



Eastern Africa Livestock Feed and Feeding Strategy (2023-2037)





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(2023-2037) EALFFS

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Foreword

For livestock producers, the inability to feed animals adequately so as to meet the maintenance and production requirements of nutrients all year round is a major constraint in the Eastern Africa region1. For countries lying mostly in dry zones, the quantity of forages is often not sufficient for the number of livestock reared on rangelands and pastures. Dry season feeding poses a major problem in all countries in this zone. For countries lying in wetter zones, feed supplies are considered ample, but the quality of forage is usually poor, that is, protein, energy, vitamin and micronutrient contents are considered to be low. In recent times the frequency and severity of droughts have also increased in the region, which further exacerbate the unavailability of feed resources in the region. As a result of the ongoing climate changes, heat stress to animals, soils and plants has increased. And it is likely to increase further in the coming years. This has caused adverse effects on health and production of not only livestock, but also of plant resources including those used as livestock feeds. Furthermore, feed shortages due to shrinking grazing land has led to conflicts, which have increased in the last decades. In addition to the input costs incurred by livestock enterprises, feed cost accounts for between 50 to 70 percent of the total production costs. Feed shortage (in terms of quantity and quality) can make a livestock production enterprise uneconomical, and severely affect the livelihood of pastoralists, as has been evident from a huge livestock mortality during recent droughts in Eastern Africa. Additionally, the existing feed resources are not efficiently utilized, due to lack of human capacity and unavailability of materials. For example, vitamin and mineral mixes, quality supplements and processing tools and machines. Also, feed safety is a challenge that is being adversely affected by the ongoing climatic changes. An example being the increasing occurrence of mycotoxins. Presence of antibiotics and pesticide residues especially in the intensive system of livestock rearing is another challenge. There is a movement of animals and feed between regions, within countries and between the countries; so, many feed-related issues are transboundary in nature. That feeds and feeding are central to the livestock production and an issue which acts as a fulcrum to livestock production, with a capability to tilt it towards sustainability or un-sustainability, cannot be neglected. It is clear from the above that the livestock sector in the region is facing enormous challenges in the areas of feed production and feeding. Most of the enlisted challenges are common to the countries of the Intergovernmental Authority on Development (IGAD) and East African Community (EAC). There is need for concerted efforts so as to address these shortcomings, both within countries and in the region. This has prompted the Food and Agriculture Organization of the United Nations Subregional Office for Eastern Africa (FAO-SFE) and IGAD center for pastoral areas and Livestock development (ICPALD) to take lead in developing a regional animal feed strategy.

Strengthening of technological, institutional and policy dimensions are important in addressing the high-magnitude challenges identified in this document (some of which are listed above). The Eastern Africa Livestock Feed and Feeding Strategy is developed through multi-stakeholders' participation from the region, and covers these dimensions under the four pillars:

- a) Take stock of the feed and water availability and accessibility, formulate and put in practice technical solutions to enhance their availability and accessibility, especially during the drought periods.
- b) Develop and implement appropriate feed processing, feeding strategies, and water provision approaches, both for normal and emergency periods.
- c) Develop and strengthen Agri-feed businesses; and;
- d) Develop and strengthen institutional, policy-formulation andresearch and human capacities on feed production and feeding.

It is anticipated that this strategy will guide the countries to develop country-specific feed-focused action plans and embed them in their livestock development strategies and action plans and that this will contribute to the achievement of the Sustainable Development Goals (SDGs).

1 Burundi, Djibouti, Ethiopia, Eritrea, Kenya, Rwanda, Somalia, South Sudan, Sudan, Tanzania and Uganda.

Acronyms and Abbreviations

AIMS ASAL AU CP CPF DM EAC	Agricultural Information Management System Arid and semi-arid lands African Union Crude Protein Country Programme Framework Dry Matter East African Community						
EALFFS	Eastern Africa Livestock Feed and Feeding Strategy						
FAO-SFE	Food and Agriculture Organization of the United Nations						
	Sub-regional Office for Eastern Africa						
FAOSTAT	Food and Agriculture Organization Corporate Statistical Database						
FCI	Forage Condition Index						
GDP	Gross Domestic Product						
GHG	Greenhouse Gases						
ICT	Information and Communication Tool						
IGAD ICPALD	Intergovernmental Authority on Development						
ICPALD	Intergovernmental Authority on Development Center for Pastoral Areas and Livestock Development						
KFA	Key Focus Area						
ME	Metabolizable Energy						
MENA	Middle East and North Africa						
MoA	Ministry of Agriculture						
NDVI	Normalized Difference Vegetation Index						
NGO	Non-governmental Organization						
NOAA	National Oceanic and Atmospheric Administration						
PEG	Polyethylene Glycol						
PLEWS	Predictive Livestock Early Warning System						
R&D	Research and Development						
REC	Regional Economic Communities						
SDG	Sustainable Development Goal						
SADC	Southern African Development Community						
TAMU	Texas A&M University						
ТСР	Technical Cooperation Programme						
VDFACA	Veterinary Drug and Animal Feed Administration and Control Authority						

Executive Summary

The livestock sector, comprising of around 450 million heads of small and large ruminants, 6 million heads of pigs, and 275 million poultry, plays an important role in livelihoods, food security, nutrition, and economies across the countries in Eastern Africa2. It generates over US\$ 1 billion annually through live animal and meat exports to the Middle East and North Africa in addition to providing critical nutrients through meat, milk and eggs to the local population. This foreign exchange generated is vital for economic growth of many countries in the region. The sector has the potential to deliver both the agriculture-led growth and the socio-economic transformation in the region. However, one of the major constraints that prevents realization of this potential is the poor or inadequate livestock feed and imbalanced feeding to livestock. Poor animal nutrition directly or indirectly affects the entire livestock sector, associated services, public goods and services, including animal productivity, health and welfare, product quality and safety, land use and land-use change, and greenhouse gas emission. Depending on the species raised and the production system, the cost of animal feed takes the biggest chunk of the total cost of production, reaching between 60 and 70% in the case of poultry. Pastoral destitution in Eastern Africa is also attributed largely to the feed and water scarcity. The natural resource base in the rangelands is shrinking fast due to prolonged and more frequent climate extreme events and population growth. This region is frequently hit by severe droughts, resulting into unavailability and inaccessibility offered challenges during emergency situations. 0. With those in mind, it is being widely recognised that animal feed resources need to be considered in the broader development perspective and not just during emergency as it has been the case. Despite animal feed and feeding being the foundation of livestock systems, and food and nutrition security being heavily interlinked with feed security, particularly for the pastoralist community, it has received limited attention so far in the Eastern Africa region.

In order to address above-mentioned constraints and to realize the full potential of the livestock sector, development of a regional livestock feed and feeding strategy and action plan through multi-stakeholder participation must be considered as paramount. Through consultations with the Intergovernmental Authority on Development (IGAD) Center for Pastoral Areas and Livestock Development (ICPALD), the East African Community (EAC) and other stakeholders in member states including ministries, private sector, development organizations, farmers and pastoralists organizations, community institutions, academia and research organizations, the Food and Agriculture Organization of the United Nations Sub-regional Office for Eastern Africa (FAO-SFE) has taken a lead in developing this Eastern Africa Livestock Feed and Feeding Strategy (EALFFS). Salient points of the strategy are presented below. The strategy aims to promote and highlight the crucial roles that adequate and quality animal feed and balanced animal nutrition play in achieving sustainable livestock production that; a) supports income generation, employment creation and good human nutrition, and b) enhances resilience of livestock producers and other actors to climate vagaries in Eastern Africa. The vision is 'a vibrant and flourishing animal feed sector in Eastern Africa that adequately, efficiently and sustainably supports the livestock sector in delivering products and services for human population'. The overall objective defined by the stakeholders is to provide a framework for various animal feed types, feeding roadmaps and interventions that help to achieve the common goal of a highly productive, sustainable and resilient livestock sector, that improves community and household livelihoods and wealth, food security and nutrition, and social wellbeing of citizens, and that contributes to job creation. In Eastern Africa, feed security is interlinked with food and nutrition security, particularly for the pastoralist community.

