

Title: Establishment of multi-institutional model for the delivery of livestock technology needs in arid and semi-arid areas of Kenya

Abstract

This study was carried out in Isiolo and Kajiado counties. Livestock production and marketing have been hampered by the unavailability and accessibility to livestock technologies, and information sharing. The overall objective of this study was to assess a multi-institutional model for enhancing the uptake of livestock technologies in Isiolo and Kajiado counties. The key parameters assessed were priority livestock constraints; technology needs; stakeholder partnerships; and technology delivery platform. The data were collected from 451 households belonging to Kenya Climate Smart Agricultural Production KCSAP groups red meat value chain of pastoralists, Common Interest Groups and Most Vulnerable Groups (CIGs and VMGs) using semi-structured questionnaires, Focus group discussions with groups, key informant interviews with public and private sector actors.

The results showed that in both Kajiado and Isiolo Counties, priority livestock production constraints in Kajiado County in Dalalekutuk ward were diseases, lack of feeds, limited access to water and inadequate veterinary services, and in Isiolo County were lack of feeds, limited access to water and diseases. Priority livestock diseases in Kajiado, County, Dalalekutuk ward were, foot and mouth disease (FMD), anthrax; contagious caprine pleuropneumonia (CCPP) and cerebral coenurosis and enterotoxemia and cerebral coenurosis for the sheep. In Isiolo County, priority cattle diseases were FMD and trypanosomiasis, in the goats CCPP and cerebral coenurosis while in the sheep enterotoxemia and cerebral coenurosis. The reasons for persistent livestock production constraints were ranked and ranked as single organization interventions not sufficient to solve problems and lack of prioritization by stakeholders (water, pasture, diseases). The major livestock technology needs were: pasture, water, access to veterinary vaccines, capacity building of groups; training of para vets to support in the delivery of veterinary services; information sharing platform and market infrastructure. The multi-institutional technology exhibitions consisting of public and private sector actors were held in Kajiado and Isiolo Counties linking KCSAP pastoralist groups to technology and service providers. To enhance sharing of information, a mobile application(MITDP) was established linking CIGs and VMGs leaders with KALRO, KEVEVAPI, County Governments of Kajiado and Isiolo departments of livestock production and veterinary services; suppliers of drugs, vaccines and equipment; water technology suppliers; Agro-vets and Non-governmental organizations along the red meat value chain.

Keywords: Multi-institutional, livestock technologies, linkages, exhibitions.

Introduction

In Isiolo and Kajiado Counties, red meat offers an opportunity for increasing household food, nutrition and income security. However, past interventions have not been successful in the delivery of livestock technologies to address perennial constraints due to a single organization approach, often each with its own interests (Simon et al.; Thomas et al.; Reyes et al.).

Availability and accessibility to livestock technologies, and information sharing for enhancing red meat production and marketing is a major challenge, despite numerous research and development interventions undertaken in the ASALs (Onduso et al.; Thomas et al.; Fernández–

Rivera, Hiernaux and Williams). Productivity and commercialization are constrained by inadequate extension services, long distances to access production inputs like drugs and vaccines, livestock breeds, packaging – mismatch in demand and supply, and information (Gelan) as reported also in other livestock sectors (Yilma et al.; Mochabo et al.). Previous studies suggest that single organizational interventions in ASALS have had less impact on solving livestock production constraints (Simon et al.).

There is need to determine priority livestock technology needs and establish a multi-institutional partnership to facilitate and promote availability and access to technologies and information. The partnerships between livestock technology providers and KCSAP groups are likely to create more awareness among pastoralists on the types of livestock technologies available from various providers. In order to enhance information sharing such as disease reporting, availability of drugs and vaccines, feeds and feed conservation methods, breed improvement, water conservation technologies, this requires a robust and efficient mechanism in facilitating information flow. The development of a mobile platform was thus prioritized for purposes of information sharing among institutions and partners. Increased awareness and access to technologies will be a key adaptation strategy against drought and livestock pests and diseases which often result in loss of livelihoods due to death of livestock.

