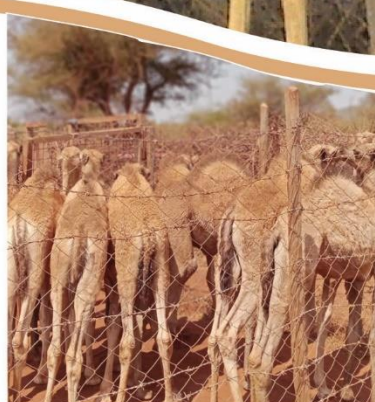
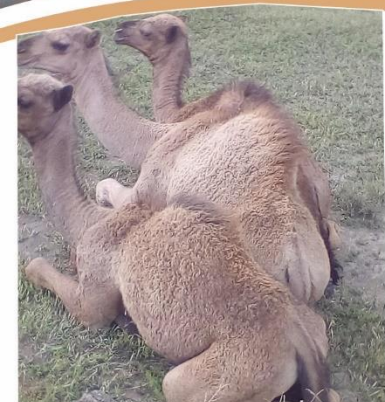
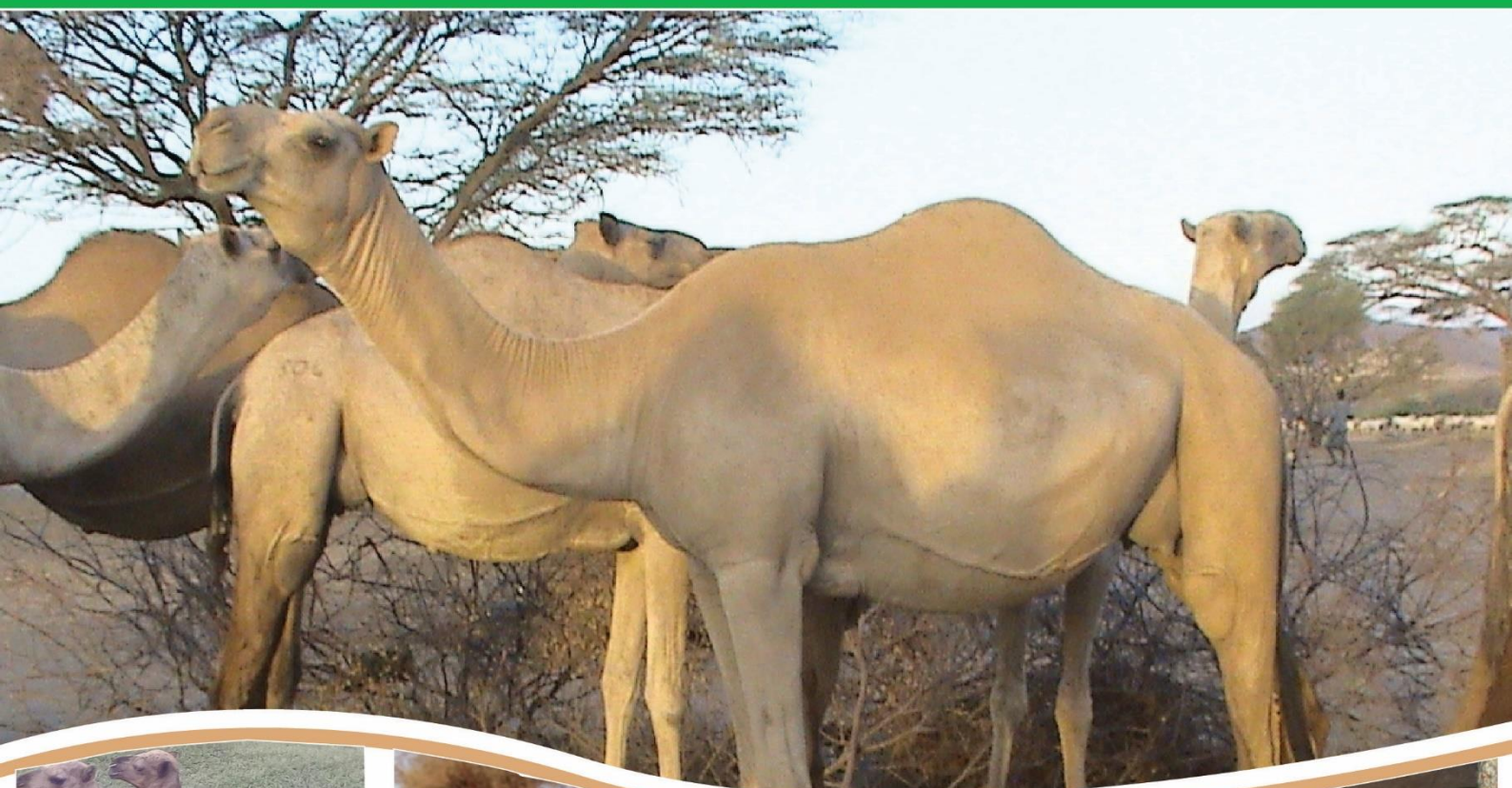




# Inventory of Climate Smart Agriculture Technologies, Innovations and Management Practices for Camel Value Chain



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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.

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## **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 the Camel 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 is fully covered in ways 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 Camel 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 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). Those that are animal production based are five (5) and include apiculture, indigenous chicken (meat and eggs), dairy (cattle and camel), red meat (cattle, sheep and goats) and aquaculture. Also, there are three (3) cross cutting themes on pastures and fodder, natural resource management, and animal health. 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, Kakemega, 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 Camel 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**

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## **ABBREVIATIONS AND ACRONYMS**

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
BiORI	Biotechnology Research Institute
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
CMM	Core-Market Management
CMT	California Mastitis Test
CSA	Climate Smart Agriculture
DNA	Deoxyribo Nucleic Acid
DVS	Director of Veterinary Services
FCDC	Frontier County Development Council
g	Gram
GHG	Green House Gas
HG	Height Girth
IGAD	Inter-Governmental Authority on Drought
ILRI	International Livestock Research Institute
IMM	Integraged Manure Managemnt
IPR	Intellectual Property Rights
ISTUS	IGAD Sheikh Technical Veterinary School
KALRO	Kenya Agricultural and Livestock Research Organization

## 1.0. INTRODUCTION

### 1.1. Definition of Terms for Technologies, Innovations and Management Practices

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

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

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

### 1.2. Inventory of TIMPS in Camel Milk Value Chain

#### Summary of the TIMPs

The inventory process resulted in a total of **17 TIMPs** including 12 technologies, 2 innovations, 3 pieces of information, distributed among the 5 sub-themes, as indicated in Table 1.

**Table 1: Number of TIMPs identified by NARS in camel Value Chain**

Commodity/ VC	Sub-Theme	Technologies	Innovations	Information
Camels	Breeds and Breeding	5	0	0
Camels	Feeds and Feeding	3	0	0
Camels	Health management	2	0	2
Camels	Post-harvest and Value Addition	2	2	0
Camels	Market Linkages and Distribution	0	0	1
<b>Overall Total</b>		<b>12</b>	<b>2</b>	<b>3</b>

### 1.3. Summary of Status of TIMPs in Camel Value Chain

The inventory process resulted in a total of **13 TIMPs ready for upscaling**, **2 require validation** and **2 require further research** in the sub-themes, as indicated in Table 2.

**Table 2: Number of TIMPs ready for upscaling, require validation or further research**

Commodity/VC	Sub-Theme	Ready for upscaling	Require validation	Further Research
Camels	Breeds and Breeding	5	0	0
Camels	Feeds and Feeding	2	1	0
Camels	Health Management	2	0	2
Camels	Post-harvest and Value Addition	3	1	0
Camels	Market Linkages and Distribution	1	0	0
<b>Overall Total</b>		<b>13</b>	<b>2</b>	<b>2</b>

\*Requires further research/validation

**Table 3: Inventory of Camel TIMPs, Categories, Status and Outputs for KCSAP**


TIMPs Sub Theme	TIMP Title	TIMP Category	Status
1 Breeds and breeding	1.1 Somali camel breed	Technology	Ready for upscaling
	1.2 Rendille/Gabbara camel breed	Technology	Ready for upscaling
	1.3 Turkana camel breed	Technology	Ready for upscaling
	1.4 Pakistan camel breed	Technology	Ready for upscaling
	Camel breeding guidelines	Technology	Ready for upscaling
2 Feeds and Feeding	2.1. Home based feed formulation for lactating camels	Technology	Requires validation
	2.2.Modified Chumvi Kuria	Technology	Ready for upscaling
	2.3. Formula for estimating the live weight of camel calves	Technology	Ready for upscaling
3 Health Management	3.1. Oral rehydration in camels	Technology	Ready for upscaling
	3.2. Integrated control of camel surra	Management practice	Ready for upscaling
	3.3. pH-based mastitis kit	Technology	Requires further research
	3.4. Mastitis Control	Management practice	Requires further research
4 Post-harvest and value addition	4.1. The donkey milk carrier	Innovation	Ready for upscaling
	4.2. Improved hemp cooling technology for milk marketing	Innovation	Ready for upscaling
	4.3. Solar milk cooler	Technology	Requires validation
	4.4. Camel Ghee	Innovation	Ready for upscaling

5 Market Linkages and Distribution	5.1. Strengthen Co-Management Model (CMM) in Livestock Markets Governance	Management practice	Ready for upscaling
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## 2. CAMEL MILK VALUE CHAIN TIMPs

### 2.1. Breeds and breeding

#### 2.1.1. Somali Camel Breed


<b>TIMP Name</b>	Somali Camel breed
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	The growth, mature body weights and milk production parameters of different breeds of camels differ. Most pastoralists keep camel breeds of low productivity potential or which are not suited for their climatic conditions and so there is need to provide breeds with higher productivity and better environmental adaptation.
What is it? (TIMP description)	<p>The Somali camel is a big sized camel which attains a mature live weight of 450-700 kg and has a milk yield average of 5 l/d under unsupplemented range conditions. This breed is usually a heavy feeder and less hardy. It has a brown-cream coat coloration.</p> 
Justification	Camels with high mature body weight and with higher milk production are likely to be preferred where information about them is available to pastoralists. Targeted cross-breeding between the Somali camel and the other smaller-sized breeds result in offspring with faster growth, bigger body size and a mix of desirable characteristics inherent in the other breeds in order to enhance survival, growth and production.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Camel pastoralists, researchers NGOs and development agents
Approaches to be used in dissemination	<ul style="list-style-type: none"> <li>• Training sessions, and extension publications (leaflets, booklets, posters), Pastoral Field Schools, Field days, demonstrations, digital platforms and Innovation platforms.</li> </ul>
Critical/essential factors for	<ul style="list-style-type: none"> <li>• A critical number of trained trainers,</li> </ul>

successful promotion	<ul style="list-style-type: none"> <li>• Availability of resources for reaching out to pastoralists</li> <li>• Availability of sufficient numbers of Somali camels</li> <li>• Favourable weather conditions to ensure feed availability</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO (lead in research and information documentation)</li> <li>• County Governments (policy formulation and resources allocation)</li> <li>• Universities (research and training)</li> <li>• Local NGO in livestock VCs (community mobilization and training),</li> <li>• Kenya Livestock Marketing Council (policy implementation and advocacy)</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Isiolo and Marsabit
Counties where TIMPs will be up-scaled	Garissa, Wajir, and Mandera, Isiolo, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Inadequate extension service capacity</li> <li>• Socio-cultural beliefs and illiteracy that would work against extension information messages</li> <li>• Low information reach due to insecurity in target areas</li> <li>• Challenges in accessing information on quality breeding camels</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Training more extension trainers</li> <li>• Linking pastoralists with Somali camel keepers to encourage cross learning among them</li> <li>• Extensive awareness creation among camel pastoralists</li> <li>• Peace building among different communities</li> </ul>
Lessons learned in up scaling, if any	The number of pure Somali camels available for breed improvement is limited and there is need to multiply and increase their numbers.
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Social acceptability of the Somali camel among non-Somali pastoralists.</li> <li>• Availability of palatable browses as camels are mostly browsers</li> <li>• Enabling policies being made by County governments</li> <li>• Development of markets for superior camel breeds among them Somali camels and their products</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	A good breeding Somali camel costs between KES. 50,000 - 60,000.
Estimated returns	With one year of lactation and at an average daily sale of 4 litres of milk valued KES. 60, a gross return of KES. 87,600 is possible. With 6 calvings/lactations, one can earn KES. 525,000.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> <li>• Women do not have major roles in breed selection and ownership of camels.</li> <li>• Women are mainly involved in processing of camel products</li> <li>• Among some camel keeping communities' women are not allowed to handle camels</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• The male gender has a bigger responsibility over camels than the female gender and men are therefore likely to benefit</li> </ul>

