



INVENTORY OF CLIMATE SMART AGRICULTURE RED MEAT TECHNOLOGIES, INNOVATIONS & MANAGEMENT PRACTICES

Compiled by

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1.0 Definition of terms and summary tables of Red Meat Technologies, Innovations and Management Practices (TIMPS)

1.1 Definition of terms

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

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

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

Summary of Inventory of TIMPs in the Red Meat Value Chain

The inventory process resulted in a total of 20 TIMPs including 16 technologies, 0 innovations and 4 management practices, distributed among the 2 sub-themes, as indicated in Table 1.

Commodity/VC	Sub-Theme	Technologies	Innovations	Management Practices
Red Meat	Breeds	6	0	4
Red Meat	Fodder	9	0	1
Overall Total		15	0	5

1.2 Summary of Status of TIMPs in Red Meat Value Chain

The inventory process resulted in a total of 11 TIMPs that are ready for upscaling, 3 TIMPs that require validation and 11 TIMPs that 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
Red Meat	Breeds	4	0	2
Red Meat	Fodder	3	2	4
	Management Practices	4	0	1
Overall Total		11	2	7

Table 3: Inventory of Red Meat TIMPs by Category and Status

TIMPs Sub-Theme	TIMPs Title	TIMPs Category	Status
2.1Breeds	2.1.1 Improved Boran	Technology	Ready for upscaling
	2.1.2 Improved Boran/Red Poll Terminal Crosses In-Calf Heifers	Technology	Ready for upscaling
	2.1.3 Improved Boran/Sahiwal Heifers	Technology	Ready for upscaling
	2.1.4 Sahiwal	Technology	Ready for upscaling
	2.1.5 Orma Boran	Technology	Require further research
	2.1.6 Small East African Zebu (SEAZ)	Technology	Require further research
2.2Fodder	2.2.1 Forage Sorghum (E6518)	Technology	Requires validation
	2.2.2 Dual Purpose Sorghums (Ikinyaruka; E1291, BJ28, BM30, Lanet1)	Technology	Requires validation

	2.2.3 <i>Chloris Gayana</i> Var X-tozi and Var Lanet	Technology	Requires further research
	2.2.4 Lanet Brachiaria Varieties (<i>B. brizatha</i> Var. Busia; <i>B. brizatha</i> Var. Bungoma ; <i>B. brizatha</i> Var. Lanet)	Technology	Requires further research
	2.2.5 Brachiaria mutant	Technology	Requires further research
	2.2.6 <i>Clitoria ternatea</i>	Technology	Ready for upscaling
	2.2.7 Tree Lucerne	Technology	Ready for upscaling
	2.2.8 Brachiaria and Dolichos or Desmodium feed blocks	Technology	Requires further research
	2.2.9 Sweet Potatoes (Wagaborige)	Technology	Ready for upscaling
2.3.Management practices	2.3.1 Use of Girth band to estimate Boran liveweight	Management practice	Requires further research
	2.3.2 50 : 50 milking suckling regime	Management practice	Ready for upscaling
	2.2.3 Integrating beef in Wildlife conservancies	Management practice	Ready for upscaling
	2.3.4.4 Beef marketing	Management practice	Ready for upscaling
	2.3.5 Silvopastoral Systems	Management practice	Requires further research

2.0 Detailed Beef Value chain TIMPS

2.1 Improved Breeds

2.1.1 TIMP name	Improved Boran
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Slow growth rates, low maturity weights and generally low productivity
What is it? (TIMP description)	<ul style="list-style-type: none"> • A beef breed that has high growth rates, is resistant to diseases and parasites, tolerant to high temperature and has high (400 kg) maturity weight at 30-36 months • It has high (60%) carcass dressed weight • Acceptable breed colour (brown; fawn, grey and bristle) by Boran Breeders Association • Has very good meat quality
Justification	Improved Boran produces quality beef in the ASALs at relatively low cost as it can be finished on grass only. It produces less greenhouse gas (GHG) emissions as compared to the grain finished beef. It utilizes low digestible forage and has high feed conversion efficiency
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small- and large-scale farmers, ranchers, pastoral and agro-pastoral beef producers
Approaches to be used in dissemination	Field days, Extension publications (posters, brochures and leaflets) Breeders shows, Trade fairs, Exhibitions, Agricultural Society of Kenya (ASK) and County agricultural shows, Exchange tours, Pastoral Field schools, Farmer to farmer visits
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> - Need for a stable beef market and availability of large productive animals - Adequate feed is a must for the technology potential to be realised
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Universities- Carry out research to work on technology improvement • Ranchers - for breed multiplication • County Government - to support farmers in the uptake of the technology • NGOs - to support farmers in the uptake of the technology • Pastoral groups - to form training platforms to access the technology • Kenya Livestock Marketing Council - build farmer capacity to access the breed • KMC and red meat processors - provide market for the product • Kenya Animal Genetics Resource Centre (KAGRC) - to provide semen

	<ul style="list-style-type: none"> Ewaso Nyiro Development Authority (ENDA), Wildlife conservancies and Tana Athi River Development Authority to multiply the breed
C: Current situation and future scaling up	
Counties where already promoted	Machakos, Makueni and Taita Taveta, Nakuru, Laikipia Kajiado,
Counties where TIMP will be upscaled	Isiolo, Taita Taveta, Tana River, Wajir, Lamu
Challenges in dissemination	<ul style="list-style-type: none"> Inadequate extension services Poor breeding practices Pastoral breeding goals that emphasis on numbers vs productivity Poor marketing infrastructure High cost of acquiring breeding animals Variable feed availability in the ASAL
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Capacity building of the value chain actors Training of the pastoralists on appropriate breeding practices and on beef production as a business Develop the market infrastructure Multiply the breed to bring down the cost of the technology (currently the population is 2-3% of livestock in Kenya) Establish feed reserves to increase productivity efficiency
Lessons learned	<ul style="list-style-type: none"> The breed is in high demand in Kenya and East Africa Production of improved Boran is highly profitable Current cost of the technology is high
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> Market intervention to promote sale on live weight basis Disease free zones to widen the Market of beef cattle especially the export market Improve the market infrastructure Formalization of cross border trade on meat
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of Unregistered Bull Ksh 100,000 -130,000; Registered Bull sold at Ksh 240,000
Estimated returns	<ul style="list-style-type: none"> Sale price: Ksh 120,000 Cost of Production under free range: Ksh 4,373.20. Estimated returns per Unregistered bull: Ksh 115,500 while for a Registered bull – Ksh 135,500
Gender issues and concerns in development, dissemination, adoption and scaling up	Deliberate effort is needed to build the capacity of women headed households since breeding in most communities is a male dominated activity
Gender related opportunities	All gender especially youth can take up the enterprise to produce the bulls as a business
VMG issues and concerns in development dissemination, adoption and scaling up	Deliberately build the capacity of the VMGs to access the technology

VMG related opportunities	VMGs can produce the bulls as a business
E: Case studies/profiles of success stories	
Success stories	<ul style="list-style-type: none"> - The Improved Boran is the breed of choice for most ranchers and pastoralists in East Africa, Australia, South Africa and other countries. It is also the breed of choice for crossbreeding to increase hybrid vigour. - Some producers in Laikipia , Taita Taveta, Machakos and Makueni ranches produce the breed (bulls, in-calf heifers, steers) for sale
Application guidelines for users	<p>Feed the bull well and introduce it to females in good body condition at the Ratio of 1:40. But depending on the vegetation structure and age of the bull, a higher or lower ration of bull: cow may be required.</p> <p>-Technology can be accessed by using a bull, in-calf heifers, artificial insemination (AI) and embryo transfer</p>
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	1. Ready for upscaling
G: Contacts	
Contacts	Director Beef Research Institute, KALRO Lanet
Lead organization and scientists	KALRO; Mwangi Githui
Partner organizations	Boran Breeders Association, County Government, Universities (Egerton and Nairobi, Michigan University) International Atomic Energy Agency, Austria, Embrapa Brazil, Ranches CBOs, Kenya Animal Genetic Resources Centre (KAGRC),

GAPS

1. Inadequate breeding bulls
2. Inadequate awareness of the breed among pastoral and agro-pastoral producers leading to relatively low adoption rates
3. Lack of adaptation studies in most areas
4. Lack of beef finishing rations/systems
5. Evaluation of Improved Boran's contribution to green house gas emission under different production systems
6. Evaluation of improved Boran performance on poor pasture and watering regimes



Improved Boran Bull

2.1.2 TIMP name	Improved Boran/Red Poll Terminal Crosses In-Calf Heifers
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	

Problem addressed	<ul style="list-style-type: none"> - Lack of adapted dual (beef and milk) purpose breed - Low milk yield - Slow growth rates of most beef breeds - Demand for cattle with high maturity weights, - Increasing demand for quality beef
What is it? (TIMP description)	A dual-purpose cattle breed that provides both meat and milk. It produces up-to 20 litres of milk daily. The breed is tolerant to both diseases, parasites and high temperatures as well as utilizes poor quality feed. It has high (250-350 kg) maturity weight at 30-36 months and carcass dressed weight of 60% for steers.
Justification	There is an increasing demand for meat in Kenya which calls for high growth rates and maturity weight. Further, the effect of climate change necessitates that breeds kept in the ASAL be both heat and disease tolerant. In addition, the changing consumption habits for the increasing affluent Kenyan population is increasing the demand for high quality beef.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small- and large-scale farmers, ranchers, pastoral and agro-pastoral beef producers
Approaches to be used in dissemination	Field days, extension publications (posters, brochures and leaflets) Breeder shows, Trade fairs, Exhibitions, ASK and County agricultural shows, exchange tours, farmer to farmer visits, Local FM stations
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Stable beef/milk market • Availability of breeding animals to meet the demand for the breed • Availability of good quality feeds to reduce GHG production
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Ranchers - for breed multiplication • County Government - to support farmers in the uptake of the technology • NGOs - to support farmers in the uptake of the technology • Pastoral groups - to form training platform to ease access to the technology • Kenya Livestock Marketing Council - Build farmer capacity to access the breed • KMC and red meat processors - provide beef market • ENDA and Athi River Development Authority (TARDA) - breed multiplication • KAGRC- to provide semen
C: Current situation and future scaling up	
Counties where already promoted	Kisumu, Laikipia ranches, Kajiado
Counties where TIMP will be upscaled	<ul style="list-style-type: none"> • Lamu, Isiolo, Taita Taveta, Tana River, Wajir
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate extension services, • Poor breeding practices,