In order to realize the vision, the EALFFS, has four pillars in the form of four strategic objectives: a) take stock of the feed and water availability and accessibility, and formulate and put in practice technical solutions to enhance their availability and accessibility at all times; b) develop and implement appropriate feed processing, feeding strategies, and water provision approaches, both for day to day living and during emergencies; c) value addition and agri-feed business development; and d) develop and strengthen institutional, policy-formulation and-research and human capacities on feed production and feeding. The strategy also presents three to six strategic outcomes under each of the strategic objectives, with suggested activities that fall under several key focal areas of action. The list of key activities identified in this document is not exhaustive. Each country, based on its own priorities and specific context such as agroecological zones and farming systems, could identify additional key activities.

The strategy embraces all the prevalent livestock production systems in Eastern Africa i.e., pastoral, agro-pastoral, mixed-crop livestock and intensive systems: and is inclusive of smallholder, pastoralists and large or industrial farmers. Pastoralism needs special mentioning in this context because it is the predominant livelihood and production system practised in the arid and semi-arid lands (ASALs). ASAL cover at least 75 percent of the land area of Eastern Africa. A majority of the member countries of IGAD and EAC have considerable populations of pastoralists, and livestock as a major component of the economies of both regions. In the EALFFS the suggested activities that would lead to realization of the strategic objectives are relevant for all the production systems and all types of farmers including pastoralists.

It is expected that the EALFFS will help countries to develop their specific action plans for making their animal feed sectors vibrant and feeding strategies climate smart.

² Burundi, Djibouti, Ethiopia, Eritrea, Kenya, Rwanda, Somalia, South Sudan, Sudan, Tanzania and Uganda.

I. Introduction

Eastern Africa3 is home to diverse and rich cultures, resources, and opportunities. These richness and diversity have enabled local populations to come up with an array of livelihood-supporting ventures. Key among them is the livestock sector. This sector livestock plays an important role in the people's livelihoods, food security, human nutrition, economy, and resilience within the region. It is common knowledge that thriving livestock sector and livelihoods prevents conflicts. Livestock feed is the fulcrum of the livestock sector because it affects almost all operations and services of the animal industry. The sustainability of the livestock sector hinges on how feed is produced and fed to livestock. A holistic view of animal nutrition illustrates that animal feeding impacts the health of livestock, reproduction and productivity, environment including biodiversity, land degradation and land-use change, animal welfare and health, food-fuel-feed competition, animal product safety and quality among others. Furthermore, adequate, safe and quality animal feed forms the basic foundation of all livestock production systems, from pastoral to agro-pastoral, mixed and intensive systems. Animal feed is one of the major components of cost of production of most semi-intensive and intensive farming systems. Severe feed shortages coupled with a wide seasonal variation in feed availability and accessibility, severe feed deficiency during droughts, and inadequate feed manufacturing capacity result in low livestock productivity, nutritional ill-status and deaths during droughts in Eastern Africa. Land and natural resources have always been at the heart of social, political, and economic life in most if not the entire of rural Africa. Sad to say though that in most countries, the natural resource base in the rangelands is fast shrinking. This is because of prolonged and more frequent drought occurrences, bush encroachment, land degradation and land changes in land use. Rising human population, high rate of urbanization and exploration for minerals and fuels are taking up significant amounts of land that would otherwise be grazing land. This has led to reducing access to land, pasture and, most critically, water for livestock. Other inherent constraints are unclear land tenure management and rights, and inadequate national feed-related data, which make it difficult to develop strategies, regulations and policies for efficient management of feed resources. In addition, stakeholders in the region site lack of a national animal feed policy, strategy, and institutional framework to support the animal feed sector in the region as a major impediment for growth in the feed sector.

The Eastern Africa Livestock Feed and Feeding Strategy (EALFFS) has previously been elaborated in several workshops and consultancies through multi-stakeholder participation. This strategy will give a thrust to the feed sector in Eastern African countries. It will offer the much-needed strategic direction and guidance. The tactic will pave way for building programmes in the feed sector, within countries and among countries based on individual country's strengths and opportunities. South-south cooperation and regional feed trade would also get a boost.

³ Burundi, Djibouti, Ethiopia, Eritrea, Kenya, Rwanda, Somalia, South Sudan, Sudan, Tanzania and Uganda.

The Strategy also aims to contribute to the achievement of the Sustainable Development Goals (SDGs) of the United Nations. The eight SDGs with direct linkage with animal feeds, pasture and water resources as inputs for the livestock, and the products that the livestock sector provides to the society are: SDG 1-End poverty in all its forms everywhere, 2-End hunger, achieve food security and improved nutrition and promote sustainable agriculture, 3-Ensure healthy lives and promote well-being for all at all ages, 4-Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all, 5-Achieve gender equality and empower all women and girls, 6-Ensure availability and sustainable management of water and sanitation for all, 10-Reduce inequality within and among countries, and 16-Peaceful inclusiveness and equitable resource use.

Similarly, the objectives pursued in the Strategy, their expected outcomes, and impacts are in sync with the aspirations expressed in the African Union Malabo Declaration of 2014. Specifically, the objectives, and outcomes identified and developed in the current EALFFS are supportive of Commitments two to six of the Declaration; namely, 2-Commitment to Enhancing Investment Finance in Agriculture, 3-Commitment to Ending Hunger in Africa by 2025, 4-Commitment to Halving Poverty by the year 2025, through Inclusive Agricultural Growth and Transformation, 5-Commitment to Boosting Intra-African Trade in Agricultural commodities and services, and 6-Commitment to Enhancing Resilience of Livelihoods and Production Systems to Climate Variability and other related risks. The EALFFS also aligns with the policy and regulatory frameworks of IGAD4 and EAC5 regions of Africa formulated in 2017 by the Alliance for Food Sovereignty in Africa. The implications of these frameworks for the practice of pastoralism, and food sovereignty are consistent with the EALFFS. Enhancing feed security will reduce feed and livestock related conflicts and advance food sovereignty. These two benefits have a particular relevance to pastoralism, because this food production system is based on agro-ecological and indigenous approaches that sustain food sovereignty and the livelihoods of communities. In addition, Livestock Development Programme of the Southern African Development Community (SADC), though heavily inclined towards improvement of animal health in the region, the EALFFS supports two components of the SADC programme: a) strengthening of the Agricultural Information Management System (AIMS) by generating sound data on feed resource availability in the region, which is necessary for policy development, emergency preparedness, planning, and decision making in the livestock sector, b) implementation of the Codex Alimentarius standards for food safety by strengthening feed safety, and c) development of livestock value chains by enhancing the availability of quality and safe animal feeds. Enteric methane is the biggest contributor of greenhouse gas emissions from the ruminant sector in East African countries. The enteric emission is heavily dependent on types of feeds being fed and the manner they are fed to livestock. The Strategy would play an important role in realising the objectives of the recently validated IGAD Strategy on sustainable and resilient livestock development in view of climate change for Eastern Africa (2022 - 2037).

⁴ IGAD member countries, Djibouti, Ethiopia, Eritrea, Kenya, Somalia, South Sudan, Sudan, and Uganda......

