KALRO
Kenya Agricultural & Livestock Research Organization

KCSAP
Kenya Climate Smart Agriculture Project

Inventory of Climate Smart Agriculture Technologies, Innovations and Management Practices for Sheep and Goat Value Chain

Adongo A.O., Changwony D.K., Nyambati E., Walaga H., Golicha D.D., Qabale D.B., Bulle H.D., Chemuliti J., Mugambi J., Kipronnoh A., Sagala I.J., Olum M., Ndungu B.W. and Ilatsia E. D.

OCTOBER 2022

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 in order to fully benefit from the inventory recommendations.

Published by
Kenya Agricultural and Livestock Research Organization
KALRO Secretariat
P O Box 57811-00200
Nairobi, KENYA

Email: directorgeneral@kalro.org Tel. No(s): +254-722206986/733333223

Compiled by: Adongo A. O., Changwony K., Nyambati E., Walaga H., Golicha D.D., Qabale D. B., Bulle H. D., Chemuliti J., Mugambi J., Mungube E.O., Kipronoh A., Sagala I. J., Olum M., Ndung'u B.W., Wamuongo J.W. and Ilatsia E.D.

Editors: Nyabundi K.W., Mukundi K.T., Maina P., Wanyama H.N., Kedemi R.M., Changwony, K. and Adongo A.O.

Editing and Publication Coordination: Wamuongo J.W. and Lung'aho C.

Design and layout: Nyaola E.

Typesetting: Mogaka I.

FOREWORD

Kenya Climate-Smart Agriculture Project (KCSAP) tasked the Kenya Agricultural and Livestock Research Organization (KALRO) with the 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 also 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 in Pastures and Fodders value chain.

Extensive information from research and background data has been used to develop this TIMPs inventory. 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 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's project 'Triple Wins' of increased productivity, enhanced resilience and reduction of greenhouse gases emissions. Thus, this TIMPs inventory is to be used in conjunction with the respective Sheep and Goat ToT Manual.

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 the project objectives and aspirations.

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

PREFACE

The Kenya Climate-Smart Agriculture Project (KCSAP) is a Government of Kenya project with support from both the World Bank and the government. The project runs for five years and 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, 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 gas (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 Components 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 goat) 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 TIMPs inventory for Sheep and Goat Value Chain. 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

Table of Contents

ABBREVIATIONS AND ACRONYMS

AMR	Antimicrobial Resistance
ASALs	Arid and Semi-Arid Lands
ASK	Agricultural Society of Kenya
AU-PANVAC	Pan African Veterinary Vaccine Centre of the African union
AVCD	Accelerated Value Chain Development
BHS	Black Head Persian
CBOs	Community based organization
CCPP	Contagious Caprine Pleuropneumonia
CDR	Community Disease Reporters
CDVS	County Director of Veterinary Services
CGIAR	Consultative Group for International Agricultural Research
CIGs	Community Interest Groups
CSA	Climate Smart Agriculture
DNA	Deoxyribo Nucleic Acid
DVS	Director of Veterinary Services
FAO	Food and Agriculture Organization
FCDC	Frontier County Development Council
GAP	Good Agricultural Practice
GHG	Green House Gas
GMP	Good Manufacturing Practice
Ha	Hectare
ILRI	International Livestock Research Institute
IMM	Integrated Manure Management
IPR	Intellectual Property Rights
KALRO	Kenya Agricultural and Livestock Research Organization
KCSAP	Kenya Climate-Smart Agriculture Project
KEBs	Kenya Bureau of Standards
KenTTEC	Kenya Tse tse fly Eradication Council
KES	Kenya Shilling
KEVEVAPI	Kenya Veterinary Vaccines Production Institute
Kg	Kilogram
KIRDI	Kenya Industrial Research and Development Institute

KVB	Kenya Veterinary Board
MMUMB	Medicated Molasses Urea Mineral Block
MoA&LD	Ministry of Agriculture and Livestock Development
NARS	National Agricultural Research Systems
NDMA	National Drought Management Authority
NGO	Non-Governmental Organization
PDO	Project Development Office
PPR	Peste des Petitis Ruminants
PRM	Participatory Range Management
SGCRI	Sheep, Goat and Camel Research Institute
TIMPs	Technologies, Innovation and Management Practices
ToT	Training of Trainer
USD	United States Dollars
VMD	Veterinary Medicine Directorate
VMG	Vulnerable and Marginalized Group
VSRI	Veterinary Sciences Research Institute

1. INTRODUCTION

1.1 Definition of Terms for Technologies, Innovations and Management Practices

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, laboratory techniques, models etc.

Management Practice: This is defined as a recommendation on practice that is considered necessary for a technology to achieve its optimum output. These include, for instance, different agronomic practices (seeding rates, fertilizer application rates, spatial arrangements, planting period, land preparation, watering regimes, etc.), protection methods, and gathering practices for crops; and feed rations, management systems, disease control methods, herding practices, etc. for animal breeds. This is therefore important information, generated through research to accompany the parent technology released to users. 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 originally intended use. (e.g., fireless cooker modified to be used as a hatchery)

2.0 INVENTORY OF TIMPS IN RED MEAT (SHEEP AND GOAT) VALUE CHAIN

2.1 Summary of the TIMPs

The inventory process resulted in a total of **18 TIMPs** including **12** technologies, **1** innovation and **5** management practices, distributed among the sub-themes, as indicated in Table 1.

Table 1: Number of TIMPs identified by NARS in Red meat (sheep and goat) Value Chain

Commodity/VC/ Theme	Sub-Theme	Technologies	Innovations	Management practice
Red meat	Germplasm improvement	4	0	0
Red meat	Housing	1	0	0
Red meat	Feeds and feeding	1	0	2
Red meat	Health Management	4	0	2
Red meat	Postharvest management	1	1	1
Red meat	Marketing	1	0	0
Total		**12**	**1**	**5**

2.2 Summary of Status of TIMPs in Red meat (sheep and goat) value chain

The inventory process resulted in **18 TIMPs, 11** Ready for upscaling, **6** requiring validation and **1** requiring further research in the sub-themes, as indicated in Table 2.

Table 2: Number of Red meat (sheep and goat) TIMPs ready for upscaling, requiring validation or further research

Commodity/VC	Sub-Theme	Ready for upscaling	Require validation	Further Research
Red meat	Germplasm improvement	2	2	0
Red meat	Housing	0	1	0
Red meat	Feeds and feeding	2	0	1
Red meat	Health management	3	3	0
Red meat	Postharvest management	3	0	0
Red meat	Business and marketing	1	0	0
Total		**11**	**6**	**1**

Table 3: Inventory of Red meat (sheep and goat) TIMPs by category and status

TIMP Sub Theme	TIMPs Title	TIMPs Category	Status
2.1 Germplasm improvement	2.1.1 Galla goat	Technology	Ready for upscaling
	2.1.2 Boer goat	Technology	Requires validation
	2.1.3 Dorper sheep	Technology	Requires validation
	2.1.4 Black head Persian sheep	Technology	Ready for upscaling
2.2 Housing	2.2.1 Resayon mobile house	Technology	Requires validation
2.3 Feeds and feeding	2.3.1 Medicated Molasses Urea Mineral blocks (MMUMBs)	Technology	Ready for up-scaling
	2.3.2 Dry season supplementary feeding	Management practice	Requires further research
	2.3.3 Participatory rangeland management	Management practice	Ready for upscaling
2.4 Health management	2.4.1 Thermo-tolerant Peste des Petits Ruminants (PPR) vaccine	Technology	Requires validation
	2.4.2 Recombinant HC58 DNA Vaccine	Technology	Requires validation

	2.4.3 Latex agglutination diagnostic test for contagious caprine pleuro-pneumonia	Technology	Ready for upscaling
	2.4.4 Integrated helminth control	Management practice	Ready for upscaling
	2.4.5 Push-pull tsetse fly control	Technology	Requires validation
	2.4.6 Innovations in animal health delivery for pastoralists	Management practice	Ready for upscaling
3.5 Postharvest management	2.5.1 *Nyirinyiri* (ready to eat meat) processing	Innovation	Ready for up scaling
	2.5.2 Wet salting of skin	Technology	Ready for upscaling
	2.5.3 Integrated manure management	Management practice	Ready for upscaling
2.6 Business and marketing	2.6.1 Weight estimation tape	Technology	Ready for upscaling