	<ul style="list-style-type: none"> • Pastoral breeding goals that emphasis on numbers vs productivity. • Inadequate numbers • Poor marketing infrastructure • Variable feed in the ASAL
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Capacity building of the value chain actors • Creation of a beef value chain platform • Multiplication of the breed • Improve feed quality and have strategic feed reserves
Lessons learned in upscaling for, if any	The breed is hardy and can be produced in most of the semi-arid areas in extensive systems as it can walk long distances
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Some communities require animals with a certain colour and that may require sensitization • Adequate numbers of the breed • Functional markets • Strategic feed reserves and seed systems in the ASAL
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of in-calf heifers: Ksh 130,000
Estimated returns	Cost of production under free range Ksh 4,373.20 Estimated returns Ksh 125,627
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Milking is a women activity in most communities, mechanizing may release women labour and increase hygiene • Breeding in most communities is a male activity meaning female headed households should be sensitized on the same
Gender related opportunities	All gender especially youth can take up the technology and produce milk and steers as a business
VMG issues and concerns in development, dissemination, adoption and scaling up	- The genetic base may need to be improved -Mechanization of milking may enable VMGs to adopt the technology – refer to development and dissemination
VMG related opportunities	VMGs can produce the heifers as a business for milk and beef
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<ul style="list-style-type: none"> • Cross Improved Boran heifers and Red Poll by use of a bull or Artificial Insemination (AI) • Feed the in-calf female well when it calves down • Observe appropriate animal husbandry practices and health • F1 Females can be served (bull or AI) with Red Poll breed
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	1. Ready for upscaling
G: Contacts	

Contacts	Director Beef Research Institute, KALRO Lanet
Lead organization and scientists	KALRO; Mwangi Githui
Partner organizations	Boran Breeders Association, KAGRC, County Governments, Universities (Egerton and Nairobi)

GAPS

1. Inadequate number of females of the Cross breeds
2. Lack of management packages
3. Lack of finishing rations
4. Low awareness of the breed among pastoral and agro-pastoral producers and availability of AI leading to relatively low adoption rates
5. Inadequate Artificial Insemination infrastructure (Technical staff and artificial insemination kits)
5. Performance (meat and milk) of the breeds under ASALs conditions unknown
5. Evaluation of the steers on growth and meat quality under different feeding regimes

2.1.3 TIMP name	Improved Boran/Sahiwal heifers
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> • Lack of an appropriate dual (beef and milk) purpose breed • Low milk yield • Slow growth rates and low maturity weights • Need for disease and heat tolerance breed. • Poor quality beef
What is it? (TIMP description)	A dual-purpose cattle breed for both meat and milk with improved udder setting and suspension. It is tolerant to diseases and high temperatures and utilizes poor quality forage. Steers have high (420 kg) maturity weight at 30-36 months with high (60%) dressed carcass weight and quality
Justification	Improved Boran x Sahiwal cross produce both milk and quality beef in the ASALs at relatively low cost. It can be finished on grass only compared to the grain finished beef thus less GHG production. It utilizes low digestible forage and high feed to weight gain conversion ratio.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoral and agro-pastoral beef producers
Approaches to be used in dissemination	Field days, extension publications (posters, brochures and leaflets) Breeder shows, Trade fairs, Exhibitions, ASK and County agricultural shows, exchange tours, farmer to farmer visits, Local FMs

Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • -Low numbers of the Breed • Stable beef/milk markets and large productive animals as well as • -Availability of adequate feeds
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County Government – to support farmers in the uptake of the technology • NGOs – to support farmers in the uptake of the technology • Pastoral groups –to form training platform • Kenya Livestock Marketing Council– Build farmer capacity to access the breed • KMC and red meat processors – provide market for the product • ENDA and TARDA for breed multiplication
C: Current situation and future scaling up	
Counties where already promoted	-In Laikipia County ranches, Kisumu, Nakuru in KALRO Lanet
Counties where TIMP will be upscaled	Lamu, Taita Taveta, Wajir, Isiolo
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate extension services • Inadequate animal breeding knowledge • Pastoral breeding goals that emphasise numbers vs productivity • Low numbers of the breed • Poor marketing infrastructure • Poor quality feeds in the ASALs
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Breed multiplication • creation of a beef value chain platform and capacity build of the beef value chain actors, • - Improve feed quality and have strategic feed reserves
Lessons learned	<ul style="list-style-type: none"> - The breed has reduced incidence of mastitis due to the improved udder setting - The breed is hardier than the pure Sahiwal
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Some pastoral communities only prefer Sahiwal and effort to create awareness of the cross may be needed • Development of disease-free zones can widen the market • Need for strategic feed reserves and seed systems in the ASALs • There is need to improve the market infrastructure, and make market intervention to promote sale on live weight basis and stabilize milk prices
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	A heifer cost Ksh 130,000
Estimated returns	<p>Sale price is Ksh130,000</p> <p>If produced under free range, the cost of production is Ksh 4,373</p> <p>Returns Ksh 125,627</p>
Gender issues and concerns in development,	<ul style="list-style-type: none"> • The cost of a bull is expensive thus need to ensure alternative technologies such Artificial Insemination

dissemination, adoption and scaling up	<ul style="list-style-type: none"> Deliberate effort to be taken to involve female headed household as breeding is done by men. /
Gender related opportunities	<ul style="list-style-type: none"> All gender especially youth can take up the technology and produce the bulls as a business
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> The relatively high cost of the technology may exclude adoption by VMGs
VMG related opportunities	VMGs can produce the bulls as a business.
E: Case studies/profiles of success stories	
Success stories	The breed is reported to produce 12 litres of milk from KALRO Lanet.
Application guidelines for users	<ul style="list-style-type: none"> Use an improved Boran dam/female and a Sahiwal bull or AI Serve the F1 with Sahiwal Bull or AI Feed in-calf heifer/cows well and after calving
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	1. Ready for up scaling
G: Contacts	
Contacts	Director KALRO Beef Research Institute, KALRO Lanet
Lead organization and scientists	KALRO, Mwangi P Githui.
Partner organizations	Boran Breeders Association, Sahiwal breeders Association, County Government, Universities (Egerton and Nairobi), Ranchers, Kenya Animal Genetic Resources Centre (KAGRC)

GAPS

- Inadequate number of the breed
- Lack of management packages
- Lack of finishing rations
- Low awareness of the breed and inadequate use of AI among pastoral and agro-pastoral producers
- Inadequate Artificial Insemination infrastructure (Technical staff and artificial insemination kits)
- Inadequate information on the performance (meat and milk) of the breed under ASAL conditions
- Evaluation of the steers on growth and meat quality under different feeding regimes

2.1.4 TIMP Name	Sahiwal
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> Lack of adapted dual (beef and milk) purpose breed for the arid and semi-arid areas (ASAL) Low milk yield Low growth rates

	<ul style="list-style-type: none"> • Low maturity weights • Low disease and heat tolerance • Poor quality beef
What is it? (TIMP description)	A dual-purpose (meat and milk) cattle breed. The breed is relatively tolerant to diseases, parasites, and high temperatures and utilizes poor quality feed. It has high maturity weight with males weighing 300 kg at 24 months and females 270 kg in 27 month and produces high-quality beef.
Justification	Sahiwal produce high quality beef and yields more milk than other Zebus in the ASALs at a relatively low cost. It can be finished on grass only compared to the grain finished beef thus less GHG production. It utilizes low digestible forage and has high feed conversion ratio (feed: weight gain).
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small- and large-scale farmers, Ranchers, Pastoral and agro-pastoral beef producers
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of adequate numbers of the breed seed • Stable beef/milk market • Availability of adequate feeds • Effective extension services to address animal health
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO – to continue improving on the technology • Ranchers and Pastoral groups – to adopt the breed for production of quality beef • County Government - create awareness of the breed and build farmers capacity for adoption • NGOs - build farmers capacity for adoptionTARDA and ENDA – to multiply the breed • Kenya Livestock Marketing Council - Link farmers to markets KAGRC- to provide semen
C: Current situation and future scaling up	
Counties where already promoted, if any	<ul style="list-style-type: none"> • Ranches in: Narok, Kajiado, Laikipia, Mandera
Counties where TIMP will be upscaled	Lamu, Taita Taveta
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate numbers of the breed • Inadequate extension services • High cost of the breed • Pastoral breeding goals that emphasise numbers as opposed to productivity • Poor markets and marketing infrastructure that discourage technology adoption
Suggestions for addressing the challenges	<p>Improve extension services</p> <p>Train pastoralists on livestock production as a business</p> <p>Multiply breeding material</p>
Lessons learned in upscaling, if any	<ul style="list-style-type: none"> • Breed is in high demand in East Africa • The production of the Sahiwal is highly profitable

Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • It is a socially acceptable breed among pastoralist in Need for strategic feed reserves and seed systems in the ASALs • Need for functional markets
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Sale price Ksh. 130,000
Estimated returns	Cost of production under free range Ksh 4,373.20 Estimated returns Ksh125,627
Gender issues and concerns in development, dissemination, adoption and scaling up	Deliberate efforts to build the capacity of women headed households as breeding in most communities is a male dominated activity
Gender related opportunities	All gender especially youth can take up the production of breeding bulls and heifers as a business
VMG issues and concerns in development, dissemination, adoption and scaling up	The capacity of the VMGs to access and utilize the technology should be enhanced
VMG related opportunities	VMG can produce the bulls and heifers as a business.
E: Case studies/profiles of success stories	
Success stories	It is the breed of choice for pastoralists in southern semi-arid areas and ranches. In Kajiado County, the Maasai call it ' <i>Rangi ya pesa</i> '
Application guidelines for users	<ul style="list-style-type: none"> • Use a Sahiwal bull or AI • Maintain the bull in good condition • Bull:cow ratio should be 1:40 depending on the environment
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	1. Ready for up scaling
G: Contacts	
Contacts	<ul style="list-style-type: none"> • Institute Director, KALRO, Dairy Research Institute • Centre Director, Beef Research Institute, Transmara Research Centre
Lead organization and scientists	KALRO; Ilatsia, Evans; . Pulei, Richard
Partner organizations	Sahiwal Breeders Association County Government, Universities (Egerton and Nairobi), KAGRC

GAPS

1. Narrow genetic base
2. Inadequate awareness of the breed among pastoral and agro-pastoral producers leading to relatively low adoption rates
3. Lack of adaptation studies under different pasture and watering regimes
4. Lack of beef finishing rations/systems
5. Evaluation of the breed contribution to greenhouse gas emission under different production systems

.1.5 TIMP Name	Orma Boran
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Trypanosomosis which is a challenge to beef production in the ASALs as well as Coastal and Lake region.
What is it? (TIMP description)	An indigenous dual-purpose breed that is fast growing (400 g/day) and has been found to be tolerant to trypanosomosis. Age at first calving (36-52 months) at 225-355 kg
Justification	High mortality due to trypanosomosis in tsetse infested areas is a set-back to most livestock keepers and affects livelihoods negatively. Trypanosomosis is controlled and treated using chemical formulation, whose effect on the environment is hazardous. The Orma Boran trypanotolerance trait can be used to minimize livestock loses and environmental pollution by the chemical formulations
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralist in Northern Kenya(Tana River) and Garissa county
Approaches to be used in dissemination	Field days, posters, Breeder shows, Trade Fairs, Exhibitions, ASK and County agricultural shows, Brochures and Leaflets agricultural shows, exchange tours, farmer to farmer visits, local FM stations
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Selection of the breed and its multiplication • Availability of the breed • Creation of awareness of the breed • Registration of the breed
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Ranchers – for breed multiplication • County Government – to support farmers in the uptake of the technology • NGOs – to support farmers in the uptake of the technology • Pastoral groups –to form training platform for ease of accessing the technology • Kenya Livestock Marketing Council– Build farmer capacity to access the breed
C: Current situation and future scaling up	
Counties where already promoted	Garissa, Tana River
Counties where TIMP will be promoted	Lamu, Tana River, Taita Taveta, Isiolo, Wajir
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate animal numbers • Inadequate awareness of benefits of the breed
Recommendations for addressing the challenges	<ul style="list-style-type: none"> • Multiply the breed • Register the breed to increase its value • Create awareness of the breed to increase adoption
Lessons learned	<ul style="list-style-type: none"> • There is inadequate knowledge on the breed • The breed growth rate is high

Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Some communities are have preference for a particular colour of the animal since they think it contributes to its value • Adequate numbers and semen of the breed • Strategic feed reserves and seed systems in the ASALs
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • All gender will be able to benefit. • The breed may enable women and women headed household to keep livestock because of low disease incidence and maintenance costs • Need to plan for feed reserves to minimize movement of home herds that may disadvantage women , children and the youth who take care of the herds
Gender related opportunities	All gender can multiply the breed as a business besides sale of milk
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Need to have feed reserves to minimize movement of home herds that may disadvantage VMGs
VMG related opportunities	VMG can produce the bulls as well as beef cattle as a business besides sale of excess milk
E: Case studies/profiles of success stories	
Success stories	Tana River County pastoralists have kept the Orma Boran for many years with minimal trypanosomosis losses
Application guidelines for users	Obtain female Orma Boran and feed the animal well. Introduce a Orma Boran bull or use Orma Boran semen to inseminate
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	3. Requires further research
G: Contacts	
Contacts	Director, KALRO Beef Research Institute, Lanet
Lead organization and scientists	KALRO, Mwangi Githui
Partner organizations	Egerton University, Nairobi University

GAPS

1. Inadequate knowledge on mode of tolerance and potential opportunities for scientific manipulations
2. Inadequate numbers of the breed
3. Limited numbers to allow effective selection for traits of interest (beef or dual purpose)
4. Lack of breed descriptors and registration
5. Need to determine breed productivity
6. The greenhouse gas production of the breed using different feeds and in different ecological zones

2.1.6 TIMP name	Small East African Zebu (SEAZ)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> - The disease and pest challenge in the ASALs - Low quality and quantity of feed in agro-pastoral and pastoral areas - Inadequate water and long distances animals must walk to access feed and water - The high temperature and recurrent droughts characteristic of the ASAL
What is it? (TIMP description)	The SEAZ is a dual-purpose indigenous breed which though small, is hardy, disease and pest tolerant
Justification	Water and feed in the ASALs is scarce especially during dry seasons and drought periods. The SEAZ is a hardy breed that is disease, pest and drought tolerant.. The SEAZ can walk long distances to access water and feed. It tolerates high temperatures and water stress as it is watered twice in a week during drought periods and produces beef and milk under low quality natural pastures.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Agro-pastoralist and pastoralist
Approaches to be used in dissemination	Field days, extension publications (posters, brochures and leaflets) Breeder shows, Trade Fairs, Exhibitions, ASK and County agricultural shows, exchange tours, farmer to farmer visits, Local FM stations
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Selection of the breed and its multiplication • Availability of the breed • Registration of the breed
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Ranchers - for breed multiplication • Service providers (County extension staff, NGOs) - to support farmers in the uptake of the technology • Pastoral groups –to form training platform • Kenya Livestock Marketing Council– Build farmer capacity to access the breed
C: Current situation and future scaling up	
County where already promoted	Baringo, Lamu, Tana River, Taita Taveta, Baringo, Bomet, Elgeyo Marakwet, Kajiado, Laikipia, Machakos, Nyandarua, Nyeri, Tharaka Nithi, West Pokot, Garissa, Mandera, Wajir, Isiolo
Counties where TIMP will be upscaled	Baringo, Lamu, Tana River, Taita Taveta, Baringo, Bomet, Elgeyo Marakwet, Kajiado, Laikipia, Machakos, Nyandarua, Nyeri, Tharaka Nithi, West Pokot, Garissa, Mandera, Wajir, Isiolo
Challenges in dissemination	<ul style="list-style-type: none"> - Conflicting extension messages - Inadequate animal numbers - Poor perception of the breed

	<ul style="list-style-type: none"> - Small size of the breed - Low productivity of the breed - Lack of registration of the breed - Inadequate awareness of the advantages of breed
Suggestions for addressing the challenges	<ul style="list-style-type: none"> - Multiply the breed to get enough numbers to select from - Select the breed for high yield and size - Register the breed to increase its value - Create awareness of the breed to increase adoption - Develop feeding management practices for the breed
Lessons learned	<ul style="list-style-type: none"> - As it is currently, there breed is not appreciated - The breed has high genetic diversity which can be exploited faster with the current breeding techniques to produce high growing and yielding animals
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • SEAZ is socially acceptable in all communities • Select animals for size and productivity to increase adoption • Create awareness of the importance of the breed in the changing climate
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • SEAZ is the breed of choice for many communities due to its hardiness and any improvement should not compromise on the disease and heat tolerance qualities • Need to have strategic feed reserves that will ensure home herds have adequate feed to support women and children when the larger herds migrate
Gender related opportunities	<ul style="list-style-type: none"> - Different household members can keep it as a business
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> - Need to have feed reserves to minimize movement of home herds that would disadvantage VMGs - However, establishment of strategic feed reserves may make the production more efficient - The VMGs can easily manage the breed as it is hardy thus low production costs
VMG related opportunities	VMGs can produce the bulls as a business.
E: Case studies/profiles of success stories	
Success stories	Has sustained pastoralists and agropastoralists for millennia throughout the entire country.
Application guidelines for users	Select cows/females in good condition and mate them with good quality bulls Feed female F1s well and serve them with good quality SEAZ bulls, making sure that there is no inbreeding
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	3. Requires further research
G: Contacts	

Contacts	Director , KALRO ARLRI
Lead organization and scientists	KALRO, Katiku P. N.
Partner organizations	Egerton University, Nairobi University

GAPS

1. Inadequate knowledge on mode of tolerance and potential opportunities for selection
2. Inadequate numbers of the breed
3. Limited numbers to allow effective selection for traits of interest (beef or dual purpose)
4. Lack of breed descriptors and registration
5. Determination of the productivity of the breed
6. The greenhouse gas production of the breed using different feeds and in different ecological zones