Materials and Methods

The study was carried out in the Dalalekutuk ward of Kajiado County and in the Oldonyiro and Ngaramara wards of Isiolo County. The study used exploratory designs to assess the livestock technologies needs of pastoralists. These were done by obtaining insights from various stakeholders including livestock keepers, sub-county administration, animal health, animal production service providers and input suppliers.

Sample size and sampling

The sample size needed was determined using the formula suggested by (Mugenda and Mugenda) and (Kothari; Kothari).

For known target population sizes----- $n = \frac{N}{1+N(e^2)}$

Where n = required sample size, N = Estimated population size, e = Acceptable marginal error, which is 5% or 0.05. The human population for Isiolo Sub-County was estimated to be 88,000, while the number of household is 17,600 Isiolo County Integrated Development programme (ICIDP 2018). The human population for Kajiado Central Sub- County where Dalalekutuk ward is located was estimated to be 255,000, while the number of households was 33,400, Kajiado County Integrated Development Programme (KCIDP 2018). Hence the total number of households where the study was carried out was 51,000. Therefore, using the above formula

For known target population sizes----- $n = \frac{N}{1+N(e^2)}$

The sample size was $51000/1+51000(0.05^2) = 400$. The number of households sampled from this population was proportional to the population of the sub-counties.

Therefore, the number of households sampled in Isiolo Sub- County was $17600/51000*400 = 138$, while in Kajiado Central Sub-County was $33400/51000*400 = 262$

Identification of pastoralists' livestock technology needs -Household baseline survey

Pastoralist households were randomly selected among the KCSAP groups of the red meat value chain in both Isiolo and Kajiado Counties. Semi-structured questionnaires were developed to collect household data and pre-tested in Makueni County for reliability and validity. The questionnaire was uploaded to Open Data Kit (ODK). Ten enumerators were recruited per ward. Recruitment was based on the highest education level, gender and diploma in the agricultural field was an added advantage. The enumerators were trained on the electronic Open Data Kit (ODK) tool application and modalities for interviewing.

Focus group discussions and Key informant interviews

Ten Focus Group Discussions (FGDs) with a total of 120 participants (30 men and 90 women) were conducted in the KCSAP red meat value chain groups. Four FGDs (48 livestock keepers - 11 men and 37 women) were held in Kajiado County and in Isiolo county six FGDs (72 livestock keepers-20 men and 52 women) were held.

Fourteen Key Informant Interviews (KIIs) were conducted in Kajiado and Isiolo Counties with the following stakeholders: Two counties' directors of livestock production and three Animal health services providers, one county the KCSAP –coordinator, three ward administrators, three area chiefs, three KCSAP group leaders (CIGs and VMGs) and three Nongovernmental Organization (NGO)

Mapping of stakeholders and their roles in a multi-institutional livestock technology delivery model involving Public-Private-Partnership Model

Visits and planning meetings was held with different stakeholders including county departments of livestock, NGOs, Suppliers of veterinary drugs and vaccines, feeds companies, equipment suppliers in both Kajiado and Isiolo Counties. The aim was to validate and assess the capacity of partners for delivery of livestock technologies through a multi-institutional approach in the red meat value chain.

Data cleaning, analysis

Data collected were cleaned to remove outliers. Quantitative data were analyzed using SPSS Statistics (Version 20). Proportions and means for Isiolo and Kajiado were compared using Chi-square and t-test at a 95% confidence interval ($p < 0.05$). Qualitative data from KII and FGDs were analyzed based on thematic areas.

Results

Livestock constraints

The survey assessed 451 respondents (149 females and 302 males) from both counties. The major priority livestock production constraints in Kajiado County in the Dalalekutuk ward were diseases, lack of feeds, limited access to water, inadequate veterinary services, conflict with wild animals and poor management of grazing land. In Isiolo County the priority livestock production constraints were lack of feeds, limited access to water, diseases, inadequate veterinary services, cattle rustlers and poor management of grazing land (Table 1).