3.0 DETAILED TIMPS FOR RED MEAT (SHEEP AND GOATS) VALUE CHAIN

3.1 Germplasm Improvement

3.1.1 TIMP Name	**Galla goat**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Small-sized meat goat breeds with slow growth rates reared by pastoralists (Small East African goats)
What is it? (TIMP description) 	Galla goats have faster growing rates and attain high dressing weight for better meat production. They are indigenous to, and culturally acceptable in, Northern Kenya and are classified into a short-eared, medium-sized goat and a larger pure white type. They have black-colored skin, nose, feet and under the tail. Adult bucks weigh up to 70 kg, while a female reach kidding weight of 45-55 kg. Some have a black stripe down the spine. They are adapted to warm, low altitudes with acacia bush and their large size enables them to reach browse that the smaller East African goats cannot. Adoption in non-pastoral ASAL areas is evident.
Justification	Poor growth rate of meat goat and low offtake

	weight in the ASALs has led to deficiency of chevon in Kenya. The fast-growing Galla goat attain high dressing weight for better meat production. The breed is adapted to low altitudes with acacia bush. Its large size enables it to browse at greater heights than the smaller East African goat. This is a more attractive breed for the pastoralists as it promises larger-bodied animals and better returns to improve the livelihoods of the pastoralists.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Public and private extension service, Goat breeders, researchers, pastoralists and agro-pastoralists
Approaches to be used in dissemination	Farmers field days, Agricultural Innovation platforms, digital platforms, Agricultural Shows, Demonstrations, mass media.
Critical/essential factors for development and successful promotion	• Availability of finance to access breeding stock • Breed multiplication centres • Enhanced record keeping
Partners/stakeholders for scaling up and their respective roles	• County staff in the MOA&LD (mobilization, implementation, monitoring and evaluation) • Private and public Service providers to offer training and mount demonstrations • NGOs to mobilize the pastoralists, and create awareness • Financial institutions to provide funding • Private sector to provide markets for produce • National and County government to provide policies to enable exploitation of the enterprise
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit, Isiolo
Counties where TIMPs will be up scaled	Isiolo, Marsabit, Garissa, Mandera, Wajir, West Pokot and Kajiado
Challenges in dissemination	• Cultural beliefs on use of other breeds, limited distribution of Galla breed. • Poor record keeping and poverty among pastoralists also inhibit uptake • Lack of appropriate information • Limited impact by individual pastoralists
Suggestions for addressing the challenges	• Promotion of Galla goat through participatory training and provision of information on where to source the breed • Formation of meat goat pastoral groups
Lessons learnt in up-scaling if any	• Trained pastoralists have benefited by changing from keeping the Small East African goat to Galla goats, which has a high offtake due to high growth rate. • Galla goats also fetch higher prices.

Social, environmental, policy and market conditions necessary for development and up-scaling	• Acceptance of breeds with quality traits by community, There is a saying among most of the pastoralists that '*A Buck from outside sires healthy and stronger kids*'. • Buck exchange programs among the VMGs work very well. Only 4 families need to be in a group. • There is need to link pastoralists with Galla production/multiplication centres. • Market demand for the improved
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs *Prices of 2022	Cost of a good buck is KES.10,000*
Estimated returns *Prices of 2022	Galla goats sold for meat fetch KES 8,000* x 80 kids per buck = 640,000/=
Gender issues and concerns in development, dissemination, adoption and scaling up	No gender barrier affects the development, dissemination, adoption and scaling up of this technology.
Gender related opportunities	• Women have a big say in goat management as this is regarded as household food security. • Men herd, water and provide security for the animals. • Live goats are said to be equivalent to a bank current account and women benefit more as they have more say. Pastoralists' flocks will increase thus increasing offtake and improved livelihoods.
VMG issues and concerns in development, dissemination, adoption and scaling up	The concern will be on how VMGs will acquire the best breeds and management practices as well as the financial resources to establish and maintain Galla goat flocks.
VMG related opportunities	Galla breeds will offer high returns and more meat for home use and sale. More herding labor for the bigger herds will also be required creating employment opportunities and improved livelihoods for VMGs
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Kulamawe pastoralists (where the technology has been adopted) supply meat in local centres in and around Isiolo town.
Application guidelines for users	Sheep and Goat ToT training manual
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3 . Requires f urther research)	1. Ready for upscaling
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., K. Changwony and H. Walaga) County Governments –MoAL&F
Partner organizations and their roles	Egerton University: - Provision of expert knowledge on the Galla goat County Governments: - Provision of support during training and dissemination of technology. ILRI: Provision of technical and expert advice on technology.

3.1.2 TIMP name	**Boer goat**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor growth rates and poor carcass weight of native goats reared by the pastoral communities
What is it? (TIMP description) 	The Boer goat, whose origin is South Africa, is white with red or brown colour on the head or neck. It has horns and large drooping ears and is 75-80 cm in height at the shoulders. Males and females weigh up to 90 and 75 kg, respectively. It possesses superior rib and body length with good muscling. The dressing percentage is 49-55% with excellent carcass quality and adaptability. It breeds all year round when on adequate nutrition.
Justification	Compared to the small East African goat, the Boer goat is early maturing, has higher average growth rate and weaning weight, is prolific non-seasonal breeders and with a high dressing percentage (cold dressed weight), can produce a good return for investment.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Public and private extension service, Goat breeders, researchers, pastoralist and agro-pastoralists
Approaches to be used in dissemination	Farmers field days, Agricultural Innovation platforms, digital platforms, Agricultural Shows, Demonstrations, mass media.
Critical/essential factors for successful promotion	• Sensitization on availability and benefits of the Boer goat (Training and demonstrations) • Availability of finance to ensure affordability • Breed multiplication centres for better access to breeding stock • Training to ensure accurate record keeping
Partners/stakeholders for scaling up and their roles	• County staff in the MOA&LD: - For mobilization, implementation, monitoring and evaluation. • Service providers: For training and demonstrations • KALRO:- For breed multiplication

	• NGOs to mobilize farmer groups • Financial Institutions to offer financial services
C: Current situation and future scaling up	
Counties where already promoted if any	Laikipia, Nakuru and Nyandarua
Counties where TIMP will be up scaled	Isiolo, Marsabit, West Pokot, Garissa, Mandera and Wajir
Challenges in dissemination	• Lack of information on in improved breeds and where to source them • Limited number of the Boer breed. • Lack of improved management packages and an initial high cost of the breed
Suggestions for addressing the challenges	• Provide information on where to source breeding stock. • Form pastoral groups to purchase the breeding stocks • Capacity build farmer groups on management practices.
Lessons learned in up scaling if any	None
Social, environmental, policy and market conditions necessary	• Good traits in Boer goat that are socially acceptable to the pastoralists • Improved feed availability • Better market conditions • Formation of pastoral groups and awareness of availability and the advantages of the Boer breed.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs *2022 prices	Breeding buck costs KES 40,000 to 60,000 (pedigree)*
Estimated returns *2022 prices	80 kids @ KES 10,000* = KES 800,000*
Gender issues and concerns in development, dissemination, adoption and scaling up	Within the pastoral communities, goats are mostly a preserve of women and they should be targeted during training on Boer goats. However all household members are involved in different roles during in production and marketing phases.
Gender related opportunities	All household members will benefit from increased consumption and sale. Pastoralists' goat herds will increase thus increasing offtake and improved livelihoods as all gender are involved
VMG issues and concerns in development, dissemination, adoption and scaling up.	There is restricted access to initial breeding stock by VMGs due to limited breeding stock and high cost.
VMG related opportunities	VMGs will be involved throughout in entire value chain (production, transport/distribution and marketing)
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	Draft Goat Manual at KALRO Marsabit
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	2. 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., K. Changwony and H. Walaga) County Governments –MoA&LD
Partner organizations and their roles	1. County Governments: Provision of support during training and dissemination of technology, mobilization, implementation, monitoring and evaluation. 2. Service providers: - For training and demonstrations 3. KALRO: For breed multiplication 4. CBOs: For mobilization and implementation 5. NGOs: For partnering in mobilization and training 6. Private ranchers in Laikipia:- Breed multiplication

3.1.3 TIMP Name	Dorper sheep
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Poor growth rates and poor carcass weight of native sheep reared by the pastoral communities
What is it? (TIMP description) **(Dorper sheep)**	Dorper sheep is mostly white with a black head. It can also be wholly white. It is a fast growing and high dressing weight mutton breed which was developed by crossing the Dorset horn with Persian black head sheep.
Justification	The Dorper has good carcass characteristics (fat well marbled). Its ability to adapt to the ASAL's is almost as good as that of indigenous sheep and when used for crossbreeding with native breed, the resulting lambs have improved growth rate and excellent carcass weight/composition. It is a good bet for improving the pastoralists local breeds.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Public and private extension service, Goat breeders, researchers, pastoralist and agro-pastoralists
Approaches used in dissemination	Farmers field days, Agricultural Innovation platforms, digital platforms, Agricultural Shows, Demonstrations, mass media.
Critical/essential factors for successful promotion	• Sensitization on availability and benefits of the Dorper sheep (Training and demonstrations) • Availability of finance to ensure affordability • Breed multiplication centres for better access to breeding stock • Training to enhance accurate record keeping
Partners/stakeholders for scaling up and their respective roles.	• County staff in the MOA&LD: - For mobilization, implementation, monitoring and evaluation. • Service providers: - For training and demonstrations

	• KALRO:- For breed multiplication • Financial institutions to offer financial services • NGOs to mobilize farmer groups
C: Current situation and future scaling up	
Counties where already promoted if any	Laikipia and Kajiado
Counties where TIMPs will be upscaled	Isiolo, Marsabit, West Pokot, Garissa, Mandera and Wajir
Challenges in development and dissemination	• Limited number of the breeding stock • Lack of improved management packages • High initial costs.
Suggestions for addressing the challenges	• Provide information on sources of breeding stock • Mobilize farmers to form pastoral groups to purchase the breeding stocks • Capacity building on management practices.
Lessons learned in up scaling, if any	The Dorper sheep is widely accepted by different communities where the dissemination has taken place.
Social, environmental, policy and market conditions necessary for development.	• Policy direction by county government to push for improvement of breeds • Improved feed availability • Better market conditions • Community willingness to participate in formation of pastoral groups and awareness of availability and the advantages of the Dorper sheep.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Breeding ram will cost about KES 6,000 to KES 8000.
Estimated returns	Estimated 80 lambs/ram @ KES10,000 = KES 800,000
Gender issues andconcerns in development, dissemination, adoption and scaling up	Within the pastoral communities, goats are mostly a preserve of women and they should be targeted during training on Dorper sheep management. However, all household members are involved in different roles during in production and marketing phases.
Gender related opportunities	Since sheep and goats are mostly a preserve of women within the pastoral communities, training on Dorper sheep ought to target them. Pastoralists sheep flocks will increase thus increasing offtake and improved livelihoods since all gender are involved.
VMG issues and concerns in development, dissemination, adoption and scaling up	Higher costs of initial breeding stock will discourage most VMGs. Acquisition of the right breeds and required management practices is also a challenge as they are not readily available.
VMG related opportunities	Improved livelihoods for VMGs from sale of more sheep. Provision of labour for the management, marketing of sheep will also benefit the VMGs.
E: Case studies/profiles of success stories	
Success stories	Farmers in Laikipia, Narok and Kajiado counties currently getting more returns from sale of Dorper sheep and their crosses.