	<p>financially more than the women.</p> <ul style="list-style-type: none"> <li>• With more camel products expected from higher productivity, there will be more business opportunity for women</li> </ul>
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> <li>• The prices of breeding Somali camels are high and VMGs may not raise the amount needed to buy a camel.</li> <li>• Since the Somali camel is a heavy feeder, resource poor VMGs may have difficulties accessing the requisite feed resources.</li> <li>• Most VMGs have not been trained on value addition and agri-business.</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Milk is important for health and there is need to target VMGs for dissemination.</li> <li>• Improved livelihoods for pastoralists from selling high volumes of milk, hence improved nutrition and increased income.</li> <li>• Increased involvement of VMGs in milk marketing, need to train them.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Demand for Somali camel bulls increased in both Rendille and Gabbra communities.
Application guidelines for users	<ol style="list-style-type: none"> <li>1. Kenya Camel Manual for service providers (Available online)</li> <li>2. Camel breeds in Kenya. Brochure series No.72/2008. Available in KALRO/SGCRI, Marsabit and KALRO website</li> </ol>
<b>F: Status of TIMP Readiness</b>	
(1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	1. Ready for upscaling
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO-SGCRI P.O. Box 147-60500 Marsabit director.sgir@kalro.org www.kalro.org
Lea organization and scientists	KALRO SGCRI Sagala J., Changwony K.
Partner organizations	County Governments MoA&LD Kenya Camel Association

### 2.1.2. Rendille/Gabrra Camel


<b>TIMP Name</b>	Rendille/Gabrra Camel
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	The growth, mature body weights and milk production parameters of different breeds of camels differ. Some pastoralists keep camel breeds which are not suited for their climatic conditions and so there is need to avail breeds with higher productivity and better

	environmental adaptation.
What is it? (TIMP description)	<p>The Rendille/Gabbara camel breed is a small sized camel which attains a mature live weight of 300-450 kg with milk yield averaging 3 litres per day. The camel breed is a moderate feeder with brown- cream coat color. It is rated as being of moderate hardiness.</p> 
Justification	Availability of the Rendille/Gabbara camel breeds and their information can be used to improve productivity through making informed choices of breed, based on the production system and breeding objectives. Targeted cross-breeding between the Rendille/Gabbara camel and the high milk producers such as the Pakistan or Somali camel breeds result in offspring with faster growth, bigger body size and a mix of desirable characteristics inherent in the Rendille/Gabbara camel, which benefits with better survival, growth and production.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Camel pastoralists, researchers, NGOs and development agents
Approaches to be used in dissemination	Training sessions and extension publications (leaflets, booklets, posters), Pastoral Field Schools, Field days, demonstrations, digital platforms and innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• A critical number of trained trainers</li> <li>• Availability of resources for reaching out to pastoralists</li> <li>• Availability of camels breed multiplication centres for better access to breeding animals</li> <li>• Favourable weather conditions to ensure feed availability</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO (lead in research and information documentation)</li> <li>• County Governments (policy formulation and resources allocation),</li> <li>• Universities (research and training),</li> <li>• local NGO in livestock VCs (community mobilization and training),</li> <li>• Kenya Livestock Marketing Council (policy implementation and advocacy)</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Isiolo and Marsabit

Counties where TIMPs will be up-scaled	Garissa, Wajir, and Mandera, Isiolo, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Inadequate extension service capacity</li> <li>• Socio-cultural beliefs and illiteracy.</li> <li>• Insecurity that limit flow on information</li> <li>• Challenges in accessing quality information on breeding camels</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Training more extension service staff</li> <li>• Linking pastoralists with Somali camel keepers to encourage information sharing</li> <li>• Awareness creation among camel pastoralists</li> <li>• Peace building among different communities</li> </ul>
Lessons learned in up scaling, if any	The number of camels available for breed improvement is limited and there is need to multiply and provide more.
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Social acceptability of the Rendille/Gabbara camel among non-Rendille and non-Gabbara pastoralists.</li> <li>• Availability of palatable browses as camels are mostly browsers</li> <li>• Enabling policies being made by County governments</li> <li>• Development of sufficient markets for camels and their products</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	A good breeding camel costs between KES. 40,000 - 50,000.
Estimated returns	With one year of lactation and at an average daily sale of 3 litres of milk valued KES 60, a gross return of KES. 65,700 is possible. With 6 calvings/lactations, one can earn KES. 394,200.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> <li>• Women do not have major roles in breed selection and ownership of camels.</li> <li>• Women are mainly involved in processing of camel products</li> <li>• Among some camel keeping communities' women are not allowed to handle camels</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• The male gender has a bigger responsibility over camels than the female gender and men are therefore likely to benefit financially more than the women.</li> <li>• With more camel products expected from higher productivity, there will be more business opportunity for women</li> </ul>
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> <li>• The prices of breeding camels are high and VMGs may not raise the amount needed to buy a camel.</li> <li>• Since camels are generally heavy feeders, resource poor VMGs may have difficulties accessing the requisite feed resources.</li> <li>• Most VMGs have not been trained on value addition and agri-business.</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Milk is important for health and there is need to target VMGs for dissemination.</li> <li>• Improved livelihoods for pastoralists from selling high volumes of milk, hence improved nutrition and increased income.</li> </ul>

	<ul style="list-style-type: none"> <li>Increased involvement of VMGs in milk marketing, need to train them.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	This camel breed is most popular with the Rendille and Gabbra communities and its demand is increasing in communities keeping less productive camel breeds.
Application guidelines for users	<ul style="list-style-type: none"> <li>Kenya Camel Manual for service providers (Available online)</li> <li>Camel breeds in Kenya. Brochure series No.72/2008. Available in KALRO/SGCRI, Marsabit and KALRO website</li> </ul>
<b>F: Status of TIMP Readiness</b>	
(1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	1. Ready for upscaling
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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.
Partner organizations	County Governments MoA&LD Kenya Camel Association

### 2.1.3. Turkana Camel


<b>TIMP Name</b>	Turkana Camel
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Growth, mature body weights and milk production parameters of different breeds of camels differ. Some pastoralists keep camel breeds which are not suited for their climatic conditions and therefore it is necessary to provide breeds that can survive and yield low feed environments.
What is it? (TIMP description)	<p>Turkana camel breed is a small sized camel that attains a mature live weight of 250-350 kg. Its daily milk yield averages 1.5 litres and requires less feed than other Kenyan camel breeds. It is predominantly grayish in coat color and is quite hardy.</p> 

Justification	Availability of the Turkana camel breed and its information is essential in improving productivity through breeding Targeted cross-breeding between the Turkana camel and the high milk producers such as the Pakistan or Somali camel breeds result in offspring with faster growth, bigger body size and a mix of desirable characteristics inherent in the Turkana camel, which benefits from better survival, growth and production.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Camel pastoralists, researchers, NGOs and development agents
Approaches to be used in dissemination	Training sessions and extension publications (leaflets, booklets, posters), Pastoral Field Schools, Field days, demonstrations, digital platforms and Innovation platforms.
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• A critical number of trained trainers,</li> <li>• Availability of resources for reaching out to pastoralists</li> <li>• Availability of camels breed multiplication centres for better access to breeding animals</li> <li>• Favourable weather conditions to ensure feed availability</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO (lead in research and information documentation)</li> <li>• County Governments (policy formulation and resources allocation)</li> <li>• Universities (research and training)</li> <li>• local NGO in livestock VCs (community mobilization and training)</li> <li>• Kenya Livestock Marketing Council (policy implementation and advocacy)</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Isiolo and Marsabit
Counties where TIMPs will be up-scaled	Garissa, Wajir, and Mandera, Isiolo, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Inadequate extension service resource capacity</li> <li>• Socio-cultural beliefs and illiteracy.</li> <li>• Insecurity which limit information availability</li> <li>• Challenges in accessing quality breeding camels</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Training more extension service staff</li> <li>• Linking pastoralists with camel breeders</li> <li>• Awareness creation among camel pastoralists</li> <li>• Peace building among different communities</li> </ul>
Lessons learned in up scaling, if any	The number of camels available for breed improvement is limited and there is need to multiply and avail more.
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Social acceptability of the Turkana camel among non-Turkana pastoralists.</li> <li>• Availability of palatable browses as camels are mostly browsers</li> <li>• Enabling policies being made by County governments</li> <li>• Development of sufficient markets for camels and their products</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	A good breeding camel costs between KES. 30,000 - 40,000.
Estimated returns	With one year of lactation and at an average daily sale of 1.5 litres of milk valued KES 60, a gross return of KES. 32,850 is

	possible. With 6 calvings/lactations, one can earn KES. 197,100.
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of awareness of existence of different breeds by women who have low literacy level and are influenced by social cultural beliefs</li> <li>• Breed selection is majorly a role of Men and youth as women are involved in camel products</li> <li>• Women have poor access to the resources needed e.g. credit</li> <li>• Information and awareness flow to female farmers may be Slow due to low education levels.</li> <li>• Among some camel keeping communities' women are not allowed to handle camels</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Improved breeds will lead to increased camel milk production hence improved household nutrition and increased income</li> <li>• Have well organized gender friendly markets and marketing systems for camel milk as women are more involved in milk marketing</li> <li>• Make credit accessible to women</li> </ul>
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of awareness on existence of different camel breeds by VMGs</li> <li>• VMGs have poor access to the resources needed e.g. credit</li> <li>• information and awareness flow to VMGs may be Slow due to low education levels</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Target VMGs for camel breeds upscaling activities and ensure their animals are included in scaling up of technologies</li> <li>• Increased production will lead to increased consumption of nutritious camel products, hence improved health of VMGs;</li> <li>• Increased awareness on health benefits of camel products and changing consumer behavior leading to increased demand for camel products hence improved incomes for VMGs</li> <li>• Make credit accessible to VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	The Turkana camel is very popular in extremely dry environments where it survives and produces milk, however little for the survival of the camel keepers' families.
Application guidelines for users	<ul style="list-style-type: none"> <li>• Kenya Camel Manual for service providers (Available online)</li> <li>• Camel breeds in Kenya. Brochure series No.72/2008. Available in KALRO/SGCRI, Marsabit and KALRO website</li> </ul>
<b>F: Status of TIMP Readiness</b>	
(1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	1. Ready for up scaling
<b>G: Contacts</b>	

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.
Partner organizations	County Governments MoA&LD Kenya Camel Association