2.2 Fodder

2.2.1 TIMP name	Forage Sorghum (E6518)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Inadequate high-quality feed. Low forage yields
What is it? (TIMP description)	It is a white mid rib (WBR) open pollinated sorghum variety (OPV) that is high yielding (17-26 t/ha dry matter) that is highly digestible.
Justification	Insufficient feed quantity and quality for beef production in the dry highlands, semi-arid and arid areas
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small- and large-scale beef and dairy producers
Approaches to be used in dissemination	ASK and County agricultural shows, Field days, Day visits, Demonstrations
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of quality seed • Stable beef and milk prices
Partners/stakeholders for scaling up	Small- scale and large - scale farmers, County Government, NGOs, CBOs
C: Current situation and future scaling up	
Counties where already promoted	Laikipia, Bomet, Busia
Counties where the TIMP will be promoted	Bomet, Tana River, Lamu, Wajir, Taita Taveta
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate extension services, • Lack of awareness • Inadequate clean seed • Bird damage
Suggestions for addressing the challenges	Develop technology to reduce bird scaring labour Multiply clean seed Create awareness

Lessons learned in upscaling, if any	<ul style="list-style-type: none"> • Provides high biomass and good for silage making • Create awareness of the technology • Need to multiply seed • Higher quality than maize forage • Highly digestible hence low emission of GHG
Social, environmental, policy and market conditions necessary	Need for attitude change on use of sorghum and sensitization on the qualities of forage sorghum as feed
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	KSh. 28,500 (Seed cost per acre 7 kg @350, fertilizer, labour for planting, weeding and bird scaring harvesting)
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Women overworked due to drudgery associated with manual planting and seed harvesting • Bird damage requires bird scaring largely done by children and women • Develop technology to reduce bird scaring labour to create time for women to do other activities and children to go to school • Mechanization of planting and harvesting would eliminate the drudgery associated with planting and harvesting and make the technology attractive to youth
Gender related opportunities	All gender can produce the forage to improve beef and milk production
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • The manual activities associated with production and harvesting may limit access to the VMG • Mechanize planting, weeding and harvesting to eliminate the associated drudgery and make the technology attractive to youth and accessible VMGs
VMG related opportunities	VMGs can produce the forage for increasing beef and milk production
E: Case studies/profiles of success stories	
Success stories	High demand of the seeds by small scale dairy farmers in western Kenya and the dry highlands in Kabarak and Bomet
Application guidelines for users	<p>Use good quality seed and:</p> <ul style="list-style-type: none"> - Plant 6-8 kg/ha at a spacing of 75 by 10 cm for forage and 60 by 20 cm for grain and forage in the dry highlands - Plant with DAP at a rate of 50 kg/ha. Thin at three weeks to attain the right spacing and density - Top dress with CAN in two splits at a rate of 50 kg/ha The first CAN application should be applied after thinning while the other should be applied at tasseling - Feed sorghum to livestock as wilted green chop, silage and grain. - When making silage, harvest at milk-dough stage
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires	2. Requires validation in the arid and semi-arid (ASAL) areas.

validation; 3) Requires further research)	
G: Contacts	
Contacts	Director, KALRO Beef Research Institute Lanet
Lead organization and scientists	KALRO, Fatuma Fora
Partner organizations	ICRISAT, Universities (University of Nairobi, Egerton)

GAPS

1. Inadequate seed
2. Lack of validation in the semi-arid areas, coastal semi-arid areas and oasis in the arid areas
3. Inadequate awareness of the technology
4. Lack of mechanization technology for farm operations
5. Lack of technologies for processing to increase utilization (e.g. removal of tannins)

2.2.2. TIMP Name	Dual purpose sorghums (Ikinyaruka; E1291, BJ28, BM30, Lanet1)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Inadequate quantity and quality feed, low forage yields and disease challenge in Napier grass the conventional forage
What is it? (TIMP description)	Open pollinated varieties (OPV) that are dual purpose that gives high grain (5-7t/ha) yield and high (14-18 t/ha) forage dry matter in the dry highlands as well as in the coastal Lowland zone V. In the dry highlands, ratoon crop can be harvested for up-to 5 years. The sorghums are highly digestible and hence low emission of GHG
Justification	- Inadequate feed quantity and quality for both dairy and beef production systems -Need for high yielding forages for increased milk and beef productivity
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small and large scale farms, ranches, pastoral and agro-pastoral beef producers
Approaches to be used in dissemination	ASK and County agricultural shows, Field days, Day visits, Demonstration
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Stable beef and milk prices • Availability of good quality seed
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County Government to create awareness and build farmers capacity to adopt the technology • NGOs to create awareness and facilitate farmers capacity to access and adopt the technology • CBOs to organize farmers to adopt the technology and produce large quantities for their use and sale
C: Current situation and future scaling up	

Counties where already promoted, if any	Laikipia, Bomet, Busia
Counties where the TIMP will be promoted	Lamu, Tana River, Taita Taveta, Wajir, Isiolo
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate extension services • Limited awareness of the technology • Inadequate clean seed
Recommendations for addressing the challenges	<ul style="list-style-type: none"> • Improve extension services by employing staff and provide adequate resources • Create awareness of the technology • Multiply seed
Lessons learned	<ul style="list-style-type: none"> • Provides high biomass that is good for silage • Silage quality is better than that of maize • Highly digestible hence low GHG emission
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Attitude change on use of sorghum for livestock feeding • Need for sensitization on sorghum as feed • Adapt/develop technologies for processing sorghum to increase its utility in the feed industry
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ksh 28,500 per acre (Seed cost per acre 7 kg @ Ksh 350, fertilizer, labour for planting, weeding and bird scaring harvesting)
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Most production activities (planting, bird scaring, harvesting) are done by women and children • Develop technology to reduce bird scaring labour to release women and children for other activities • Mechanize planting and harvesting to reduce women and children labour requirement and make the technology attractive to youth.
Gender related opportunities	All gender can grow sorghum to improve beef and milk production
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> - Most production activities are carried out manually - Develop technology to reduce bird scaring labour to reduce women and children drudgery - Mechanization of planting and harvesting would the technology accessible to the VMG
VMG related opportunities	VMG can produce sorghum for increasing beef and milk production which can have an impact on their nutrition and health
E: Case studies/profiles of success stories	
Success stories	Adopted by mall scale farmers in western Kenya and the dry highlands in Kabarak and Bomet
Application guidelines for users	<ul style="list-style-type: none"> • Use quality seed • Plant 6-8 kg/ha at a spacing of 75 by 10 cm for forage and 60 by 20 cm for grain and forage in the dry highlands. Plant with DAP at a rate of 50 kg/ha. Thin at three weeks to attain the right spacing and density

	<ul style="list-style-type: none"> • Top dress with CAN in two splits at a rate of 50 kg/ha. The first CAN application should be applied after thinning while the other should be applied at tasseling • You can feed sorghum to livestock as wilted green chop, silage and grain • When making silage, harvest at milky dough stage
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	2. Requires validation in the arid and semi arid areas
G: Contacts	
Contacts	Director KALRO KALRO Beef Research Institute, Lanet
Lead organization and scientists	KALRO, Fatuma Fora
Partner organizations	ICRISAT, University of Nairobi

GAPS

1. Inadequate clean seed
2. Lack of validation in the semi-arid areas, coastal semi-arid areas and oasis in the arid areas
3. Low awareness of the technology
4. Lack of Mechanization technology for farm operations
5. Lack of technologies for processing to increase utilization (e.g. removal of tannins)

2.2.3 TIMP Name	<i>Chloris Gayana</i> var X-tozi and Lanet
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low forage yields and poor-quality feeds for livestock
What is it? (TIMP description)	<ul style="list-style-type: none"> • Lanet Rhodes is a perennial stoloniferous grass adapted to dry highlands and semi-arid areas, it is high yielding (500-600 bales/ha) and drought tolerant • X-tozi is a leafy perennial and grows to a height of between 30-150cm, it is adapted to the semi-arid areas and coastal lowlands. It is high yielding (833 bales/ha)
Justification	Feed quantity and quality in semi-arid and arid areas limits livestock production. The ASALs are degraded and are characterized by low producing annual forages. Grazing land in beef producing areas has been reducing necessitating intensification of forage production.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small- and large- scale ranchers, pastoral and agro-pastoral beef producers
Approaches to be used in dissemination	ASK and County agricultural shows, Field days, Day visits, Demonstrations, posters and leaflets
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> - Availability of quality seeds - Stable beef and milk prices

	- Functional fodder value chain for hay marketing
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County Governments - create awareness of the technology • NGOs - create awareness and facilitate access to the technology and link farmers to markets • Small scale livestock producers - adopt the technologies • Seed companies - produce and market seeds • Kenya Plant Health Inspectorate Service (KEPHIS)- for seed certification and variety release
C: Current situation and future scaling	
Counties where already promoted	Laikipia, Bomet, Kajiado, Narok, Makeni, Machakos
Counties where TIMP will be upscaled	Lamu, Taita Taveta, Wajir, Isiolo
Challenges in dissemination	<ul style="list-style-type: none"> • Both species are yet to be certified and registered thereby inadequate seed availability and illegal informal marketing • Inadequate extension services • Inadequate awareness
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Carry out National Performance Trials (NPT) and Distinct Uniform and Stability (DUS) and multiply the seed to increase availability • Improve extension services • Create awareness of the varieties to go hand in hand with efforts to avail seed.
Lessons learned	<ul style="list-style-type: none"> • Most pastoralists and agro pastoralists are not aware of the technology • There is inadequate technical capacity in the country of pasture breeders for continued technology improvement
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Most pastoralists and agro pastoralists are unaware that the grasses can be planted • Need for review of seed policy to allow exchange of seeds among farmers • Fodder value chain is undeveloped thus no platforms for coordinating the production and marketing channel necessary to spur adoption
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Planting and harvesting of forage and seed is manual which is a drudgery and discourages the youth adopting the technology • The manual production activities require mechanization to reduce labour for women who have multiple household rolesDevelop the fodder value chain with platforms to address lack of formal marketing channels for seed and forage
Gender related opportunities	All gender can produce seed and hay to improve beef and milk production for own livestock and for sale

VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Initial costs of establishment are high due to the mode of labour used which would be a challenge for VMG • Planting and harvesting of forage and seed is manual and may limit adoption by VMG • No formal marketing channels and this may discourage VMG from adopting the technology • The mechanization of production and harvesting will reduce drudgery and enable VMG to adopt the technology
VMG related opportunities	VMG due to their limited financial capability, if supported with resources to hire labour for development and planting can establish a business of selling the grass
E: Case studies/profiles of success stories	
Success stories	Farmers in Kwale have taken up X-tozi production as a business; Laikipia County Government buys large quantities of Lanet Rhodes to distribute to farmers; KALRO Lanet produces hay for sale to farmers
Application guidelines for users	<ul style="list-style-type: none"> • Plant at a seed rate of 5 kg/ha in shallow furrows 50 cm apart by drilling. Cover seeds lightly with soil Seed Feed fresh or cut, wilt and bale or make silage
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	3. Requires further research - NPT and DUS studies
G: Contacts	
Contacts	Director, KALRO KALRO Beef Research Institute, Lanet Centre Director, KALRO Mariakani
Lead organization and scientists	KALRO, Ondabu, Naftali
Partner organizations	County Governments, Ranches CBOs, University of Nairobi, Kenya Plant Health Inspectorate Service (KEPHIS)

GAPS

1. The varieties are yet to be certified and released by KEPHIS (need NPT and DUS)
2. Inadequate seed quantities
3. The technology need to be validated in the arid and semi-arid areas
4. Inadequate awareness of the technology in agropastoral and pastoral areas
5. Lack of mechanization technology for farm operations

2.2.4 TIMP Name	Lanet Brachiaria Varieties (<i>B. brizatha</i> var. Busia; <i>B. brizatha</i> Var. Bungoma ; <i>B. brizatha</i> var. Lanet)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> - Low forage yield and low feed quality - Failure of imported Brachiaria varieties to produce viable seeds in most parts of the country

What is it? (TIMP description)	Tufted perennial Brachiaria varieties which are high yielding (up-to 30 ton/ha), disease and drought tolerant and produce viable seeds for propagation. They have high (12%) crude protein levels
Justification	Feed quantity and quality for beef production in semi-arid and arid areas is a challenge due to reduction of grazing land and low feed production dry season
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small and large scale farmers, ranchers, pastoral and agro-pastoral beef producers
Approaches used in dissemination	Not disseminated but ASK and County shows, Field days, Day visits, demonstrations can be used
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • The certification and release by KEPHIS of the varieties • Availability of quality seed • Stable beef and milk prices
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County Government - build capacity of producers to adoption of the technology • NGOs - build farmers capacity to increase adoption of the technology • CBOs - organize the production for marketing • Kenya Plant Health Inspectorate Service (KEPHIS)- for seed certification and variety release • Seed companies - produce and market the seeds
C: Current situation and future scaling up	
Counties where already promoted	Not promoted
Counties where TIMP will be upscalled	Lamu, Tana River, Taita Taveta, Baringo, Marakwet, Kajiado, Laikipia, Uasin Gishu, West Pokot, Garissa, Wajir
Challenges in dissemination	The varieties are yet to be released by KEPHIS hence there is no certified seeds and only a few farmers can access tillers
Recommendations for addressing the challenges	Fast track the NPT and DUS for Certification and registration of the varieties to allow for seed multiplication
Lessons learned	The high yielding Brachiaria species are in high demand. The release of the varieties will bring down the cost of imported Brachiaria grass technologies that is currently high (Ksh 5,500-8000 per kg)
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Review of seed policy to allow for exchange of seeds among farmers • A functional fodder value chain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	Planting and harvesting of forage and seed is manual discourages the youth and men; most of the activities are manual The manual production process should be mechanized to encourage participation of youth and men and relieve women of the associated drudgery

Gender related opportunities	Forage production can be commercialized by men, women and the youth for own livestock or for sale
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Planting and harvesting of forage and seed is manual which may limit access of the technology for VMG The production and harvesting processes may need to be mechanized to allow VMG to adopt the technology The initial high cost of production may require a start-up kit for VMG
VMG related opportunities	VMGs can produce seeds and hay for the market if the production and harvesting processes are mechanized
E: Case studies/profiles of success stories	
Success stories	KALRO Lanet is producing hay from the grasses and seeds for own use.
Application guidelines for users	<ul style="list-style-type: none"> Plant at a seed rate of 5 kg per ha in shallow furrows which are 50 cm apart by drilling, cover seeds lightly with soil Feed fresh-cut and bale or make silage
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	3. Require further research (NPT and DUS)
G: Contacts	
Contacts	Director, KALRO Beef Research Institute Lanet
Lead organization and scientists	KALRO; Ondabu, N.
Partner organizations	International Atomic Energy Agency, Austria, Embrapa Brazil, Ranches CBOs, University of Nairobi Kenya Plant Health Inspectorate Service (KEPHIS)

GAPS

1. The varieties are yet to be certified and released by KEPHIS (need NPT and DUS) –
2. Inadequate seed quantities
3. The technology need to be validated in the arid and semi-arid areas
4. Inadequate awareness of the technology in agropastoral and pastoral areas
5. Lack of mechanization technology for farm operations
6. Adaption on performance of different varieties of Brachiaria under rainfed and irrigations in ASALs

2.2.5 TIMP Name	Brachiaria Mutant Variety
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> Low forage yield and low feed quality Failure of imported Brachiaria varieties to produce viable seeds in most parts of the country Need for drought tolerant Brachiaria variety with wide adaptation

What is it? (TIMP description)	Tufted perennial variety which is high yielding (up-to 30 ton/ha), disease and drought tolerant and produce viable seeds for propagation. it has(12%) crude protein content
Justification	Feed quantity and quality for beef production in semi-arid and arid areas is a challenge due to degradation and reduction in grazing land. Need to reseed the degraded areas with high yielding forage varieties.-
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small and large scale, ranchers, pastoral and agro-pastoral beef producers
Approaches used in dissemination	Not disseminated
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • The certification and release by KEPHIS of the varieties • Availability of quality seed • Stable beef and milk prices • Mechanization of the production process
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • KALRO- research to have the variety released and continue improving the variety qualities • Small- and large-scale farmers - produce and market seed and hay • County Government - build capacity of producers to adoption of the technology • NGOs - build farmers capacity to increase adoption of the technology • CBOs - organize the production for marketing • Seed companies - produce and market the seeds Kenya Plant Health Inspectorate Service (KEPHIS)- for seed certification and variety release
C: Current situation and future scaling up	
Counties where already promoted	None
Counties where TIMP will be upscaled	Lamu, Tana River, Taita Taveta, Baringo, Marakwet, Kajiado, Laikipia, Uasin Gishu, West Pokot, Garissa, Mandera, Wajir
Challenges in dissemination	The varieties are yet to be released by KEPHIS hence there is no certified seeds and only a few farmers can access tillers
Recommendations for addressing the challenges	Fast track the NPT and DUS for Certification and registration of the varieties to allow for seed multiplication
Lessons learned	The high yielding Brachiaria species is in high demand. The release of the variety will bring down the cost of the Brachiaria grass technologies that is currently high (Ksh 5,500-6000 per kg)
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Review of seed policy exchange of seeds among farmers • Availability of the seed • - A functional fodder value chain
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done

Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Planting and harvesting of forage and seed is all manual that discourages the men and youth Planting, weeding and harvesting is done by women manually thus taking a lot of time. The manual production process may need mechanization to enable youth and men to adopt and relieve women of the associated drudgery
Gender related opportunities	Can be produced by household members to improve beef and milk production for own livestock and for sale
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> Planting and harvesting of forage and seed is manual which may limit access of the technology The production and harvesting processes may need to be mechanized to allow VMG to adopt the technology The initial high cost of production may require VMG to be given a start-up kit
VMG related opportunities	VMGs can produce seeds and hay for the market if the production and harvesting processes are mechanized
E: Case studies/profiles of success stories	
Success stories	KALRO Lanet is producing hay from the grasses and seeds for own use
Application guidelines for users	<ul style="list-style-type: none"> Plant at a seed rate of 5 kg per ha in shallow furrows 50 cm apart by drilling, cover seeds lightly with soil Feed fresh-cut and bale or make silage
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	3. Require further research (NPT and DUS)
G: Contacts	
Contacts	Director KALRO Beef Research Institute, KALRO Lanet
Lead organization and scientists	KALRO, Ann Indetie
Partner organizations	<ul style="list-style-type: none"> International Atomic Energy Agency, Austria, Embrapa Brazil, Ranches CBOs, University of Nairobi, Kenya Plant Health Inspectorate Service (KEPHIS)

GAPS

- The variety is yet to be certified and released by KEPHIS (need NPT and DUS)
- Inadequate seed
- Technology need to be validated in the arid and semi-arid areas
- Inadequate awareness of the technology in agropastoral and pastoral areas

2.2.6 Technology name	Clitoria (<i>Clitoria ternatea</i>)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Low feed quality