2. Context

The livestock sector in Eastern Africa plays an important role in the livelihoods, food and nutrition security and economies of the region through local, intra-regional, intra-African and global trade. A large number of livestock are reared in Eastern African countries. According to FAOSTAT, in 2019, the heads of cattle, sheep, goats, and camel were 181.7, 145.1, 170.2 and 18.2 million respectively, and the poultry population was 275.9 million (Table 1). The sector contributes significantly to export revenues, national gross domestic product (GDP), and to the region's broader socioeconomic development. At a national level, the livestock sector provides between 30 and 80 percent of the agricultural GDP, and at farmer level it contributes up to 70 percent of cash income is generated from livestock. The livestock sector employs over 60 percent of the people, particularly in arid and semi-arid regions. It generates more than US\$ 1 billion annually in earnings through live animal and meat exports to the Middle East and North Africa (MENA) in addition to providing critical micro-nutrients for local population, preventing stunting and malnutrition. The exports cover around 60 percent of live animals and 10 percent of meat demands in MENA countries. Other

Country	Camel	Cattle	Sheep	Goats	Pigs	Poultry
Burundi		756,036	728,050	3,227,903	804,013	2,728,000
Djibouti	70,894	300,328	469,329	514,941		
Eritrea	388,152	2,122,945	2,455,974	1,815,820		1,127,000
Ethiopia	1,281,468	63,284,177	31,849,003	34,045,216	36,535	64,455,000
Kenya	4,721,900	20,898,769	27,440,945	35,172,749	596,414	56,659,000
Rwanda		1,330,192	587,949	2,685,038	1,228,465	5,601,000
Somalia	6,647,164	5,530,921	30,516,421	12,983,154		3,721,000
South Sudan		13,143,378	18,614,300	13,580,117	49,553	15,000,000
Sudan	4,895,000	31,489,000	40,896,000	32,032,000		50,015,000
Tanzania		27,821,063	8,291,176	18,918,816	523,563	39,531,000
Uganda		16,334,337	2,069,583	16,701,172	2,746,453	37,038,000
Total	18,601,206	181,712,638	145,089,731	170,160,540	5,988,855	275,875,000

Table 1. Population (head) of livestock in Eastern African countries in 2019 (source www.fao.org/ faostat and from Misintries in charge of Livesotck

meat export opportunities for example to Vietnam and Hong Kong, also exist. Also, because of population growth, urbanization and increasing incomes, demand for livestock products will increase continuously in Eastern Africa. From 2021 to 2035, the aggregate consumption of all livestock products will increase by more than 50%. In Eastern Africa only, it is projected that demand is expected to grow at least 3% for all meats (> 6 percent in some countries) and > 6 percent for eggs on annual basis for the coming decade. Currently, most countries in Eastern Africa consume one-third of the recommended amounts of animal source foods. This offers a huge opportunity to increase income of livestock farmers.

The livestock sector has the potential to deliver both the agriculture-led growth and the socio-economic transformation as envisioned in the June 2014 African Union (AU) Malabo Declaration on Accelerated Africa Agriculture Growth and Transformation for shared prosperity and improved livelihoods. Despite huge potential of the livestock sector in Eastern

Africa, it faces a number of challenges, which are illustrated in subsequent sections. One of the major challenges is a wide seasonal variation in feed availability and accessibility, inadequate availability of feed in the dry period and severe deficiency during droughts, which result in low livestock productivity, nutritional status and death of a large number of livestock in the region. Available data show that in 2008 and 2011 droughts, Ethiopia lost 52 percent and 23 percent of its animals, respectively. During the 2017 drought, Somalia lost 400 million US\$ revenue from the decreased export of live animals. This was blamed on climate changes that make droughts be increasingly frequent and severe. In the recent times, the gap between feed availability and requirement has been further exacerbated due to the increasing climatic change and variability, recurrent droughts and conflicts. Between end 2019 and end 2021, massive desert locust infestations in most countries in Eastern Africa exacerbated the feed shortage after huge damages on natural pastures and grasslands, and crop and forage cultures.

Adequate, safe and quality animal feed is the driver of all the livestock production systems, from pastoral to agro-pastoral, mixed and intensive systems. Availability of diverse feed resources is another constraint – quality forages (grasses and legumes), quality supplements and vitamin-mineral mix are scarce in most Eastern African countries, which prevent formation of a balanced least cost diets. Feeding of balanced, quality and safe feed enhances productivity and resilience of the livestock sector, promotes livelihood of livestock owners, and increases income of farmers. Channelisation of by-products of agro-based industries towards production of animal feed also enhances income of these industries, besides improving animal production, enhancing animal productivity and decreasing environmental pollution. Animal feed production and feeding play a central role in the circular and sustainable food production by absorbing by-products and co-products of various processes. However, the animal feed sector has been neglected by policy makers and planners. This has resulted to low private investment in the sector. Furthermore, neglect of the feed sector by donors has also

been an inhibitory towards promotion of Research and Development (R&D) work in the animal feed and feeding domain in the region. A holistic approach that embraces - in a balanced manner the development and application of appropriate technologies and strengthening of institutional and policy dimensions would result in a higher impact at the grassroot level than using piecemeal and fragmentary approaches.

The people in the region have a socio-cultural motivation to own livestock; however, a shift in thinking is taking place even among pastoralists to enhance monetary value of their outputs because they have now to pay for feed and water for their livestock. Feed and water are no longer free commodities. A vibrant feed sector with provision of safe and quality feed in sufficient amounts throughout the year, including during droughts, in a cost-effective manner, and that equips livestock farmers including pastoralists to efficiently utilize the available feed, is vital for socio-economic development in the region. To achieve this, formidable steps have already been taken by different countries in the feed sector, but they lack strategic direction and policy support, which limit their impact. Regional and national animal feed strategies supported by appropriate policies would further the feed sector growth. In light of this, formulation of an Eastern Africa Feed and Feeding Strategy was of paramount importance.

3. Approach followed

A collaborative, multi-stakeholder driven process was used to identify the vision, goals, and strategies. The approach taken to formulate the Strategy was to collate various themes, strategic issues, priority areas, pillars and actions that emanated from various workshops, expert consultations, Country Programme Frameworks (CPFs) prepared under the guidance of FAO. These were analyzed, consolidated and summarized for common threads, as the basis for formulating strategic objectives and outcomes of the Strategy.

The strategy is the result of consultative and participatory process building on experiences and lessons learnt by an array of key stakeholders in public and private institutions, notably, researchers, academia, pastoralist and farmers' organizations, government representatives, feed manufacturers and traders, civil societies and Non-governmental Organizations (NGOs), policy makers, and national and international development partners.

4. Scope

This strategy covers Burundi, Djibouti, Eritrea, Ethiopia, Kenya, Rwanda, Uganda, Somalia and South Sudan, belonging to the East Africa Community (EAC) or the IGAD, or both and covered by the FAO Subregional Office for Eastern Africa (FAO-SFE). The Strategic Objectives, Strategic Outcomes developed for the EALFFS are also applicable to Sudan

(belonging to the IGAD and FAO Office for Near East and North Africa), and Tanzania (belonging to the EAC, SADC and FAO Subregional Office for Southern Africa) even though not falling under FAO-SFE. The EALFFS will provide governments, private sector, national and international development organizations, academia, research organizations, NGOs, livestock producers and other stakeholders with a systematic and guided strategic objectives and key focus action areas to deliver the desired outcomes that will facilitate sustainable development of the livestock sector in Eastern Africa. The strategy will also help donors to prioritise allocation of resources.

5 Challenges

A number of challenges and opportunities related to the feed sector were identified through expert consultations and participative workshops. These formed the basis for development of the four strategic objectives, corresponding strategic outcomes and key strategic action areas. These challenges and opportunities have been contextualised in the respective strategic objectives. However, some major country-specific challenges are presented in this section.

Burundi

Declining availability of fodder and grazing lands led to small livestock becoming the most important animals on smallholder farms. Reduction, degradation and overexploitation of natural pastures are the mayor challenge for cattle rearing. Natural communal pastures have mostly disappeared in densely populated areas. Where they still exist, they are gradually shifting to more marginalized land with poor soils. Cattle numbers are less than half those that were there fifty years ago. Even with cattle playing an important economic and social role in Burundian society, and are the principal form of capital accumulation, production of milk and meat is currently insufficient. This has in turn led to high prices thus only accessible to wealthier households. Burundi has adopted policies for the uptake of zero grazing. Currently 25% of ruminants are kept in extensive systems and 75% others in zero grazing systems, as well as 80% of poultry and 100% of rabbits. To date, eight feed companies exist, which had previously suffered many constraints due to insecurity, but are picking up. However, these few livestock feed manufacturing units are installed only in the town centres of mainly Bujumbura. The feed, therefore, is not easily accessible to livestock owners located far from Bujumbura. Furthermore, due to low income of smallholder farmers, commercial feed concentrates are not always affordable. Even though little quantitative information on accurate feed demand and supply scenarios exists, access to animal feed and biomass is still limited. Research in the feed area is still at infancy stages. But is strengthened, it could enhance feed availability due to favourable conditions offered by the long rainy season of 9 months. However, appropriate feeding strategies based on locally available feed resources are lacking. A database on the "Composition and nutritional value of animal feed in Burundi" was recently established, which can be used for formulation of balanced rations for livestock. Capacity building opportunities in the feed sector and for farmers are also poor, and elaboration and valorisation of adapted technical feed formulation sheets is necessary. Equally important are: a) increased availability of diversified feed resources, for example good quality forages, both grasses and legumes, supplements and vitamin-mineral mixtures; b) installation of feed manufacturing units in different parts of the country and increasing availability of feed ingredients; and c) strengthening of feed and feed ingredient distribution networks.

