI, • Pan African Veterinary Vaccine Centre of African Union (AU-PANVAC) • FAO
Approaches to be used in dissemination	• On-farm demonstrations • Digital platforms • Agricultural Shows and exhibitions • Print and mass media
Critical/essential factors for successful promotion	• Stakeholder participation especially County livestock and veterinary staff • Sustainable supply of the vaccine • Affordable vaccine
Partners/stakeholders for scaling up and their roles	• Egerton University – Technical backstopping, training of trainers, registration of the vaccine, • KALRO – Validation of vaccine • KEVEVAPI – Production and distribution, • DVS – Policy and regulation, • VMD – Registration and certification, • Farmers- End users • County Governments – Extension and vaccine distribution • Non-Governmental Organizations (NGOs) – Promotion and users
C: Current situation and future scaling up	
Counties where already promoted if any	• Inadequate capacity at KEVEVAPI to produce the vaccine • Low acceptance of a vaccine against worms • Inadequate information and guidelines on the use of the vaccine
Counties where TIMP will be up-scaled	• Need to foster partnership and building capacity of KEVEVAPI for vaccine production • Create awareness and promote the vaccine • Lobby for resources to equip KEVEVAPI for production of the vaccine • Develop user guides on vaccine use
Challenges in dissemination	• Inadequate capacity at KEVEVAPI to produce the vaccine • Low acceptance of a vaccine against worms • Inadequate information and guidelines on the use of the vaccine
Suggestions for addressing the challenges	• Need to promote acceptance of the vaccine • Need for policy to guide the incorporation of Recombinant HC58 DNA Vaccine in helminth control in sheep and goats in Kenya

	• Need to register the vaccine with the Veterinary Medicine Directorate (VMD) and other regional regulatory bodies for its use in Kenya and the region
Lessons learned in up-scaling if any	Yet to be determined
Social, environmental, policy and market conditions necessary	• Need to promote acceptance of the vaccine • Need for policy to guide the incorporation of Recombinant HC58 DNA Vaccine in helminth control in sheep and goats in Kenya • Need to register the vaccine with the Veterinary Medicine Directorate (VMD) and other regional regulatory bodies for its use in Kenya and the region
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not yet determined
Estimated returns	Cost of the *H. contortus* infection in sheep and goats leads to losses of USD 26 million (KES 3.1 billion) per annum or /KES 268 per kg of meat produced
Gender issues and concerns in development, dissemination, adoption and scaling up	• Recombinant HC58 DNA vaccine is administered through injections thus requiring that animals are properly restrained which may not be favourable for women. • Cultural practices that limit participation of certain gender categories in various aspects livestock production including vaccination • Limited time and mobility for women to attend extension activities when there are conflicting roles • Women have limited ability to influence decision-making in their household around vaccination and animal health • Women and youth have limited access finances necessary to acquire the vaccine
Gender related opportunities	• Develop gender targeted information and promotional materials • Affirmative action, capacity building and provision of support to women to participate • Trained vaccinators are likely to earn an extra income by actively participating in ECF vaccination drives • Knowledgeable women and youth can enter in to the distribution chain for income generation • The use of vaccine will increase income and provide household nutrition
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to their social status VMGs are often excluded from decision making during dissemination of technologies • VMGs face barriers in accessing information • VMGs have limited access to credit to acquire the vaccine • The technology is labour intensive and very technical may require VMGs to hire labour as service providers
VMG related opportunities	• Capacity building and support to be provided to VMGs

	• Create incentives for VMG owned vaccine distribution networks • Lobby for access to credit by VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Not yet determined
F: Status of TIMP readiness (1. Ready for up-scaling; 2. Requires validation; 3. Requires further research)	Requires further research
G: Contacts	
Contacts	Egerton University P.O. Box 536 - 20115, Egerton-Njoro, KENYA Institute Director Veterinary Research Institute P.O. Box 32-00902 Kikuyu, Kenya Tel. +254-20-2524616/2519769, Tel/fax +254-20-2020512 email: director.vsri@kalro.org
Lead organization and scientists	Egerton University, Prof. Charles Muleke; KALRO VSRI Muguga, Dr Erick Mungube
Partner organizations	KEVEVAPI, DVS, AU-PANVAC, FAO

Gaps

i) Determine the cost-benefit of the using the vaccine
ii) Develop guidelines for successful use of the vaccine
iii) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration
iv) On farm validation of the vaccine

4.1.6 TIMP name	**Thermostable I-2 Newcastle Disease Vaccine (AVIVAX-I2®)**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Loss of chicken due to high Newcastle disease incidence arising from lack of cold chain facilities in rural areas for vaccine storage
What is it? (TIMP description)	This is a live thermostable vaccine based on the lentogenic Australian I-2 Newcastle disease virus strain produced and marketed by KEVEVAPI under the trade name, AVIVAX-I2® It retains it activity at 28°C in a lyophilised form for at least 12 weeks and for nearly a year at 4-8°C. These vaccines also have the advantage

	of being easy to administer as they can be given intranasally, intraocularly, by injection or by mixing with feed and drinking water. The vaccine remains potent for two days after reconstitution.  ***Vial containing 100 doses of thermostable Newcastle disease vaccine***
Justification	Newcastle disease outbreaks have been reported all over the world, resulting in 80-100% mortality in chickens. High levels of vaccine failure due to an insufficient cold chain, particularly in rural areas. Low vaccination coverage due to limited availability of existing NCD vaccines that necessitate refrigeration/cold chain. The use of AVIVAX-12, as well as its storage, reconstitution, and administration will sustainably control Newcastle disease and thus reduce the losses indigenous chicken farmers suffer.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	All chicken producers in extensive, semi-intensive and intensive systems as well as multipliers especially in rural areas, Extension service Providers, Researchers, Agrovets
Approaches to be used in dissemination	Demonstration of vaccine transportation, reconstitution and administration during training, exhibition of vaccine in agricultural shows and trade fairs, farmer/pastoral field schools as well as farmer to farmer extension
Critical/essential factors for successful promotion	• Increased accessibility to AVIVAX-12 vaccine through local agrovets • VMD should step up its crackdown on counterfeit vaccine products.
Partners/stakeholders for scaling up and their roles	• KALRO – Source of technology • KEVEVAPI- Vaccine production • County governments to mobilize farmers and provide capacity building on use of AVIVAX-I2 • Chicken farmer groups to mobilize village chicken vaccinators for capacity building on use of AVIVAX-12.
C: Current situation and future scaling up	

Counties where already promoted if any	Busia and Machakos County
Counties where TIMP will be up scaled	All 47 Counties
Challenges in dissemination	• Some training channels are difficult to use due to low literacy levels. • Women's triple roles limit the amount of time available for training. • Limited information sharing via digital network
Recommendations for addressing the challenges	• More hands-on training/ experiences (in Farmer field Schools, Pastoral field schools) • More practical sessions and the use of visual aids during training • Develop tailored training models specific to each community based on assessed needs
Lessons learned in up scaling if any	• The vaccine prevents massive losses when used to vaccinate chicken • With a little training, farmers can easily handle and use the vaccine for vaccinating their chicken flocks
Social, environmental, policy and market conditions necessary for development and up scaling	• Acceptability of the farmers to use the vaccine • Need of policy to regulate importation of Newcastle disease vaccines • Need of conducive policy to regulate importation of poultry and poultry products and to create sustained market for local IC products
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of 100 doses of AVIVAX-I2 is KES 200.00, hence the cost per dose is KES 2.00
Estimated returns	• 80% return on investment • NCD is a deadly disease causing 100% mortality in chicken. AVIVAX-I2 confers over 60% direct immunity against NCD
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth have limited knowledge of Indigenous chicken diseases due to lack of access to agricultural information and extension services • There is low level of vaccination coverage in remote areas mainly due to lack of awareness the existence of vaccine by women • Women, who usually own small flocks do not have financial capacity to purchase the minimum vaccine packaging of 100 doses • Women, lack adequate skills on vaccine storage, reconstitution and administration procedure
Gender related opportunities	• Opportunity for youth and women trained in animal health to take up vaccine/vaccinating as a business • Organize chicken farmers into groups that can vaccinate their chicken at the same time • Women and youth can easily adopt for increased income and better nutrition for families due to