Application guidelines for users	Draft Goat Manual at KALRO Marsabit
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	2.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., Changwony K. and Walaga H.) County Governments –MoA&LD
Partner organizations	1. County Governments: Provision of support during training and dissemination of technology, mobilization, implementation, monitoring and evaluation. 2. Service providers: For training and demonstrations 3. KALRO: For breed multiplication 4. CBOs: For mobilization and implementation 5. NGOs: For partnering in mobilization and training 6. Private ranchers in Laikipia:- Breed multiplication

2.1.4 TIMP Name	**Black Head Persian (BHP) sheep**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low production of mutton from the local breed. This is due to its slow growth rate and low carcass weight.
What is it? (TIMP description) 	The Black head Persian is a fat-tailed sheep which is fast growing and with a high dressing weight compared to the local sheep breeds. It has a white coloration, a black head and a characteristic fat tail. It is well adapted to ASAL environments and socially accepted among pastoralists.
Justification	Compared to the local breed Black Head Persian breed has faster growth rate and high offtake weight in the ASALs. Cross-breeding with local sheep breeds will results in crosses with improved growth rates. The sheep has good returns to investment from sale of mutton and better suited to ASAL areas
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralists and agro-pastoralists, other ASAL based livestock keepers, processors, extension providers, consumers, researchers and breeders.
Approaches used in dissemination	Farmers field days, Agricultural Innovation platforms, digital platforms, Agricultural Shows, Demonstrations, mass

	media
Critical/essential factors for successful promotion	• Sensitization on availability and benefits of the Dorper sheep (Trainings) • Availability of finance to ensure affordability • Breed multiplication centres for better access to breeding stock • Accurate record keeping
Partners/stakeholders for scaling up and their respective roles.	1. National Government:- Policy and regulation 2. County Governments:- Provision of support during training and dissemination of technology, mobilization, implementation, monitoring and evaluation. 3. Service providers:- For training and demonstrations 4. KALRO:- For breed multiplication 5. CBOs:- For mobilization and implementation 6. NGOs:- For partnering in mobilization and training 7. Private ranchers in Laikipia:- Breed multiplication
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit, Isiolo
Counties where TIMPs will be up scaled	Isiolo , Marsabit, West Pokot, Garissa, Mandera and Wajir, Kajiado
Challenges in development and dissemination	Cultural beliefs on use of other breeds, limited distribution of Black Head Persian breeds, Uncontrolled husbandry practices coupled with poor record keeping
Suggestions for addressing the challenges	Demystify the cultural beliefs through participatory training, avail information on where to source other breeds. Formation of mutton sheep pastoral groups to be supported and self-support through a kitty
Lessons learned in up scaling, if any	Trained pastoralist have benefited by:- 1) changing from keeping Red Maasai sheep to Black Head Persian sheep, 2) selling at higher prices and 3) selling more due to fast growth rates
Social, environmental, policy and market conditions necessary for development.	Ram exchange programs among the VMGs work well with 4 families in a group to purchase rams to reduce inbreeding. Linking of pastoralists with Black head Persian breeders Favourable climatic conditions (less drought episodes) Establishment of abattoirs in ASAL counties as a value addition and marketing policy
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs (*2022 price of a breeding ram)	A breeding ram costs about KES 8,000*
Estimated returns	Sheep sold for meat fetch KES 8,000* x 80 kids per buck = 640,000/=
Gender issues and concerns in development, dissemination, adoption and scaling up	• Increased labour for women who are already overburdened. may reduce their chance of adopting the technology • Financial empowerment where women and youth

	may not have funds to acquire inputs • information and awareness flow to female farmers may be Slow due to low education levels
Gender related opportunities	• Technologies are appropriate for women and youth since women culturally take care of sheep and goats • The youth can make and sell the producct as a source of livelihood • Increased incomes for women who are mainly involved in making decisions on use of income accrued from the sales of sheep and goats as these are small livestock • Have well organized gender friendly markets and marketing system • making credit accessible to women • Make gender friendly training materials with illustrations to enhance communication to all gender
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs lack of access to input services including information • VMGs have limited access to training and extension services • The VMG will be able to preserve feed for their livestock and sell the excess • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There may be low adoption by VMGs due lack of awareness • VMGs have less access to extension services due to prejudice and their social status • VMGs have less access to markets than the other gender categories
VMG related opportunities	• VMGs can make and sell the blocks as a source of livelihood • Empower the VMGs by connecting them to financial sources • Provide friendly training materials with illustrations to enhance communication • Improved livelihoods for VMGs
E: Case studies/profiles of success stories	
Success stories	Pastoralists from northern Kenya can now supply mutton in town for sale and household consumption
Application guidelines for users	Draft Goat Manual in KALRO Marsabit, brochures
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	1. Ready for upscaling
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., K. Changwony and H. Walaga) County Governments – MoALD
Partner organizations	County Governments, CBOs, NGOs and Laikipia ranchers

Research Gap

- Need for adaptive research for genitive conservation and multiplication**.**

3.2 Housing for sheep and goat

3.2.1 TIMP name	**Resayon mobile house for kids and lambs**
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	High kid and lamb mortality rates are recorded in ASALs due to poor housing. Kid and lamb droppings/waste in poorly designed houses aids in disease and parasites/pest manifestation.
What is it? (TIMP description) 	The mobile house for kids and lambs is made from locally available materials and environmentally friendly. It saves on woodland trees as less wood material is required to construct. It also saves on labour for handling kids and lambs. It meets the basic requirement for a good house and has multiple benefits.
Justification	Resayon is a well-ventilated mobile house hence good for housing young stock. Its mobility controls build-up of pests and parasites and accumulation of manure. It reduces kid and lamb mortality rates from 35 to 10% allowing faster growth of pastoralists flocks .
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Extension officers from County Government and and NGOs, Researchers, Pastoralist and agro-pastoralists.
Approaches used in dissemination	Farmers field days, Agricultural Innovation platforms, digital platforms, Agricultural Shows, Demonstrations, mass media.
Critical/essential promotion factors for Successful promotion	Reaching as many pastoralists as possible through a combination of appropriate disseminations methods.
Partners/stakeholders for scaling up and their role	County Governments (Policy, resources), Universities and KALRO (research and training), local NGO's in livestock value chain (community mobilization and training), Kenya livestock

	marketing council (Policy implementation and advocacy).
C: Current situation and future scaling up	
Counties where already promoted if any	Isiolo and Marsabit.
Counties where TIMPs will be up scaled	Marsabit, Kajiado, Isiolo, Laikipia, West Pokot, and Baringo.
Challenges in dissemination	• Insufficient financial resources to disseminate the technology in areas where pastoral goats are kept. • Some pastoralists may not afford the initial cost of the technology.
Recommendations for addressing the challenges	• Avail resources to train the pastoralists on how to construct Resayon mobile house and its benefits in the Red meat (sheep and goat) value chain. • Avail some credit facility to willing pastoralists for construction of the mobile house.
Lessons learned	• The technology package is beneficial and was adopted by non-test pastoralist • Involvement of partners is key in technology dissemination
	• Use of locally available materials made it easy to adopt • As an alternative house for kids/lambs in areas lacking suitable local building materials, convectional building materials can be used • Its ability to reduce kid and lamb mortality improves adoption
Social, environmental, policy and market conditions necessary	• Social acceptability of the technology • Environmental friendliness of the technology • Demonstrated advantage of the Resayon house over conventional housing
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs (*2022 prices)	Mobile house construction costs about KES 8000* depending on size.
Estimated returns	25% more kids and lambs survive hence 25% more goats and sheep will be sold. 25% more revenue.
Gender issues and concerns in development, dissemination, adoption and scaling up	• Men, women and youth are involved but at different stages of the technology; cutting the branches for construction is done by men while women and youth transport branches and construction and repairs is done by women. In pastoral areas, dissemination should focus on the female gender as they are mostly involved in construction and maintenance of the house.