Djibouti

Around 90% of livestock in Djibouti is raised in traditional pasture systems and they depend on natural feed resources. 10% are raised in sedentary agro pastoral systems. Livestock provides direct employment to about 200,000 people out of one million Djiboutians, including pastoralists, agro-pastoral, livestock traders, butchers and related activities. Djibouti as an entirely arid and semi-arid country has no permanent watercourse exploiting only residual water and lakes. Some sedentary farmers follow a model planting fodder (Sudan grass, alfalfa, panic grass) mostly fed as green grass or hey. There is limited investment in institution building and technical infrastructure improvement. Other limitations include: lack of 'win-win' feed trade agreements with neighbouring countries; feed imports from China and Pakistan, making feed cost high; non-existent regional agreements, actions and investments on feed resourcing; weak or non-existent feed quality and legislative issues, especially with regard to transboundary feed transaction and their poor implementation due to weak infrastructure and skills; difficult animal feed import procedures and process; and limited capacity of farmers

Ethiopia.

There is a severe shortage of feed in Ethiopia. According to a FAO study, there is a shortage of dry matter by 21 percent and of protein and energy by around 50 percent. Other constraints are: inconsistent supply of ingredients needed for feed manufacturing; feed-related data collection process is not robust, and it is difficult to access feed demand and supply information; inefficient use of existing feed resources; unclear land tenure and rights and core drought grazing areas not protected; limited

outreach activities; slow adoption of recent technologies by feed manufacturers; quality of animal feed and its control; limited awareness of livestock farmers about feed quality; policies and regulations relating to value added tax (VAT), do not favour domestic feed producers; and ban on export of feed ingredients.

Eritrea

About 50% of Eritrea's land surface area is a rangeland which provides feed and shelter to domestic and wild ungulates; and food, shelter and aesthetic values to the pastoral communities and visitors. However, the availability of pasture and browse is highly affected by rainfall amount and distribution. Besides, sometimes, the standing hay is exposed to termite damage and fire caused by the pastoralists while preparing their foods. Thus, range ruminants face feed shortages in the most critical months of year that is April to end of June.

Likewise, feed ingredients required for the preparation of formulated feeds are in short supply and unaffordable for the ordinary livestock keepers and feed processors. In fact, it is not unusual to see seasonal fluctuations in feed availability and price.

For that reason, the extension officers from the Ministry of Agriculture (MoA) encourage farmers and agro-pastoral communities to conserve crop residues and hay for critical time use and income generation purposes. Even though there is a limited irrigated land under forage, the MoA intensifies efforts to encourage the production of fodder through the distribution of improved forage seeds to dairy farmers.

Kenya

Kenya also experiences a shortage of feed ingredients, and the little that is available is costly. Huge fluctuation in the feed ingredient supply exists, which poses challenge in feed formulation. Farmers experience cash constraint for buying feed and other inputs. The policy environment for the feed sector is unfriendly. Existing policies are not properly implemented or coordinated. Recurring droughts that have decreased grazing biomass and water availability in the rangelands are major causes of diminished livestock productivity, especially in 23 Arid and Semi-Arid Land (ASAL) counties. All ASAL counties are in severe negative feed balance. In the central areas (non-ASAL counties), the major challenges include shortage of land and the high cost of supplementary feed. Land tenure and rights are unclear and core drought grazing areas are not protected.

Somalia

There is shortage of feed and feed ingredients. The little that is available is often of poor quality. Livestock obtain feed mainly through grazing and browsing on natural pastures, from limited use of crop residues, cultivated pasture and food-crop species and concentrated feed like sesame cake, and range pellets imported from Dubai, Oman and Egypt. In the drier pastoral areas, the amount of forage available is quite limited. This is due to recurrent and increasing frequent droughts and dependence on rainfall pastures, which are not sustainable and insufficient as rangeland management

is mostly weak. In the mixed farming areas, natural pastures are being taken over for cropping. As a result, crop residues and by-products are becoming the most important livestock feed. However, due to limited knowledge and capacity to process and conserve these, they go to waste or are used inefficiently. Most fodder harvested for sale is tied into armload sized bundles and transported by trucks with fodder costs being very highly variable depending on supply, demand and high transportation costs. Low level of nutritive fodder varieties (Sudan grass, Alfalfa etc.) are produced in the country. Mostly only natural pasture comprising grass, shrubs and trees, and stalks of maize and sorghum residues are used. There are no reliable livestock feed producers in the country and there is overall a lack of investment in this sector. Riverine districts (Juba and Shabelle rivers) are potential areas for fodder production in Somalia but insecurity and accessibility pose a huge challenge. The development of the livestock sector has been hampered by decades of civil strife, resulting in weak central institutions with low budgets at their disposition, poor infrastructure and delivery systems, and more focused being put on emergency and short-term issues. Other constraints include increasing drought frequency and as a result chronic feed deficiency; lack of frameworks, policies and strategies for investment in the feed sector and to support the private sector; absence of drought-resistant forages for improvement of rangelands; and poor rangeland management practices.

South Sudan

South Sudan is endowed with vast grazing resources and land - 90% suited for arable agriculture. Mismanagement of grazing resources (uncontrolled fire, restricted seasonal mobility, prolonged excessive grazing, loss of vegetation cover, and encroachment of alien invasive plants) constitutes key challenge in the predominantly pastoral and agro-pastoral production system. Despite the huge primary production from native grasslands and crop residues, limited experience in feed conservation practices has predisposed the country to considerable fluctuation in seasonal supply of feed. The favourable policies and environment needed for private sector investments in feed production, processing, marketing, and improved forage development are lacking. As a result, feeds bridging seasonal feed deficits and supporting increased livestock production and productivity are very much limiting. Forage seed system that facilitates access to suitable forage genotypes and promote appropriate production strategies (key to the development of market-oriented livestock), is totally lacking.

Sudan

The research support for the feed sector is weak. Animal feed resources in Sudan were estimated to be 74% range pasture, 21% by-products, 4% green fodder and 1% cereals. There are six sugar factories producing 2.5 million tons of sugar tops, 3.2 million tons of bagasse and 250,000 tons of molasses that is used as animal feeds. Overall data on availability of agro-industrial by-products is insufficient. The crop residues and other by-products that are there are not efficiently utilized thus far. The private sector lacks

investment and necessary skill sets required to support the development of the feed sector. There are no enough extension services to promote use of agro-industrial by-products. This has made technology transfer and adoption very poor. The capacity building opportunities for the feed sector development are also weak. The availability of premixes required for the dairy and poultry sectors is inadequate, as these are not manufactured locally, and the quality of the imported premixes is not guaranteed. Finally, there is need to develop sustainable range management to complement the already existing good infrastructure to ensure quality fodder production for export. There is also need to emphasize production of quality fodder for use within the country.