#### 2.1.4. Pakistan Camel

<b>TIMP Name</b>	Pakistan Camel
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Growth, mature body weights and milk production parameters of different breeds of camels differ widely. Most pastoralists keep camel breeds of low productivity potential or which are not suited for their climatic conditions and there is need to provide breeds with higher productivity and better environmental adaptation.
What is it? (TIMP description)	The Pakistan camel breed is a large sized camel that attains a mature live weight 400-600kg with milk yield averaging 10 litres per day. It is a heavy feeder with predominantly grayish coat color and droopy lips. It has a wider chest compared to native Kenyan camels and is the least hardy among the camels kept in Kenya. 
Justification	The Pakistan camel breed is used in improving the productivity of the local camels breeds Targeted cross-breeding between the Pakistan camel and the other smaller-sized breeds result in offspring with faster growth, more milk, bigger body size and a mix of desirable characteristics inherent in the other breeds in order enhance, survival, growth and production.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Camel pastoralists, researchers, NGOs and development agents
Approaches to be used in dissemination	Training sessions and extension publications (leaflets, booklets, posters), Pastoral Field Schools, Field days, demonstrations, mass media.
Critical/essential factors for	<ul style="list-style-type: none"> <li>• A critical number of trained trainers</li> </ul>

successful promotion	<ul style="list-style-type: none"> <li>• Availability of resources for reaching out to pastoralists</li> <li>• Availability of sufficient numbers of Somali camels</li> <li>• Favourable weather conditions to ensure feed availability</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO (lead in research and information documentation)</li> <li>• County Governments (policy formulation and resources allocation)</li> <li>• Universities (research and training)</li> <li>• local NGO in livestock VCs (community mobilization and training)</li> <li>• Kenya Livestock Marketing Council (policy implementation and advocacy).</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Isiolo and Marsabit
Counties where TIMPs will be up-scaled	Garissa, Wajir, and Mandera, Isiolo, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Inadequate human resource capacity</li> <li>• Socio-cultural beliefs and illiteracy.</li> <li>• Insecurity limits free flow of information</li> <li>• Challenges in accessing quality breeding camels</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Training more trainers</li> <li>• Linking pastoralists with Somali camel keepers</li> <li>• Awareness creation among camel pastoralists</li> <li>• Peace building among different communities</li> </ul>
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> <li>• The number of Pakistan camels available for breed improvement is limited and there is need to multiply and provide more.</li> </ul>
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Social acceptability of the Pakistan camel among pastoralists.</li> <li>• Availability of palatable browses as camels are mostly browsers</li> <li>• Enabling policies being made by County governments</li> <li>• Development of markets for the Pakistan camel and their products</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	A good breeding Pakistan camel costs between KES. 50,000- 60,000.
Estimated returns	<p>With one year of lactation and at an average daily sale of 10 litres of milk valued KES 60, a gross return of KES. 219,000 is possible.</p> <p>With 6 calvings/lactations, one can earn KES. 1,314,000.</p>
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of awareness of existence of different breeds by women who have low literacy level and are influenced by social cultural beliefs.</li> <li>• Breed selection is majorly a role of Men and youth as women are involved in camel products</li> <li>• Women have poor access to the resources needed e.g. credit</li> <li>• Information and awareness flow to female farmers may be Slow due to low education levels</li> </ul>

	<ul style="list-style-type: none"> <li>• Among some camel keeping communities' women are not allowed to handle camels</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Improved breeds will lead to increased camel milk production hence improved household nutrition and increased income</li> <li>• Have well organized gender friendly markets and marketing systems for camel milk as women are more involved in milk marketing</li> <li>• Make credit accessible to women</li> </ul>
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of awareness on existence of different camel breeds by VMGs</li> <li>• VMGs have poor access to the resources needed e.g. credit</li> <li>• information and awareness flow to VMGs may be Slow due to low education levels</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Target VMGs for camel breeds upscaling activities and ensure their animals are included in scaling up of technologies</li> <li>• Increased production will lead to increased consumption of nutritious camel products, hence improved health of VMGs;</li> <li>• Increased awareness on health benefits of camel products and changing consumer behavior leading to increased demand for camel products hence improved incomes for VMGs</li> <li>• Make credit accessible to VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Demand for Pakistan camel bulls increased in both Rendille and Gabbra communities.
Application guidelines for users	<ul style="list-style-type: none"> <li>• Kenya Camel Manual for service providers (Available online)</li> <li>• Camel breeds in Kenya. Brochure series No.72/2008. Available in KALRO/SGCRI, Marsabit and KALRO website</li> </ul>
<b>F: Status of TIMP Readiness</b>	
(1. Ready for up scaling; 2. Ready for upscaling Requires validation; 3. Requires further research)	1. Ready for up scaling
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO-SGCRI P.O. Box 147-60500 Marsabit <a href="mailto:director.sgir@kalro.org">director.sgir@kalro.org</a> <a href="http://www.kalro.org">www.kalro.org</a>
Lead organization and scientists	KALRO SGCRI Sagala J., Changwony K.
Partner organizations	County Governments MoA&LD Kenya Camel Association

### 2.1.5. Camel Breeding Guidelines

<b>TIMP Name</b>	<b>Camel Breeding Guidelines</b>
Category (i.e. technology, innovation or management practice)	Management Practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Inappropriate breeding practices that lower milk production
What is it? (TIMP description)	Camel Breeding Guidelines is a management practice through which a farmer uses young female of less than 6 parities and bull not exceeding 13 years of age. Controlling inbreeding is achieved by ensuring that the bull do not mate closely related females or through timely replacement of the breeding bulls. Desirable traits are propagate in a camel herd through breeding bulls and not females.
Justification	Use of Camel Breeding Guidelines to manage camel breeding ensures conservation of germplasm of the desired traits hence improving herd productivity and adaptation to local environment.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Researchers, CIGs in camel breed multiplication, Individual camel keepers, Extension Officers from the County Governments
Approaches to be used in dissemination	Field days, On-farm and on-station demonstrations, ASK shows, Farmer to farmer exchange programs, Mass media (Pastoral production programs), Pastoral training centres, Training of Trainers ToTs), Promotional materials (brochures, posters, leaflets), Digital media, innovation platforms, social media (whatsapp, Facebook, Twitter)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Preferred camel traits based on geographical suitability</li> <li>• Promotion methods adopted, Involvement of all stakeholders in the Camel value chain</li> </ul>
Partners/stakeholders for scaling up and their roles.	<ul style="list-style-type: none"> <li>• KALRO- Research and information generation</li> <li>• County Governments - policy, resources.</li> <li>• Egerton University (research and training).</li> <li>• Local NGO in livestock VCs (community mobilization and training).</li> <li>• Kenya Livestock Marketing Council - policy implementation and advocacy.</li> <li>• Kenya Camel Association (KCA) – Policy advocacy and mobilisation</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted. if any	Isiolo and Marsabit
Counties where TIMPs will be upscaled	Garissa, Wajir and Mandera, Turkana, West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> <li>• Diminishing camel preferred feed resources for high yielding breeds in some areas,</li> <li>• Inadequate financial resources</li> <li>• Low technical human resource capacity</li> <li>• Socio-cultural beliefs and attachment to some low yielding breeds and high illiteracy levels among camel keepers,</li> </ul>

	insecurity.
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Training more extension services trainers</li> <li>• Linking with more partners</li> <li>• Awareness creation of different breeds among camel keepers</li> <li>• Develop dry season feed rations for camels</li> <li>• Train more technical staff</li> <li>• Carry out national suitability mapping for the different breeds of camels.</li> </ul>
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> <li>• Communal/family ownership of camels is still a hindrance to adoption of the guidelines especially the recommended age for breeding females.</li> <li>• Promoting private ownership of camels is key to enhanced adoption.</li> </ul>
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Acceptance of recommended breeds with quality traits by community for example the Somali and Pakistan breeds are high yielders but are also heavy feeders. Bull exchange programs among the camel keepers can work very well.</li> <li>• Adoption of breeds suitable for particular areas/terrains. Somali breeds do not do well in hilly and rocky terrains.</li> <li>• There is need to link camel keepers with Somali breed production/multiplication centres.</li> <li>• Market demand for the improved breeds.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs *2022 prices	The direct cost would be that of buying the manual for reference and brochures (at most KES 700 or USD 5.5)
Estimated returns	It is hard to estimate returns from the guidelines in isolation
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of awareness of existence of different breeds by women who have low literacy level and are influenced by social cultural beliefs.</li> <li>• Breed selection is majorly a role of Men and youth as women are involved in camel products.</li> <li>• Women have poor access to the resources needed e.g. credit.</li> <li>• Information and awareness flow to female farmers may be Slow due to low education levels.</li> <li>• Among some camel keeping communities' women are not allowed to handle camels.</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Improved breeds will lead to increased camel milk production hence improved household nutrition and increased income</li> <li>• Have well organized gender friendly markets and marketing systems for camel milk as women are more involved in milk marketing</li> <li>• Make credit accessible to women</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Lack of awareness on existence of different camel breeds by VMGs</li> <li>• VMGs have poor access to the resources needed e.g. credit</li> <li>• Information and awareness flow to VMGs may be Slow due to low education levels</li> </ul>

VMG related opportunities	<ul style="list-style-type: none"> <li>• Target VMGs for camel breeds upscaling activities and ensure their animals are included in scaling up of technologies</li> <li>• Increased production will lead to increased consumption of nutritious camel products, hence improved health of VMGs;</li> <li>• Increased awareness on health benefits of camel products and changing consumer behavior leading to increased demand for camel products hence improved incomes for VMGs</li> <li>• Make credit accessible to VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Demand for the high producing breeds (Somali breed) on the rise among Gabra, Rendille camel keepers in Marsabit County.
Application guidelines for users	<ol style="list-style-type: none"> <li>1. The Kenya Camel Manual (Online)</li> <li>2. Kuria <i>et al.</i>, 2015. Breeding guidelines: KALRO Brochure No. (Available at KALRO/SGCRI and KALRO HQTs)</li> </ol>
<b>F: Status of TIMP Readiness</b>	Ready for up scaling
<ol style="list-style-type: none"> <li>1. Ready for up scaling;</li> <li>2. Requires validation</li> <li>3. Requires further research</li> </ol>	
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO-SGCRI P.O. Box 147-60500 Marsabit director.sgir@kalro.org
Lead organization and scientists	KALRO SGCRI (Sagala J., K. Changwony)
Partner organizations	County Governments –MoA&LD, Kenya Camel Association

### Research Gaps

1. Conduct cost benefit analysis of breeding guidelines TIMP delivery
2. Further study on cross breeds within pastoral herds and their performance

## 2.2. Camel Feeds and Feeding

### 2.2.1. Home based feed formulation for lactating camels

<b>TIMP name</b>	Home based feed formulation for lactating camels
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low milk yield due to poor quality feeds in the peri-urban pastoral systems. Low income from milk due to low volumes
What is it? (TIMP description)	The technique consist of mixing rations of <i>Euphorbia tirucalli</i> with <i>Acacia spp pods</i> , <i>Prosopis Juliflora pods</i> . Local composite grass hay is used as basal diet and can be enriched with urea and yeast cultures for higher digestibility and milk production. Urea is included at 4% of hay.