	In non-pastoral areas, all gender may be involved.
Gender related opportunities	• Increased number of kids and lambs joining the main flocks, incomes and business opportunities from sale of live animal and milk is an additional opportunity.
VMG issues and concerns in development, dissemination, adoption and scaling up	• Acquisition of construction materials is a challenge to the VMGs. • The initial cost of construction materials, in situations where local materials are not available, may become prohibitive to the VMGs. • Adoption is not a problem because it is a modification of their previous permanent houses
VMG related opportunities	• The technology developed as a modification of what some VMGs (pastoralists) invented and the poor get casual jobs in the construction of mobile units. • Increased kid and lamb survival leads to improved livelihoods for VMGs.
E: Case studies/profiles of success stories	
Success stories	• The Resayon mobile house technology was adopted by the test farmers. Pastoralists neighboring the test site including Manyatta Lengima, Karare, and Ngurunit housing units (manyattas) also adopted the technology. • Mortality rates reduced from 35 to 10% thus reducing poverty rates.
Application guidelines for users	Sheep and Goat manual, brochures and posters are available in KALRO Marsabit.
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation
F: 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 (K. Changwony, Sagala J., and H.K. Walaga)
Partner organizations	County Governments –MoA&LD, CBOs, NGOs

Research Gaps

- Adaptive research to establish its suitability in other agro ecological zones and production systems

3.3 Feeds and feeding

3.3.1 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	i) Fluctuating quality and quantity of feed during drought leading to low productivity of sheep and goats ii) Increased risk of worm infestation
What is it? (TIMP description) 	Medicated MUMB is a composite supplement made from molasses, urea and mineral premixes impregnated with a dewormer to control chronic worm infections especially in lactating cattle, calves, sheep and goats.
Justification 	Medicated Molasses Urea Mineral blocks are cheap alternatives to commercial supplements made from locally available materials and are a source of nitrogen and energy during drought. Medicated MMUMB is useful in reducing the worm burden
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Private sector (Agrosalers), Red meat farmers/pastoralists, breeders of sheep and goats, County Governments extension officers, Researchers (for training purposes)
Approaches to be used in dissemination	On-farm demonstrations, field days, shows and exhibitions, print media, Agrovets, commercialization approaches through private sectors.
Critical/essential factors for successful promotion	• Sensitization on availability and benefits of the blocks • Availability of raw materials for making blocks
Partners/stakeholders for scaling up and their roles	County Governments (end users), farmer groups (end users), National Drought Management Authority (NDMA) (end users), KALRO (technology development)
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, Isiolo, Laikipia, Nyandarua, Bomet, Uasin Gishu, Elgeyo Marakwet, Busia, Kajiado, West Pokot
Challenges in dissemination	• Lack of information to wide population • Seasonal variation in demand for the blocks. Limited access to some information on ingredients used in making the technology
Suggestions for addressing the challenges	• Improvement of access to information • Further refinement to improve information on

	methods of packaging appealing products • Provide information of preparation of pellets types • Support to CIGs access to information to develop business plans for making the technology on commercial basis.
Lessons learned in up scaling if any	MMUMBs 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	• Favourable climatic conditions (less drought episodes) • Establishment of abattoirs in ASAL counties as a value addition and marketing policy • Marketing groups and awareness on availability of the technology, Kenya Bureau of Standards (KEBS) • Certification is necessary.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 100-120 per kg
Estimated returns	KES 50-70 per kg
Gender issues and concerns in development, dissemination, adoption and scaling up	• Increased labour for women who are already overburdened. may reduce their chance of adopting the technology • Financial empowerment where women and youth may not have funds to acquire inputs • information and awareness flow to female farmers may be Slow due to low education levels
Gender related opportunities	• Technologies are appropriate for women and youth since women culturally take care of sheep and goats • The youth can make and sell the producct as a source of livelihood • Increased incomes for women who are mainly involved in making decisions on use of income accrued from the sales of sheep and goats as these are small livestock • Have well organized gender friendly markets and marketing system • making credit accessible to women • Make gender friendly training materials with illustrations to enhance communication to all gender
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs lack of access to input services including information • VMGs have limited access to training and extension services • The VMG will be able to preserve feed for their livestock and sell the excess • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There may be low adoption by VMGs due lack of

	awareness • VMGs have less access to extension services due to prejudice and their social status • VMGs have less access to markets than the other gender categories
VMG related opportunities	• VMGs can make and sell the blocks as a source of livelihood • Empower the VMGs by connecting them to financial sources • Provide friendly training materials with illustrations to enhance communication • Improved livelihoods for VMGs
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	A brochure on how to make **MMUMB is available** at KALRO and is indicated on the product package
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 North P.O. Box 32 -00902 KIKUYU, Kenya
Lead organization and scientists	KALRO VSRI, Nginyi J. KALRO Buchuma, Syomiti M.
Partner organizations	NDMA, County Governments

Research Gaps

- There is need for adaptive research in other counties to promote and increase adoption and commercial viability.

3.3.2 TIMP name	**Dry season supplementary feeding**
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Scarcity of feed for livestock in dry seasons leading to poor nutrition of livestock.
What is it? (TIMP description)	This is a management practice for dry season feeding using preserved local feed materials. The supplementary feeds are fed to lactating sheep and goats either for maintenance of body condition or continued milk production during the dry season.
Justification	Preventing livestock death through starvation and maintaining productivity of drought-resilient species such as small ruminants' cushions pastoralists through milk and meat supply during drought. The increasing demand for chevon and mutton can be

	met by a corresponding increased production. Improving the productivity of small stock would also contribute to alleviating poverty and sustain livelihoods of pastoralists.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralists and agro pastoralists, extension officer, researchers and agro-input dealers
Approaches used in dissemination	Farmers field days, Agricultural Innovation platforms, digital platforms, Agricultural Shows, Demonstrations, mass media.
Critical/essential factors for successful promotion	• Availability of local feed materials for the formulation of the ration. • Understanding need to preserve in time of plenty • Knowledge on simple supplementary feed processing
Partners/stakeholders for scaling up and their roles	• County Governments (policy, resources), • Universities and KALRO (research and training), • NGOs in livestock value chain (community mobilization and training), • Kenya livestock marketing council (policy implementation and advocacy).
C: Current situation and future scaling up	
Counties where already promoted if any	Isiolo and Marsabit
Counties where TIMPs will be up scaled	Baringo, Garissa, Marsabit, Isiolo, Laikipia, Uasin Gishu, Elgeyo Marakwet, Busia, Kajiado, West Pokot
Challenges in dissemination	• Illiteracy which makes information targeting difficult. • Dr o u g h t feed seasonality tha limit r e a c h o f i n f o r m a t i o n m a t e r i a l a s p e o p l e m o v e i n s e a r c h o f p a s t u r e • Insecurity limit access to extension, , • Cultural orientation that hampers storage and use of supplementary feed.
Recommendations for addressing the challenges	• Avail informatin and resources to train the pastoralists, • Strengthening peace initiatives, • Incorporation of technology transfer in County Government extension messages, • CBOs and NGOs work programs, devise mobile storage facilities.
Lessons learned	• The technology package is beneficial to the pastoralists • Involvement of partners is key in technology dissemination • Limited local knowledge on feed conservation practices • The strong research-extension-farmer linkage were useful
Social, environmental, policy and market conditions necessary	The availability of local feed resources for use in ration. Animals to be supplemented should be home-based Preservation method should be able to prevent spoilage.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs *2022 prices	A bale of hay is retailed at between KES 300-500* and a small bag of pods at KES 500
Estimated returns	Survival of small stock and availing of more as replacement stock.

Gender issues and concerns in development, dissemination, adoption and scaling up	• Increased labour for women who are already overburdened. may reduce their chance of adopting the technology • Financial empowerment where women and youth may not have funds to acquire inputs • information and awareness flow to female farmers may be slow due to low education levels
Gender related opportunities	• Technologies are appropriate for women and youth since women culturally take care of sheep and goats • The youth can make and sell the product as a source of livelihood • Increased incomes for women who are mainly involved in mal decisions on use of income accrued from the sales of sheep an goats as these are small livestock • Have well organized gender friendly markets and marketing system • making credit accessible to women • Make gender friendly training materials with illustrations to enhance communication to all gender
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs lack of access to input services including information • VMGs have limited access to training and extension services • The VMG will be able to preserve feed for their livestock and sell the excess • Due to their social status VMGs are often excluded from decision making in development and dissemination activities • There may be low adoption by VMGs due lack of awareness • VMGs have less access to extension services due to prejudice and their social status • VMGs have less access to markets than the other gender categories
VMG related opportunities	• VMGs can compound and sell the supplementary feeds as a source of livelihood • Empower the VMGs by connecting them to financial sources • Provide friendly training materials with illustrations to enhance communication • Improved livelihoods for VMGs
E: Case studies/profiles of success stories	
Success stories	The technology was adopted by 70% in Manyatta Lengima, Karare, and Ngurunit and all trees were used as stores for feeds (storage)
Application guidelines for users	Brochures and posters are available in KALRO Marsabit
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires further research
F: 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., K. Changwony and H. Walaga)
Partner organizations	County Governments –MoAL&F, Kenya Camel Association Egerton University, CBOs, NGOs

Research/ knowledge gaps

- Technologies on feeding strategies and conservation of range feed resources and feed formulation
- Determine cost-benefit of the technology