Tanzania

Communally owned natural pastures in rangelands support most of the traditional livestock production system in Tanzania. The feed balance is relatively good in the highlands. Dairy farming performs better in such typology compared to the central areas of the country where traditional livestock keeping (extensive system) is mostly practiced. Generally, the communal semi-arid rangelands in Tanzania are constrained by several challenges including poor quality of forage and its availability. The forage is characterized by seasonal variation in quantity and quality with high-quality forage only being found during the wet season. Land available for grazing in Tanzania is only 10.5%. This is a small space and it is speculated that it could be the main reason for conflict between livestock farmers and other land users, especially during dry season when livestock are moved around in search of water and pastures. Raw materials used for the production of commercial feed such as maize, fishmeal and sardines are expensive. This makes making animal feed costly and hence drives poultry products price high. Furthermore, the frequent use of sardines and fishmeal in poultry feed produces fish taint especially table eggs and chicken meat. Sometimes it gets contaminated by salmonella. This makes locally produced poultry products to not meet international standards. The tourism industry is then forced to r import poultry products to bridge the gap, and most hatcheries import lots of their hatching eggs. Lack of infrastructure such as laboratories and inadequate financial resources for inspectorate services affect enforcement of quality control of animal feeds, inspection in the feed storage and production premises, and feed standards.

Uganda

Most cows are in the 'Cattle Corridor', which extends diagonally from the pastoralist Ankole area in the Southwest to the Karamoja region in the Northeast, where the highest concentration of cattle is found. Grazing land is shrinking, while information on availability of grazing land is unavailable. Feed shortages in the dry season are still frequent. In the agro-pastoral production system (Eastern, Central 2, Western, North and West Nile Sub-regions), farmers also feed livestock with crop by-products but investments to improve productivity, are insufficient and sometimes not even there at all. There is inadequate knowledge of feed and fodder market structures including feed and fodder value chain actors, and feed resources. Feeding systems are poorly characterized. Forage availability in rangelands and watering points for livestock are not enough. The forage seed production and distribution system are poorly developed. Ranching (usually 500-3000 head per holding) where animals browse / graze during the day in fenced areas and are often paddocked at night, is prevalent in the Southwest and the Central 2 subregions. Here farmers make significant investments. In the semi-intensive system mainly found in Central 1 and 2 and the Southwest sub-regions, animals are kept in kraals, paddocks and barns/stalls and fed high-quality

feed, again making significant investments. Some feedlots have emerged while pastoral and agro-pastoral production has decreased. Poultry productivity in Uganda has developed well during the last decade. It is very high, due to huge investments and government ensuring compliance of good rules and regulations that safeguard sustainability. However, they still face small challenges here and there. The main one being the lack of raw material, competing uses like mulching, alcohol brewing, direct human consumption and fuel, and only local use of agro-industrial by products, due to their bulkiness and high costs of transportation. Furthermore, output of raw materials varies from season to season, leading to inconsistency in quality and quantity of animal feeds within and between firms. Limited access to credit of farmers and feed companies hinders expansion of the feed business. The domestic market for feeds is still weak, with supplies of uneven quality both of ingredients and finished products. Prices of some ingredients vary enormously leading in escalating costs of production. Though manufacturers of animal feeds have identified regional markets (Rwanda, Kenya), quality and limited capacity hampers their utilisation. Policies, institutional arrangement for regulation and guiding of the animal feeds industry and their implementation to be able to put defaulting manufacturers to task, are limited.

These country-specific challenges were also considered in the formulation of strategic objectives and identification of strategic actions that could provide solution for the problems faced by the countries as well as to mitigate the constraints.

6.The Strategy

The vision, overall objective, strategic objectives, goals, outcomes, strategic actions and key focus areas of interventions and actions of the Eastern Africa Livestock Feeds and Feeding Strategy (EALFFS) are as follows.

6. I Vision

The vision is 'a vibrant and flourishing animal feed sector in Eastern Africa that adequately, efficiently and sustainably supports the livestock sector in delivering products and services for human populations.'

6.2 Overall Objective

The Overall Objective is to provide a framework for various types of animal feed and feeding roadmaps and interventions to achieve the common goal of a highly productive and sustainable livestock sector to improve community and household livelihoods and wealth, food security and nutrition, and social and economic wellbeing of citizens, and creation of jobs, especially for women and youth.

6.3 Strategic Objectives, Goals, Outcomes Strategic Actions and Key Focus Areas

Each of the four Strategic Objectives has three to six Strategic Outcomes, with suggested activities that fall under several Key Focal Areas of Action, Investigations and Interventions. The four strategic objectives take stock of the availability and accessibility of feed and water, and formulate and put in practice technical solutions to enhance their availability and accessibility; develop and implement appropriate feed processing, feeding strategies and water provision approaches; promote agri-feed business development; and enhance institutional, policy-formulation and -research and human capacities in the area of feed and feeding.

An over-arching issue for, and common to all the four Strategic Objectives is the policy development and changes that provide conducive environment to not only realize them but also amplify their impact

Strategic Objective 1: Feed and water availability, accessibility and development

The Objective statement is:

'Take stock of the feed and water availability and accessibility, and formulate and implement technical solutions to enhance their availability and accessibility at all times, including periods of drought.'

It aims to assess feed resource base and water availability and accessibility, then design and implement technical solutions to overcome seasonal fluctuations in

feed and water availability. The goal is to ensure year-round quality feeds and water accessibility, with concomitant reduction in cost of feed production and water development and management for sustainable livestock production. Embedded in these are the development and implementation of appropriate policies geared towards enhancing feed and water obtainability and accessibility, and their development.

Goal. To empower public, private and community institutions to establish forwardlooking feed and water generation and user programmes that meet the needs of various classes of livestock in diverse production systems, and at the same time led to cost reduction in production and distribution, for increased competitiveness of the animal feed sector and livestock industries in general.

Strategic Outcomes

Outcome 1: Strengthened efforts of National and Regional Economic Communities (RECs) to support climate change adaptation and mitigation measures that promote increased availability and accessibility of feed and water sources for livestock in extensive, semi-intensive and intensive systems.

Outcome 2: Innovative and efficient feed-crop farming strategies and practices that improve quantity and quality of animal feeds are supported and promoted by public, private and community institutions in the livestock feed sector.

Outcome 3: Improved assessment and forecasting of feed and water availability and efficient planning on use of these resources for animals in all livestock production systems. Outcome 4: Improved practices in feed storage, and water harvesting, conservation and distribution to improve their year-round availability and use to support livestock production.

Outcome 4: Improved practices in feed storage, and water harvesting, conservation and distribution to improve their year-round availability and use to support livestock production.

Outcome 5: Better information collection and exchange and learning mechanisms created and practiced on availability and accessibility of feed ingredients, feeds and water by government agencies and private sector partners.

Context. SSeasonal fluctuations in animal feed and water availability pose challenges to livestock production in most countries in Eastern Africa. The challenges are exacerbated by the poor quality of feed, and thus necessitate the need for supplementing livestock feeds with expensive ingredients, additives and other complementary feeds. These actions often lead to increase in the cost of production and as a result reduce competitiveness of

the livestock industry. Nevertheless, there is evidence that the demand for feed resources in the region is growing. In addition, severity and frequency of droughts have increased. This calls for increased production of feeds including novel ones, cultivated fodder and food crops whose residues contribute to feed resources. In pastoral and agro-pastoral livestock production systems a vast majority of animal feeds and drinking water for livestock are found on the rangelands. For improved livestock productivity therefore, forage development and establishment and/or rehabilitation of watering points on rangelands are deemed important. To realise this, sustainable rangelands management measures and conflict management play a vital role in the region. The conflict in sharing pastures and water exists not only between livestock farmers and other users of land but also between livestock and wildlife species.