Justification	There is increasing demand for camel milk due to awareness of its health benefits hence consumption in many areas despite its low availability. However, increasing negative effects of climate change have significantly reduced availability of natural forages in the ASALs. The technology is a sure bet for more sedentary households who keep camels in the periphery of town centres. They feed camels on Euphorbia and supplement with hay, minerals and sometimes concentrates to boost milk production.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Camel keepers, Researchers, Extension officers from County Governments and NGOs/CBOs, Private sector (Agro-traders
Approaches to be used in dissemination	Field days, On-farm and on-station demonstrations, ASK shows, Farmer to farmer exchange programs, Mass media (Pastoral production programs), Pastoral training centres, Training of Trainers ToTs), Promotional materials (brochures, posters, leaflets), Digital platforms, agricultural innovation platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Availability of finance to access breeding stock</li> <li>• Breed multiplication centres</li> <li>• Enhanced record keeping</li> <li>• Willingness by camel keepers to adopt new guidelines</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• CIGs involved in camel breed multiplication</li> <li>• Individual farmers</li> <li>• Agro-traders</li> <li>• KALRO/ Egerton University - on farm validation, capacity building, data collecting and monitoring.</li> <li>• County Government (MoALD) - (Community mobilisation, extension services, monitoring and evaluation)</li> <li>• Kenya Camel Association - Policy advocacy and promotions</li> <li>• NGOs and CBOs working in the area - provide entry, promotion and provision of extension services provision</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Marsabit, Isiolo and Garissa
Counties where TIMP will be upscaled	Garissa, Mandera and Wajir, West Pokot and Isiolo
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Cultural beliefs on preferred camel feeds.</li> <li>• Traditional camel grazing practices among pastoralists.</li> <li>• Inadequate information on alternative feeds available</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Involving camel value chain stakeholders to address cultural beliefs.</li> <li>• Capacity build on the potential of alternative feed resources in sustainability of camel production systems.</li> <li>• Set up Pastoral field school for continuous learning</li> </ul>
Lessons learned in upscaling if any	<ul style="list-style-type: none"> <li>• Alternative feeds and feeding system</li> <li>• Improving feeding is critical to achieving sustainability of pastoral production systems</li> </ul>

Social, environmental, policy and market conditions necessary for development and upscaling	<ul style="list-style-type: none"> <li>• Willingness of pastoralist to adopt new feeding system.</li> <li>• Agreement from the targeted communities to participate in the training sessions.</li> <li>• Access to camel milk markets for the extra milk produced.</li> <li>• Involvement of camel milk and red meat value chains actors and supporters.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Note determined
Estimated returns	Note determined
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> <li>• Slow flow of information and awareness for female farmers due to low levels education</li> <li>• Capacity building of women and youth on need to conserve and provide feeds for camel throughout the year</li> <li>• Increased labour for women who are already overburdened may reduce their chance of adopting camel feeds</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• High chance of adoption of technologies by women and youth who mainly take care of camel calves</li> <li>• Business opportunity for youth and women in fodder trade.</li> <li>• Improved feeding leading to increased marketing of milk</li> <li>• More youth will be hired for herding, milking and milk transportation to the collection points</li> <li>• Improved livelihoods for pastoralists from selling high volumes of milk, hence improved nutrition and increased income</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs may be disadvantaged in terms of lacking capital to acquire the required inputs</li> <li>• VMGs have limited access to information, technology and knowledge on improved camel technologies</li> <li>• Slow information and awareness flow to VMGs due to low academic levels</li> <li>• VMGs may be excluded from decision making during dissemination because of their social status</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Target VMGs for camel milk production upscaling activities and ensure their animals are included in scaling up of technologies</li> <li>• Increased involvement of VMGs in milk marketing,</li> <li>• Need to train VMGs on value addition and agribusiness production</li> <li>• Capacity building of VMGs on need for conserved feeds to provide feed for livestock throughout the year</li> <li>• Improved livelihoods for pastoralists from selling high volumes of milk, hence improved nutrition, increased income</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	Home based stall feeding using formulated ration has successfully been promoted in Karare ward at a farmer's herd, Marsabit and at the SGCRI ranch in KALRO Marsabit

Application guidelines for users	To be developed
<b>F: Status of TIMP readiness</b> (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO-SGCRI P.O. Box 147-60500 Marsabit <a href="mailto:director.sgir@kalro.org">director.sgir@kalro.org</a>
Lead organization and scientists	KALRO and Egerton University, Amos Adongo; Prof. J. Matofari; O. Kashongwe, Sagala I. J
Partner organizations	Egerton University, Kenya camel association, Kenya livestock marketing council, The County government's department of livestock

### Research Gap

1. Validation of developed rations both in calves and lactating dams.

#### 2.2.2. Modified Chumvi Kuria for camels


<b>TIMP Name</b>	Modified Chumvi Kuria for camels
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low milk production due to mineral deficiency among lactating camels
What is it? (TIMP description)	The formulation ratio: A mineral ration comprising of 1 dicalcium phosphate: 0.992g Chalbi salt: 0.873g calcium carbonate: 0.001g Magnesium sulphate.
Justification	Mineral deficiency is a major nutritional limitation to productivity in camels in Kenya. Camel keeping communities have traditionally not used feed supplements for camels believing their pastures/browse and water were adequate to meet their requirement. However, changing lifestyle restricting extended migration has denied the camels access to salty waters that previously supplied the necessary minerals. This formulation has been found to improve milk yield of camels by 17% and calf growth by 25%.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Livestock feed producers at local regional and national levels, Camel producers, agro-traders, County Government and NGO extension officers.
Approaches to be used in dissemination	Commercialization through livestock feed producers. Field days, On-farm and on-station demonstrations, ASK shows, Farmer to farmer exchange programs, Mass media (Pastoral production programs), Pastoral training centres, Training of Trainers ToTs), Promotional materials (brochures, posters, leaflets), Digital media, agricultural innovation platforms
Critical/essential factors for	<ul style="list-style-type: none"> <li>• Availability of finance to access inputs</li> </ul>

successful promotion	<ul style="list-style-type: none"> <li>• Willing partners to manufacture the product</li> <li>• Enhanced record keeping</li> <li>• Willingness by camel keepers to adopt new mineral supplementation guidelines</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO - Research and Information generation.</li> <li>• County Governments - Policy regulation, mobilisation resources.</li> <li>• Egerton University - Research and training.</li> <li>• Local NGO in livestock VCs - community mobilization and training .</li> <li>• Kenya Livestock Marketing Council - Policy implementation and advocacy.</li> <li>• Input suppliers/Manufacturers – Commercialization of the product and distribution to agro-wholesalers and retailers</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted. if any	Parts of Wajir, Mandera and Garissa
Counties where TIMPs will be upscaled	Wajir, Garissa and Mandera, Turkana and West Pokot
Challenges in development and dissemination	<ul style="list-style-type: none"> <li>• Funds to support local groups to establish cottage industries</li> <li>• Release procedures of the formula not clear</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Source for funds to fast-track patenting of the formula and then sell it to the feed companies</li> <li>• Promote to CIG and a potential business start-up project</li> </ul>
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> <li>• Improving the mineral nutrition of camels can substantially increase the milk yield</li> <li>• Manufacturing and promotion of the product are necessary to stimulate adoption</li> </ul>
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Willingness of pastoralists to adopt new mineral supplementation products other than natural mineral sources</li> <li>• Commercialization and promotion of the product across borders especially within the IGAAD EAC region.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	It costs KES 70 (USD 0.58) per 200g of the product
Estimated returns	KES 150.00 (USD 1.24) per 200g. From gross margin analysis.
Gender issues and concerns In development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Slow flow of information and awareness for female farmers due to low levels education</li> <li>• Capacity building of women and youth on need to supplement the camels for increased milk production</li> <li>• Increased labour for women who are already overburdened may reduce their chance of adopting camel supplementation</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• High chance of adoption of technologies by male adults and youth who mainly take care of lactating camels</li> <li>• Business opportunity for youth and women in mineral supplement trade.</li> <li>• Improved feeding leading to increased marketing of milk</li> <li>• More youth will be hired for, milking and milk transportation to the collection points due to increased milk output from</li> </ul>

	<p>supplemented dams</p> <ul style="list-style-type: none"> <li>Improved livelihoods for pastoralists from selling high volumes of milk, hence improved nutrition and increased income</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>VMGs may be disadvantaged in terms of lacking capital to acquire the required inputs</li> <li>VMGs have limited access to information, technology and knowledge on improved camel technologies</li> <li>Slow information and awareness flow to VMGs due to low academic levels</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>Target VMGs for camel milk production upscaling activities and ensure their animals are included in scaling up of technologies</li> <li>Increased involvement of VMGs in mineral product marketing,</li> <li>Need to train VMGs on value addition and agribusiness production</li> <li>Capacity building of VMGs on need for supplementing camels with mineral salts</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Has been promoted among KCSAP CIGs in Mandera, Garissa and Wajir. Commercialization on large scale is yet to be achieved.
Application guidelines for users	Modified Chunvi Kuria for Camels. KALRO brochure 2015.No. (Available at KALRO/SGCRI)
<b>F: Status of TIMP Readiness</b> (1. Ready for up scaling; 2. Requires further validation; 3. Requires further research)	Validated and Ready for upscaling
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO-SGCRI P.O. Box 147-60500 Marsabit <a href="mailto:director.sgir@kalro.org">director.sgir@kalro.org</a>
Lead organization and scientists	KALRO SGCRI Sagala J., Changwony K., Walaga H.
Partner organizations	County Governments –MoALD, Kenya Camel Association

### 2.2.3. Estimating live weight of camel calves

<b>TIMP Name</b>	Formula for estimating live weight of camel calves
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Inaccurate methods of monitoring growth rates of camel calves. This has led to slow or no response to their health and nutritional needs and consequently resulting in increased cost of interventions and slowed growth of camel calves.

<p>What is it? (TIMP description)</p>	<p>This technology is a formula of using body linear measurements to estimate the live weight of camel calves. The formula is as follows:  <math display="block">\text{Body weight (k)} = 200.86 + 105.91 \text{ TG(m)} + 79.63 \text{ HG(m)} + 56.22 \text{ SH(m)}</math> Where;  TG – thoracic girth HG – heart girth  SH – shoulder height</p> 
<p>Justification</p>	<p>Pastoralists rarely have access to weighbridges to accurately take weight measurements for their camels, especially calves. However, there is need for pastoralists to monitor the weight and growth performance of their camel calves and be able to correctly administer correct drug dosage and institute feed supplementation early enough. A practical and cheaper way of estimating weights is necessary as long as the accuracy is assured. The accuracy of the formula presented here is 95% and is a very close estimation of live weight. Pastoralists only need a tape measure, a calculator and the formula.</p>
<p><b>B: Assessment of dissemination and scaling up/out approaches</b></p>	
<p>Users of TIMP</p>	<p>Pastoralists and extension agents</p>
<p>Approaches to be used in dissemination</p>	<p>Training of Trainers (ToTs) and extension publications (leaflets, booklets, posters), Pastoral Field Schools, Field days, demonstrations, mass media.</p>
<p>Critical/essential factors for successful promotion</p>	<ul style="list-style-type: none"> <li>• Building the capacity of extension agents to train pastoralists on how to take measurements.</li> <li>• Capacity to use the formula to calculate weights.</li> </ul>
<p>Partners/stakeholders for scaling up and their roles.</p>	<ul style="list-style-type: none"> <li>• KALRO - (Research and information generation)</li> <li>• County Governments- (policy, extension services),</li> <li>• Egerton University (research and training),</li> <li>• Local NGO in livestock VCs (community mobilization and training)</li> <li>• Kenya Livestock Marketing Council (policy implementation and advocacy).</li> </ul>
<p><b>C: Current situation and future scaling up</b></p>	
<p>Counties where already promoted if any</p>	<p>Marsabit, Wajir and Garissa</p>
<p>Counties where TIMPs will be upscaled</p>	<p>Marsabit, Wajir, Garissa WestPokot, Kajiado, Tana River and Mandera</p>
<p>Challenges in development and dissemination</p>	<p>Use of the technology in initial stages requires more skill than most herders</p>

	have.
Suggestions for addressing the challenges	The training of the herders should mainly target the members of the family who are sufficiently literate as to be able to assimilate the complexities of calculating weights.
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> <li>• Can assist in monitoring camel growth for early feed supplementation during drought.</li> <li>• Drug administrations will be more accurate with better weight estimation.</li> <li>• This formula can also be used to take weights of mature camels for sale on weight basis.</li> </ul>
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Agreement from the targeted communities to participate in the training sessions.</li> <li>• The technology is cheap and can be used everywhere once the formula is understood and internalized.</li> <li>• The sale of camels on weight basis will accelerate the uptake of this technology.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Tape measure (KES. 100) and a simple calculator (KES. 200).
Estimated returns	Cannot be directly estimated
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Increased labour for women who are already overburdened. This may reduce their chance of adopting the technology</li> <li>• Information and awareness flow to female farmers may be slow due to low education levels.</li> <li>• The male gender have a bigger responsibility over camels than women</li> <li>• and are therefore likely to economically benefit more than women</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Both men and women should be involved to be able to use the technology</li> <li>• Men women warriors and the boys who have attained the herding age should be targeted during dissemination</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs have limited access to training and extension services</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities</li> <li>• There may be low adoption by VMGs due lack of awareness</li> <li>• VMGs have less access to extension services due to prejudice and their social status</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Pastoral women who are mostly VMGs are the ones that take care of camel calves and there is need to target VMGs for dissemination.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	In the measurement of weight, the use of the tape measure is widely adapted wherever it has been tried.
Application guidelines for users	Camel Manual for Service Providers is available on the website.
<b>F: Status of TIMP</b>	Validated and Ready for upscaling