Table 1: Livestock production constraints in Kajiado and Isiolo, Counties

Rank	Kajiado county	Isiolo county
1	Diseases	Pasture
2	Pasture	Water
3	Water	Diseases
4	Inadequate veterinary services	Inadequate veterinary services
5	Poor management of grazing land	Cattle rustling/Insecurity
6	Invasive plant species	Poor management of grazing land
7	Human-wildlife conflict	Invasive plant species

Priority livestock diseases in Kajiado, County, Dalalekutuk ward included foot and mouth disease (FMD), anthrax, East Coast fever (ECF) and lumpy skin disease (LSD) for cattle; contagious caprine pleuropneumonia (CCPP) and cerebral coenurosis, peste des petits ruminants (PPR) for goats and enterotoxemia, cerebral coenurosis and heartwater for sheep. In Isiolo County, priority cattle diseases were FMD, trypanosomiasis, ECF and LSD. In goats CCPP, cerebral coenurosis and PPR were reported as key diseases while in sheep enterotoxemia, cerebral coenurosis and heartwater were predominant (Table 2).

Table 2: Priority diseases for cattle, goats and sheep in Kajiado and Isiolo, Counties

Species	Kajiado County	Rank	Isiolo County	Rank
Cattle	FMD	1	FMD	1
	Anthrax	2	Trypanosomiasis	2
	ECF	3	ECF	3
	LSD	4	LSD	4
Goats	CCPP)	1	CCPP	1
	Cerebral coenurosis	2	Cerebral coenurosis	2
	PPR	3	PPR	3
Sheep	Enterotoxemia	1	Enterotoxemia	1
	Cerebral coenurosis	2	Cerebral coenurosis	2
	Heart water	3	Heart water	3

Persistence of livestock constraints in pastoral ecosystems

Livestock production constraints reasons for their persistence were reported as single organization interventions not sufficient to solve problems, lack of prioritization livestock needs such as water, pasture, diseases control amongst others (Table 3).

Table 3: Reasons for the persistence of livestock constraints in pastoral ecosystems

- 1 Single organization interventions not sufficient to solve complex problems.
- 2 Lack of prioritization by stakeholders (water, pasture, diseases)
- 3 Inadequate funding for disease control.
- 4 Lack of business approach to pastoralism
- 5 Dependence-syndrome on external support and lack of community ownership of projects.

6 Lack of holistic models that are sustainable

The priority livestock technology needs identified through KCSAP CIGs are indicated in Table 4.

Table 3: Priority livestock technology needs

1	Technologies on pasture production and conservation
2	Water harvesting technologies
3	Drugs and vaccines accessibility
4	Training of community disease reporters and Para vets
5	Technologies on how to control invasive plant species
6	Business approaches for pastoralism: Finishing strategies for red meat
7	Marketing Infrastructure. e.g holding grounds
8	Training on management of rangelands

Mapping stakeholders and their roles in a multi-institutional livestock technology delivery model involving in a Public-Private-Partnerships Model

In this study stakeholders were mapped and their roles. The results indicate that technologies by these organizations are available and are able to address livestock technology needs through a multi-institutional approach. The study identified over 20 institutions which included government intuitions, Non-Governmental organizations, Veterinary Pharmaceuticals, Agro-vets and private institutions that were in a position to contribute towards enhanced livestock production.

Promotion of priority livestock technologies and information sharing through multi-institutional linkages.

Multi-institutional livestock technology delivery model was established as shown in Figure 1. It is purposed as a management practice to facilitate and promote availability and access to inputs, technologies and information sharing through multi -institutional linkages involving private and public partnership through exhibitions. To enhance information sharing, a mobile Application link <https://play.google.com/store/apps/details?id=com.kalro.lmitdp.introscreen&hl=en&gl=KE>) was developed to link pastoralist groups to technology and service institutions in the public and private sectors. The platform is for sharing information on disease reporting, drugs and vaccines, feeds and feed conservations, breed improvement, water technologies, small veterinary equipment, marketing and holding of multi-institutional technology exhibitions on a needs basis. Through the model, two livestock technologies exhibitions were organized in Kajiado and Isiolo counties in the Delelakutuk ward –Sajilon market and Ngaremara ward respectively. The exhibition showcased the priority technology needs of the red meat value chain. During the exhibitions livestock and livestock inputs such as drugs, dry hay, hay seeds and salts were sold. Also, information was sought by famers from the different stakeholders such as water and pasture conservation technologies.