What is it? (TIMP description)	A perennial herbaceous forage legume with high protein content
Justification	<ul style="list-style-type: none"> - Feed in most agro-pastoral and pastoral have low protein Incorporating - Clitoria improves the feed quality
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small scale farmers
Approaches to be used in dissemination	ASK and County agricultural shows, Field days, farmer visits, Extension publications
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> - Availability of seeds - Farmers to have high productive animals
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Small- and large-scale farmers - produce and market seed and hay • County Government - build capacity of producers to adoption of the technology • NGOs - build farmers capacity to increase adoption of the technology • CBOs - organize the production for marketing Seed companies - produce and market the seeds
C: Current situation and future scaling up	
Counties where already promoted	Kilifi, Kwale, Lamu
Counties where TIMP will be upscaled	Baringo, Lamu, Tana River, Taita Taveta, Isiolo, Kajiado, Laikipia, Garissa, Wajir, Isiolo
Challenges in dissemination	<ul style="list-style-type: none"> • Expensive seeds • Inadequate seeds • limited land size for fodder production, preference given to food crops
Suggestions for addressing the challenges	<ul style="list-style-type: none"> - Multiply seed to increase availability and reduce costs - Train farmers on intercropping with food crops
Lessons learned	There is need for sensitization of farmers on benefits of legumes as livestock feed
Social, environmental, policy and market conditions necessary	<p>Clitoria has been accepted as a forage in the Counties where it has been introduced</p> <p>Harmonize seed regulation laws to allow for seed sharing between farmers</p>
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Ksh 500/kg of seed
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> - Planting and seed harvesting is manual and mostly done by women and discourages the youth from adopting it - Mechanization of the production process can reduce the drudgery especially for women who have multiple household roles
Gender related opportunities	All gender can produce seeds for the markets as well as feed for own livestock or for sale

VMG issues and concerns in development, dissemination, adoption and scaling up	-All the production process is manual in many areas and many need mechanization for VMG to access the technology
VMG related opportunities	Mechanization of the production process may increase adoption by VMGs who can produce the seed for the market as well as feed for own livestock or for sale
E: Case studies/profiles of success stories	
Success stories	Farmers have realized improved milk production in dairy cows supplemented with Clitoria in the coastal lowland
Application guidelines for users	Drill seeds at a rate of 10 -15 kg/ha and 2 cm depth at 50 cm between rows and cut the herbage at 50% flowering
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	1.Ready for upscaling
G: Contacts	
Contacts	Director, KALRO Agric Mechanization Research Institute Katumani Centre Director, KALRO Horticultural Research Institute, Matuga
Lead organization and scientists	KALRO Njarui, D., Njunie, M, Beattie Jones, R. K, Keating, B. A.
Partner organizations	Ministry of Agriculture, Livestock and Fisheries, CSIRO

Gaps

1. Inadequate seed
2. Inadequate awareness of the technology
3. Lack of mechanization of seed production and feed

2.2.7 TIMP Name	Tree Lucerne
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	- Low protein content in beef feed especially during the dry season
What is it? (TIMP description)	Tree Lucerne is an evergreen perennial legume shrub rich in crude protein (18-25%). It grows in warm attitudes and cold highlands (1500 – 2500 masl with 600 – 1600 mm annual rainfall
Justification	Quality feed is a major challenge for beef in all ecological zones. The feed challenge is more severe during the dry season when most forage species dry up. Tree Lucerne is evergreen and has high protein content that can improve feed quality during this dearth period
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Large- and small-scale beef producers

Critical/essential factors for successful promotion	Availability of adequate seed
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • Small- and large-scale farmers - produce and market seed and hay • County Government - build capacity of producers to adoption of the technology • NGOs - build farmers capacity to increase adoption of the technology • CBOs - organize the production for marketing Seed companies - produce and market the seeds
C: Current situation and future scaling up	
Counties where already promoted, if any	Nakuru, Bomet, Nyandarua
Counties where TIMP will be upscaled	Lamu, Taita Taveta, Laikipia, Isiolo
Challenges in dissemination	Seed availability
Suggestions for addressing the challenges	Multiply seed
Lessons learned in upscaling, if any	Tree Lucern provides an appropriate feed during the dry season
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Tree Lucerne is accepted as a forage in the Counties where it has been introduced • Harmonize seed regulation laws to allow for seed sharing between farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Cost of a seedling is Ksh 20
Estimated returns	Not done
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Management guidelines on the height of the tree to be maintained to allow for utilization by all gender • Development of simple measures to ensure the recommended inclusion amounts of the feed are used • Fodder provision for home herds is a women activity and need to target them during training • Land in most communities is controlled by men and need to involve men in sensitization to avoid conflict
Gender related opportunities	<ul style="list-style-type: none"> • The adoption of the technology saves time for women especially during the dry season since feed for calves will be readily available • Reduced cost of supplementation • Can be a business opportunity for all gender where dried feed can be packaged in the required amounts and sold as animal supplement
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • Development of simple measures to ensure the recommended amount are included in a feed ration • Recommendation of height management for all gender to benefit

VMG related opportunities	<ul style="list-style-type: none"> • Can be a business opportunity for VMGs where dried feed can be packaged in the required amounts
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Plant Tree Lucerne seeds at rate- about 100 g/ha or use seedling and plant at a spacing of 1 x 2 m. If using seeds, soak them in water for 24-48 hours before planting. Seeds can be planted directly or grown in a nursery and then transplanted to the field. It takes about 10-12 months to mature. Seeds and seedlings are available at Ksh 2000 per kg and Ksh. 20 each respectively. Recommended supplementation is at 15 to 30 % of the total animal feed, or about 500 tree shrubs /cow/year would be enough to provide this meal
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	1. Ready for up scaling
G: Contacts	
Contacts	Institute Director, Dairy Research Institute
Lead organization and scientists	KALRO Naphtali Kanegeni , KALRO Ol Joro Orok
Partner organizations	Universities (Egerton and Nairobi),

Gaps

1. Inadequate germplasms
2. Need for performance trials in ASALS under rainfed and irrigation.
3. Animal performance for animals fed tree lucern in milk production and growth performance under ASAL conditions

2.2.8 TIMP Name	Brachiaria spp and Dolichos (<i>Dolichos lablab</i>) and Desmodium feed blocks feed blocks
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> • Voluminous nature of conserved grass in the form of hay and associated cost of transport • Reduce deterioration of feed quality while on transit
What is it? (TIMP description)	Square feed block comprising of compressed dried Brachiaria grass and Dolichos (Lablab) or Desmodium stabilized block that is nutritious and easy to transport from feed surplus regions to feed deficit areas with ease.
Justification	Arid and semi arid areas experience high forage production during the rains and scarcity in the dry season. Feed is conserved in the form of hay that is voluminous and quite often deteriorates in quality due to the form of storage. Feed blocks

	provide an alternative form of feed conservation with low deterioration, requiring relatively small space and reduced transportation costs
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small scale and large scale farmers.
Approaches to be used in dissemination	ASK and County agricultural shows, Field days, farmer exchange visits, Publications
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Availability of Dolichos, Desmodium and Brachiaria forage • Availability of machinery for mixing, molding and drying the feed blocks,
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • NGOs to support farmers in the uptake of the technology • Pastoral groups –to form training platforms
C: Current situation and future scaling up	
Counties where already promoted	not yet promoted
Counties where TIMP will be upscaled	Lamu, Tana River, Isiolo, Wajir, Taita Taveta, Kajiado, Garissa, Marsabit
Challenges in dissemination	<ul style="list-style-type: none"> • Low production volumes • Lack of machines to produce en-mass • Inadequate feed materials to go commercial • Inadequate awareness of livestock producer
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Involve farmers and agro-pastoralists in production of the feed materials • Mechanize the production process • Produce the blocks in large quantities • Create awareness and capacity of the pastoralists and agro-pastoralist on the technology
Lessons learned	<ul style="list-style-type: none"> • The feeding of the block eases animal handling • The technology reduces wastage of stored feed and reduces transportation costs
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Feed blocks are not the conventional feed in beef production systems and some awareness creation may be required
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Production costs per block is about Ksh.120
Estimated returns	Sale price Ksh 180 - 250. Profit margin per block is Ksh 60 - 130
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • The production process of the block is laborious as it is manual which discourages the youth and makes it hard for women to adopt • Mechanization of the production process of the block may attract the youth and allow women benefit
Gender related opportunities	Can provide a business opportunity for all especially the youth if the production process of the feed block is mechanized
VMG issues and concerns in development,	<ul style="list-style-type: none"> • The manual process of the feed block production may make it difficult for VMGs to adopt Mechanization of the

dissemination, adoption and scaling up	production process of both the ingredients and the block will enable VMGs to adopt.
VMG related opportunities	Can provide a business opportunity for VMGs if mechanized
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<ul style="list-style-type: none"> • Dry the Brachiaria and Dolichos forage to about 10-15% moisture content. • Mill the Brachiaria and the Dolichos or Desmodium • Mix 2 kg of Brachiaria with a 0.25 kg of Dolichos or lablab, 2 tablespoons of salt, 3 tablespoons of bentonite two litres of molasses and one litre of water • Mold to the desired weight and dry under shade
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	3. Requires further research
G: Contacts	
Contacts	Director, KALRO Beef Research Institute, Lanet
Lead organization and scientists	KALRO Ann Indetie
Partner organizations	Egerton University, University of Nairobi

GAPS

1. Nutritional profile analysis and evaluation of effect on animal performance
2. Identification of an appropriate block making machine
3. Cost benefit analysis of feed block feeding
4. Dissemination and upscaling of the feed block technology
5. Capacity building on feed block technology

2.2.9 TIMP Name	Sweet Potato (Wagaborige)
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	Poor quality feed in agro pastoral and pastoral beef producing areas
What is it? (TIMP description)	A sweet potato variety that is high yielding (tuber - 7t/ha and forage - 24 t/ha) with high (16.5%) protein rich forage
Justification	Feed quantity and quality for beef production in highland, lowland semi-arid and arid areas is a challenge. Grasses, the main feed in natural pasture have low crude protein and hence need for supplementation with high crude protein to meet animal requirements especially during dry season
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small scale farmers and KALRO Centres