<b>Readiness</b> (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO-SGCRI P.O. Box 147-60500 Marsabit <a href="mailto:director.sgir@kalro.org">director.sgir@kalro.org</a>
Lead organization and scientists	SGCRI KALRO, Sagala J. and Changwony K.
Partner organizations	County Governments –MoA&LD. Kenya Camel Association

## 2.2. Health Management

### 2.3.1. Oral rehydration in camels

<b>TIMP Name</b>	Oral rehydration therapy for Camels calves
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low productivity due high mortality in camel calves
What is it? (TIMP description)	It is a formulation of honey, salt, eggs, and Sulphur-based drugs. It consists of: 3 table spoonful honey + 1½ table spoonful table salt + 3 litres water, 1 egg from chicken that interact with or pick parasites from lumen of camels. Additionally, sulphur-based drugs e.g. S-dime tablets is also administered.
Justification	The technology(s) is easy to use, cheap and most importantly has capacity to reduce calf mortality.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Camel keepers, private sector (agro-vets suppliers and retailers, Public and private extension agents, Researchers, Universities
Approaches to be used in dissemination	Field days, demonstrations, agricultural shows, training of trainers
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Willingness by camel keepers to adopt the technology</li> <li>• Affordability of the drug by camel keepers</li> <li>• Promotion methods used</li> <li>• Involvement all camel value chain actors and supporters in the promotion</li> </ul>

Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO - Research and Information generation.</li> <li>• MoALD – Policy regulation, training of camel keepers</li> <li>• Local NGOs - Community mobilization and training.</li> <li>• Private animal Health Practitioners – Promotion of the product</li> <li>• Kenya Livestock Marketing Council - Policy advocacy and product marketing.</li> <li>• Community Based Animal Health Groups - community mobilization and promotion.</li> <li>• Public Health Department - Quality assurance on livestock products</li> <li>• KEVEVAPI – Production and distribution.</li> <li>• DVS – Policy and regulation.</li> <li>• VMD – Registration and certification.</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Marsabit, Isiolo
Counties where TIMPs will be upscaled	Garissa, Wajir, West Poko and Mandera
Challenges in development and dissemination	<ul style="list-style-type: none"> <li>• Lack of awareness on the technology among chain actors and supporters.</li> <li>• Access to inputs by camel keepers and other users of the TIMP</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Training more trainers on use of TIMP</li> <li>• linking more partners in promotion of the technology</li> <li>• Creating more awareness among camel keepers on the benefits of technology.</li> </ul>
Lessons learned in up scaling, if any	Continued capacity building of pastoralists can boost adoption of the technology
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Use of local materials to control camel diseases can enhance adoption</li> <li>• Policies and regulation on recommended practices around the technology will ensure environmental safety</li> <li>• Control of camel diarrhoea using this technology will improve herd structure and replacement stock.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Controlling diarrhea in one calf costs about KES 266.00 (USD 2.2).
Estimated returns	Equivalent to the market value of the calves saved from death through use of this technology. Weaners costs KES 45,000.00 (USD 372.00)
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Camel calves are herded by managed by women, most of whom are semi-illiterate lack adequate skills on camel health management.</li> <li>• Women and youth have limited access to productive resources such as credit to purchase the required inputs</li> <li>• Women and youth have limited knowledge of camel diseases due to lack of access to agricultural information and extension services.</li> <li>• Men, women and youth who have attained the herding age should be targeted during dissemination.</li> </ul>

Gender related opportunities	<ul style="list-style-type: none"> <li>• Opportunity for youth to be trained in camel health technologies.</li> <li>• Adoption of camel management technologies will benefit all gender since there will be less mortalities and increased productivity hence increased income.</li> <li>• Increases household income leading to more business opportunities.</li> <li>• Adoption of camel health management practices leads to improved productivity, hence food and nutrition security for youth and women.</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Limited knowledge of camel health management technologies among VMGs who have limited access to agricultural information and extension services.</li> <li>• VMGs have limited access to credit to buy required inputs.</li> <li>• VMGs have limited access to training and extension services</li> <li>• Due to their social status VMGs are often excluded from decision making in development and dissemination activities.</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• There is need to reach out to marginalized and vulnerable persons with animal health information as they are the least likely to access regular veterinary services.</li> <li>• Adoption of camel health technologies will lead to increased productivity hence increased incomes and improved food and nutrition security for VMGs.</li> <li>• Business opportunities for VMG to sell camel oral rehydration drug which is popular because of its health benefits.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	No case study has been conducted
Application guidelines for users	How to reduce diarrhoea in camel calves. KALRO Brochure No. 73/2008. Kenya Camel Manual for service providers (Available online).
<b>F: Status of TIMP Readiness</b> (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO-SGCRI P.O. Box 147-60500 Marsabit <a href="mailto:director.sgir@kalro.org">director.sgir@kalro.org</a> <a href="http://www.kalro.org">www.kalro.org</a>
Lead organization and scientists	KALRO SGCRI Sagala J. and K. Changwony
Partner organizations	County Governments –MoALD, Kenya Camel Association

### Research Gap

1. Requires adoption studies in other areas with different social cultural practices

### 2.3.2. Integrated Control Strategy for Camel Surra

<b>4.4.2 TIMP name</b>	Integrated Control Strategy for Camel Surra
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	High incidence of Surra in camel keeping areas in the country
What is it? (TIMP description)	This involves use of approaches that use drugs injected to rid camels of the <i>Trypanosoma evansi</i> parasites which cause surra. It minimizes production losses and also ensures the disease does not spread outside endemic areas.
Justification	Surra is the most serious disease of camels caused by <i>T. evansi</i> spread by biting flies. The disease reduces milk and meat production compromising household food and nutrition security for pastoralists. This affects their resilience to cope climate change shocks. Current control practices are insufficient due to significantly reduced morbidity, mortality and the associated economic losses.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Camel keepers, Kenya Camel association, County Governments
Approaches to be used in dissemination	Field days, shows and exhibitions, mass media, digital platforms, innovative platforms
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Availability of relevant and effective trypanocidal drugs</li> <li>• Trained personnel to administer trypanocidal drugs in camels</li> <li>• Ensure full involvement of the pastoralists and stakeholders in the Camel milk and meat value chain.</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• County governments- extension services</li> <li>• DVS – Regulation of drug use in disease control</li> <li>• VMD – Registration of new trypanocidal drugs before use in the country</li> <li>• Pharmaceutical companies – Distribution of trypanocidal drugs</li> <li>• Kenya Camel Association – Advocating for the welfare of camel keepers</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Marsabit
Counties where TIMP will be up scaled	Baringo, Garissa, Marsabit Tana River, Isiolo, Taita Taveta, Laikipia, Kajiado, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Inadequate awareness about existence and effectiveness of the integrated surra control strategy</li> <li>• Proliferation of trypanocidal drug brands in the market some of which are counterfeits</li> </ul>

	<ul style="list-style-type: none"> <li>• Liberalized market which is hard to regulate</li> <li>• Underdosing since treatment of surra is based on animal live weights</li> <li>• Poor drug reconstitution techniques</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Create awareness about how the integrated surra control strategy works</li> <li>• Enforce regulations on registration of drugs to enhance quality</li> <li>• Capacity build camel keepers and technicians on correct doses</li> <li>• Provide simple and easy to use weighing techniques to encourage dosing based on live weight</li> <li>• Ensure worming is done based on season and risk of helminth infection.</li> </ul>
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>• Reconstitution and administration of trypanocidal drugs should be done by trained personnel</li> <li>• Prophylaxis when done at the right time reduces risk of camels getting infected with surra</li> <li>• Building the capacity of pastoralists improves the management of surra in their camel herds for better productivity</li> <li>• The control of surra enhances camel productivity for food, nutrition and income security.</li> </ul>
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> <li>• Uptake and use of the integrated surra control strategy is socially acceptable among pastoralists</li> <li>• Surra should be controlled as per the Animal disease Act (CAP 364) as enforced by DVS</li> <li>• Manufacturer recommendations on observing withdrawal periods for trypanocidal drugs should be adhered to in surra control</li> <li>• Market only trypanocidal drug brands which are duly registered for use in Kenya by the VMD</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Quinapyramine sulphate/chloride (Triquin®) packed in 2.5 gram packets sold at KES 300-400.
Estimated returns	Reduction in abortion in pregnant camels will result in improved camel productivity
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women, children and the elderly may not have challenges handling camels during injection</li> <li>• Women and children are rarely involved in decision making on when and how to treat for surra</li> <li>• Women, children and the elderly may access extension messages and on controlling surra in camel herds due to low levels of education and other cultural barriers.</li> </ul>

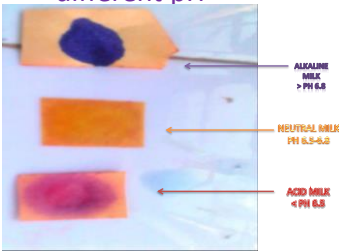
	<ul style="list-style-type: none"> <li>Ownership of camels is predominately a preserve of men which disadvantages women and youth when it comes to decision making.</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>Improved productivity of camels will lead to increased incomes for both gender and youth</li> <li>The women and youth may get an opportunity to conduct capacity building control of surra as well as community extension services</li> <li>The youth may be involved in generation of messages to popularize the integrated control of surra within their community</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>VMGs especially PWDs may be disadvantaged they may not effectively restrain camels during injections</li> <li>VMGs may lack the resources to acquire Triquin for treating surra in their camels</li> <li>PWDs will be disadvantaged in walking long distances to buy trypanocidal drugs<sup>9</sup></li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>The VMGs may be involved in generation of messages to popularize the integrated control of surra within their community</li> <li>Improved productivity of animals increases household income leading to more business opportunities for VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories from previous similar projects	KALRO BiORI Muguga through funding from African Union promoted the integrated control of surra in camels in Marsabit and Somaliland from 2017 to 2021
Application guidelines for users	<ul style="list-style-type: none"> <li>Camel Manual for Service providers (Available online)</li> <li>Integrated Control Strategy for Camel <i>Surra</i>. KALRO brochure</li> <li>Trypanosomiasis in Camels. Poster available at KALRO/SGCRI, Marsabit</li> </ul>
<b>F: Status of TIMP readiness</b> (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Ready for up-scaling
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO – BioRI Muguga P.O. Box 362 -00902 Kikuyu, Kenya
Lead organization and scientists	KALRO-BioRI Muguga, Chemuliti J., Godia L., Wanjala K., Mdachi R., Wamwiri F., Auma J., Alusi P.
Partner organizations	Terra Nouva, IGAD Sheik Technical Veterinary School (ISTVS), Kenya Camel Association, DVS, VMD

### Research Gaps

1. Conduct promotional activities to catalyze the adoption of the management practice for wide use in the camel rearing regions to control surra.

2. Determine the cost-benefit of using the practice.
3. Assess development, adoption and scaling up of the technology with gender and VMGs in consideration.
4. On farm validation of the management practice.