Multi institutional model for delivery of livestock technologies

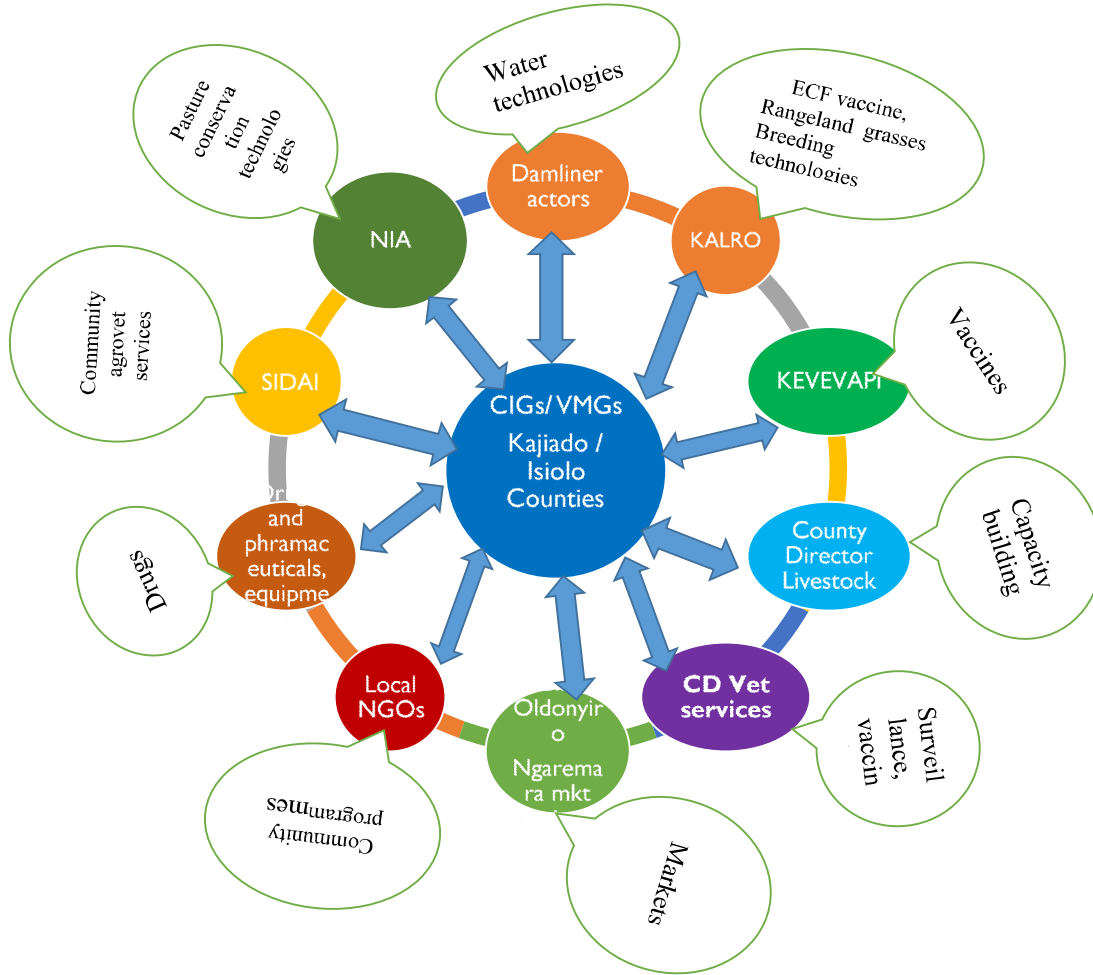


Figure 1: Multi-institutional model for delivery of livestock technologies Sustainability of multi institutional linkages

The study establishment of multi-institutional livestock technology model, KCSAP group leaders and representatives of service provider organizations agreed to share the information on the delivery of technologies through the developed mobile application. In Kajiado County, group leaders will coordinate this initiative and take the lead in organizing exhibitions on a need basis, while in Isiolo, SIDAI and KCSAP groups will be the lead actor for sourcing technologies from other stakeholders and organizing grassroots technology delivery initiatives.