Increased frequency and duration of drought spells in many parts of Eastern Africa is considered to be closely linked with the ongoing climate changes, exerting negative impact on the availability and accessibility, and quality of animal feeds derived from pasture lands and rangelands. Since the trends in the annual rainfalls are unpredictable and climate change continues to be unfavourable for plant growth, it has been argued that there is a need for developingbetteradapted, more productive and more disease-resistant for age species. Also, the reduced amount and quality of feed available to livestock, has made it necessary to provide feed supplements richer in nutrients to livestock. Concentrates, compounded from various food sources, reinforced with additives often constitute the bulk of the feed supplement, and they are expensive. In intensive livestock production systems where animals are intensively fed to achieve higher level of production, concentrates often are major component of the livestock diet. The compounded feed manufacturing industry is reported to be going through a myriad of challenges among them shortages of concentrate feed ingredients and their high costs. Absence or weak market information systems that track the availability, distribution and sources of feed ingredients; and prices of ingredients and finished products add to transaction costs and eventually to the cost of animal feeds. In general, there is lack of quality feed-related data, e.g., information on availability of agro-industrial by-products and other feed resources and how they are currently used is scarce, so is the information on the extent of utilization of these resources as animal feed and their competitive uses. This makes it hard to take sound policy and technical decisions for efficient utilization of feed resources and to also promote the use of novel feed resources such as insects like locusts and insect meals, single cell proteins, improved cultivated forages including native ones, spineless cactus, among others. Sound feedrelated data are requisite for developing sound climate-

smart livestock systems. Mapping regions for the feed surplus and inefficient use of available feed resources would enhance feed availability

and accessibility in regions that go through feed scarcity. A strong seed production and distribution network and an efficient seed value chain would also enhance availability and use of cultivated forages, which are of good quality in terms of crude protein and metabolizable energy contents. Equally important is the seed production and distribution of good quality indigenous forages, and development and promotion of their agronomical practices. Native or indigenous forages have advantages that they are adapted to harsh conditions of poor soils, high temperatures and low water availability.

Main challenges. The main challenges to achieving year-round adequate feed and water availability and accessibility, especially in extensive and semiintensive livestock production systems in Eastern Africa, to realize sustained quality animal production at competitive prices include:Lack of sound feedrelated data that prevents taking sound decisions on efficient management and utilization of feed resources.

- Lack of sound feed-related data that have hindered making sound decisions on efficient management and utilization of feed resources.
- Predominance of undesirable, poor quality, unpalatable pasture species and emergence of invasive species on degraded rangelands due to poor management practices, overuse and climate variability.
- Poor management of crop residues from mixed crop-livestock systems and of agro-industrial by-products that could provide valuable source of feed to livestock are often wasted through ignorance and poor management.
- Absence of farm level technologies for water harvesting and storage during the rainy season, that would then be used by livestock during the dry season.
- Lack of reliable supply of concentrate feed ingredients including protein supplements and vitamin-mineral mixes, especially for making compounded feed and feeding non-ruminant species such as poultry and pigs.
- Slow delivery of climate-smart feed production technologies that aim at developing drought resistant forage crops that can produce reasonable amounts of feed in years of reduced rainfall and droughts.
- Poor forage seed production and distribution system and poorly understood seed value chains, both for the improved and native forages.
- Limited private sector engagement in large scale commercial fodder production and marketing

- Limited incentive mechanism in place to support the private sector engagement in fodder and forage seed production.
- Undeveloped and uncoordinated markets for animal feeds, and weak market information on manufactured animal feeds.
- Poor genetic potential of animals, especially ruminant livestock, having lower feed use efficiency.efficiency.

Opportunities. Some of the exciting opportunities to address the challenges and constraints are:

- Emerging greater understanding and appreciation among livestock farmers/producers on the linkages between better feeding/nutrition and higher outputs (animal source foods) from livestock, that results in better financial and economic outcomes. This better understanding and appreciation of the relationships between inputs and outputs is driving market-orientation farmers to make better provision of inputs that supports year-round production of animal source foods.
- Availability of new methodologies and tools for feed inventory and feed balance assessments, and feed availability projections that enable sound policy formulation and technological developments for making efficient use of feed resources and for planning future feed needs.
- Considerable innovations being made in animal feed sector that are driving climate-smart farming practices. They include the use of droughtand disease-resistant fodder and pasture crops, adoption of sound agronomic practices for feed crops and balanced feeding strategies for livestock, to substantially increase the quantity of feed available throughout the year, for livestock feeding.
- Innovations in processing such as densification of crop residues, grasses and cultivated forages that decrease costs of transport and storage and increase shelf-life, and emergence of opportunities in transportation services and infrastructure development. Those make significant impact on movements of feeds to areas of demand, and on the transport of inputs into feed manufacturing areas, at a lower unit cost.
- Availability of supportive regional frameworks and protocols such as the transhumance protocol, regional rangeland management strategy.

Extensive local knowledge on native forages, which could be harnessed for the benefit of the livestock sector, at the same time preserving biodiversity.

Strategic Actions

Based on this strategic objective goal and outcomes, here are the strategic actions identified that will support realization of the outcomes of Strategic Objective 1.

- Support actions on assessments of feed resources, feed balance, water availability and water requirement at national and subnational levels. These will enable sound policy formulation and technological interventions for enhancing their availability and their efficient use, and for projecting future feed and water demands.
- Support the production of better adapted, more productive and more disease-resistant and drought-tolerant forages including indigenous forages, augmented with preservation of harvested feed types, for release at critical periods to ensure constant supply all year round. This, coupled with strengthening of seed production and distribution system for cultivated forages, including indigenous ones will go a long way.
- Support research in, and identification and production of, novel highquality feed resources.
- Support efforts that are geared towards improving pastures and rangelands through over sowing, sustainable grazing and water-use practices (based on determined carrying capacity), area enclosures, controlled grazing, and control of bush encroachment and fires. This will enhance the regenerative capacity of rangelands and other land degradation-arresting methods. The intervention needs to go hand-inhand with strengthening of seed production and distribution system for forages, including native ones that are particularly adapted to harsh rangeland conditions in Eastern Africa. Harvesting of local knowledge on these forages and their seed production and distribution are vital requisites. Some indigenous forages have medicinal properties, which could also be exploited for improving rumen microbial efficiency and gut health, for prevention and cure certain animal diseases and as alternatives to anti-microbial growth promoters and anthelminthics, among others.

Key Focus Areas for Actions, Investigations and Interventions

Key Focus Areas (KFA) for actions, investigations and interventions are listed below. They emphasise on assessment of feed and water at local, national and regional levels and increase in their availability for the livestock sector. The list is not exhaustive and other country-specific KFAs may be identified and defined, based on the context and challenges in a country.

1. Determining feed and water requirements in volume relative to target livestock populations

Feed requirements estimates on dry matter (DM), metabolizable energy (ME) and crude protein (CP) basis should be done at local, state and national levels for proper planning on the use of feed resources. These estimates are critical in determining the overall feed demands. Some assessments have already been done for IGAD countries by the FAO-IGAD6, which can be replicated to other countries and regions. It is also important to assess the availability and requirements of vitamin-mineral mixes, as forages are often deficient especially in calcium and phosphorus, mainly for the dairy and monogastrics (poultry and pig)

2. Establishing inventory of availability and accessibility of feed and water resources

Information on available and accessible water and feed resources in terms of quantity (DM) and quality (ME and CP), as well as their seasonal fluctuations and location is of vital for policy and decision making. Such information is critical for sourcing feed for an emergency response. It is equally important for water and feed resource management and utilisation, developing business models, sustainable livestock intensification, market-oriented fattening, and dairy and poultry production.

3. Mapping agro-industrial by-products, crop residues and develop strategies for their efficient use

Agro-industrial by-products such as oilseed cakes and brans are high nutrient animal feeds. In African countries, livestock production largely relies on crop residues such as straws and stoves of maize, sorghum, barley, wheat, teff, among others. Mapping involves identifying the different agro-industrial by-products and crop residues, amount being produced and wasted, the potential feed safety hazards associated with their use, their locations and key players or actors in the value chain (e.g., small producers, large producers, small-scale processing units, wholesalers, small retailers, etc.). More importantly, the value chain

⁶ https://www.cabdirect.org/cabdirect/abstract/20203302547

nodes from production, aggregation, processing and distribution (both formal and informal) need mapping.