### 2.3.3. pH-based mastitis tests

<b>4.2.1 TIMP name</b>	pH-based mastitis kit
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Poor, highly technical, costly and delayed detection of mastitis in lactating animals.
What is it? (TIMP description)	<p>This is a rapid, farmer friendly and cost-effective kit which is used at farm level to test and detect sub-clinical mastitis in milking animals with accuracy agreement with the laboratory based tests of &gt;95%. The kit is made from a paper strip which is impregnated with pH indicators. The colour of the strip when dipped in milk changes on the basis of the acidity and alkalinity of milk. For mastitic milk with pH of &gt;6.8, the strip changes from orange to blue while in fermented milk which slightly acidic (&lt;6.5), the strip changes from orange to pink. In normal milk with pH of between 6.5 to 6.8, the strip remains unchanged</p> <p style="text-align: center;">Colour changes of pH-based milk of different pH</p>  <p>The diagram illustrates the color changes of a pH-based milk test strip. It shows three horizontal strips. The top strip is blue and labeled 'ALKALINE MILK &gt; pH 6.8'. The middle strip is orange and labeled 'NEUTRAL MILK pH 6.5-6.8'. The bottom strip is pink and labeled 'ACID MILK &lt; pH 6.5'.</p>
Justification	Detection methods currently used such as California Mastitis Test (CMT), somatic cell counts and culture are highly technical and require trained personnel and laboratory facilities. This makes the diagnosis of mastitis expensive for smallholder dairy farmers. The use of the pH based mastitis kit solves this problem since it allows farmers to actively be involved in diagnosis and control of mastitis. The use of the kit will enhance productivity as well contribute to food safety as milk from mastitic animals will be discarded at milking.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	

Users of TIMP	<ul style="list-style-type: none"> <li>• Cattle and camel keepers,</li> <li>• County veterinary and livestock staff</li> <li>• Private veterinary professionals</li> <li>• Kenya Dairy Board (KDB)</li> <li>• Dairy cooperative societies</li> </ul>
Approaches to be used in dissemination	Field days, shows and exhibitions
Critical/essential factors for successful promotion	Simple for use by animal health service providers
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• Farmers - End users</li> <li>• Dairy cooperatives- End users</li> <li>• County Governments- Extension services</li> <li>• KALRO, Universities- Research</li> <li>• VMD – Registration of the strip</li> <li>• DVS – regulator</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Nakuru, Kajiado and Laikipia
Counties where TIMP will be up scaled	Counties with smallholder dairy cattle (Kakamega Taita Taveta, Nyandarua, Bomet, Kericho, Uasin Gishu, Elgeyo Marakwet, Kajiado, Nyeri Machakos, Kisumu, Siaya) Camel raising counties (Laikipia, Garissa, Marsabit, Mandera, Wajir, Tana River Isiolo),
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Long registration process with VMD which has delayed commercialization efforts</li> <li>• Patent process for the kit is long and tedious</li> <li>• Kit still requires proper packaging</li> <li>• Limited awareness about the kit</li> </ul>
Recommendations for addressing the challenges	<ul style="list-style-type: none"> <li>• Consult VMD personnel when filling the registration dossier to hasten the process</li> <li>• Involve the KALRO legal team to engage with KIPI to fast track patenting process</li> <li>• Fast track kit packaging</li> <li>• Develop user information and guidelines on how it works</li> </ul>
Lessons learned in up scaling if any	<ul style="list-style-type: none"> <li>• With a little training, farmer are able to conduct mastitis screening and make interpretation of the results accurately</li> <li>• Farmers are willing to adopt the technology</li> <li>• With proper training the kit can be produced with ease in any diagnostic laboratory</li> <li>• The kit needs to be stored in a dry and cold place away from direct sunlight</li> <li>• Holding of the kit with hands is likely to cause changes on the kit which may interfere with its diagnostic accuracy</li> </ul>
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> <li>• The use of the strip will be acceptable irrespective of production system</li> </ul>


	<ul style="list-style-type: none"> <li>• Proper and hygienic disposal of the used kit is required to minimize environmental contamination</li> <li>DVS to develop guidelines to regulate manufacture, quality and use of the strip Kit</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	<ul style="list-style-type: none"> <li>• Involvement of private actors in the marketing and distribution of the kit for ease of access by dairy animal keepers</li> <li>• Conduct economic analysis on the use of strip kit in the diagnosis control of mastitis</li> </ul>
Basic costs	KES 100 per strip package of 10
Estimated returns	Udders free of mastitis produce 40% more milk than mastitis affected udders. This will result in increase in amount of milk available to households for food and for sale to earn income.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Adoption of the strip kit is likely to be a challenge for women since they are not the overall decision makers at household level</li> <li>• Most women lack the resources with which to buy mastitis strip kit</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• The kit has the potential to contribute to increased milk production for food, nutrition and income security at household level<sup>6</sup></li> <li>• There is an opportunity to value addition and marketing following improvement in milk quality.</li> <li>• Women who are the involved in milking animals are likely to be main users of the technology</li> </ul>
VMG issues and concerns in development, dissemination and adoption and scaling up	<ul style="list-style-type: none"> <li>• Visually impaired persons are disadvantaged since the technology is based on colour visualization.</li> <li>• VMGs may lack the resources to acquire the strip kit for screening mastitis in the milking animals</li> </ul>
VMG related opportunities	Increased productivity of good quality presents an opportunity for VMGs to engage in milk value addition for high returns.
<b>E: Case studies/profiles of success stories</b>	
Success stories	During field validation of the kit on Cattle in kajiado and on camels in Laikipia, livestock keepers appreciated the simplicity with which mastitic diagnosis can be done at herd level without a need for laboratory and trained staff
Application guidelines for users	Mastitis kit user information booklet. Draft available KALRO/VSRI Muguga
<b>F: Status of TIMP readiness</b> (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director KALRO VSRI, Muguga North

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

### Research Gaps

1. Validation of pH-based mastitis kit for detection and control of sub clinical mastitis dairy goats.
2. Determine the cost-benefit of using the test in the control of sub-clinical mastitis in dairy animals.
3. Develop guidelines for successful use of the test.

### 2.3.4. Mastitis control practices

TIMP name	Mastitis Control
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low milk yield and postharvest losses due to high incidence of sub-clinical mastitis in lactating camels
What is it? (TIMP description)  5	<p>This is the regular pen-side testing of milk using a simple, easy-to-use mastitis kit to rapidly detect sub-clinical mastitis. The testing of each quarter and each animal will enable early detection and treatment and so minimize loss and increase marketable milk.</p> 
Justification	High prevalence of subclinical mastitis in camel reduces milk output by about 33% and affects milk quality and marketability. Pastoralists have inadequate knowledge on management of mastitis in lactating camels. The practice is to encourage sale of milk based on somatic cell count hence the need for a convenient pen-side mastitis test kit. This will also assist in early detection and control of mastitis for increased production of quality milk (white milk shown on the right in picture).
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Camel producers, County veterinary and livestock staff, Certified Private animal health practitioners, Kenya Dairy Board (KDB), Camel milk bulkers, processors.
Approaches to be used in dissemination	Commercialization of the service through certified animal health practitioners. Field days, On-farm and on-station demonstrations, ASK shows, Farmer to farmer exchange programs, Mass media (Pastoral production programs), Pastoral training centres, Training of Trainers ToTs), Promotional materials (brochures, posters, leaflets), Digital

	media, Social media (whatsapp, Facebook, Twitter)
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Camel keepers awareness about subclinical mastitis in lactating camels</li> <li>• Willingness by camel keepers to adopt the various testing kit technologies (CMT and Ph-based testing methods)</li> <li>• Willingness by milk trader to pay premium price for quality milk delivered by producers.</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO - Research and information generation and sharing</li> <li>• Camel milk producers - end users.</li> <li>• County Governments - Extension services and capacity building. Egerton University – Research and training</li> <li>• Milk bulkers/ cooperatives - End users.</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted if any	Isiolo and Marsabit, parts of Garissa and Wajir
Counties where TIMP will be up scaled	Marsabit, Isiolo, Garissa, Mandera, Wajir, West Pokot
Challenges in dissemination	<ul style="list-style-type: none"> <li>• Lack of awareness on subclinical mastitis</li> <li>• Limited supply of the kit and awareness of its use</li> <li>• Inability to access camels given their frequent mobility in search of forage.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Capacity building on control and prevention of subclinical</li> <li>• Mastitis</li> <li>• Involvement of local communities in accessing target camels</li> <li>• Provide information on where to source test kits.</li> </ul>
Lessons learned in up scaling if any	Farmers are willing to adopt the technology
Social, environmental, policy and market conditions necessary	Increased demand for clean, hygienic milk by consumers and processors.
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Entails cost of CMT reagent, labour and treatment with antibiotic gives a total cost of KES 350.00 per lactating camel
Estimated returns	This refers to cost of milk lost if control of mastitis is not undertaken. At 33% of milk saved from loss due to mastitis. A farmer saves KES 33.00 per litre of milk fresh by controlling in a camel herd.
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women, most of whom are semi-illiterate lack adequate skills on camel sub management.</li> <li>• Women and youth have limited access to productive resources such as credit to purchase testing kits such as California Mastitis Test (CMT) kit for testing subclinical mastitis.</li> <li>• Women and youth have limited knowledge of camel diseases due to lack of access to agricultural information and extension services.</li> </ul>


Gender related opportunities	<ul style="list-style-type: none"> <li>• Opportunity for youth to be trained in camel health technologies</li> <li>• Adoption of camel management technologies will benefit women and youth since there will be less mortalities and increased productivity hence increased income</li> <li>• Increases household income leading to more business opportunities</li> <li>• Adoption of camel healthy management practices leads to improved productivity, hence</li> <li>• Food and nutrition security for youth and women</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	Visually impaired persons are disadvantaged since the technology is based on colour visualization
VMG related opportunities	<ul style="list-style-type: none"> <li>• There is need to reach out to marginalized and vulnerable persons with management of subclinical mastitis information as they are the least likely to access regular veterinary services</li> <li>• Adoption of camel mastitis management practices will lead to increased productivity hence increased incomes and improved food and nutrition security for VMGs</li> <li>• Business opportunities for VMG to sell more camel milk which is popular because of its health benefits</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	<ul style="list-style-type: none"> <li>• Management of subclinical mastitis has successfully been promoted among the Salato women group in Ngurunit.</li> <li>• Marsabit County, Anolei cooperative affiliated camel keepers in Isiolo County.</li> </ul>
Application guidelines for users	Camel Manual for service providers (Available online) Control Mastitis for Hygienic camel milk. KALRO Brochure No....(Available in KALRO/SGCRI, Marsabit)
<b>F: Status of TIMP readiness</b> (1. Ready for upscaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO – VSRI, Muguga P.O. Box 32 -00902 KIKUYU, Kenya
Lead organization and scientists	KALRO Peter Ndirangu and Monica Maichomo
Partner organizations	MMUST and Kibabii University

### Research Gap

1. Cost benefit analysis needs to be done in different camel keeping counties in Kenya.

## 2.3. Post-Harvest and Value Addition

### 2.3.1. The donkey milk carrier


TIMP Name	The donkey milk carrier
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Camel milk is usually carried in plastic containers, which are difficult to properly clean. The frequent handling of these plastic containers during transportation of milk also add to the unhygienic conditions which often lead to milk spoilage and endangering the health of the milk consumers.
What is it? (TIMP description)	<p>The tool is made of canvas, which withstands tensile stress. It comprises of 4 chambers for carrying 4 metal cans. The bottom of each compartment is flat and semi-circular to allow for standing before placement on the donkey or camel. It has six straps for tying around the animal, a soft padding to enhance Comfort of the carrier animal.</p> 
Justification	There is need to transport milk in more hygienic containers in such a way as to minimize post-harvest losses and safeguard the health of the consumers. Introduction of metal cans enhances hygienic handling of marketed milk and reduces losses along the milk productivity value chain. Carrying many cans using one animal requires a tool that enhances hygienic handling of the product as well as assuring comfort of the carrier animal. This fabricated donkey carrier can also be used with camels in the transportation of more milk per animal.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Camel milk producers in areas where vehicle transportation is more difficult or impossible.
Approaches to be used in dissemination	<ul style="list-style-type: none"> <li>• Demonstrations in field days, exhibition in ASK shows.</li> <li>• Mostly target camel farmers who are already connected to milk traders and introduce others gradually based on demand.</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Identification of designers of the carrier is essential.</li> <li>• Capacity building on benefits of using metal cans.</li> </ul>