Discussion

The study showed that livestock production constraints are similar. These constraints are not new and have been persistent as reported by past studies in pastoral production systems (Onduso et al.; Mati et al.; Ndathi et al.; Manyeki et al.; Syomiti et al.; Mbae et al.). These findings suggest the need for a multi-institutional approach in the delivery of livestock technologies. The results further indicated that the diseases in both counties were similar. These diseases can be broadly categorized into endemic and transboundary diseases. Similar findings reported livestock diseases ranking as the number one constraint affecting goat production (Kipronoh et al.). Fortunately, technologies for the control of these diseases are available such as vaccines and

drugs but have not been accessible by pastoralists. There is therefore a need to establish partnerships in the delivery to control diseases in the pastoral community. In both counties, FMD ranked highly due limited disease control initiatives since counties are not allocating money for vaccines and control strategies.

Livestock production constraints in pastoral ecosystems have been persistent despite many interventions in the past, mainly due to single-organization approaches which quite often are insufficient since these constraints are interrelated and hence the need for a multi-institutional approach in the delivery of technologies (Kidali et al.). The reason for the persistence of livestock constraints based on the community views were ranked as single organization interventions not sufficient to solve complex problems in rangelands, Lack of prioritization by stakeholders, Inadequate funding for disease control, few veterinary personnel, Lack of business approach to pastoral livestock keeping, Dependence-syndrome on external support and Lack of holistic models that are sustainable (Table 3). Other studies have shown persistent reasons for livestock constraints (Mohamed; Shanguhya; Kidali et al.). Research institutions, drugs and vaccine producers experience constraints at institutional levels that impacted negatively on animal health management (Kidali). Based on the priority livestock technology needs the requirement of a public/private partnership was of essence based on these needs. Hence a multi-institutional livestock delivery model was essential.

Conclusion

Livestock production in both Kajido and Isiolo Counties had a myriad of constraints which single organization approaches could not resolve as these constraints are interrelated, hence the need for a multi-institutional approach in the delivery of technologies. The majority of providers are in major towns; pastoralists are unaware of most of the available technologies as was reported in the study. Increased awareness and access to technologies through Multi-institutional livestock technology delivery models and platforms will be a key adaptation strategy against drought and livestock pests and diseases which often result in loss of livelihoods due to the death of livestock. Increased awareness among pastoralists on the types of livestock technologies available from various providers would enable them access priority livestock inputs from suppliers which previously was not possible due to lack of viable partnerships. Multi-institutional livestock technology delivery model enables pastoralist (women, men and youth) to save labour since they do not travel long distances to access technologies. Multi-institutional livestock technology delivery model: enables men, women and youth have more time for different chores instead of travelling looking for livestock technologies and inputs. Access to inputs and technologies and markets information through the mobile application will enhance their involvement and socio economic well-being

Recommendations

- i. Multi-institutional livestock technology delivery model is a management practice which is to facilitate and promote availability and access to inputs, technologies and information sharing through multi-institutional linkages involving private and public partnership, the exhibitions and information sharing. It is a holistic approach to solving most the persistent pastoralists livestock constraints in order to achieve increasing household food, nutrition and income and security.
- ii. Going forward, using the established platform, members through their group leaders will be able to share information and demand for specific technologies services directly from providers who are also on the platform. Livestock technology producers will be able to produce according to demand priority, right packages and information.

- iii. Multi-institutional livestock technology delivery model will create more awareness among pastoralists on the types of livestock technologies available and enable them access priority livestock inputs from suppliers which previously was not possible due to lack of viable partnerships. Increased awareness and access to technologies will be a key adaptation strategy against drought and livestock pests and diseases which often result in loss of livelihoods due to death of livestock.

Acknowledgements

This study was made possible by the cooperation and collaboration of pastoralists KCSAP groups, Kajiado and Isiolo county government, livestock production and veterinary staff, local media stations, NGOs, drugs and vaccines producers, hay traders, Agro vets, Market councils, Dams digging companies, VSF Germany, Action Aid, ASDSP, NAWIRI –USAIDs, World Vision, World Food Program, FAO. Funding for the study was made possible through KALRO-KCSAP project.

Consent

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

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