A thorough assessment of the existing roughages including crop residues roughages is important for making their efficient utilization. Roughages are plant-based feedstuffs (forages, herbages) that constitute the largest portion of livestock diets in Eastern Africa, depending on the zootechnico-physiological status of the animal to be fed. For example, roughage content of complete diets is 60–70 percent for dry animals, 30–40 percent for high-yielding animals, and 40–50 percent for growing animals. Therefore, when doing the assessment, include cereal straws, pulse aerial parts, oilseed straw/aerial part, grazing pasture, stubble feeding (aftermath), root aerial parts, permanent crops, industrial crops and their by-products and cultivated fodders.

Assessment of competitive use of these feed resources helps to assess actual availability of the feed resources and to provide additional options to feed livestock during times of scarce feed availability in Eastern Africa.4.

4. Characterizing feeding systems

Characterization of feeding systems implies generation of information on 'which feed ingredients and in what proportion these are fed to livestock, at different periods of the year.' This information is important to assess nutritional imbalances. It also helps to 'fine tune' the feeding regimens and to make it balanced diets, so that feed-use efficiency could be enhanced, and nutrient requirements of animals affordable. Knowledge about feeding systems is also a requisite for accurate calculation of greenhouse gases (GHGs) from the livestock sector and formulation of mitigation and adaptation measures, because the GHG emission from the livestock sector is highly dependent on the nature of diet an animal consumes. Systematic efforts at a country level are required to characterize feeding system in various agro-ecological zones at different periods (or seasons) of the year.

5. Assessing infrastructure and enablers

Infrastructure and enablers like feed suppliers, processing facilities, feed sites/reserves, feed analysis laboratories, roads, markets, transport, storage facilities, and security situation. Understanding these is fundamental in emergency feed response and water provision during drought.

6. Mapping zones and systems at risk of feed deficiency/in excess

Mapping of zones and livestock production systems at risk of feed and water scarcity and excess (baseline and periodic monitoring) is vital for providing early warning on feed and water availability and access, and better plan and prepare for early response to emergencies associated with droughts. It could also assist in designing appropriate development pathways along the value chain. Early warning tool such as Predictive Livestock Early Warning System tool (PLEWS) enables assessment of near real-time and projected availability of grazing biomass (grasses and shrubs) in the rangelands. Accessibility of the forages for livestock can also be estimated by PLEWS using various filters. For example, mountains with high slopes where grazing is not possible, water ponds and national parks. The PLEWS uses data from a GeoEye satellite and excludes values for inedible species to produce Forage Condition Index (FCI). The FCI has the capability to disaggregate forage based on the feeding habits of browsers and grazers. Another example of the tool for early warning system on feed availability is the Pictorial Evaluation Tool (PET) for forage and body condition assessment.

7. Developing feed and water balance sheet/information system

Feed balance sheet or information system is an important tool for strategic planning, including early warning and early response allowing the public, private and development actors to make informed decisions. Such a unified method of feed balance calculations in the region can utilise all information available on feed resources, using the most up todate tools and

approaches, among others, the Crop Tool that assesses crop-based feed resources, and the PLEWS which depends on satellite imagery, Normalized Difference Vegetation Index (NDVI), National Oceanic and Atmospheric Administration (NOAA) weather predictions, soil conditions, etc., and provides quantitative data on availability of grazing biomass. The information system should be robust enough to provide the most accurate status at the time and forecast feed balance changes in months so that appropriate and timely actions can be taken. This should also include, short-cycle production of quality forages using hydroponic approaches or pre-positioning animal feed reserve to areas where the deficit can be averted. Alternatively, feed resources base can be augmented before disaster hits. The concept of feed balance assessment at the national or regional level should also be scaled down to farm level to assist farmer plan feed resourcing and storage for the dry or drought periods. Assessment of water deficiency or surplus must not be overlooked because it is important for voluntary feed intake. In addition, during severe droughts a large number of animals die as a result of both feed and water scarcity.

8. Development of feed banks for emergencies and assessing capacities for prepositioning feeds

There are a number of countries in the region with strategic grain reserves. This is not the case for animal feeds. Support towards the establishment and capacity building in management of strategic animal feed reserves and feed banks, especially for ruminant livestock are likely to yield positive results in many instances. Strategic reserves in good storage facilities will ensure that animals have access to quality feeds throughout the year. The feed banks should be as near as possible to the areas frequently affected by droughts.

In Eastern Africa, the ability of countries to provide feed supplies quickly and cost effectively is often a great challenge due to emergencies and access restrictions in pastoral and agro pastoral areas. To reduce the time taken to respond to livestock feed emergencies, it is essential that governments, private sector and other organisations are able to quickly distribute feeds stored to feed banks. Pre-positioning of livestock feeds with due consideration of shelf life would support production continuity, reduce feed delivery lead times and cut the cost of transportation. This will in turn contribute to saving of livestock-based livelihoods in times of emergency. An assessment of the infrastructure and capacities to establish and manage feed banks and to distribute the feed as well as assessment of accessibilities must be undertaken, and adequate steps taken to strengthen them.

9. Assessing contingency planning capabilities at regional and national levels

UUnderstanding the national and regional preparedness and response capacity is key to delivering successful livestock emergency action at community, country and regional levels. The assessment should look at the livestock preparedness plans and institutional readiness to respond to livestock emergency at national and regional levels. This assessment will facilitate a national and regional livestock emergency understanding and decisions making in advance, for the management of human and financial resources, coordination and communication procedures, and range of technical and logistical responses. The assessment can assist the region to develop a cross border management tool involving all partners, which can help ensure timely and effective provision of humanitarian aid to those most in need when a disaster strike. Insecurity and accessibility of certain potential areas for fodder production might be a challenge and needs to be considered. Institutional strengthening to effectively respond

to livestock emergencies would bear extensive fruits and this action forms a part of the Strategic Objective 4.

10. Selecting potential priority areas for fodder production using irrigation, and strategic areas for water harvesting

Irrigation in the countries under consideration is very limited. The few irrigated areas focus mainly on crop production and very few are left for fodder production. Generally, irrigation rates in some of the countries are very limited, with most crop production being rainfed. Countries should be encouraged to map out the areas that can be put under irrigated fodder production. Actions on improving forage seed production and distribution system in addition to livestock production need to be undertaken so as to enhance availability of improved cultivated forages. However, these efforts must go hand in hand with conserving and developing drought tolerant local pasture species e.g., Cenchrus ciliaris and Eragrostis superba, among others. Strategic areas for water harvesting should be identified and water harvested used for production of cultivated forages and other crops.

11. Improve forage and water availability and accessibility for livestock on rangelands

For improving grazing biomass availability on rangelands, harvesting of local knowledge on native forages adapted to harsh condition of high temperatures and water scarcity, and their seed production and distribution are vital requisites. The use of other good practices for land and water management such as over sowing, rotation grazing and water harvesting must be

strengthened so as to exploit the production potential of rangelands and ensure sustainable natural resource use. Shortage of water for livestock drinking is a serious issue in most African countries. Also, the lack of technical knowhow on water harvesting and irrigation technologies and its operations, mainly in pastoral settings are a big constraint. Therefore, reparation of inventory of strategic water sources/bore holes, categorised as functional and those requiring rehabilitation should be considered. Rehabilitation and increase in number of strategic bore holes and use of solar power to extract water from bore holes would enhance availability of water. There is also a need for adequate on-the-job and/or off-the-job trainings for beneficiaries and local operators on inclusive management and maintenance of the bore holes.

12. Use of novel and untapped feed resources

Due to increasing demand of protein for both animals and humans, the use of insects as food and feed has attracted the attention of scientists, feed industry and development workers. Use of black soldier fly and house fly maggots are increasingly being used as animal feed. Insects such as locusts have recently caused a huge loss to a number of crops in Ethiopia, Kenya, Eritrea, Uganda, South Sudan, Somalia, Djibouti and Sudan. Their harvesting and use as animal feed would not only enhance feed availability but also contribute to control of locust infestations. Additionally, the adverse effects on environment, human and animal health from using pesticides to control locusts are likely to decrease. Recently, several other novel resources have been explored as animal feed. Some examples being use of single cell protein, algae, spineless cactus, by-products of the biofuel industry, prosopis pods, vegetable and fruit wastes especially from the wholesale market as animal feed. Their widespread use would also decrease food-feed competition in the region. Introduction of lupins for animal feeding in Eastern Africa would also be an option. Use of appropriate dual-purpose food-feed crops in the region would also contribute to both food and feed availability.