3.3.3 TIMP name	**Participatory rangeland management**
Name of Innovation	
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Decline in traditional rangeland management systems and weakness of local institutions has reduced rangeland ecosystem productivity. There is also These f combine in turn to reduce drought resilience and capacity for adapting to climate change.
What is it? (TIMP description)	Participatory Rangeland Management (PRM) is a systematic process following a series of steps, aimed at understanding rangeland resources, rangelands users and the context in which they operate. This is followed by the development of a rangeland management plan for an agreed rangeland unit, and its implementation to improve rangelands productivity. It is an integrated approach addressing social, institutional, ecological and productivity aspects of rangeland management in communal pastoralist settings.
Justification	Interventions in support of rangeland management by communities in pastoralist settings have either failed or had short-lived successes. This is often because of failure to address key dimensions of the complex contexts and required enabling elements. Participatory Rangeland Management builds on traditional pastoralist systems, to reinvigorate them and at the same time helping to strengthen vertical connections to governance frameworks that can legitimize and provide a foundation for community efforts and strengthen horizontal relationships with neighboring communities in settings where pastoral mobility and flexibility have the potential to undermine purely local interventions.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralist and agro-pastoralist communities
Approaches used in dissemination	Capacity development and technical support to implementing agencies (County governments and NGO

	partners) for their work with pastoralist communities.
Critical/essential factors for successful promotion	• Legal recognition of community rangeland management systems (e.g., County rangeland management/grazing control Acts and/or Community Land Act 2016 being implemented, etc.) • Political will to empower communities to manage grazing systems • Sufficient time for capacity building of both implementing agencies and community institutions • Sufficient time allotted for implementation to traverse at least one drought cycle, preferably two drought cycles
Partners/stakeholders for scaling up and their roles	KALRO and ILRI (coordination and awareness creation), County governments, Frontier Counties Development Council, Northern Rangelands Trust, Mercy Corps and Other NGOs (provide respective services)
Counties where already promoted if any	Baringo, Turkana, Wajir
Counties where TIMPs will be up scaled	Isiolo, Marsabit, Baringo, Tana River, and West Pokot
Challenges in dissemination	• Insufficient resources. Most County governments reluctant to allocate funding to ongoing programs • Lack of sufficient enabling legal/institutional environment • Wealthy elites owning large herds of livestock may see empowerment of community institutions as a threat to their monopoly.
Recommendations for addressing the challenges	• Continue engaging the County governments and lobbying for stable donor funding for support rangeland management • Continue engagement with County governments on rangeland management legislation
Lessons learned	• The potential contribution to climate smart agriculture from PRM is great but requires sustained nurturing of community institutions and an enabling legal and institutional framework
Social, environmental, policy and market conditions necessary	• Reduced levels of inter-communal conflict • An implemented legal framework that recognizes the management rights of community rangeland institutions.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	Community institutional structures are usually not gender sensitive. Traditional cultural norms often exclude women in most decision making.
Gender related opportunities	Strengthening community institutional structures requires approaches that allow for meaningful participation and representation of women. Nesting interventions targeted at women within PRM. e.g., community enclosures for milk herds, fodder development by

	women, and income generation through small stock production for niche markets.
VMG issues and concerns in development, dissemination, adoption and scaling up	Decision-making is often dominated by a few majority groups. Inclusivity of all ethnic groups is not often addressed.
VMG related opportunities	If done well, PRM can promote equity and inclusion for minority ethnic groups within pastoral communities.
E: Case studies/profiles of success stories	
Success stories	Flintan, F., A. Ebro & B. Eba (forthcoming), A Review of Participatory Rangeland Management (PRM). Working Paper.
Application guidelines for users	*Participatory Rangeland Management Toolkit for Kenya* has been developed by ILRI.
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	**George Wamwere-Njoroge**| AVCD Livestock Program Coordinator International Livestock Research Institute | ilri.org P. O. Box 30709, Nairobi, Kenya Mobile: +254 +254 728 546069| Off: +254 700 719763 Email: gwamwere-njoroge@cgiar.org
Lead organization and scientists	International Livestock Research Institute. Lance W. Robinson (l.robinson@cgiar.org). Jason Sircely (j.sircely@cgiar.org).
Partner organizations	County governments.

Research Gaps

- Adaptive research is needed to generate more data that many inform policy development on Rangeland resources management

3.4 Health management

3.4.1 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	The cold chain dependence of the current PPR vaccine which makes it inappropriate for use especially in Arid and Semi-Arid Lands (ASALs)
What is it? (TIMP description)	This technology is a live attenuated thermo-tolerant virus vaccine that can be kept viable at room temperature conditions (20-25 ^{o}C for several months; 37 ^{o}C for 7-14 days)
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, DVS, Kenya KEVEVAPI, Pan African Veterinary Vaccine Centre of African Union AU-PANVAC), FAO
Approaches to be used in dissemination	On-farm trials, field days, shows and exhibitions, print media, mass media
Critical/essential factors for successful promotion	Livestock willingness to adopt the technology Stakeholder participation especially County livestock and veterinary staff, Sustainable supply of the vaccine
Partners/stakeholders for scaling up and their roles	KALRO (research), KEVEVAPI (vaccine production and distribution), DVS (policy and regulation) County Governments (extension services), Non-Governmental Organizations (NGOs) (dissemination)
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be up scaled	Baringo, Garissa, Marsabit, Kajiado, Tana River, Isiolo, Laikipia, Elgeyo Marakwet.
Challenges in dissemination	Socio-cultural challenges like rustling and transhumance Poor road infrastructure
Recommendations for addressing the challenges	Advocacy for change of socio-cultural practices. Improvement of road access especially in ASAL areas.
Lessons learned in up scaling if any	The vaccine has a shelf life of up to 14 days under room temperature allowing for wider coverage during vaccination.
Social, environmental, policy and market conditions necessary	i) VMD authorization for the use of the vaccine ii) Relaxing the DVS supervision of vaccinations to allow involvement of private service providers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not determined
Estimated returns	Not determined
Gender issues and concerns in development, dissemination, adoption and scaling up	• Increased labour for women who are already overburdened. may reduce their chance of adopting the technology • Financial empowerment where women and youth may not have funds to acquire vaccines • information and awareness flow to female

	farmers may be slow due to low education levels • Limited credit access by women • Make gender friendly training materials with illustrations to enhance communication to all gender
Gender related opportunities	• Technology is appropriate for women and youth since women culturally take care of sheep and goats • Increased incomes for women who are mainly inv in making decisions on use of income accrued fro sales of sheep and goats as these are small livestoc
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs lack of access to input services including information • 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 • There may be low adoption by VMGs due lack of awareness • VMGs have less access to extension services due to prejudice and their social status • Training materials ought to be friendly with illustrations to enhance communication
VMG related opportunities	• Improved livelihoods for VMGs through improved survival of their sheep and goats.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	None in print; like all other vaccines, it should be administered by Vets
F: Status of TIMP readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	KALRO VSRI Muguga
Lead organization and scientists	KALRO VSRI Muguga-Dr Soi Reuben KEVEVAPI, Dr. Wachira Jane
Partner organizations	KEVEVAPI, DVS, AU- PANVAC, FAO

Research Gaps:

- Adaptive research required to develop sustainable model for availing the vaccine to farmer in addition to establishing cost benefit analysis

3.4.2 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
What is it? (TIMP description)	Haemonchus DNA is expressed in *Escherichia coli* vector and used to produce a vaccine
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 US$ 5,000 million annually. Haemonchosis control is 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 andup-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 trials, field days, shows, exhibitions, print media, mass media
Critical/essential factors for successful promotion	Stakeholder participation especially County livestock and veterinary staff. Sustainable supply of the vaccine. Affordable vaccine price
Partners/stakeholders for scaling up and their roles	Egerton University – innovators, KALRO – for on- station and on-farm trials KEVEVAPI – Production and distribution DVS – Policy and regulation, VMD- Registration and certification. County Governments – Mobilization and promotion of the TIMP to End users NGOs – Promotion to end users
C: Current situation and future scaling up	
Counties where already promoted if any	None
Counties where TIMP will be upscaled	Baringo, Garissa, Marsabit Isiolo, , Laikipia, Nyandarua, Uasin Gishu, Elgeyo Marakwet, Kajiado, Nyeri West Pokot
Challenges in dissemination	Not yet disseminated
Suggestions for addressing the challenges	None

Lessons learned in up-scaling if any	None
Social, environmental, policy and market conditions necessary	Adherence to DVS and VMD regulations
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Yet to be determined
Estimated returns	Yet to be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	Delivery may require a cold chain which imparts on logistics and costs The anticipated technology will be appropriate for use by youth, men and women
Gender related opportunities	The vaccine is expected to reduce morbidity and mortality of small ruminants thus increasing their reproduction and productivity. A larger number of healthy animals will therefore be available to youth and women for sale to raise income and contribute to food and nutrition security
VMG issues and concerns in development, dissemination, adoption and scaling up	Delivery may require a cold chain which imparts on logistics and costs Handling of sheep and goats during immunization may present a challenge to VMGs
VMG related opportunities	Reduced mortality provides more livestock for domestic use and for sale to generate income
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	None in print; Shall be administered by Vets
F: Status of TIMP readiness (1. Ready for up-scaling; 2. Requires validation; 3. Requires further research)	Requires validation
G: Contacts	
Contacts	Egerton University and KALRO VSRI Muguga
Lead organization and scientists	Egerton University Prof. Charles Muleke
Partner organizations	KEVEVAPI, DVS, AU-PANVAC, FAO

Research Gap

- Adaptive research is required to develop guidelines for disseminating the technology before wide application