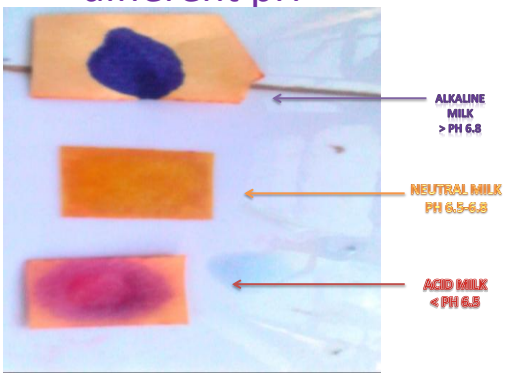
	increased flock sizes at the HH level with vaccination against NCD.
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • VMGs have limited access to agricultural information and extension due lack of awareness leading to low adoption of technologies. • VMGs, mainly have small flocks of chicken have limited finances and might not be able to purchase the vaccines whose minimum packaging is 100
VMG related opportunities	• The technology can improve food and nutrition security for VMGs • Adoption of IC disease management practices will lead to improved productivity hence more income for VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Thermostable I-2 ND vaccine has provided 100% protection of housed chickens and 89% protection to unhoused chickens against ND as has been reported in Tanzania, Ghana, Zambia, Cameroon, South Africa among other African countreies
Application guidelines for users	Available in a leaflet or online from KEVEVAPI (https://kevevapi.or.ke)
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	1 Ready for use
G: Contacts	
Contacts	
Lead organization and scientists	KALRO; Ann Wachira, Jane Wachira, David M. Mwangi, Evans Ilatsia, Peter Alaru, Ochieng Ouko, Tobias K'Oloo and Sophie Miyumo
Partner organizations	KEVEVAPI, DVS, County Governments

Research Gaps

1. Creating awareness to encourage adoption, particularly in rural and ASAL areas
2. Revising guidelines based on new information

4.2 Diagnostic tests

4.2.1 TIMP name	**pH-based mastitis kit**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	

Problem to be addressed	Low milk production in the dairy sector from undetected prolonged mastitis infection
What is it? (TIMP description)	This is a rapid, farmer friendly and cost-effective kit which is used at farm level to test and detect sub-clinical mastitis in milking animals with accuracy agreement with the laboratory-based tests of >95%. The kit is made from a paper strip which is impregnated with pH indicators. The colour of the strip when dipped in milk changes on the basis of the acidity and alkalinity of milk. For mastitic milk with pH of >6.8, the strip changes from orange to blue while in fermented milk which slightly acidic (<6.5), the strip changes from orange to pink. In normal milk with pH of between 6.5 to 6.8, the strip remains unchanged Colour changes of pH-based milk of different pH 
Justification	Mastitis is an udder infection of lactating animals that reduces milk yield, changes milk composition and shortens the productive life of affected animals and as such requires rapid detection and treatment. However, this cannot be achieved with the current detection methods such as California Mastitis Test (CMT), somatic cell counts and culture which are highly technical, require trained personnel and laboratory facilities. This makes the diagnosis of mastitis expensive for smallholder dairy farmers. The use of the pH-based mastitis kit solves this problem since it ensures rapid detection and treatment of the disease and can be used by the farmer in mastitis detection. The use of the kit will enhance productivity as well contribute to food safety as milk from mastitis animals will be discarded at milking.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Cattle and camel keepers, County veterinary and livestock staff, Private veterinary professionals, Researchers, Extension service providers
Approaches to be used in dissemination	Field days, agricultural shows, exhibitions, Digital platforms, Mass media, Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Availability of reagents for kit production • Registration and patenting • Acceptability of the kit in mastitis detection

	Simple for use by animal health service providers
Partners/stakeholders for scaling up and their roles	• Farmers - End users • Dairy cooperatives- Promotion and dissemination of information • County Governments- Extension services • KALRO, Universities- Research • VMD – Registration of the strip • DVS – Regulator
C: Current situation and future scaling up	
Counties where already promoted if any	Nakuru, Kajiado and Laikipia
Counties where TIMP will be up scaled	Counties with smallholder dairy cattle (KakamegaTaita Taveta, Nyandarua, Bomet, Kericho, Uasin Gishu, Elgeyo Marakwet, Kajiado, Nyeri Machakos, Kisumu, Siaya) Camel raising counties (Laikipia, Garissa, Marsabit, Mandera, Wajir, Tana River Isiolo),
Challenges in dissemination	• Long registration process with VMD which has delayed commercialization efforts • Patent process for the kit is long and tedious • Kit still requires proper packaging • Limited awareness about the kit
Recommendations for addressing the challenges	• Consult VMD personnel when filling the registration dossier to hasten the process • Involve the KALRO legal team to engage with KIPI to fast-track patenting process • Fast track kit packaging • Develop user information and guidelines on how it works
Lessons learned in up scaling if any	• With a little training, farmer are able to conduct mastitis screening and make interpretation of the results accurately • Farmers are willing to adopt the technology • With proper training the kit can be produced with ease in any diagnostic laboratory • The kit needs to be stored in a dry and cool place away from direct sunlight • Holding of the kit with hands is likely to causes changes on the kit which may interfere with its diagnostic accuracy
Social, environmental, policy and market conditions necessary	• Acceptability of the use of the strip in mastitis diagnosis in all dairy production systems • Guide on proper and hygienic disposal of the used kit to minimize environmental contamination • Policy guidelines to regulate manufacture, quality and use of the strip • Need to incorporate use of kit in milk marketing
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	• Involvement of private actors in the marketing and distribution of the kit for ease of access by dairy animal keepers • Conduct economic analysis on the use of strip kit in the diagnosis control of mastitis
Basic costs	KES 100 per strip package of 10

Estimated returns	Udders free of mastitis produce 40% more milk than mastitis affected udders. This will result in increase in amount of milk available to households for food and for sale to earn income. (KES 23000 per cow per year due to subclinical mastitis
Gender issues and concerns in development, dissemination, adoption and scaling up	• Adoption of the strip kit is likely to be a challenge for women since they are not the overall decision makers at household level • Most women lack the resources with which to buy mastitis strip kit • Low levels of adoption of the mastitis kit by women, most of whom are semi-illiterate • lack of adequate skills on use of the kit by women who have limited access to information and extension service
Gender related opportunities	• Use of the kit has the potential to contribute to increased milk production for food, nutrition and income security at household level6 • There is an opportunity to value addition and marketing following improvement in milk quality. • Women who are the involved in milking animals are likely to be main users of the technology
VMG issues and concerns in development, dissemination and adoption and scaling up	• Visually impaired persons are disadvantaged since the technology is based on colour visualization. • VMGs may lack the resources to acquire the strip kit for screening mastitis in the milking animals • Limited knowledge of KIT among VMGs who have low access to agricultural information and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities
VMG related opportunities	• Increased productivity of good quality presents an opportunity for VMGs to engage in milk value addition for high returns. • There is need to reach out to marginalized and vulnerable persons with animal health information as they are the least likely to access regular services • Business opportunities for VMG to sell camel milk which is popular because of its health benefits
E: Case studies/profiles of success stories Success stories	During field validation of the kit on Cattle in Kajiado and on camels in Laikipia, livestock keepers appreciated the simplicity with which mastitis diagnosis can be done at herd level without a need for laboratory and trained staff
E: Case studies/profiles of success stories	
Application guidelines for users	Mastitis kit user information booklet. Draft available at VSRI, Muguga
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director

	KALRO VSRI, Muguga North P.O. Box 32 -00902 KIKUYU, Kenya
Lead organization and scientists	KALRO VSRI Muguga Dr Peter Ndirangu
Partner organizations	Veterinary Medicines Directorate (VMD), MMUST, Kibabii University, County governments and DVS

Gap

i) Validation of pH-based mastitis kit for detection and control of sub clinical mastitis dairy goats
ii) Determine the cost-benefit of using the test in the control of sub-clinical mastitis in dairy animals
iii) Develop guidelines for successful use of the test
iv) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration

4.2.2 TIMP name	**Latex agglutination diagnostic test for Contagious Caprine Pleuro-Pneumonia (CCPP)**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity in goats arising from prolonged infection with Contagious Caprine Pleuro-Pneumonia (CCPP) as a result of late detection of the disease due to limitations in the current laboratory based diagnostic tests which are unsuitable for field diagnosis
What is it? (TIMP description)	Latex agglutination diagnostic test is a simple rapid penside test for identifying goats that have been exposed to CCPP causative organisms. The test works with either whole blood or serum and does not require refrigeration making it suitable for rapid field diagnosis of CCPP in Arid and semi-arid lands (ASALs) where the disease is prevalent.  ***Postmortem lesions of goat with CCPP***
Justification	CCPP causes huge economic losses in form of reduced productivity through high mortality in goats. Currently available detection tests for CCPP have limitations in

	sensitivity, specificity, operation time, requirements of sophisticated equipment, need for skilled personnel and cost implications. The current tests, which are laboratory-based, delay disease detection and result in increased losses from prolonged disease. In addition, late diagnosis of the disease increases the risk of irrational use of antimicrobials by some pastoralists for treatment and prophylaxis which is a public health hazard attributed to anti-microbial residues and drug resistance. The latex agglutination diagnostic test is a rapid pen side test which addresses the limitation in the current CCPP diagnostic tests and is important for effective and rapid detection of CCPP for informed decision making on the use of vaccines/drugs. It can also be used during vaccination to detect exposed animals and decrease incidences of high vaccine failure that result from vaccination infected goats.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralists, Researchers, Goat traders associations, Goat Breeder associations, DVS, County Governments, Private animal health practitioner, Extension service providers
Approaches to be used in dissemination	• Farmer Field days • On-farm demonstrations • Digital platforms • Agricultural Shows and exhibitions • Print and mass media • Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Availability of reagents and other consumables • Availability of effective marketing channels for the kit • Adequate infrastructural capacity to produce and supply kits
Partners/stakeholders for scaling up and their roles	• KALRO- Provide technical backstopping and training of trainers • Extension service providers (Public and private) will offer advice and collect information on the uptake of the kit. They will also ensure proper use of the kit. • County Governments- Promote and create awareness on the advantages of the kit • DVS and VMD-Policy and regulation on use of the kit • Pastoralists, farmers and farmer groups- will spread information on the use of the kit and are the end-users. • AU/PANVAC- Ensure quality assurance • Private Institutions-Production, Commercialization and marketing of the kit

C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Baringo, Garissa, Marsabit Tana River, Isiolo, Tharaka Nithi, Elgeyo Marakwet, Kajiado, Nyeri, Machakos, West Pokot
Challenges in dissemination	• It is difficult to get appropriate droppers (10µl) for dispensing the reagents • Large dose packaging • Low awareness of the technology • Inadequate capacity to use the kit by extension workers and pastoralists • Lack of appropriate diagnostic kit marketing channels
Recommendations for addressing the challenges	• Fabricate the right dispenser • Seek alternative dispensing methods • Package in small packs • Promotion to raise awareness of the technology. • Capacity building of extension workers and pastoralists on use of the kit • Collaboration with private institutions to enhance kit production and commercialization.
Lessons learned in up scaling if any	• Proper guideline on kit application including type and state of samples compatible with the kit will enhance its accurate use. The technology does not work well with frozen serum samples
Social, environmental, policy and market conditions necessary for development and up scaling	• Need to create awareness and promote the kit in Kenya and the sub-Saharan Africa region • Need for policy to guide the incorporation of kit in detection and control of CCPP in Kenya • Need to register the kit with the Veterinary Medicine Directorate (VMD) and other regional regulatory bodies for its use in Kenya and the region
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 10,000 per 100 tests
Estimated returns	Average economic losses due to CCPP in 100 goat herd is KES 171,266 per year
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limited financial capacity to purchase the kit • Women and youth have limited knowledge of sheep and goat diseases due to lack of access to agricultural information and extension services • Women, most of whom are semi-illiterate lack adequate skills on diseases management
Gender related opportunities	• Develop gender targeted information and promotional materials • Capacity building and provision of support to women and youth to increase their uptake of the kit • The use of vaccine will increase income and provide household nutrition

	• Improved productivity of goats increases household income leading to more business opportunities for women and youth who keep small ruminants.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Due to their social status VMGs are often excluded from decision making during dissemination of technologies • VMGs face barriers in accessing information • VMGs face barriers in accessing resources such as credit
VMG related opportunities	• Capacity building and support to be provided to VMGs • Less mortalities and increased productivity hence increased income for VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• None
Application guidelines for users	Capritest LAT for CCPP-(Leaflet) – available at Biotechnology Research Centre, Kabete
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Institute Director, Biotechnology Research Institute, KALRO P.O. Box 362-00902 Kikuyu email: director.biori@kalro.org
Lead organization and scientists	KALRO, Anderson Wambugu
Partner organizations	DVS

Gaps

i) Determine the cost-benefit of using the test in the control of CCPP
ii) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration
iii) On farm validation of the test

4.2.3 TIMP name	**Protein tagged Latex Agglutination diagnostic test for Contagious Bovine Pleuro-Pneumonia**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity due to high incidence, high economic losses, trade restrictions and prolonged infection of beef cattle with Contagious Bovine Pleuro-pneumonia (CBPP) arising from limitations in the current laboratory based diagnostic tests.

What is it? (TIMP description)	This is a rapid and simple pen-side strip test embedded with a protein marker that is specific to the CBPP DIVA vaccine. The strip test forms a band when in contact with antibodies against CBPP found in exposed or vaccinated animals. The test forms a second band when in contact with antibodies specific to a protein in animals vaccinated with the CBPP DIVA vaccine thus differentiating animals vaccinated with the CBPP DIVA from infected animals. It is a field-based test that is used alongside the CBPP DIVA vaccine and suitable for use in ASALs where the CBPP is prevalent.
Justification	Contagious Bovine Pleuropneumonia is a transboundary disease that lowers beef productivity in Kenya. The disease, due to being transboundary, has important consequences on international trade. As such detection of the disease in an area attracts trade barriers and restrictions. Current diagnostic tests are limited in that they are laboratory based, costly, time limiting and require use of skilled personnel and equipment. In addition, they are unable to differentiate between truly infected animals from vaccinated ones. The protein tagged Latex Agglutination CBPP diagnostic test addresses the limitations of the current CBPP diagnostic tests and is important for effective and rapid detection of CBPP for decreased productivity and economic losses and reduction in trade barriers along the beef value chain. The test will support informed decision making on the use of vaccines/drugs in control of CBPP.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralists, Researchers, Beef traders associations, Beef Breeder associations, DVS, County Governments Private animal health practitioners, Extension service providers
Approaches to be used in dissemination	• Farmer Field days • On-farm demonstrations • Digital platforms • Agricultural shows and exhibitions • Print and mass media • Agricultural Innovation Platforms (AIPs)
Critical/essential factors for successful promotion	• Availability of reagents and other consumables • Availability of effective marketing channels for the kit • Adequate infrastructural capacity to produce and supply kits
Partners/stakeholders for scaling up and their roles	• DVS- Policy and regulation • County Governments- End users, extension services • Private animal health practitioners-End users). • KALRO-Provide technical backstopping and training of trainers

	• Extension service providers (Public and private) will offer advice and collect information on the uptake of the kit. They will also ensure proper use of the kit. • County Governments- Promote and create awareness on the advantages of the kit • DVS and VMD-Policy and regulation on use of the kit • Pastoralists, farmers and farmer groups- will spread information on the use of the kit and are the end-users. • AU/PANVAC- Ensure quality assurance • Private Institutions-production, Commercialization and marketing of the kit
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Garissa, Marsabit Tana River, Isiolo, Tharaka Nithi, Taita Taveta, Laikipia, Bomet, Elgeyo Marakwet, Kajiado,
Challenges in dissemination	• Low awareness of the technology • Inadequate capacity to use the kit by extension workers and pastoralists • Lack of appropriate diagnostic kit marketing channels
Recommendations for addressing the challenges	• Promotion to raise awareness of the technology. • Capacity building of extension workers and pastoralists on use of the kit • Collaboration with private institutions to enhance kit production and commercialization.
Lessons learned in up scaling if any	• Collaboration with partners with comparative advantages will result in successful uptake of the vaccine • Proper guideline on kit application including type and state of samples compatible with the kit will enhance its accurate use.
Social, environmental, policy and market conditions necessary for development and up scaling	• Acceptability of the kit for diagnosis of CBPP in Kenya and the sub-Saharan Africa region • Need for policy to guide the incorporation of kit in detection and control of CBPP in Kenya • Need to register the kit with the Veterinary Medicine Directorate (VMD) and other regional regulatory bodies for its use in Kenya and the region
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 100 per test
Estimated returns	Estimated cost of CFT CBPP test is KES 400 per test therefore use of CBPP agglutination test reduces costs by KES 300 per test.