Approaches to be used in dissemination	ASK and County agricultural shows, Field days, farmer visits, extension publications
Critical/essential factors for successful promotion	Availability of sweet potato vines for planting
Partners/stakeholders for scaling up and their roles	County Governments - to create awareness of the technology Small- and large-scale farmers - to utilize the technology Pastoralist and agro-pastoralists - to utilize the technology
C: Current situation and future scaling up	
Counties where already promoted	Bomet, Narok, Nakuru
Counties where TIMP will be up-scaled	Baringo Lamu, Tana River, Taita Taveta, Elgeyo Marakwet, Kajiado, Isiolo, Laikipia, Machakos, , West Pokot, Garissa, Mandera, Wajir
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate awareness of livestock producers • Inadequate seed
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Multiply the vines • Create awareness and build capacity of the pastoralists and agro-pastoralists on the technology
Lessons learned	The use of potatoes vines has been reported to increase milk yield in dairy animals and weight gain in beef.
Social, environmental, policy and market conditions necessary	Sweet potatoes are socially acceptable in most communities Change of seed policy to allow for seed sharing between farmers
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • It may be laborious without mechanization thus discouraging the youth • Mechanization of the production process may attract the youth • Will reduce the amount of time women spend in looking for calf feed
Gender related opportunities	Can provide a business opportunity for all gender if mechanized
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • It may be laborious without mechanization thus discouraging to the VMGs • Mechanization of the production process may enable the VMGsto adopt
VMG related opportunities	Can provide a business opportunity for VMGs if mechanized to produce, the seed and feed for the market or for own livestock
E: Case studies/profiles of success stories	
Success stories	Dissemination been on
Application guidelines for users	Plant cutting 40 cm long at 30-90 cm, cut at 6-8 week and feed about 15 kg per animal per day as a supplement
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires	1. Ready for up-scaling

validation; 3) Requires further research)	
G: Contacts	
Contacts	Director , KALRO Beef Research Institute, Lanet
Lead organization and scientists	KALRO Ondabu, Naftali.
Partner organizations	Egerton University, University of Nairobi

GAPS

1. Inadequate germplasms
2. Need for performance trials in ASALS under rainfed and irrigation
3. Evaluation of animal performance in weight gain, milk production and calf performance under ASALS

2.3 Management

2.3.1 TIMP Name	Use of heart girth band to estimate Boran liveweight
Category (i.e. technology, innovation or management practice)	Innovation
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> • High cost of purchase and maintenance of weigh bridges • Lack of an easy method for animal growth monitoring on-farm and in the market
What is it? (TIMP description)	Estimation of the body liveweight of Boran using the Bos Taurus weigh-band
Justification	Farmers often manage beef cattle without using liveweight which is crucial for drug administration, growth monitoring and marketing. Weighbridge is costly to buy and maintain and hence the need for a cost effective and method
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Small- and large-scale farmers, ranchers, pastoral and agro-pastoral beef producers
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Policy intervention on beef marketing on body liveweight basis • Development of appropriate livestock market infrastructure
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County extension officers – to create awareness on the utilization of the band • NGOs - support farmers in the uptake of the technology • Pastoral groups - form training platforms
C: Current situation and future scaling up	
Counties where already promoted, if any	Not upscaled
Counties where TIMP will be upscaled	Kajiado, Laikipia, Taita Taveta, Isiolo, Wajir
Challenges in dissemination	<ul style="list-style-type: none"> • The existing mode of marketing beef that resist weighing of the animals

	<ul style="list-style-type: none"> • Lack of a policy to enforce the use of body liveweight for beef marketing • Lack of appropriate market infrastructure
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Enact a policy to ensure beef is sold based on liveweight • Sensitize beef producers on the importance of selling their animals using the body liveweight • Develop appropriate market infrastructure
Lessons learned in upscaling, if any	Not upscaled
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Policy for sale of beef cattle using liveweight • Functional beef markets • Availability of appropriate market infrastructure
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not estimated
Estimated returns	Not done
Gender issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • Low literacy levels among pastoral beef producers may limit use of the technology • Sale of beef cattle is a man's activity and need to deliberately involve them during training • Need to factor the supporting infrastructure for restraining animals in the markets • Women may be disadvantaged as it requires restraining of the animals
Gender related opportunities	The technology will make it easy for women, men and youth to sell beef cattle through the estimated weights
VMG issues and concerns in development, dissemination, adoption and scaling up	<ul style="list-style-type: none"> • It will make it easy for VMG to sell as the process will be straight forward • VMG may be disadvantaged as it requires some restraining of the animals
VMG related opportunities	The band will make it possible for VMG to sell livestock without being exploited
E: Case studies/profiles of success stories	
Success stories	None
Application guidelines for users	Measure the heart girth circumference and read the measurement and equivalent conversion of the liveweight
F: Status of TIMP readiness (1. Ready for upscaling; 2.; 3) Requires further research)	1. Requires validation Ready for up scaling
G: Contacts	
Contacts	Institute Director, KALRO Beef Research Institute
Lead organization and scientists	KALRO, Indetie Douglas
Partner organizations	Universities (Nairobi and Egerton)

Gaps

1. Produce/manufacture girth liveweight estimation band for *Bos Indicus*
2. Validate the use of the girth liveweight estimation band for *Bos indicus*

2.3.2 TIMP Name	50:50 Milking and Suckling Regime in Beef Cattle
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> - High calf mortality due to starvation arising from competition for milk between the calf and household food security - Slow growth rates of calves due to under feeding - Household conflicts between the men who are responsible for the calves and women who control the use of milk
What is it? (TIMP description)	Half of the udder of a lactating cow is milked while the other half is suckled by the calf for increased calf survival. Calves raised using this regime have low weaning weights but are finished at the same age as those raised on 100% suckling of the dam
Justification	Calves in the pastoral and agropastoral production system is high partly reportedly have slow growth rates and high mortality partly due to underfeeding. Calves are fed by suckling but which is only allowed after the cows have been milked and enough milk for the family and market has been obtained. Often, the calves hardly get enough.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoral and agro-pastoral beef producers
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Institutionalization of beef production as a business to create incentives for quality beef
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County extension officers – to create awareness on the technology • NGOs - support farmers in the uptake of the technolog • Pastoral groups - form training platforms
C: Current situation and future scaling up	
Counties where already promoted, if any	Not upscaled
Counties where TIMP will be upscaled	Laikipia, Isiolo, Lamu, Kajiado, Wajir, Wajir, Taita Taveta
Challenges in dissemination	Households which depend on all the milk for food may not be keen to adopt
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Sensitization on appropriate calve feeding for successful beef production • Sensitization on availability of milk replacers to maintain the calves
Lessons learned in upscaling, if any	<ul style="list-style-type: none"> • Not upscaled
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Functional market for milk • Adequate feed for the dams to allow for milking
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	

Basic costs	<ul style="list-style-type: none"> • 10,000 for purchase of milking jars
Estimated returns	<ul style="list-style-type: none"> • Milk production per cow – 2 litres sold @60 ; Ksh. 120 per cow per day
Gender issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Training of women who milk on the technology • Sensitization of men who own the calves on the advantages of the technology • Target both men and women as men own the calves while women milk and control the use of milk
Gender related opportunities	<ul style="list-style-type: none"> • Improved food security because animals which were not milked will be milked with minimal effect on the calf • Increase income from the sale of milk and quality beef • Improved calf welfare and eventually, improved beef productivity
VMG issues and concerns in development and dissemination	<ul style="list-style-type: none"> • Training of women who milk on the technology • Sensitization of men who own the calves on the advantages of the technology
VMG issues and concerns in adoption and scaling up	<ul style="list-style-type: none"> • Target both men and women as men own the calves while women milk and control the use of milk
VMG related opportunities	<ul style="list-style-type: none"> • Improved food security because animals which were hitherto were not milked will be milked with minimal effect on the calf • Increased income from the sale of milk and quality beef • Improved calf welfare and eventually, improved beef productivity
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	<ul style="list-style-type: none"> • Use aluminium milking jars to milk two teats and leave the other two teats for the calf • Observe milk hygiene and often test the milk for mastitis
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	1. Ready for upscaling
G: Contacts	
Contacts	Institute Director KALRO Dairy Research Institute
Lead organization and scientists	KALRO Ouda , Jack
Partner organizations	Universities (Egerton and Nairobi)

Gaps

Packaging and dissemination of the technology

2.3.3 TIMP Name	Integrating beef in Wildlife conservancies
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Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> • Reduction in grazing land due to conservancy establishment • Optimizing productivity from the rangelands by integrating beef and wildlife utilization • Conflict between pastoral beef producers and wildlife
What is it? (TIMP description)	<ul style="list-style-type: none"> • Pastoralists set a part of their grazing land for wildlife conservation. The land is zoned into core conservation and buffer areas. Livestock are not allowed in the core conservation area but are grazed in the buffer area during the dry season • The core conservation areas is used for tourism and ecotourism as a form of wildlife utilization to generate income for the community • Appropriate range management practices that include reseeding, bush management and optimal stocking rates are implemented <p>Beef finishing and organized marketing for the beef is done</p>
Justification	Most of the wildlife in Kenya is outside the game parks in pastoral areas. Pastoralists have for a long time not been benefiting from the wildlife and thus consider it as a menace because of perceived competition for forage with livestock. The technology of Community wildlife Conservancy is seen as a win/win scenario for both wildlife conservation and pastoral livelihoods due to increased income from both wildlife and livestock
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	Pastoralist and agro-pastoralists, ranchers, Kenya Wildlife services, Conservation NGOs and Entrepreneurs
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Appropriate land size of about 6000 ha or 60km² • Willingness of the community to set up the conservancy • A willing entrepreneur to set up tourism and ecotourism facilities • Strategies for conflict resolution arising from the effects of wildlife on beef production (eg. Predation) • Support by the County governments
Partners/stakeholders for scaling up and their roles	KWS, Conservation NGOs, Communities, Entrepreneurs County governments
C: Current situation and future scaling up	
Counties where already promoted, if any	Kajiado, Samburu, Laikipia, Narok, Kwale, Taita Taveta, Garissa
Counties where TIMP will be upscaled	Kajiado, Laikipia, Narok, Taita Taveta, Garissa
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate community knowledge on the technology • Inadequate community technical capacity and capital to establish the conservancies