3.4.3 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	Slow and expensive diagnostic processes of Contagious Caprine Pleuro-Pneumonia (CCPP) leading to huge losses due to mortality and cost of control. The disease manifests as outbreaks in ASALs and is a highly contagious trans-boundary disease of goats.
What is it? (TIMP description)	Latex agglutination diagnostic test is a rapid 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 field diagnosis.
Justification	CCPP causes huge economic losses in form of reduced productivity through high mortality in goats. There are incidences of high vaccine failure if immunization is done on already exposed/infected goats. In addition, there is increased risk of irrational use of antimicrobials by some pastoralists for prophylaxis. This is a public health hazard attributed to anti-microbial residues and drug resistance. A rapid pen-side test such as the latex agglutination diagnostic test is important for effective detection for informed decision making on the use of vaccines/drugs.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralists, DVS and County Governments, Private animal health practitioners.
Approaches tobe used in dissemination	Field days, shows, mass media and exhibitions
Critical/essential factors for successful promotion	Availability of reagents and other consumables
Partners/stakeholders for scaling up and their roles	KALRO (diagnostic test development), DVS (policy and regulation), County Governments (end users, extension services), private animal health practitioners (end users)
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, West Pokot.
Challenges in dissemination	• It is difficult to get appropriate droppers (10 µl) for dispensing the reagents • Packaging in large doses restricts access by small-scale farmers. • Awareness of the technology is low
Suggestions for addressing the challenges	i) Fabricate the right dispenser ii) Seek alternative dispensing methods iii) Packaging in small packs

	iv) Promotion to raise awareness of the technology.
Lessons learned in up scaling if any	The technology does not work well with frozen serum samples
Social, environmental, policy and market conditions necessary	VMD authorization before commercialization Sensitization of the goat keepers on need for the rapid diagnosis on their goats
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KES 10,000 per 100 tests
Estimated returns	To be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	• Increased labour for women who are already overburdened. may reduce their chance of adopting the technology • Financial empowerment where women and youth may not have funds to acquire test kits • Information and awareness flow to female farmers may be slow due to low education levels • Limited credit access by women • Make gender friendly training materials with illustrations to enhance communication to all gender
Gender related opportunities	• Technology is appropriate for women and youth since women culturally take care of sheep and goats • Increased incomes for women who are mainly involved in making decisions on use of income accrued from the sales of sheep and goats as more small livestock will survive.
VMG issues and concerns in development, dissemination and adoption and scaling up	• Visually impaired persons are disadvantage in the use of this technology • VMGs lack of access to input services including information • 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 • There may be low adoption by VMGs due lack of awareness • VMGs have less access to extension services due to prejudice and their social status • Training materials ought to be friendly with illustrations to enhance communication
VMG related opportunities	• Improved livelihoods for VMGs through improved survival of their sheep and goats.
E: Case studies/profiles of success stories	
Success stories from previous similar projects	None
Application guidelines for users	-Capri test LAT for CCPP- (Leaflet)

	-User instructions (Manual)
F: Status of TIMP readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	Centre Director KALRO, Biotechnology Research Centre-Kabete
Lead organization and scientists	KALRO, Anderson Wambugu
Partner organizations	DVS

Research Gap

- Adaptive research to assist in dissemination of the technology before it is rolled out to farmers.

3.4.4 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	The economic losses due to worm infestation in livestock and the increasing cost of routine deworming.
What is it? (TIMP description)	Integrated helminth control is the practice of deworming animals during potentially high-risk periods of worm infestation at the period of the highest risk using several methods that work together.
Justification	Routine deworming as often practiced may result in unnecessary treatments and aid in selection for resistance. On the other hand, strategic deworming is a more cost-effective method of helminth control as it reduces the frequency of deworming.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small ruminant pastoralists
Approaches to be used in dissemination	Field days, shows, exhibitions, on-farm, digital platforms, innovation platforms demonstrations and posters
Critical/essential factors for successful promotion	Use of correct dose, dosing technique and timing.
Partners/stakeholders for scaling up and their roles	County Governments (extension services), pharmaceutical companies (supply of drugs)
C: Current situation and future scaling up	
Counties where already promoted if any	Nyeri and Kericho
Counties where TIMP will be up scaled	Baringo, Garissa, Marsabit Tana River, Isiolo, Tharaka Nithi, Elgeyo Marakwet, Kajiado, West Pokot
Challenges in dissemination	Inadequate information about existence of practice, Use of incorrect drug doses (incorrect weight

	estimates), technique and timing.
Recommendations for addressing the challenges	Awareness creation, capacity build farmers and technicians on correct doses, dosing technique and time of deworming
Lessons learned in up scaling if any	Application of the management practice saves unnecessary costs
Social, environmental, policy and market conditions necessary	• -Animal Disease Act (CAP 364) as enforced by DVS to guide use of anthelmintics. • -Manufacturer recommendations on observing withdrawal periods for anthelmintics be adhered to.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of drugs and labour
Estimated returns	Can save up to 30% of costs incurred when implementing conventional deworming
Gender issues and concerns in development, dissemination, adoption and scaling up	• Women will be disadvantaged during handling of livestock especially the large stock • Women and children are rarely involved in decision making as to when and how to deworm • Women do not often get adequate information on new approaches to deworming due to low levels of education and other cultural barriers.
Gender related opportunities	• Improved productivity of animals will lead to increased incomes for both gender and youth
VMG issues and concerns in development, dissemination, adoption and scaling up	• People with disability will be disadvantaged in handling of animals and may require help.
VMG related opportunities	Increased incomes for VMGs rearing animals
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Yet to be documented
Application guidelines for users	-Integrated helminth control (Technical Note)
F: Status of TIMP readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for up scaling
G: Contacts	
Contacts	KALRO VSRI
Lead organization and scientists	KALRO VSRI Dr. Nginyi J., Dr. Mugambi J.
Partner organizations	DVS

Research Gap

- Need to come up with Cost Benefit Analysis.

3.4.5 TIMP name	**Push-pull 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	High incidence of trypanosomiasis and antimicrobial resistance issues
What is it? (TIMP description) (Photo)	A technique of applying Tsetse fly repellants on the host and attracting them into traps to control fly population.
Justification	The Cost of treatment of trypanosomosis is high. Ineffectiveness of tsetse fly repellants/traps used in isolation and drug resistance is a challenge
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Livestock keepers, County Government extension officer, NGOs/CBOs.
Approaches to be used in dissemination	Field days, shows and exhibitions
Critical/essential factors for successful promotion	Adherence to DVS regulations
Partners/stakeholders for scaling up and their roles	Kenya Tsetse and Trypanosomiasis Eradication Council (KenTTEC) (surveillance), Kenyatta University (research), DVS (policy and eradication), Bio-innovate (funding), Gulu University (research), County Governments (extension services)
C: Current situation and future scaling up	
Counties where already promoted if any	Nyeri and Kericho
Counties where TIMP will be up scaled	Baringo, Garissa, Marsabit Tana River, Isiolo, Tharaka Nithi, Elgeyo Marakwet, Kajiado, West Pokot
Challenges in dissemination	Yet to be determined
Suggestions for addressing the challenges	None
Lessons learned in up scaling if any	None
Social, environmental, policy and market conditions necessary	Need for environmental considerations while using chemicals to repel and attract tsetse flies
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	To be determined
Estimated returns	To be determined
Gender issues and concerns in development, dissemination, adoption and scaling up	To be determined
Gender related opportunities	Increased household food and incomes for all
VMG issues and concerns in development, dissemination, adoption and scaling up	To be determined
VMG related opportunities	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	To be developed

F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires field validation
G: Contacts	
Contacts	Centre Director, KALRO Biotechnology Research Centre – Kabete
Lead organization and scientists	KALRO Biotechnology Research Centre, Mdachi, R., Mireji, P., Chemuliti, J.,
Partner organizations	Kenya Tsetse and Trypanosomiasis Eradication (KenTTEC), Council, Kenyatta University, DVS, Bioinnovate, Gulu University, County Governments

Research Gaps

- Adaptive research to validate the technology
- Develop Cost Benefit Analysis

3.4.6 TIMP name	**Innovations in animal health delivery for pastoralists**
Category (i.e. technology, innovation or management practice)	Management Practice
A: Description of the technology, innovation or management practice	
Problem addressed	High prevalence of preventable diseases, frequent market disruptions and high incidence of zoonotic diseases.
What is it? (TIMP description)	It is a delivery model that has been proven to improve animal health services in a pastoral setting. It borrows from the ILRI partnership with the County Governments and private sector companies has successfully piloted several times. The two models are: • Model 1: Vaccination campaigns organized by the County Governments which provide an opportunity for additional services by the private sector at reduced costs. Pastoralists bring animals for vaccination and get additional services such as deworming, tick control, trypanocide drugs and other extension services. The model is easily rolled out to other pastoralist counties if a proper regulatory framework is developed. • Model 2: Using a mobile based veterinary clinic a scheduled private veterinary service through areas of high livestock concentrations such as watering points and markets is organized in collaboration with community disease reporters (CDRs). The private sector stays for 2 to 3 days to provide other services which the pastoralists pay for. A clear

	business arrangement between the community disease reporters and the private sector is developed so that the CDRs act as agents of the private sector. They could also be trained to provide non-veterinary disease interventions under the supervision of the private sector.
Justification	Animal health services in pastoral systems will only improve with significant participation of the private sector. Due to the unique nature of livestock production in pastoral systems, private sector is unlikely to thrive without innovative ways to attract it. The two models described have been piloted successfully in the three counties and are ready to roll out in other counties as one of the options for improving animal health services in the pastoral systems.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Livestock producers, private animal health service providers, County governments, NGOs
Approaches used in dissemination	Identification of private sector players willing to invest in animal health delivery, agreements with County governments, clear regulations, coordination of other animal health players to regulate subsidies.
Critical/essential factors for successful promotion	• Willingness of the County governments to try new ways • Cooperation from livestock keepers. • Organized marketing systems to be arranged together with these visits to encourage offtake of animals to assist farmers in getting resources to fund their costs.
Partners/stakeholders for scaling up and their roles	ILRI and KALRO (awareness creation) County Director of Veterinary Services (CDVS), DVS, Private animal health service providers (collaborate to implement the models), pastoralists organizations and livestock keepers (end users)
C: Current situation and future scaling up	
Counties where already promoted if any	Isiolo, Garissa and Marsabit
Counties where TIMPs will be up scaled	West Pokot, Turkana, Marsabit, Isiolo, Wajir, Garissa, Tana River and Mandera
Challenges in dissemination	• Current regulations are not conducive to private sector investments in new approaches. • Lack of targeted information to support the models • Lack of supportive partners willing to take lead of the models and disseminate them.