	Due to added advantage of differentiating vaccinated animals from infected animals, the test reduces losses due to decreased market value
Gender issues and concerns in development, dissemination, adoption and scaling up	• Limitations in information access due to gender inequalities in education • Gender inequalities in resources and decision making may limit access to the kit • Limited time and mobility for women to attend extension activities due to conflicting responsibilities
Gender related opportunities	• The kit is easy to use by women and youth • The use of kit will lead to increased income and provide household nutrition • Increased opportunities for youth involvement in CBPP testing and marketing of the kit
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs face barriers in accessing information • Due to their social status VMGs may be excluded from decision making during upscaling • VMGs face barriers in accessing resources such as credit
VMG related opportunities	• Use of the kit will benefit VMGs through increased household food and incomes for VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• None
Application guidelines for users	None at the moment
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires Validation
G: Contacts	
Contacts	Institute Director, Biotechnology Research Institute, KALRO P.O. Box 362-00902 Kikuyu email: director.biori@kalro.org
Lead organization and scientists	KALRO Mwirigi Martin
Partner organizations	DVS, County Governments

Gaps

i) Determine the cost-benefit of using the test in the control of CBPP
ii) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration
iii) On farm validation of the test
iv) Develop guidelines for successful use of the test

4.3 Resistant breeds

4.3.1 TIMP name	**Trypanotolerant Orma Boran Cattle**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity due to high incidence of trypanosomosis and widespread trypanocide resistance.
What is it? (TIMP description)	This is an indigenous cattle breed with ability to survive and remain productive in high tsetse challenge zones with minimal curative and prophylactic treatments against nagana. Orma boran breed of cattle is adapted to the semi-arid and arid areas particularly in Tana River County and especially in the Tana delta where tsetse challenge is very high  ***Herd of Orma boran***
Justification	The control of trypanosomosis relies largely on the use of curative and prophylactic drugs, tsetse (vector) control, resistant cattle breeds and or an integrated control approach combining all the control strategies. Use of drugs to treat or prevent the disease is limited by drug costs and availability, and by resistance. Development of new drugs is unlikely in the foreseeable future because associated high and prohibitive costs. Vector control methods relying on insecticides are effective but expensive contribute environmental concerns and greenhouse gases emission. Additionally, targets and traps as a means of tsetse control are less costly, but their effectiveness depends on the tsetse species involved and the stability of the community level control infrastructure. Trypanotolerance of livestock is therefore a promising sustainable option for control of Nagana.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Beef farmers in trypanosomosis endemic areas, Extension service providers, Researchers, Input suppliers
Approaches to be used in dissemination	Field days, shows and exhibitions, media, digital platforms
Critical/essential factors for successful promotion	• Multiplication of trypanotolerant cattle breeds for use by pastoralists in high tsetse challenge areas • Sensitization of pastoralists on the need for controlled breeding to avoid diluting the trypanotolerant traits • Proper records on breeding of Orma boran

Partners/stakeholders for scaling up and their roles	• KALRO BRI – Multiplication of Orma Boran breeds • University of Nairobi- Collaborative research • ADC- Provide semen for breeding animals • Kenya Stud book – Registration of elite breeds • Animal recording centre – Record keeping • KAGRIC- Supply semen for breeding • County Governments- Extension services).
C: Current situation and future scaling up	
Counties where already promoted if any	Tana River, Garissa, Busia and Narok.
Counties where TIMP will be up scaled	Baringo, Garissa, Marsabit Tana River, Isiolo, Tharaka Nithi, Taita Taveta, Laikipia, Uasin Gishu, Elgeyo Marakwet, Busia, Kajiado, Machakos, Kisumu, Siaya, West Pokot
Challenges in dissemination	• Limited number of cattle to disseminate in areas with high tsetse challenge • Indiscriminate cross breeding or Orma boran breed with other indigenous cattle breeds with susceptible to nagana • Inadequate information required to guide the dissemination process in different production systems • Farmers preference for large bodied and high milk producing breeds • Inadequate awareness on the usefulness of the cattle breed in surviving and remaining productive in high tsetse challenge areas
Recommendations for addressing the challenges	• Multiply the Orma boran for extensive distribution as breeding stock • Regulate the breeding of Orma boran to minimize diluting and eroding trypanotolerance traits • Wide spread sensitization of farmers on trypanotolerance potential and benefits of Orma Boran • Develop breeds that meet the farmers' preference for large bodied and high milk producing breeds.
Lessons learned in up scaling if any	• Farmers keeping the breed spend less on trypanosomosis treatment • Orma boran can be used for draught power, milk proand meat production
Social, environmental, policy and market conditions necessary	• Acceptance of the Orma boran in tsetse infested areas • Need for policy guideline to incorporate Orma boran in National breeding programme • Streamline the production, distribution and marketing of Orma boran semen
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 20,000 per reproductively mature heifer
Estimated returns	• Estimated savings accrued from reduction of trypanosomiasis related control and production losses

	by keeping of Orma Boran in tsetse infested areas (KES 36,000) • 40kg higher body weight of mature Orma Boran compared to Zebu in tsetse infested areas (estimated at KES 16,000 per animal • 75% reduction in prophylaxic treatment for Trypanosomiasis estimated at KES8,000 • 50% reduction in of vector control estimated at KES 12,000
Gender issues and concerns in development, dissemination, adoption and scaling up	• Orma Boran being a smaller cattle breed is likely to be adopted by women compared to bigger and aggressive indigenous breeds such as short horned Boran • Women and youth have limited access to productive resources and credit for buying start-up cattle • The fact that Orma boran remain reproductive and productive in high tsetse challenge areas is likely to achieve food, nutrition and income security for children, women and youth
Gender related opportunities	• Opportunity for youth to be trained in animal production to take up keeping or Orma boran as an agro-enterprise • Organize Orma keepers into groups so that they can engage in community breeding initiatives to supply breeding heifers • Opportunity for youths to be trained on provision of AI services • Opportunity for milk from Orma boran to be used as food for young children, the elderly and lactating mothers in households
VMG issues and concerns in development, dissemination, adoption and scaling up	• Grazing and other husbandry practices for Orma boran may present a challenge to VMGs • Access to information and extension services on sustainable breeding of Orma boran among VMGs may be difficult • Access to credit for startup by VMGs may be a challenge
VMG related opportunities	• VMGs can form common interest groups to breed the animals for sale • VMGs will benefit by using the milk from Orma boran for food and also earning an income
E: Case studies/profiles of success stories	
Success stories from previous similar projects	High demand for the breed in Nguruman Kajiado where tsetse challenge is high
Application guidelines for users	Maichomo, M.W and Orenge, C.O. (2020) Use of Trypanotolerant Breeds: The Case of the Orma Boran. IGI Book chapter. *DOI: 10.4018/978-1-7998-6433-2.ch005*
F: Status of TIMP readiness	Requires validation

(1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	
G: Contacts	
Contacts	Institute Director KALRO KALRO VSRI Muguga P.O. Box 32-00902 Kikuyu
Lead organization and scientists	KALRO, BRI Lanet Mr Tura sako, BiORI Muguga Dr. Chemuliti, Dr. Godiah.
Partner organizations	KALRI BRI Lanet, University of Nairobi, ADC, KAGRC, Land O'Lakes, DVS, County Governments

Gaps

ii) Determine trypanotolerance mechanisms in Orma Boran.
iii) Introgress genes for trypanptolerance in other climate smart indigenous cattle breeds.
iv) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration.
v) Determine the costs/benefits of trypanotolerant breeds.
vi) Determine willingness to pay