	<ul style="list-style-type: none"> Stringent conditions in lopsided agreements against beef producers when conservancies are set up by entrepreneurs
Suggestions for addressing the challenges	<ul style="list-style-type: none"> Sensitize communities on the technology and its benefits Develop models to build community capacity to establish and manage communities Assist communities in making win/win agreements when entrepreneurs are the ones that establish the conservancies
Lessons learned in upscaling, if any	<ul style="list-style-type: none"> Community Wildlife Conservancies (CWC) or Sanctuaries provide a win/win scenario for wildlife conservation and beef production if well-structured and managed The Conservancies lead to optimal utilization of the rangelands as well as improve household incomes and livelihoods
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> Support from the community and the County County land use policy that support the establishment of Conservancies
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Variable depending on the type of tourism facilities to be established
Estimated returns	Variable but returns of up to Ksh. 5,000,000 to communities have been reported
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> Land is owned by men and often, women and the youth are left out thus need for a model that includes all gender
Gender related opportunities	<ul style="list-style-type: none"> Integrating beef in Wildlife conservancies create employment and income generation opportunities Integrating beef in Wildlife conservancies establishment leads to establishment of other enterprises e.g curio shops, market for food crops and beef; these businesses provide opportunities for men, women and the youth
VMG issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> VMGs are often left out in development affairs thus need for deliberate effort to involve them in sensitization as well as through the entire process
VMG related opportunities	Integrating beef in Wildlife conservancies can provide employment opportunities for VMG
E: Case studies/profiles of success stories	
Success stories	There are over 160 conservancies spread across different countries that include Samburu, Laikipia, Narok, and Kajiado that generate revenue from both wildlife and beef production
Application guidelines for users	Sensitize pastoral communities in areas with wildlife on the benefits of integrating beef in wildlife Conservancies. Link them with interested partners who can invest in establishment of a Wildlife conservancy. Let the communities set a part of land for the establishment of the wildlife conservancy.

	Assist the communities to enter in to win/win agreements with the partners that allow for beef production in the buffer area.
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	1. Ready for up scaling
G: Contacts	
Contacts	Institute Director, KALRO Dairy Research Institute
Lead organization and scientists	KALRO Muthiani E.N
Partner organizations	Universities (Moi and Nairobi), Kenya Wildlife Service, Conservation NGOs, County Governments

GAPs

1. Impact studies on Integrating beef and wildlife on the ecosystem
2. Performance of beef animals reared in this system *visa vis* the pastoral system
3. Evaluation of the economics of the model

2.3.4 TIMP Name	Beef marketing
Category (i.e. technology, innovation or management practice)	Management practice
A: Description of the technology, innovation or management practice	
Problem addressed	Mismatch between the beef produced and the market demands
What is it? (TIMP description)	The National market for livestock demands a well finished beef after 2½ years and weighing more than 350 kg. All animals should be free from notifiable diseases, no bruises and blemishes and not fed with growth hormones or animal products.
Justification	Beef production in Kenya is done in the arid and semi- arid areas by pastoralists and agro pastoralists, mostly at subsistence level and without a target market. The beef market is stratified into different segments all of which have different requirements. Lack of market-oriented focus in beef production makes it impossible for majority of producers to access certain markets. Knowledge of the different market requirements by the producers may enable market-oriented production with impact on the profitability hence livelihoods.
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	All the beef value chain actors
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Defining the requirement of each market segment • Enforce the policy on GAP for beef production
Partners/stakeholders for scaling up and their roles	All beef value chain Actors to develop a functional beef value chain to increase efficiency
C: Current situation and future scaling up	
Counties where already promoted, if any	Kajiado, Laikipia
Counties where TIMP will be upscaled	Lamu, Taita Taveta, Wajir, Isiolo, Laikipia, Kajiado

Challenges in dissemination	<ul style="list-style-type: none"> • Beef market cartels that may resist change • Breeding goals of keepers that not in line with market demands and requirements • Lack of producer associations to benefit from economies of scale and increase bargaining power
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Formation of value chain platforms to address issues of cartels • Orienting keepers breeding objectives and management towards market requirements • Form beef producer associations • Explore contract beef production
Lessons learned in upscaling, if any	Not upscaled
Social, environmental, policy and market conditions necessary	<ul style="list-style-type: none"> • Availability of functional markets to act as an incentive to producers • Favourable beef marketing policies to spur the growth of the value chain • Strong beef consumer organization to help develop standards and ensure their adherence.
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not estimated
Gender issues and concerns in development, dissemination adoption and scaling up	Men, women and the youth should be involved in sensitization because it make it easy for each gender to sell beef as opposed to earlier model where men were the main players in beef marketing
Gender related opportunities	Beef marketing is appropriate as a business for men, women and the youth
Gender issues and concerns in development, dissemination adoption and scaling up	<ul style="list-style-type: none"> • VMGs should be involved in the development and dissemination • The technology makes it possible for VMG to participate in beef marketing
VMG related opportunities	VMGs can take beef marketing as a business
E: Case studies/profiles of success stories	
Success stories	Kajiado County who were once producing for KMC
Application guidelines for users	<ul style="list-style-type: none"> • Identify the target market • Establish the requirements of the target market • Align production objectives to market demands and specification
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3) Requires further research)	1. Ready for up scaling
G: Contacts	

Contacts	Institute Director, KALRO Arid and Range Lands Research Institute
Lead organization and scientists	KALRO Manyeki, J.K
Partner organizations	Universities (Nairobi), Kenya Livestock Marketing Council, Counties,

Gaps

1. Limited knowledge of producers on market demands and requirements
2. Weak policy on marketing livestock
3. Development and promotion of beef marketing systems
4. Determination of cost benefit analysis of different beef marketing systems

2.3.5 TIMP Name	Silvo-pastoral system
Category (i.e. technology, innovation or management practice)	Technology
A: Description of the technology, innovation or management practice	
Problem addressed	<ul style="list-style-type: none"> • High temperatures that lower feed intake and suppress .animal comfort zone • Land degradation • Soil erosion • Maximizing on land productivity.
What is it? (TIMP description)	Silvo-pastoral systems are land use practices which involve the deliberate combination of trees and animals on the same land management unit in some form of spatial arrangement or temporal sequence such that there are significant ecological and economic interactions between tree and livestock components
Justification	Climate change is associated with increasing temperatures and increased draught frequency in some agroecological zones. Integrating trees and forage will increase range productivity besides providing natural shade to animals while feeding during the day. Silvopastoral systems increases carbon sequestration
B: Assessment of dissemination and scaling up/out approaches	
Users of TIMP	All beef producers
Critical/essential factors for successful promotion	<ul style="list-style-type: none"> • Sensitization of the Land tenure system- possible in individual or group ranches. • Water is critical for this system. Can best perform along riverines
Partners/stakeholders for scaling up and their roles	<ul style="list-style-type: none"> • County government -to sensitize communities on the importance of silvopastoral systems • Kenya forest service – to provide planting materials • KEFRI and ICRAF – Research on appropriate tree species for different ecological zones
C: Current situation and future scaling up	
Counties where already promoted, if any	Kilifi County

Counties where TIMP will be upscaled	Garissa, Isiolo, Kilifi, Tana river, Lamu, Wajir
Challenges in dissemination	<ul style="list-style-type: none"> • Inadequate seedling of the appropriate tree species • Land tenure • Inadequate awareness
Suggestions for addressing the challenges	<ul style="list-style-type: none"> • Create awareness • Identify adapted multipurpose trees for the system • Sensitize communities and develop an incentive to hasten adoption
Lessons learned in upscaling, if any	Not upscaled
Social, environmental, policy and market conditions necessary	Individual land ownership
D: Economic, gender, vulnerable and marginalized groups (VMGs) considerations	
Basic costs	Not done
Estimated returns	Not done
Gender issues and concerns in development, dissemination adoption and scaling up	Trees usually belong to men and grass to women, need for proper training to avoid conflicts
Gender related opportunities	May lead to time saving for women and girls due to easy access to feed and firewood
Gender issues and concerns in development, dissemination adoption and scaling up	Technology may benefit VMGs as it will make feed available for a longer period
VMG related opportunities	May ease access to feed and firewood for VMGs besides the opportunity of planting trees as a business.
E: Case studies/profiles of success stories	
Success stories	
Application guidelines for users	Identify the desired multipurpose tree adapted to the area. Plant the trees using the recommended guidelines. For expansive grazing areas, spacing between rows should be between 50-100 meters
F: Status of TIMP readiness (1. Ready for upscaling; 2. Requires validation; 3)	1. Requires further research
G: Contacts	
Contacts	KALRO Director, Beef Research Institute
Lead organization and scientists	KALRO Muthiani E.N
Partner organizations	KEFRI, ICRAF, Moi University

GAPs

1. Appropriate multipurpose trees for silvopastoral systems in arid and semi-arid areas
2. Evaluation of livestock performance under silvopastoral systems

3. Effect of range productivity of silvopastoral system in arid and semi-arid areas.