Recommendations for addressing the challenges	• Create awareness on the opportunities among animal health private sector actors • Create awareness among livestock keepers of the availability of the new services • Clarify regulations regarding delivery of vaccines by the private sector actors among County veterinary authorities • Develop business arrangements between CDRs and private animal health service providers and disseminate the same • Coordinate and disseminate information on provision of subsidies in animal health services by various donors so that they do not distort the markets
Lessons learned	Pastoralists are willing to pay for quality services when they are provided. Private sector is willing to invest in animal health services the ASALs if the appropriate incentives are provided and clear regulatory framework is developed to capitalize on the large livestock numbers in the ASALs.
Social, environmental, policy and market conditions necessary	A proper regulatory framework is critical for the success of this innovation. Improved market systems for livestock will enhance the ability of pastoralists to pay for the services.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Approximately KES 10M to: • Create awareness among livestock keepers • Provision of business support services among private sector actors and CDRs • Stakeholder dialogues to clarify regulatory issues regarding types of animal health services by private sector • Coordination forum among animal health service providers to regulate the provision of subsidies in animal health
Estimated returns	Improved access to animal health by 20%, reduced mortality and morbidity, reduced exposure to zoonotic diseases, reduced use of counterfeits and substandard drugs, that would usually lead to antimicrobial resistance (AMR), growth of business. All these could translate to a return of at least KES 121 million.
Gender issues and concerns in development, dissemination, adoption and scaling up	The business opportunities provide a great opportunity for the youth in the ASALs. Provision of animal health services near the pastoralists is particularly important to women who, for cultural reasons are not allowed to travel to towns to seek these services. The innovation is gender friendly and both grassroot men and women can be trained as CDRs
Gender related opportunities	Business opportunities for the youth. Easy access to animal health for women.

VMG issues and concerns in development, dissemination, adoption and scaling up	The innovation has been developed through basic adaptive research and all segments of the community are involved, including VMGs with no limitations to its scaling up.
VMG related opportunities	The innovation allows improved access to animal health to all segments of the society and especially for women and the aged.
E: Case studies/profiles of success stories	
Success stories	The two models were successfully piloted in Isiolo, Garissa and Marsabit. The County government improved services to the communities, private sector create additional business and communities benefited due to improved services this was case of win-win situation for all except perhaps to merchants who sell counterfeits and substandard drugs.
Application guidelines for users	As described under TIMP description. Regulations to govern the private public cooperation defining the roles of private sector and other stakeholders will be developed and documented
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
G: Contacts	
Contacts	George Wamwere-Njoroge| AVCD Livestock Program Coordinator International Livestock Research Institute | ilri.org P. O. Box 30709, Nairobi, Kenya Mobile: +254 +254 728 546069| Off: +254 700 719763 Email: gwamwere-njoroge@cgiar.org
Lead organization and scientists	ILRI (George Wamwere-Njoroge, Bernard Bett, Haret Hambe & Henry Kiara)
Partner organizations	KALRO, DVS, County Governments, Kenya Veterinary Board (KVB), Veterinary Medicines Directorate (VMD) and Frontier County Development Council (FCDC)

3.5 Postharvest management

3.5.1 TIMP Name	**Nyirinyiri (Ready to-eat meat) processing**
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem to be addressed	More than 30% of red meat (sheep and goat) is lost to drought leaving many pastoralists exposed to severe food

	insecurity
What is it? (TIMP description)	Nyirinyiri is a ready to eat deep fried meet product made from goat meat cooked and preserved in oil. Nyirinyiri also known as kooche in is traditional recipes common among pastoralists. of Northern Kenya. Nyirinyiri is prepared by women to celebrate homecoming of a husband from a journey. It is also cooked during weddings and other ceremonies within the village.
Justification	It has a longer shelf life (12 months) compared to local meat preservation recipes if preserved under sterile condition. Has the potential to fetch more income to vulnerable segments of the communities
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Private sector, Pastoralists, Ready-to-Eat meat consumers in urban centres, Researchers.
Approaches used in dissemination	Training CIGs on processing and marketing, On-farm demonstrations, field days, shows and exhibitions, print media
Critical/essential factors for successful promotion	Capacity building. Demonstration on practical use of the recipe, Involvement of the private sector, willingness to pay for value added meat product by consumers
Partners/stakeholders for scaling up and their respective roles.	Universities and KALRO (trainings and research), County Governments, (mobilizations, policy implementation and monitoring and evaluation), Local service providers (trainings and demonstrations), Consumer, hotel industry players Kenya Bureau of Standards, Kenya Livestock Marketing Council.
C: Current situation and future scaling up	
Counties where already promoted if any	Marsabit and Garissa
Counties where TIMPs will be upscaled	Wajir, Mandera, Marsabit, Isiolo
Challenges in development and dissemination	• Sanitary and phytosanitary conditions in ASALs • Waste management for of offal's and blood. • Market for nyirinyiri is still confined to pastoralists • Lack of seed money for SMEs startups for processing the product.
Suggestions for addressing the challenges	• Practice good Manufacturing Practices (GMP) in processing of nyirinyiri. • Marketing outlets to be fully identified and developed. • County Governments to establish seed money for supporting agricultural based SMEs startups.
Lessons learned in up scaling, if any	• Marketing of nyirinyiri in supermarkets in Isiolo and Nairobi is picking up but requires realistic research supported business plan.
Social, environmental, policy and market conditions necessary for development and up-scaling	• Capacity building on hygienic handling for women groups Waste management in abattoirs, strict adherence to KEB standards.

	• Processing facilities be established
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Total cost KES 6000 for a medium goat and oil for cooking and preservation
Estimated returns	Gross income of 9000. Profit of KES 3000 from the 30 bottles made and sold at KES 300 per bottle (9000 – 6000)
Genderissues and concerns in development, dissemination, adoption and scaling up	• Women have less access to agricultural information, technology and knowledge than men. • information and awareness flow to female farmers may be Slow due to low education levels
Gender related opportunities	• Poverty levels are high among women and the technologies can be used to economically empower women. • Nyirinyiri handling is a traditional domain of women and adoption will be expected to be high
VMG issues and concerns in development, dissemination, adoption and scaling up	• VMGs have less access to agricultural information, technology and knowledge than men. • Aggregation of raw skins may require financial support.
VMG related opportunities	• Target VMGs for nyirinyiri upscaling activities and ensure their expertise are included in scaling up of technologies • Increased involvement of VMGs in nyirinyiri marketing, need to train them on value addition and agri-business • Improved livelihoods for pastoralists from selling high volumes of nyirinyiri, hence improved nutrition and increased incomes
E**: Case studies/profiles of success stories**	
Success stories	Was successfully validated in Ngurunit among Salato women group and the Isiolo Muslim youth prepare for sale on orders
Application guidelines for users	A trainer's manual and brochure is available in KALRO
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-SGCRI P.O. Box 147-60500 Marsabit director.sgir@kalro.org www.kalro.org
Lead organization and scientists	Amos Adongo and Prof J. W. Matofari
Partner organizations	County Governments –MoAL&F, Universities

Research Gap: Adaptive research needed to help identify more recipes among livestock keepers in other parts of the country such West Pokot, Laikipia, Kajiado among others. Generate data on technical and cost of producing the TIMP for newly identified recipes

3.5.2 TIMP Name	**Wet salting of skin**

Category (i.e. technology, innovation or management practice)	Innovation/Product
A: Description of the technology, innovation or management practice	
Problem to be addressed	More than 80% of sheep and goat skin is lost due to poor handling techniques.
What is it? (TIMP description)	Salt has been used as a direct preservative for many years. Skins are composed of about 60% water, 35% fibrous and non- fibrous proteins and the rest are lipids, carbohydrates and mineral salts. The preservation action of salt is through a reduction of water activity. Salt has an additional protective effect as it penetrates the tissue and with its presence inhibits the growth of deteriorating organisms hence preserving the fresh skin.
Justification	Wet salted skin and hides have longer shelf life and fetches more prices than sun dried by more than 50% They are also an important source of foreign exchange earnings for Kenya and other African countries. However, the full potential of skins has not been realized by livestock keepers due to poor handling leading to low market prices and therefore leading to low demand in both domestic and export market.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Sheep and goat keepers, butchers and traders, processors/tanneries, Research organisations such as KALRO, Universities, Extension officers form the County Government and NGOs/CBOs.
Approaches used in dissemination	Training CIGs on curing and marketing of skins, On-farm demonstrations, field days, shows and exhibitions, print media
Critical/essential factors for successful promotion	• Availability of quality fresh skins from farmers. • Willingness to pay for improved skins by traders and tanners. Ready market niches for skins. • Promotion platforms and messages that targets herders/producers and aggregators • Involving all stakeholders in the promotion chain • for well cured skins
Partners/stakeholders for scaling up and their respective roles.	• KALRO and Universities -trainings and research • County Government -mobilizations, policy implementation and monitoring and evaluation), Local service providers (trainings and demonstrations) • NGO and CBOs – Policy advocacy, mobilization, support marketing and mobilization of CIGs. • KIRDI, Tanneries
C: Current situation and future scaling up	
Counties where already promoted if any	Selected parts of Marsabit and Garissa
Counties where TIMPs will be upscaled	Wajir, Mandera, Marsabit, Isiolo, West Pokot