4.4. Disease control strategies

4.4.1 TIMP name	**Integrated helminth control**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity in cattle, sheep and goats due to high helminth burden and high cost of deworming due to lack of a guideline on sustainably helminth control.
What is it? (TIMP description)	This is a strategy where deworming is based on the agro-ecological zone and season. In areas with two rainy seasons, four worming sessions are required. Rain is conducive for the development of helminths in the animals making them shed more eggs on pastures. Time worming to happen shortly before onset of the rains to minimize contamination of pasture with infective helminth eggs which exposes livestock to the risk of re-infection during grazing. Repeat worming should be done at the end of the rainy season so that animals enter the dry season with a less worm load. Animals in agro-ecological zones with only one rainy season, worming is done twice a year at the start and end of the rainy season.
Justification	Unguided use of dewormers results in high worm burden and increased cost of deworming. These reduces productivity in the red meat and dairy value chains. The use of the integrated helminth control strategy will ensure control of helminths while helping farmers save costs by only doing deworming in a justifiable manner. Routine deworming as often practiced may result in unnecessary treatments and also aid in resistance development. Milk,

	meat and eggs will reduce contamination with anthelmintic residues.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy, beef and small ruminant farmers, Extension Service Providers, Researchers, Agrovets
Approaches to be used in dissemination	Field days, shows, exhibitions, on-farm, digital platforms, Agricultural Innovation Platforms (AIPs) demonstrations and posters
Critical/essential factors for successful promotion	• Use of correct dose, dosing technique and timing. • Policy guideline on regulated use of anthelmintics • Awareness creation on integrated helminth control • Good working relationship and incorporation of DVS and County Governments in development and promotion of the strategies
Partners/stakeholders for scaling up and their roles	• KALRO- Research on new and alternative anthelmintic drugs, monitor resistance trends and develop resistance best-bet management options • County Governments - Extension services- dissemination of information and ensure proper use of Management practice • Private veterinarians – Clinical services • Pharmaceutical companies - Supply of anthelmintic drugs • VMD-Registration of new anthelmintic drugs before they go to the market • DVS – Regulate use of anthelmintic drugs • Livestock keepers- end users of the management practice and dissemination of information on the management practice
C: Current situation and future scaling up	
Counties where already promoted if any	Nyeri and Kericho
Counties where TIMP will be up scale	Baringo, Garissa, Marsabit Kakamega, Tana River, Isiolo, Tharaka Nithi, Taita Taveta, Laikipia, Nyandarua, Bomet, Kericho, Uasin Gishu, Elgeyo Marakwet, Busia, Kajiado, Nyeri Machakos, Kisumu, Siaya, West Pokot
Challenges in dissemination	• Inadequate awareness about existence of the integrated helminth control strategy • Proliferation of anthelmintic drug brands in the market some of which are counterfeits • Liberalized market for anthelmintic drugs which is hard to regulate • Under dosing since worming is based on animal live weights • Wrong timing for deworming.
Recommendations for addressing the challenges	• Create awareness about how the integrated helminth control strategy works • Enforce regulations on registration of drugs to enhance quality

	• Capacity build farmers and technicians on correct doses, • Develop farmer-friendly guidelines on proper dosing and application of dewormers • Avail simple and easy to use weighing techniques to encourage dosing based on live weight • Ensure worming is done based on season and risk of helminth infection
Lessons learned in up scaling if any	• Deworming can be timed to only be done when needed • Farmers if trained can be able to estimate the weight of their animals as a guide to giving correct anthelmintic drug dosages • Application of the management practice saves unnecessary costs
Social, environmental, policy and market conditions necessary	• Need for policy guidelines on anthelmintic use (in view of Animal disease Act (CAP 364) as enforced by DVS) • Need for regulation on anthelmintic quality
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 100-200/dose of anthelmintic
Estimated returns	The adoption and use of this strategy will save up to 30% of costs incurred when routine deworming after once after 3 months
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women and youth may have challenges handling cattle and rams and bucks during worming • Women and youth are rarely involved in decision making on when and how to do worming • Women, may not access extension information and on the use of integrated helminth control strategy due to low levels of education and other cultural barriers. • Ownership of cattle and small ruminants is predominantly a preserve of men which disadvantages women and youth when it comes to decision making
Gender related opportunities	• Improved productivity of animals will lead to increased incomes for both gender and youth • The women and youth may get an opportunity to conduct capacity building as well as community extension services • The youth may be involved in generation of messages to popularize the integrated helminth control strategy within their community • Business opportunity for youth to take up animal health as a business

VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs especially PWDs may be disadvantaged when it comes to walking long distances to seek for extension services on helminth control • VMGs may lack the resources to acquire dewormers for their livestock • People with disability will be disadvantaged in restraining the animals
VMG related opportunities	• Increased incomes from savings on anthelmintic drugs for other household uses by VMGs • The VMGs may be involved in generation of messages to popularize the integrated helminth control strategy within their community
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• The integrated helminth control promoted used extensively in many agro-ecological zones of Kenya by KARI-DFID (1994-2000) • The integrated helminth control strategy successfully used on dorper sheep belonging to the community sheep breeding groups in Laikipia and Kajiado Counties
Application guidelines for users	KARI-DFID (1999)- Integrated helminth control (Technical Note No. 2)
F: Status of TIMP readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Institute Director KALRO – VSRI, Muguga North P.O. Box 32 - 00902 Kikuyu, Kenya
Lead organization and scientists	KALRO VSRI Dr. Nginyi J., Dr Mungube E.O
Partner organizations	DVS, Pharmaceuticticals, County Governments, VMD

Gaps

i) Update the strategic helminth guidelines to make them responsive to changes in climatic conditions and land use patterns which have an impact on helminth prevalence.
ii) Develop and validate integrated helminth control packages to address rising incidences of anthelmintic resistance and residues in milk and meat.
iii) Develop helminth risk maps and assess anthelmintic resistance patterns
iv) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration.

4.4.2 TIMP name	**Integrated Control Strategy for Camel Surra**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	

Problem to be addressed	Low productivity of camels due to high incidence of Surra in camel keeping areas as a result of lack of guided control of the disease
What is it? (TIMP description)	This is management practice that involve the use of injectable trypanocidal drugs for prevention and treatment of the Surra in camels, targeting seasons of high burden of the disease. This minimizes production losses and also ensure the disease does not spread outside endemic areas.
Justification	Surra is the most serious disease of camels caused by *T. evansi* spread by biting flies. The disease reduces milk and meat production compromising household food and nutrition security for pastoralists. This affects their resilience to cope climate change shocks. Current control practices are insufficient to significantly reduce morbidity, mortality and the associated economic losses. The use of the integrated Surra control strategy will ensure control of the disease while helping farmers save treatment costs in a justifiable manner
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Camel keepers, Kenya Camel association, County Governments, Researchers, Extension service providers
Approaches to be used in dissemination	Field days, shows and exhibitions, mass media, digital platforms
Critical/essential factors for successful promotion	• Availability of relevant and effective trypanocidal drugs • Trained personnel to administer trypanocidal drugs in camels • Ensure full involvement of the pastoralists and stakeholders in the Camel milk and meat value chain
Partners/stakeholders for scaling up and their roles	• County governments- Extension services • DVS – Regulation of drug use in disease control • VMD – Registration of new trypanocidal drugs before use in the country • Pharmaceutical companies – Distribution of trypanocidal drugs • Kenya Camel Association – Advocating for the welfare of camel keepers • Camel keepers- End users of the management practice and dissemination of information to other camel keepers
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit
Counties where TIMP will be up scaled	Baringo, Garissa, Marsabit Tana River, Isiolo, Taita Taveta, Laikipia, Kajiado, West Pokot
Challenges in dissemination	• Inadequate awareness about existence and effectiveness of the integrated surra control strategy • Proliferation of trypanocidal drug brands in the market some of which are counterfeits

	• Liberalized market which is hard to regulate • Underdosing since treatment of surra is based on animal live weights • Poor drug reconstitution techniques
Suggestions for addressing the challenges	• Create awareness about how the integrated surra control strategy works • Enforce regulations on registration of drugs to enhance quality • Capacity building of camel keepers and technicians on correct doses, • Avail simple and easy to use weighing techniques to encourage dosing based on live weight • Ensure treatment is done based on season and risk of Surra infection
Lessons learned in up scaling if any	• Reconstitution and administration of trypanocidal drugs should be done by trained personnel • Prophylaxis when done at the right time reduces risk of camels getting infected with surra • Building the capacity of pastoralists improves the management of surra in their camel herds for better productivity • The control of surra enhances camel productivity for food, nutrition and income security
Social, environmental, policy and market conditions necessary	• Acceptability of trypanocidal treatment of camels infected with Surra • Policy guidelines on use of trypanocides for Surra control • Policy guidelines on marketing of trypanocidal drugs in Kenya
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Quinapyramine suplphate/chloride (Triquin®) packed in 2.5 gram packets sold at KES 300-400.
Estimated returns	Returns from integrated Surra control are due to reduction in surra-related productivity losses. Surra in camels results in: • 36% reduction in milk yield • 26% reduction in reproductive losses • 10% reduction in body weight gain • 8% reduction in draught power • 16% mortality
Gender issues and concerns in development, dissemination, adoption and scaling up	• Inadequate awareness about existence and effectiveness of the integrated surra control strategy among women • Women may have challenges handling camels during injection • Women and youth are rarely involved in decision making on when and how to treat for surra