Partners/stakeholders for scaling up and their roles	NGOs, Kenya Camel Association (Community mobilization and training), MoA&LD (Policy and extension), camel milk producers, milk traders, MoH, County Governments (extension), transporters, consumers (logistics and feedback) KALRO (Technology generation)
<b>C: Current situation and future scaling up</b>	
Counties where already Promoted, if any	Marsabit and Isiolo
Counties where TIMPs will be upscaled	Mandera, Wajir and Garissa and other ASAL counties
Challenges in development and dissemination	<ul style="list-style-type: none"> <li>• Poverty of the target producers who then cannot purchase the metal cans</li> <li>• Poor market linkages discourage producers from adopting the</li> <li>• Technology.</li> <li>• Metal cans are not easily accessible by camel milk producers.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Encourage input suppliers to invest in metal cans and avail them closer to producers and collectors.</li> <li>• Train artisans on design of the carrier for easy access by producers.</li> <li>• Training on hygienic handling and dispensing of milk</li> </ul>
Lessons learned in up scaling, if any	Camel milk producers can adopt the technology only if properly linked to traders who are also willing to offer better prices for quality milk.
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Willingness of the producers to abandon the use of the cheaper plastic containers.</li> <li>• Regulation on milk containers to the camel milk handlers as well.</li> <li>• Willingness of the traders and buyers to pay more for milk of better quality through better handling.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs *2022 prices	The technology costs KES 2700* excluding the cost of the metal can.
Estimated returns	25% reduction in milk spoilage
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Donkey milk carrier has a cost (initial and replacement cost) and may be less affordable by some women and youth</li> <li>• Women and youths have limited access to credit to purchase require equipment</li> <li>• Poor market linkages may discourage producers from adopting the technology</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Improved marketability of camel milk due to value addition technologies leading to increased income and improved livelihood for women and youth</li> </ul>

	<ul style="list-style-type: none"> <li>•Increased food security and nutrition for all gender categories</li> <li>•Employment creation for women and youth in the sale the carriers and more milk</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Donkey milk carrier has a cost (initial and replacement cost) and may be less affordable by some VMGs</li> <li>• Due to their social status VMGs are often excluded from technology dissemination activities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Business and employment opportunities for VMGs</li> <li>• Increased food and nutrition security for VMGs</li> <li>• Improved marketability of milk due to enhanced quality, leading to increased income and improved livelihood for VMGs</li> <li>• Technology reduces milk loses and so more milk is marketed for increased income and improved livelihoods including those of VMGs.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Camel milk losses were reduced by about 25% through this technology when it was tested among camel milk producers.
Application guidelines for users	Guidelines for use have been developed by KALRO. There is need to extend the regulation on milk containers to the camel milk handlers as well.
<b>F: Status of TIMP Readiness</b> (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	3. Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO SGRI P.O. Box 147-60500 Marsabit Tel. +254 69 210 2040 Fax +254 69 210 2220 <a href="mailto:marsabit@kalro.org">marsabit@kalro.org</a>
Lead organization and scientists	KALRO, Changwony K. and Adongo A.O.
Partner organizations	County Governments –MoA&LD., Kenya Camel Association

#### 2.4.2. Improved hemp cooling technology for milk marketing

<b>TIMP Name</b>	Improved hemp cooling technology for camel milk marketing
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Milk spoilage and losses leading to low productivity.


What is it? (TIMP description)	<p>This is a fabric made from sisal fiber. Clean sisal hemp is wrapped around metal milk can. The hemped container is soaked in clean water for at least 30 minutes before the milk is introduced. Soaking the container after wrapping assists in cooling the milk through evaporation.</p> 
Justification	More fresh milk will be available for consumption and sale to a large number of consumers. It can reduce microbial load by about 40% if used correctly.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Private sector as fabricators. Camel milk producers and collectors. County Government extension officers, Local NGOs for training purposes.
Approaches to be used in dissemination	<p>Commercialization through livestock input suppliers and local artisans.</p> <p>Field days, On-farm and on-station demonstrations, ASK shows, Farmer to farmer exchange programs, Mass media (Pastoral production programs), Pastoral training centres, Training of Trainers ToTs), Promotional materials (brochures, posters, leaflets), Digital media, Social media (whatsapp, Facebook, Twitter)</p>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Chain actors willingness to adopt the technology.</li> <li>• Availability of market for camel milk in distant markets centres.</li> <li>• Involvement of stakeholders in development and promotion of the innovation.</li> </ul>
Partners/stakeholders for scaling up and their roles.	<ul style="list-style-type: none"> <li>• KALRO – Research, information generation and training</li> <li>• Local/International NGO – Capacity building to CIGs in milk marketing using the innovation.</li> <li>• Kenya Camel Association – Mobilization and training of CIGs using the technology to market their milk.</li> <li>• MoALD – For mobilisation and training on the use of innovation</li> <li>• Camel milk VC actors – Utilization of the technology and feedback.</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Marsabit and Isiolo
Counties where TIMPs will be upscaled	Marsabit, Wajir, Mandera, Isiolo and Garissa, West Pokot

Challenges in development and dissemination	<ul style="list-style-type: none"> <li>• Poor hygiene can compromise use of the innovation.</li> <li>• Requires water for soaking which can be a challenge in some seasons in ASALs where camel are kept.</li> <li>• Availability of the hemp material in interior parts of northern Kenya.</li> <li>• Frequent shifting by camel keepers affecting smooth distribution to milk producers and poor market linkages.</li> </ul>
Suggestions for addressing the challenges	<ul style="list-style-type: none"> <li>• Improve rural access roads</li> <li>• Map out all camel movement route and establish collection centers in tandem with grazing points</li> <li>• Organize chain actors for information sharing and collective action platforms, train producers and traders on hygienic handling and dispensing of milk</li> </ul>
Lessons learned in up scaling, if any	<ul style="list-style-type: none"> <li>• Producers embrace technologies if it has direct benefits to them</li> <li>• The technology must be accompanied by trainings on hygiene.</li> </ul>
Social, environmental, policy and market conditions necessary for development and up-scaling	<ul style="list-style-type: none"> <li>• Willingness to shift from plastic containers, embrace hygiene practice that accompany the technology</li> <li>• Organized market linkages to ensure smooth transition from one node of the chain to the other</li> <li>• Kenya Dairy Board (KDB) to come up with policy that encourages processing and trading in camel milk in Kenya.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs (*2022 price)	Wrapping one 10 L metal can costs below KES 270 (USD 2.2)
Estimated returns	Can save 40% of milk loss hence saving about KES 52.8 per litre
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women have less access to information, technology and knowledge on value addition in camel milk</li> <li>• Hemp technology has a cost (initial and replacement cost) and may be less affordable by some women and youth who have limited access to credit to purchase the milk cans.</li> <li>• Poor market linkages may discourage producers from adopting the technology</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Adoption of camel milk value addition technologies would lead to addition economic empowerment for women, who are mostly in charge of camel milk</li> <li>• Improved marketability of camel milk due to value addition technologies leading to increased income and improved livelihood for women and youth</li> <li>• Increased food security and nutrition for all gender categories</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Hemp milk cooler has a cost (initial and replacement cost) and may be less affordable by some VMGs</li> <li>• VMGs lacks access to information on value addition technologies and information camel milk</li> <li>• VMGs have limited skills relating to camel milk value addition</li> </ul>

	<ul style="list-style-type: none"> <li>• Due to their social status VMGs are often excluded from technology dissemination activities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Business and employment opportunities for VMGs</li> <li>• Increased food and nutrition security for VMGs</li> <li>• Improved marketability of milk due to reduced postharvest losses leading to increased income and improved livelihood for VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	The technology is currently adopted by 3 milk producers in Kulamawe and Anolei cooperative in Isiolo County.
Application guidelines for users	KALRO Information Brochure Series No. 2017/061
<b>F: Status of TIMP Readiness</b> (1. Ready for up scaling; 2. Requires Validation; 3. Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, KALRO SGRI P.O. Box 147-60500 Marsabit Tel. +254 69 210 2040 Fax +254 69 210 2220 <a href="mailto:marsabit@kalro.org">marsabit@kalro.org</a>
Lead organization and scientists	KALRO: K. Changwony and Amos Adongo ( <a href="mailto:amos.adongo@kalro.org">amos.adongo@kalro.org</a> ; <a href="mailto:adongoam@gmail.com">adongoam@gmail.com</a> )
Partner organizations	County Governments –MoALD, Kenya Camel Association

### 2.4.3. Solar milk cooler


<b>TIMP Name</b>	<b>Solar milk cooler</b>
Category (i.e. technology, innovation or management practice)	Technology
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Post-harvest loss of milk through spoilage because high temperatures reduce the shelf life of fresh milk.
What is it? (TIMP description)	This technology is solar bulk cooler for milk. It is a system comprising of a solar power generation unit, power conditioning unit, a refrigeration unit with a cold water/ice storage tank and a milk cooling/storage tank with accessories. The system has minimum battery power storage to run the electronics and pumps for at least three days without solar. The refrigeration system should convert at least 70% of the solar energy available from solar panels into cold water or ice without use of batteries. The stored cold water/ice should be able to cool milk to 4°C for 3 days

	<p>in absence of solar energy.</p> 
Justification	<p>Due to high temperatures in Northern Kenya and the absence of facilities to quickly cool milk, there are more post-harvest losses, which reduce amount to marketable milk and so reduce profitability of milk production. This technology works to cool milk and does not require electricity grid. Its use will ensure that more fresh milk will be available for consumption and sale to many consumers.</p>
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	<p>Camel milk bulkers and sellers (women groups, producers groups, milk retailers)</p>
Approaches to be used in dissemination	<p>Commercialization, Practical demonstrations in field days, ASK shows, radio talk shows and TV programs.</p>
Critical/essential factors for successful promotion	<p>Commercialization of the technology. Skills in operation and maintenance of the equipment. Group approach to use of the coolers Capacity building in milk hygiene and handling.</p>
Partners/stakeholders for scaling up and their roles.	<p>Egerton University (Research and Technology generation), County Governments (extension services), KALRO (Technology validation) Local service providers and fabricators of the technology.</p>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted. if any.	<p>Isiolo and Nakuru</p>
Counties where TIMPs will be upscaled	<p>Wajir, Marsabit, Mandera, Garissa, Kajiado and West Pokot.</p>
Challenges in development and dissemination	<p>The high cost of the technology discourages the average camel milk value chain actors</p>
Suggestions for addressing the challenges	<p>Support through groups to acquire the technology</p>
Lessons learned in up scaling, if any	<p>None</p>
Social, environmental, policy and market conditions necessary for development and up-scaling	<p>KDB to come up with policy that encourages processing and trading in camel milk in Kenya. Policies to be put in place at County level for hygienic handling and marketing of camel milk.</p>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	

Basic costs *2022 prices	KES. 3,630,000* (USD 30,000) for 300 L capacity
Estimated returns	Not yet done
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women have less access to information, technology and knowledge on value addition in camel milk.</li> <li>• Women and youths who have limited access to credit to purchase require equipment.</li> <li>• Poor market linkages may discourage producers from adopting the technology.</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Adoption of value addition technologies for camel milk would lead to added economic empowerment for women, who are mostly in charge of camel milk.</li> <li>• Improved marketability of camel milk due to value addition technologies leading to increased income and improved livelihood for women and youth.</li> <li>• Increased food security and nutrition for all gender categories.</li> <li>• Employment creation for women and youth in the sale of milk.</li> <li>• Youth can be targeted with capacity building in hygiene production and transportation nodes</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs lacks access to information on value addition (cooling) technologies and information on camel milk.</li> <li>• VMGs have limited skills relating to camel milk value addition.</li> <li>• It is a relatively expensive technology and most VMGs may be excluded by the high cost.</li> <li>• Due to their social status VMGs are often excluded from technology dissemination activities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Business and employment opportunities for VMGs</li> <li>• Increased food and nutrition security for VMGs</li> <li>• improved marketability of milk due to reduced losses, will lead to increased income and improved livelihood for VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	None
Application guidelines for users	Should be installed in a clean dust free environment. Operator manual is available for use
<b>F: Status of TIMP Readiness</b> (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Requires validation
<b>G: Contacts</b>	
Contacts	Institute Director, SGRI P.O. Box 147-60500 Marsabit Tel. +254 69 210 2040 Fax +254 69 210 2220

	<a href="mailto:marsabit@kalro.org">marsabit@kalro.org</a>
Lead organization and scientists	KALRO Changwony K., Matofari J.W. and Adongo A.O.
Partner organizations	Egerton University (research), County Governments (extension) MoA&LD (extension)