Challenges in development and dissemination	• Poor infrastructure at production level leading to delays in collection and distribution of cured products. • Limited information on markets prices fluctuations • High taxes charged on skin by the County council affects the trade • Limited access to industrial salt especially in northern Kenya
Suggestions for addressing the challenges	• Remove the taxes • Link the traders to market • Improve infrastructures at both producer and trader nodes • Improve access to inputs (industrial salt for curing the skins)
Lessons learned in up scaling, if any	Wet salted skin fetched high prices
Social, environmental, policy and market conditions necessary for development and up-scaling	Capacity building on wet salting skin, storage Counties to develop policies on waste management in abattoirs. Strict adherence to standards. Processing facilities be established
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Total cost is KES 16/skin
Estimated returns	Profit KES 100 for salted sheep skin and 100/= for salted goat skin
Genderissues and concerns in development, dissemination, adoption and scaling up	Dissemination materials should be sensitive to women
Gender related opportunities	Wet salted skin is an alternative income generating activity especially for the youth and women Have well organized gender friendly markets and marketing system Make credit accessible to women
VMG issues and concerns in development, dissemination, adoption and scaling up	VMGs have less access to agricultural information, technology and knowledge than men. Aggregation of raw skins may require financial support
VMG related opportunities	Target VMGs for wet salting upscaling activities and ensure their expertise are included in wet salting technologies Improved livelihoods for pastoralists from selling high volumes of wet salted skins, hence increased income Increased involvement of VMGs in wet salting and marketing. Train VMGs on skin value addition and agri-business Mechanization of the production process may enable the VMGs to adopt the technologies.
E: Case studies/profiles of success stories	
Success stories	Was successfully validated in Ngurunit among Salato women group and Isiolo Ngaremara women group

Application guidelines for users	A trainer's manual and brochure is available in KALRO Marsabit.
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation; 3. Requires further	Ready for upscaling
research)	
G: Contacts	
Contacts	Institute Director, KALRO-SGCRI P.O. Box 147-60500 Marsabit director.sgir@kalro.org www.kalro.org
Lead organization and scientists	Amos Adongo and Hussein Walaga & K Changwony
Partner organizations	County Governments –MoAL&F, Universities

Research Gap

More data is needed on environmental impact of use of industrial salt and other waste management related questions

3.5.3 TIMP Name	**Integrated Manure Management**
Category (i.e. technology, innovation ormanagement practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Rangeland degradation is characterized by declining soil fertility, low yields in agro-pastoral area, increased soil moisture stress, increased soil erosion and poor soil health particularly in settled areas of rangelands Poor manure management and handling leading to increased GHG emissions
What is it? (TIMP description)	Integrated Manure Management (IMM) is the optimal, site-specific handling of livestock manure from collection, through treatment and storage up to application to forage and crops.
Justification	Manure is a major by-product in beef production systems and is the second largest contributor of greenhouse gas emissions estimated at 25.9%. Manure is rich in Nitrogen, Phosphorus and Potassium, the nutrients that are deficient in most arid and semi-arid soils. Appropriate manure management would produce bioenergy and fertilizer for improving soil fertility in the arid and semi-arid areas where depletion rates of 22 kg/ha for Nitrogen, 2.5 kg/ha for Phosphorous, and 15 kg/ha for Potassium is reported.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralists and agro pastoralists, Livestock entrepreneurs
Approaches to be used in dissemination	Open and field days, Agricultural shows, Farmer Field Schools, Mass and social media, Chief's Barazas, Farmer exchange visits and demonstration farms.
Critical/essential factors for successful promotion	• Training on feeding, management and use of manure • An appropriate dissemination approach to reach target farmers
Partners/stakeholders for	• KALRO and Universities – to continue research to

scaling up and their roles	improve on the technology • County governments – to train on the technology • ICRAF – to promote use of mobile soil testing
C: Current situation and future scaling up	
Counties where already promoted	Marsabit
Counties where TIMP will be up scaled	Isiolo, Laikipia, Kajiado, West Pokot and Marsabit
Challenges in dissemination	• Lack of model demonstration farms • Most pastoral communities do not use manure for cultural reasons • Inadequate awareness of the importance of manure • Lack of appropriated technology locally for spreading manure in large areas
Suggestions for addressing the challenges	• Establish demonstration farms in pastoral areas to showcase advantages of using manure • Create awareness and build capacity of the pastoralists and agro- pastoralists on the technology
Lessons learned	• Applying manure to soils saves on purchase of inorganic fertilizer, increases crop yield and conserves water.
Social, environmental, policy and market conditions necessary	• Change in attitude by communities that burn manure • Manure treatment to ensure it does not have pathogens and harmful residues • Availability of affordable manure spreaders for use in extensive production systems • Better prices for livestock products to spur investment
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of composting and spreading 1 ton of manure = KES 4000
Estimated returns	60% increase in crop and pasture production
Gender issues and concerns in development, dissemination adoption and scaling up	• Proper handling of manure needs labour for collecting the manure, building a compost heap, maintaining it and finally transporting and applying it field which take a lot of effort and time and may not be adopted by women who are already overburdened. • Women have less access to agricultural information, technology and knowledge than men. • Women, who are mainly in in cropping activities have inadequate awareness of the importance of manure. • Information and awareness flow to female farmers may be Slow due to low education levels. • There may be need to establish ownership of the manure to avoid human/gender conflicts. • Change of mindset on use of manure
Gender related opportunities	• Mechanization of manure spreading will release women and children who carry and spread the manure to do other important chores

	• Manure is locally available in households with livestock and may provide business opportunities for all in the household
VMG issues and concerns in development, dissemination, adoption and scaling up	• Manure management without mechanization may be laborious thus a disadvantage to the VMGs • The VMGs are also resource poor, hence may not have access to adequate manure as this presupposes they have many livestock. • VMGs have less access to agricultural information, technology and knowledge. • It may be laborious without mechanization thus discouraging to the VMGs • Mechanization of the production process may enable the VMGs to adopt
VMG related opportunities	• VMGs can sell excess manure as a business once the demand is created
E: Case studies/profiles of success stories	
Success stories from previous similar projects	Addition of manure has been reported to improve soil fertility and increased crop/forage yield in many parts of the Country
Application guidelines for users	Okoti, O. M. 2020 Integrated Manure Management. Training notes; KALRO
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	1. Ready for up-scaling
G: Contacts	
Contacts	Director, Environment & Natural Resources, KALRO Secretariat, Nairobi.
Lead organization and scientists	KALRO; Michael Okoti and Dub D. Golicha
Partner organizations	County governments, Non-governmental organizations

Research gaps

i) Identify/Develop/adapt technology for spreading manure in extensive grazing areas especially in the pastoral grazing areas

ii) Understand the cultural practices that discourage the use of manure and find an entry point to demystify the myths.

3.6 Sheep and goat business and marketing

3.6.1 TIMP Name	Weight estimation tape
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem to be addressed	Low market prices of live animal due to incorrect live weight estimation.
What is it? (TIMP description)	This involves estimating the live weight of sheep and goats using linear body measurements and a conversion table.
Justification	Inaccurate weight estimation of sheep and goats will lead to erratic decision making on feed intervention, sale pricing and dosing during drug administration. The use of tape to estimate weights can be used by pastoralists to monitor the growth of their sheep and goats, supplement feed in time, administer correct drug doses and to determine farm gate prices for their animals.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralists, extension agents and researchers
Approaches used in dissemination	Open and field days, Agricultural shows, farmer field schools, farmer exchange visits and demonstration farms
Critical/essential factors for successful promotion	Knowledge of tape measurement for weight determination Availability of the conversation sheets
Partners/stakeholders for scaling up and their respective roles.	• County Governments (policy, resources), • KALRO and Universities (research training validations), local NGO in livestock VCs (community mobilization and training), • Kenya Livestock Marketing Council (policy implementation and advocacy).
C: Current situation and future scaling up	
Counties where already promoted if any	Wajir and Garissa
Counties where TIMPs will be upscaled	Wajir, Garissa and Mandera, Samburu, Laikipia, Baringo, Kajiado.
Challenges in development and dissemination	• Incorrect use of the technology at the initial stages. Unavailability of tape in the production zones, • Illiteracy
Suggestions for addressing the challenges	• Linking pastoralist with tape stockists or use of tailor's tape, • Capacity building of pastoralists
Lessons learned in up scaling, if any	• Use of the tape estimation will help in price setting of sheep and goats based on live weight.
Social, environmental, policy and market conditionsnecessary for development and up-scaling	• Pastoralists' understanding and insistence on selling their animals on weight basis • A policy of selling livestock based on weights • Establishment of markets which guarantee good

	prices on weight basis
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Tape measure costs KES 50
Estimated returns	Improved prices due to selling on live weight
Gender issues and concerns in development, dissemination, adoption and scaling up	• Increased labour for women who are already overburdened. This may reduce their chance of adopting the technology • Information and awareness flow to female farmers may be slow due to low education levels
Gender related opportunities	• This technology is appropriate for women and youth since women culturally take care of sheep and goats • Increased incomes for women who are mainly involv making decisions on use of income accrued from the sa sheep and goats as these are small livestock • Have well organized gender friendly markets and marketing system
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 • There may be low adoption by VMGs due lack of awareness • VMGs have less access to extension services due to prejudice and their social status
VMG related opportunities	• •Provide friendly training materials with illustrations to enhance communication • •Improved livelihoods for VMGs
E: Case studies/profiles of success stories	
Success stories	Farmers/pastoralists in Ngaremara and Kulamawe in Isiolo using the tape have recorded improved sale prices of their sheep and goats
Application guidelines for users	A conversion table is used to estimate the weight as well as a brochure available at KALRO Marsabit
F: Status of TIMP Readiness (1. Ready for up scaling; 2. Requires validation;3. Requires further research)	Ready for upscaling
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 (K. Changwony, Sagala J. and Walaga H.K.,)
Partner organizations	County Governments –MoA&LD

KCSAP
Kenya Climate Smart Agriculture Project

Kenya Climate Smart Agriculture Project (KCSAP)
P.O. Box 57811-00200, City Square, Nairobi, 'Kenya

www.kalro.org