	• Women and youth may access extension messages and on controlling surra in camel herds due to low levels of education and other cultural barriers. • Ownership of camels is predominantly a preserve of men which disadvantages women and youth when it comes to decision making
Gender related opportunities	• Improved productivity of camels will lead to increased incomes for both gender and youth • The women and youth may get an opportunity to conduct capacity building control of surra as well as community extension services • The youth may be involved in generation of messages to popularize the integrated control of surra within their community
• VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs especially PWDs may be disadvantaged they may not effectively restrain camels during injections • VMGs may lack the resources to acquire Triquin for treating surra in their camels • PWDs will be disadvantaged in walking long distances to buy trypanocidal drugs
VMG related opportunities	• The VMGs may be involved in generation of messages to popularize the integrated control of surra within their community • Improved productivity of animals increases household income leading to more business opportunities for VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	KALRO BioRI Muguga through funding from African Union promoted the integrated control of surra in camels in Marsabit and Somaliland from 2017 to 2021
Application guidelines for users	Camel Manual for Service providers available at KALRO-BioRI-Muguga
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for up-scaling
G: Contacts	
Contacts	Institute Director, KALRO – BioRI Muguga P.O. Box 362 -00902 Kikuyu, Kenya
Lead organization and scientists	KALRO-BioRI Muguga, Chemuliti J., Godia L., Wanjala K., Mdachi R., Wamwiri F., Auma J., Alusi P.
Partner organizations	Terra Nouva, IGAD Sheik Technical Veterinary School (ISTVS), Kenya Camel Association, DVS, VMD

Gaps

i) Conduct promotional activities to catalyze the adoption of the management practice for wide use in the camel rearing regions to control surra
ii) Determine the cost-benefit of using the practice

iii) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration
iv) On farm validation of the management practice

4.4.3 TIMP name	**Push-Pull for tsetse fly control**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Losses in cattle due to high incidence of Nagana and increased trypanocidal drug resistance
What is it? (TIMP description)	This technology uses attractants and repellant chemicals blends to repel tsetse flies away from cattle or kill those that attempt to feed on cattle thus reducing transmission of trypanosomes and reducing the risk of spreading nagana. The technology optimized the response of tsetse flies to odors and can potentially augment the current tsetse fly-control interventions.
Justification	Over-reliance and misuse of trypanocides resulted in trypanocidal drug resistance and high incidence of Nagana and reduced cattle productivity in tsetse infested areas. The use of push-pull enables farmers to keep productive cattle in high tsetse infested areas thereby enhancing the productivity of cattle. Push-pull will contribute to building the resilience by ensuring trypano-susceptible cattle breeds survive, reproduce and produce in high tsetse challenge areas
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Livestock farmers, Extension service providers, Researchers, NGOs and CBOs, Agrovets
Approaches to be used in dissemination	Field days, on-farm demonstrations, ASKs shows, exhibitions and farmer outreach activities
Critical/essential factors for successful promotion	• Availability of effective repellants and attractants • Training on how to use repellants and attractants on cattle • Extensively promote the use of push-pull in controlling nagana • Ensure full involvement of the pastoralists and stakeholders in the Camel milk and meat value chain • To avoid counterfeiting, encourage the registration on all chemicals used as repellants and attractants by VMD

	• Involve DVS for enforcing regulated use of the repellants and attractants
Partners/stakeholders for scaling up	• Kenya Tsetse and Trypanosmiasis Eradication Council (KenTTEC) - Surveillance of Tsetse fly and nagana • KALRO – Research on tsetse and nagana control • Universities - Research on tsetse and nagana control • DVS – Policy regulations on tsetse and nagana control • Bio-innovate- Funding agency • County Governments - Extension services • Cattle keepers-end users of the technology and disseminators of information on its use
C: Current situation and future scaling up	
Counties where already promoted if any	Kwale
Counties where TIMP will be up scaled	Tana River, Isiolo, Busia, Bungoma, Kirinyaga, Kajiado, Meru, Homabay, Kisumu, Siaya, Meru
Challenges in dissemination	• The repellants and attractants not packaged in form for direct use by farmers • Production repellants and attractants is still at pre-industrial level • Low awareness levels on existence and use of the push-pull technology
Suggestions for addressing the challenges	• Package repellants in a form that can easily be used by farmers • Fast track patenting, registration and commercialization of repellants and attractants • Sensitize farmers and other stakeholders on the availability of repellants and attractants for controlling tsetse flies
Lessons learned in up scaling if any	• Proper use of push-pull technology helps to sustainably and cost-effectively control nagana in cattle reared in high tsetse challenge areas • Repellants and attractants should not be diluted before applying to cattle • There is need to involve cattle keepers when using the technology • Enhancing the capacity of cattle keepers improves the effectiveness of the push pull technology • Always remind farmers not to spray animals applied with attractants and repellants
Social, environmental, policy and market conditions necessary	• Acceptability of the technology among livestock keepers

	• Guidelines on use of attractants and repellants to prevent pollution of the environment especially water masses if not properly done • Policy on quality control of insecticides
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 300/animal per week for treatment with an attractant/repellant
Estimated returns	The spray will prevent 30% loss in cattle herds due to nagana
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women may have challenges handling and applying the repellants and attractants onto cattle • Women are rarely involved in decision making on when and how to use repellants and attractants • Women may not be able access extension messages and on push-pull of education and other cultural barriers. • Ownership of cattle is predominantly a preserve of men which disadvantages women and youth when it comes to decision making
Gender related opportunities	Youth may train to use push-pull and earn some income from practicing it by acting as distributors and service providers
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs may lack resources to procure and use attractants • VMGs may be disadvantaged in terms accessing extension material and other dissemination information on the technology • VMGs with health challenges may be affected by chemicals used in the formulation of the attractants and repellants • Persons with visual impairment may face challenges reading and internalizing manufacturer instructions handling and how to use the attractants and repellants
VMG related opportunities	VMGs may train to use push-pull and earn some income from practicing it by acting as distributors and service providers
E: Case studies/profiles of success stories	
Success stories from previous similar projects	The push-pull technology used on experimental farms in Kwale with 98% protection success on preventing nagana infection in experimental
Application guidelines for users	Mieji, P.O. et al., 2022. Perspectives on Odor-Based Control of Tsetse Flies in Africa. Frontiers in Physioloy, DOI - 10.3389/fphys.2022.831618

F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires field validation
G: Contacts	
Contacts	Institute Director, KALRO Biotechnology Research Institute Muguga P.O. Box 362 -00902 Kikuyu
Lead organization and scientists	KALRO Biotechnology Research Institute, Muguga- Dr Paul Mreji
Partner organizations	Kenya Tsetse and Trypanosmiasis Eradication (KenTTEC), Council, Kenyatta University, DVS, Bioinnovate, Gulu University, County Governments

General Research Gaps push pull TIMP

1. Validate the effectiveness of the technology in suppressing tsetse flies in different livestock production systems
2. Undertake economic analysis to determine the profitability of the technology

4.4.5 TIMP name	**Oral rehydration therapy for camel calves**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity due high mortality in camel calves
What is it? (TIMP description)	This is a management practice for rehydration of camel calves by using a formulation of honey, salt and eggs used alongside antibiotics in the treatment of gastroenteritis. The formulation consists of 30ml honey, 15ml salt, 1 chicken egg and 3 litres water.
Justification	The technology(s) is easy to use, cheap and most importantly has capacity to reduce calf mortality
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Camel keepers, private sector (agro-vets suppliers and retailers, Public and private extension agents, Researchers, Universities
Approaches to be used in dissemination	Field days, demonstrations, agricultural shows, training of trainers
Critical/essential factors for successful promotion	• Willingness by camel keepers to adopt the technology • Affordability of the drug by camel keepers • Promotion methods used • Involvement all camel value chain actors and supporters in the promotion
Partners/stakeholders for scaling up and their roles	• KALRO - Research and Information generation • MoALD – Policy regulation, training of camel keepers • Local NGOs - Community mobilization and training