#### 2.4.4. Camel Ghee

<b>TIMP Name</b>	Camel Ghee
Category (i.e. technology, innovation or management practice)	Innovation
<b>A: Description of the technology, innovation or management practice</b>	
Problem to be addressed	Low income from camel products due to lack of product diversification. Short shelf life of traditional products thus increased food insecurity among camel keeping households.
What is it? (TIMP description)	Camel ghee is a light golden brown clarified butter. It is made from cream centrifuged from camel milk using manual cream separator. The cream is boiled then cooled to room temperature before packaging into sterile containers preferably bottles. About 15 litres of camel milk yield 350 g of ghee. 
Justification	Camel Ghee has longer shelf life than milk hence can stored and used in times of food shortages. It can address food insecurity during the dry season when camel milk is in short supply. A sure bet for mitigating shortage of cooking oil at household level.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Milk traders, CIGs involved in milk trade, private sector (camel milk processors. Extension service providers (County Governments)

Approaches to be used in dissemination	Commercialization through livestock input suppliers and local artisans. Field days, On-farm and on-station demonstrations, ASK shows, Farmer to farmer exchange programs, Mass media (Pastoral production programs), Pastoral training centres, Training of Trainers ToTs), Promotional materials (brochures, posters, leaflets), Digital media, Social media (WhatsApp, Facebook, Twitter)
Critical/essential factors for successful promotion	Affordability of cream separator. Adoption of hygiene practice that accompany the technology. Organized market linkages to ensure commercialisation. Kenya Dairy Board (KDB) to come up with policy that encourages processing and trading in camel milk in Kenya. To be done during rainy seasons and immediately after when there is a milk glut
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• KALRO – Research, information generation and training</li> <li>• Local/International NGO – Capacity building to CIGs in milk marketing using the innovation.</li> <li>• Kenya Camel Association – Mobilization and training of CIGs using the technology to market their milk.</li> <li>• MoALD – For mobilisation and training on the use of innovation Camel milk VC actors – Utilization of the technology and feedback.</li> <li>• Local service providers and fabricators of the technology of the cream separator (logistics and feedback)</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Parts of Marsabit and Isiolo, Mandera, Garissa
Counties where TIMPs will be upscaled	Wajir, Marsabit, Mandera Garissa, West Pokot
Challenges in development and dissemination	Limited access to manual cream separator Milk hygiene at producer level Limited knowledge on possibility of ghee making from camel milk
Suggestions for addressing the challenges	Linking of women milk vendors with fabricators of cream separator. Capacity building on processing of ghee.
Lessons learned in up scaling, if any	Has a long shelf life, can serve to enhance food security during dry season in the areas where camel milk is produced.
Social, environmental, policy and market conditions necessary for development and up-scaling	Wider acceptability of camel Ghee as a food is necessary for this technology to be upscaled. Requires water to ensure hygienic processing at cottage level. Solar pasteurizers can be used instead of fuelwood to reduce climate related challenges
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	Cost of input would be approximately KES 80,000. The process can produce substantial quantities of ghee but there is need for cost benefit analysis
Estimated returns	No information

Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Women have less access to information, technology and knowledge on value addition in camel milk</li> <li>• Processing of ghee has a cost (initial and replacement cost) and may be less affordable by some women and youth who have limited access to credit to purchase require equipment</li> <li>• poor market linkages may discourage producers from adopting the technology</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Adoption of camel milk value addition technologies would lead to addition economic empowerment for women, who are mostly in charge of camel milk</li> <li>• Improved marketability of camel milk due to value addition technologies leading to increased income and improved livelihood for women and youth</li> <li>• Increased food security and nutrition for all gender categories</li> <li>• Employment creation for women and youth in the sale ghee.</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• Camel ghee is a fairly expensive technology and most VMGs may not afford it.</li> <li>• VMGs lacks access to information on value addition technologies and information camel milk</li> <li>• VMGs have limited skills relating to camel milk value addition</li> <li>• Value addition technologies for camel milk e.g. Camel Ghee production are labor intensive for some VMGs especially those abled differently.</li> <li>• Due to their social status VMGs are often excluded from technology dissemination activities</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Business and employment opportunities for VMGs</li> <li>• Increased food and nutrition security for VMGs</li> <li>• improved marketability of milk due to diversified products, leading to increased income and improved livelihood for VMGs</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	Was successfully tested and validated among Salato women in Samburu County
Application guidelines for users	Kenya Camel Manual for Trainers Brochures on how to process ghee available within KALRO website.
<b>F: Status of TIMP Readiness</b> (1. Ready for up scaling; 2. Requires validation; 3. Requires further research)	Ready for upscaling
<b>G: Contacts</b>	
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Lead organization and scientists	KALRO K. Changwony, Amos Adongo/KALRO and Prof Matofari J.W/Egerton University
Partner organizations	County Governments –MoALD, Kenya Camel Association

## 2.5. Market Linkages and Distribution

<b>TIMP Name</b>	<b>Livestock markets management through co-management model (CMM)</b>
Category (i.e. technology, innovation or management practice)	Management practice
<b>A: Description of the technology, innovation or management practice</b>	
Problem addressed	Livestock markets face various challenges that hinder them from operating at maximum capacity. There is inadequate support for the marketing of livestock and livestock products while existing marketing organizations are weak. Livestock market governance is also weak, thus creating challenges such as tax evasion and insecurity, causing traders to stay away from existing markets.
What is it? (TIMP description)	The Co-Management Model (CMM) for livestock markets is defined as a system of management “in which livestock farmers and other actors in the livestock value chain negotiate, define, and guarantee amongst themselves a fair sharing of the marketing functions, entitlements and responsibilities.  The model is a partnership between communities and County Governments to jointly manage livestock markets, share responsibilities and the revenue generated from them according to a pre-agreed schedule through an Act of County Assembly for the benefit of the communities and all other actors. Other agencies involved in the intervention play supportive roles to the optimal functioning of the markets.
Justification	Functional markets are key to ensuring sustenance of livelihoods of pastoralist communities as well as facilitating the sustainable supply of livestock products to consumers. Livestock markets are a critical component of the livestock value chain since they serve as the main platform for community members to sell their livestock and sustain their livelihoods. Livestock markets where the co-management model is operational has several tangible benefits including improved market organization & efficiency, reduced risks for sellers and buyers, increased trade and improved producer prices, improved revenue collection/ income generation for the County governments and improved livelihoods.
<b>B: Assessment of dissemination and scaling up/out approaches</b>	
Users of TIMP	Livestock producers, administration, traders, local leaders, officials from the local livestock markets.
Approaches to be used in dissemination	<ul style="list-style-type: none"> <li>• Facilitating legislative process to anchor the model in law;</li> <li>• Supporting stakeholders’ consultation processes through public</li> </ul>

	<p>participation.</p> <ul style="list-style-type: none"> <li>• Training, coaching and mentorship of stakeholders.</li> </ul>
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> <li>• Formulation of County Government policies to anchor the model.</li> <li>• Development of County and Community structures to facilitate rolling out of the model.</li> <li>• Adequate security within and between the livestock keeping communities</li> </ul>
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> <li>• ILRI (marketing research)</li> <li>• County Governments (departments of livestock production, veterinary services, trade and finance for regulations, security and market information)</li> <li>• County Assemblies (for legislation processes)</li> <li>• Kenya Livestock Marketing Council (KLMC) ( for logistics and mobilization)</li> <li>• Livestock Marketing Association (LMAs)</li> <li>• Livestock producers, traders and other market actors</li> </ul>
<b>C: Current situation and future scaling up</b>	
Counties where already promoted, if any	Isiolo, Marsabit, Garissa, Wajir and Mandera, Baringo, Samburu, Tana River
Counties where TIMPs Will be upscaled	Isiolo, Marsabit, Garissa, Wajir and Mandera, Baringo, Samburu, Tana River
Challenges in dissemination	<ul style="list-style-type: none"> <li>• The co-management model has not yet been anchored in law in most of the ASAL counties;</li> <li>• The legitimacy of LMAs in managing livestock markets is legally vulnerable.</li> </ul>
Recommendations for addressing the challenges	<ul style="list-style-type: none"> <li>• Engage the respective County Executive and the Legislators to anchor the CMM arrangement in law.</li> <li>• Putting up CMM structures both at County and Community level to make the model a success.</li> </ul>
Lessons learned	Adoption of CMM has given birth to a new partnership between the communities and the County government. This has not only allowed members of the community to benefit from the markets, but has also enhanced optimal functioning of markets, as well as enhancing County government's role as a facilitator. The community members have embraced ownership of markets and are increasingly willing to pay all County revenues/fees without duress.
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> <li>• Enabling policy environment</li> <li>• Public participation is key in the establishment of the CMM process.</li> <li>• Buy-in by the County governments, local communities and the market actors is essential.</li> </ul>
<b>D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations</b>	
Basic costs	<p>Estimated cost KES 2 Million</p> <p>The funds shall be used to facilitate the following;</p> <ul style="list-style-type: none"> <li>• Training of Livestock marketing associations (LMAs)</li> <li>• Facilitate coaching and mentoring sessions for LMAs</li> </ul>

	<ul style="list-style-type: none"> <li>• Support experiential learning for LMAs</li> <li>• Strengthen marketing groups and enhancing livestock market development &amp; governance</li> </ul>
Estimated returns	<p>Once the model is established and strengthened, the following returns are anticipated;</p> <ul style="list-style-type: none"> <li>• Improved market organization &amp; efficiency, Leading to competitive and inclusive markets</li> <li>• Reduced risks for sellers and buyers</li> <li>• Increased trade and improved producer prices</li> <li>• Improved revenue collection/income generation for the County Governments</li> <li>• Improved livelihoods; enhanced household income, increased funding for community development from the resource generated from the livestock markets</li> </ul>
Gender issues and concerns in development, dissemination, adoption and scaling up.	<ul style="list-style-type: none"> <li>• Women have less access to information on markets and market organization.</li> <li>• Women and youths have limited decision making on markets.</li> <li>• Poor market linkages may discourage producers from adopting the technology.</li> </ul>
Gender related opportunities	<ul style="list-style-type: none"> <li>• Access to organized markets would lead to business opportunities and economic empowerment for women and children.</li> <li>• Improved marketability of camels leading to increased income and improved livelihood for women and youth.</li> <li>• Employment creation for women and youth within the organized market environment.</li> </ul>
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> <li>• VMGs lacks access to information on markets.</li> <li>• VMGs have limited negotiating skills within the market dynamic.</li> <li>• Due to their social status, VMGs are often excluded from decision-making.</li> </ul>
VMG related opportunities	<ul style="list-style-type: none"> <li>• Business and employment opportunities for VMGs</li> <li>• Improved marketing of camels, will lead to increased income and improved livelihood for VMGs.</li> </ul>
<b>E: Case studies/profiles of success stories</b>	
Success stories	<p>Experiences/Lessons were learnt from Oldonyiro livestock market (Isiolo) and Merille market (Marsabit) where a sense of ownership and enhanced accountability and transparency in market operations was inspired by empowering the community members, through LMAs, to take lead in market governance and other marketing initiatives. Cases of revenue evasion and insecurity were minimized, leading to optimal functioning of markets as well as increasing market participation.</p>
Application guidelines for users	<p>CMM will be promoted following guidelines and provisions derived from Isiolo Livestock sale yards Act, 2016 and Marsabit Livestock Trade and Markets bill, 2019. Counties will adapt them to their unique situations.</p>
<b>F: Status of TIMP readiness</b>	<p>1. Ready for upscaling</p>

(1. Ready for upscaling; Requires validation; Requires further research)	
<b>G: Contacts</b>	
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Lead organization and scientists	ILRI George Wamwere-Njoroge & Adan Abdi Kutu
Partner organizations	<ul style="list-style-type: none"> <li>• Respective County Governments (County legislation),</li> <li>• Kenya Livestock Marketing Council (KLMC),</li> <li>• Frontier County Development Council (FCDC), and</li> <li>• LMAs (mobilization and training)</li> </ul>



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