	• Private animal Health Practitioners – Promotion of the product • Kenya Livestock Marketing Council - Policy advocacy and product marketing • Community Based Animal Health Groups - community mobilization and promotion. • Public Health Department - Quality assurance on livestock products • KEVEVAPI – Production and distribution • DVS – Policy and regulation. • VMD – Registration and certification
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit, Isiolo
Counties where TIMP will be up scaled	Garissa, Wajir, West Poko and Mandera
Challenges in dissemination	• Lack of awareness on the technology among chain actors and supporters. • Access to inputs by camel keepers and other users of the TIMP
Recommendations for addressing the challenges	• Training more trainers on use of TIMP • linking more partners in promotion of the technology • Creating more awareness among camel keepers on the benefits of technology.
Lessons learned in up scaling if any	• Continued capacity building of pastoralists can boost adoption of the technology
Social, environmental, policy and market conditions necessary for development and up scaling	• Use of local materials to control camel diseases can enhance adoption • Policies and regulation on recommended practices around the technology will ensure environmental safety • Control of camel diarrhoea using this technology will improve herd structure and replacement stock
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Controlling diarrhea in one calf costs about KES 266.00 (USD 2.2).
Estimated returns	• Equivalent to the market value of the calves saved from death through use of this technology. Weaners costs KES 45,000.00 (USD 372.00)
Gender issues and concerns in development, dissemination, adoption and scaling up	• Camel calves are herded by managed by women, most of whom are semi-illiterate lack adequate skills on camel health management • Women and youth have limited access to productive resources such as credit to purchase the required inputs • Women and youth have limited knowledge of camel diseases due to lack of access to agricultural information and extension services.

	• Men, women and youth who have attained the herding age should be targeted during dissemination
Gender related opportunities	• Opportunity for youth to be trained in camel health technologies • Adoption of camel management technologies will benefit all gender since there will be less mortalities and increased productivity hence increased income. • Increases household income leading to more business opportunities • Adoption of camel health management practices leads to improved productivity, hence food and nutrition security for youth and women
VMG issues and concerns in development, dissemination, adoption and scaling up	• Limited knowledge of camel health management technologies among VMGs who have limited access to agricultural information and extension services • VMGs have limited access to credit to buy required inputs • VMGs have limited access to training and extension services • Due to their social status VMGs are often excluded from decision making in development and dissemination activities
VMG related opportunities	• There is need to reach out to marginalized and vulnerable persons with animal health information as they are the least likely to access regular veterinary services. • Adoption of camel health technologies will lead to increased productivity hence increased incomes and improved food and nutrition security for VMGs. • Business opportunities for VMG to sell camel oral rehydration drug which is popular because of its health benefits
E: Case studies/profiles of success stories	
Success stories from previous similar projects	• No case study has been conducted
Application guidelines for users	How to reduce diarrhoea in camel calves. KALRO Brochure No. 73/2008. - Kenya Camel Manual for service providers
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director, KALRO-SGCRI P.O. Box 147-60500 Marsabit director.sgir@kalro.org www.kalro.org
Lead organization and scientists	KALRO SGCRI

	Sagala J. and K. Changwony
Partner organizations	County Governments –MoALD, Kenya Camel Association

Research Gap

Requires adoption studies in other areas with different social cultural practices

4.4.6	**Mastitis Control**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low milk yield and postharvest losses due to high incidence of sub-clinical mastitis in lactating camels
What is it? (TIMP description)	This is the regular pen-side testing of milk using a simple, easy-to- use mastitis kit to rapidly detect sub-clinical mastitis. The testing of each quarter of the udder and each animal will enable early detection and treatment and so minimize loss and increase marketable milk.  Figure 7. Screening for subclinical mastitis using California Mastitis test (CMT)
Justification	High prevalence of subclinical mastitis in camel reduces milk output by about 33% and affects milk quality and marketability. Pastoralists have inadequate knowledge on management of mastitis in lactating camels. The practice is to encourage sale of milk based on somatic cell count hence the need for a convenient pen-side mastitis test kit. This will also assist in early detection and control of mastitis for increased production of quality milk.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Camel producers, County veterinary and livestock staff, Certified Private animal health practitioners, Kenya Dairy Board (KDB), Camel milk bulkers, processors.
Approaches to be used in dissemination	Commercialization of the service through certified animal health practicers. Field days, On-farm and on-station demonstrations, ASK shows, Farmer to farmer exchange programs, Mass media (Pastoral production programs), Pastoral training centres, Training of Trainers (ToTs), Promotional materials (brochures, posters, leaflets), Digital platforms
Critical/essential factors for successful promotion	• Camel keepers' awareness about subclinical mastitis in lactating camels • Willingness by camel keepers to adopt the various testing kit technologies (CMT and pH-based testing methods)

	• Willingness by milk trader to pay premium price for quality milk delivered by producers.
Partners/stakeholders for scaling up and their roles	• KALRO - Research and information generation and sharing • Camel milk producers - End users. • County Governments - Extension services and capacity building. Egerton University – Research and training • Milk bulkers/ Cooperatives - End users and dissemination of information
C: Current situation and future scaling up	
Counties where already promoted if any	Isiolo and Marsabit,parts of Garissa and Wajir
Counties where TIMP will be upscaled	Marsabit, Isiolo, Garissa, Mandera, Wajir, West Pokot
Challenges in dissemination	• Lack of awareness on subclinical mastitis • Limited supply of the kit and awareness of its use • Inability to access camels given their frequent mobility in search of forage.
Recommendations for addressing the challenges	• Capacity building on control and prevention of subclinical Mastitis • Provide extension materials to create awareness
Lessons learned in up scaling if any	Farmers are willing to adopt the technology
Social, environmental, policy and market conditions necessary for development and up scaling	Increased demand for clean, hygienic milk by consumers and processors.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Entails cost of CMT reagent, labour and treatment with antibiotic gives a total cost of KES 350.00 per lactating camel
Estimated returns	This refers to cost of milk lost if control of mastitis is not undertaken. At 33% of milk saved from loss due to mastitis. A farmer saves KES 33.00 per litre of milk fresh by controlling in a camel herd.
Gender issues and concerns in development and dissemination, adoption and scaling up	• Women, most of whom are semi-illiterate lack adequate skills on camel sub management. • Women and youth have limited access to productive resources such as credit to purchase testing kits such as California Mastitis Test (CMT) kit for testing subclinical mastitis. • Women and youth have limited knowledge of camel diseases due to lack of access to agricultural information and extension services.
Gender related opportunities	• Opportunity for youth to be trained in camel health technologies • Adoption of camel management technologies will benefit women and youth since there will be less mortalities and increased productivity hence increased income • Increases household income leading to more business opportunities • Adoption of camel healthy management practices leads to

	improved productivity, hence • Food and nutrition security for youth and women
VMG issues and concerns in dissemination, adoption and scaling up	• Visually impaired persons are disadvantaged since the technology is based on colour visualization
VMG related opportunities	• There is need to reach out to marginalized and vulnerable persons with management of subclinical mastitis information as they are the least likely to access regular veterinary services • Adoption of camel mastitis management practices will lead to increased productivity hence increased incomes and improved food and nutrition security for VMGs • Business opportunities for VMG to sell more camel milk which is popular because of its health benefits
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Management of subclinical mastitis has successfully been promoted among the Salato women group in Ngurunit. Marsabit County, Anolei cooperative affiliated camel keepers in Isiolo County.
Application guidelines for users	Adongo, A.O. et al (2017) Control Mastitis for Hygienic Camel Milk (Brochure) https://www.kalro.org/sites/default/files/Control-mastitis-for-hygienic-camel-milk-Dec2020.pdf Camel Manual for trainers available at KALRO-VSRI, Muguga
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Institute Director, KALRO – VSRI, Muguga P.O. Box 32 -00902 KIKUYU, Kenya
Lead organization and scientists	KALRO Peter Ndirangu and Monica Maichomo
Partner organizations	MMUST and Kibabii University

4.5 Medicated feed supplements

4.5.1 TIMP name	**Medicated Molasses Urea Mineral Block (MMUMB)**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low productivity in cattle, sheep and goats due to fluctuating quality and quantity of feed during periods of drought and high worm burden.

What is it? (TIMP description)	Medicated MUMB is a composite feed supplement made from molasses, urea and mineral premixes infused with a dewormer for the control of chronic worm infections especially in lactating cattle, calves, sheep and goats.  ***MMUMB block***  ***Goat licking MMUMB block***
Justification	Feeds in the ASALs are of low quality and chronic worm infections are quite prevalent in these areas. This results in low weight gain and high mortality in cattle, sheep and goats. MMUMBs are a cheap alternative to commercial supplements and are a source of nitrogen and energy during drought. The medicated type is useful in reducing the worm burden.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Dairy and meat farmers/pastoralists, Extension service providers, Researchers, Agrovets
Approaches to be used in dissemination	On-farm demonstrations, field days, shows and exhibitions, print media, mass media, digital platforms
Critical/essential factors for successful promotion	• Sensitization on availability and benefits of the blocks • Availability of raw materials for making blocks • Availability of distribution and marketing channels
Partners/stakeholders for scaling up and their roles	• County Governments (end users) , • farmer groups (end users), • National Drought Management Authority (NDMA) (end users) • KALRO (Research and technical backstopping) • Private Institutions (Marketing of the blocks)

C: Current situation and future scaling up	
Counties where already promoted if any	Nyanza, Nyandarua, Kisumu, Nandi, Garissa, wajir, Taita Taveta, Makueni
Counties where TIMP will be up scaled	Baringo, Garissa, Marsabit Kakamega, Tana River, Isiolo, Tharaka Nithi, Taita Taveta, Laikipia, Nyandarua, Bomet, Kericho, Uasin Gishu, Elgeyo Marakwet, Busia, Kajiado, Nyeri Machakos, Kisumu, Siaya, West Pokot
Challenges in dissemination	• Technology is available but requires refinement and funding to produce the blocks for dissemination. • Presentation and packaging of the block. • Lack of appropriate marketing channels for the blocks
Recommendations for addressing the challenges	• Improve the MMUMB packaging. • Further refinement to improve on appearance and the state of the product. • Preparation of product in pellet form • Partnership with private institutions to market the blocks
Lessons learned in up scaling if any	MUMBs are highly palatable and require close supervision to avoid continuous licking as this can cause urea poisoning. They are more desired during periods of drought.
Social, environmental, policy and market conditions necessary	• Incorporation of blocks in utilization of blocks in national drought management programme • Awareness of availability of the technology • Kenya Bureau of Standards (KEBS) certification • Guidelines on use of blocks in cattle finishing programmes in ASALs
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 80 - 100 per kg
Estimated returns	KES 30 - 50 per kg (Beef ration consisting MUMMBs and Effel grass of 161-260g/day body weight gain. This enables completion of beef finishing in 6 months. Using this ration, it is possible to reduce duration of finishing an animal from birth to market weight of 250 kg from 4 years to 2 years. Thereby making 50% saving on feed, labour and veterinary care
Gender issues and concerns in development, dissemination, adoption and scaling up	• Gender bias in access to resources by women and youth may limit their access to MMUMBs • Conflicting household roles may limit participation of women in dissemination activities • Educational barriers may limit women from accessing information on the use of MMUMBs
Gender related opportunities	• Production and sale of MMUMBs can be done by all gender but is an employment creation opportunity that can benefit women and youth • Use of MMUMBs increases household income and nutrition to the benefit of all gender

VMG issues and concerns in development, dissemination, adoption and scaling up	• Social barriers could limit participation of VMGs in decision making involving the use of MMUMBs • VMGs could face barriers in accessing information • VMGs face barriers in benefitting from production and commercialization of this technology
VMG related opportunities	• Opportunity for VMGs to access incentivized benefit from production and sale of MMUMBs • Capacity building opportunity for VMGs through training in MMUMB production
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Mass purchases for drought mitigation by NDMA, Kasaku farmer group in Nyandarua, Shiners farmers group Nakuru indicating potential demand for the technology,
Application guidelines for users	Use of MMUMB as a feed supplement (Brochure)
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Institute Director KALRO – VSRI, Muguga P.O. Box 32 -00902 Kikuyu, Kenya
Lead organization and scientists	KALRO VSRI, Nginyi J. KALRO Buchuma, Syomiti M.
Partner organizations	NDMA, County Governments and Dairy Cooperatives

Research Gaps

i) Diversify the formulations of the MMUMBs to include pelleting for ease of use on animals of different age categories.
ii) Mechanize the MMUMBs production process to ensure standardized product.
iii) Assess development, adoption and scaling up of the technology with gender and VMGs in consideration.

4.6 Biosecurity

4.6.1 TIMP name	**Improved biosecurity practices on poultry farms**
Category (i.e. technology, innovation or management practice)	Management practices
A: Description of the technology, innovation or management practice	
Problem to be addressed	The presence of zoonotic disease agents in some poultry products and loss of chicken due to disease outbreaks
What is it? (TIMP description)	This is a set of biosecurity measures on the farm and along the indigenous chicken value chain, including slaughter facilities, and those hatching own eggs, so as to improve productivity of indigenous chicken and reduce the risk of zoonotic diseases, e.g., Salmonellosis, Mycoplasmosis, *Campylobacter* and *E. coli* spp. Chicks can contract diseases through egg contamination due to

	unhygienic conditions during incubation e.g. omphalitis (yolk sac infection) causing mortality.  ***Foot and vehicle bath at the entry of a poultry unit***
Justification	High mortality of chicken due to disease outbreaks leading to loss of revenue by farmers. Implementation of appropriate biosecurity measures enhance reduction on the risk of Zoonotic diseases and low productivity of indigenous chicken.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small, medium and large-scale indigenous chicken farmers, Extension service providers
Approaches to be used in dissemination	Demonstrations, agricultural shows and exhibitions, farmer field schools as well as farmer to farmer extension, social media, digital information sharing platforms
Critical/essential factors for successful promotion	Willingness of the farmers to adopt the practice
Partners/stakeholders for scaling up and their roles	• KALRO – Source of technology and training • Kenyatta University- Part of the core training and research team • County Governments mobile farmers and provide follow up extension services
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	All the 47 counties within the country.
Challenges in dissemination	• Some training channels are difficult to use due to low literacy levels. • Women's triple roles limit the amount of time available for training. • Limited information sharing via digital network
Recommendations for addressing the challenges	• More hands-on training/ experiences (in Farmer field Schools, Pastoral field schools) • More practical sessions and the use of visual aids during training • Develop tailored training models specific to each community based on assessed needs

Lessons learned in up scaling if any	• Most stakeholders in the industry do not understand the implications on both health and farm profitability arising from lapse in the practice
Social, environmental, policy and market conditions necessary for development and up scaling	• Willingness of the farmers to adopt the practice • Less environmental waste. Appropriate waste disposal arising from the IC enterprise
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not available
Estimated returns	• Not determined
Gender issues and concerns in development, dissemination, adoption and scaling up	• Easily disseminated to both gender
Gender related opportunities	• Reduction in IC mortality that will encourage adoption • improved incomes for households
VMG issues and concerns in development, dissemination, adoption and scaling up	• Easily adopted by VMGs
VMG related opportunities	• Quick returns to investments • Opportunity for VMGs trained in animal health to take up the practices as a business eg. vaccination, selling of disinfectants, PPEs, rodent traps
E: Case studies/profiles of success stories	
Success stories from previous similar projects	
Application guidelines for users	
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	Director Non-Ruminant Research Institute (KALRO) P.O. Box 169-50100 Kakamega Kalro.Kakamega@kalro.org; kalropoultrykakamega@kalro.org kalropoultry@kalro.org
Lead organization and scientists	KALRO/KU; David M. Mwangi, Prof. Kabuage, Dr. Evans Ilatsia, Peter Alaru, Ochieng Ouko, Tobias K'Oloo and Sophie Miyumo
Partner organizations	Kenyatta University

Research Gaps

1. Need to evaluate different production systems including scavenging and non-scavenging birds to determine the effect of the same on presence of zoonotic disease agents in poultry products

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