13. Enhancing local production of vitamin-mineral mixes

In most African countries, and more so in Eastern African countries there is dearth of vitamin and minerals. Vitamin and mineral mixes are largely imported, which makes them expensive, and their quality is not assured. Local production of quality premixes will overcome these constraints. In addition, the import substitution will result in higher availability of hard currency for national economic growth. Deficiency of these nutrients, even if protein and energy requirement are met, is known to decrease livestock production and adversely affect animal health. Local production of quality vitamin and mineral mixes will help increasing livestock productivity and income of farmers, and contribute towards decreasing environmental problems associated with inefficient use of protein and energy sources in the animal body and their excess excretion in the environment, in cases where vitamins and minerals are absent.

14. Use of non-animal nutrition- related approaches

Along with improvement in feed availability and accessibility and feed use efficiency, other approaches such as increase in genetic potential of animals, use of good management practices, reduction in reproductive inefficiencies and prevention and cure of animal diseases that lead to morbidity and mortality would enhance overall efficiency of feed use. They will also increase production of animal products, and decrease emissions of greenhouse gases from the livestock sector. This holistic approach would produce more from less hence enable production of same amount of animal products that is currently being produced with lower amounts of feed; or more animal products be produced from the feed currently used. Control and/or eradication of invasive species from the pastureland is another approach that would enhance availability and accessibility of pastures for livestock. Indirectly, such efforts would help overcoming the deficiency of feed available in the region.

Strategic Objective 2: Sustainable Feed Processing, Feeding Strategies and Water Provision The

Objective statement is:

'Develop and implement appropriate feed processing and feeding strategies, and water provision approaches, both for normal and emergency periods'

It focuses on development and promotion of climate-smart and sustainable feed processing, and feed and water provision practices by public and private institutions, together with incentivization of such measures to encourage feed manufacturers, communities, farmers (including pastoralists) and individuals to adopt good practices. This will lead to sustainable feed processing, conservation and storage; use of best livestock feeding practices; and economical water usage by livestock and communities of livestock owners.

Goal. To sensitize governments and their agencies in Eastern Africa to strengthen the capacities of livestock and feed producers to adopt climate change adaptation and mitigation methods and practices so as to deal with shortages in feed and water resources, and increase efficiency of feed and water provision to livestock, especially in vulnerable production systems, including pastoral systems.

Strategic Outcomes

Outcome 1: Climate-smart feeding systems and better feeding strategies and methods developed for, and promoted in, livestock production systems in Eastern Africa.

Outcome 2: Improved rangeland management practices, including management and provision of available water and pasture (holistic management) that deliver year-round feed and water to grazing livestock introduced in livestock production systems in Eastern Africa.

Outcome 3: Innovative feeds and improved feed processing methods, including the use of feed additives and novel feeds that improve feed quality and safety, and the efficient water usage practices introduced at industry and farm levels in Eastern Africa.

Context. Increased frequency and duration in occurrence of droughts, are causing quick depletion of feeds and water resources. This is resulting in inadequate intake of water and feeds especially of grazing forages, and that too usually of doubtful quality. This contributes to starvation and high livestock mortality. Inadequate nutrition also leads to decline in reproductive performance of both female and male animals, as well as impair animal health and welfare. To overcome these negative impacts on livestock productivity, it has been suggested that improved feeding strategies, such as those based on improved food-feed crops that increase nutrient quality of residues, and that make the best use of

existing and potential forages, agro-industrial by-products and crop residues should be widely practiced in relevant production systems. For example, in agro-pastoral systems where crop-residues are available, it may be important to promote feeding packages using crop-residues, agricultural and agro-industrial by-products to increase feed quantity and quality throughout the year, because seasonal feed shortage and the inefficient feed utilisation by pastoralist and agro-pastoralist communities constitute major challenges affecting livestock productivity. However, the total feed biomass on farms and rangelands, as well as the quality of the resultant feed and residues from food crops are being negatively impacted by long term droughts and other climate change related factors. Although national and international research efforts are being directed at breeding appropriate drought and disease resistant food and feed crops, technical support to strengthen and mainstream climate change adaptation measures that promote increased availability of feed and water sources and their efficient utilization for livestock are required, especially in extensive and semiintensive systems. Additional support to the development of additives, including alternatives to antibiotic growth promoters and other ingredients that improve feed quality, safety, palatability, intake and digestibility of feeds and efficiency in water usage is important. Suggested practical steps to address feed inadequacy and poor quality include scaling up good practices for pasture restoration and improved grazing management and scaling-up of the cultivation of drought resistant grass and legume varieties for feed production. With respect to management, a suggested approach is, establishing or reinforcing management structures such as water use committees and communal grazing committees. To enhance impact, a broader scale approach involving communities at subnational, national and regional level may be undertaken. Although there are challenges to implementing the suggested interventions and achieving the desired results, opportunities do exist that can be exploited to enrich the quantity and quality of feeds that support adequate livestock feeding and efficient use of water by the livestock.

Main challenges. To achieving high quality and safety of animal feeds that are acceptable to livestock and increase their production, health and welfare are:

- Soils deficient in quality nutrients that ultimately results in poor quality feed.
- Poor sanitation and wastage of feeds due to limited use of feeding troughs and chopped forages.
- Temptation of livestock keepers to use relief-time emergency feeds to entire herd, leading to inefficient use of the emergency feeds. The relief feed targets a limited number of core livestock, while the pastoralists aim to save as many animals as possible.

- Poor feed conservation and storage methods that lead to loss of nutrients in animal feeds and eventually impact negatively in implementing efficient feeding plans and regimes.
- Limited use or absence of technologies that densifying bulky fibrous feeds.
- Lack of thoughtfully planned feed formulation and feeding calendars/ systems, especially in relation to livestock productivity and performance.
- Inefficient use of crop residues and other by-products.
- Lack of balanced diets that do not meet all the required nutrient (protein, energy, vitamins and minerals) requirements of livestock, and lack of guidelines that match nutrient requirements with production level.
- Inadequate and poor-quality drinking water for livestock and inadequate provision of clean drinking water to animals.
- Inadequate local capacity for manufacturing of feed processing equipment
- Inadequate adoption of standards and protocols, guidelines and frameworks
- Inadequate appreciation of adverse effects of mycotoxins in feeds, the occurrence of which has increased due to ongoing climate changes and is likely to further increase in future.

Opportunities; that exist to address the identified challenges:

- Availability of improved animal feeds (pastures and feed crops) through innovative plant breeding techniques, bio-fortification and quality seed provision.
- Availability of improved feeding methods (e.g. use of stall feeding, balanced and challenge feeding; use of feeding troughs and forage choppers) and watering methods (e.g. use of watering troughs)
- Emerging use of leguminous trees, alley crops, fodder banks, feed reserves that enhance nutritional values of feed
- Possibilities offered by enhanced availability of agro-industrial byproducts and other novel feed resources, and increased awareness of their nutritional value.
- Availability of low-cost mycotoxin binders that reduce absorption of mycotoxins in animal body and their transfer to animal products, particularly milk.

• Availability of IGAD Strategy for sustainable and resilient livestock development in view of climate change (2022 - 2037), developed recently in August 2022.

Strategic Actions

Keeping in mind the goal, and outcomes of Strategic Objective 2, the following strategic actions have been identified. These actions would help achieve the goal and outcomes.

- Promote farming practices such as crop mix, including inclusion of legumes, multiple harvesting, as well as cropland improvement to enhance quantity as well as nutrient contents of crop residues and other feed ingredients, enabling feeding of balanced diets to livestock
- Support strategies that improve feed quality and feed use efficiency through innovative feed processing technologies, improved feeding and safe-and-efficient water provision strategies, and following the circular economy concepts and practices.
- Support the development and use of feeding strategies based on novel feed resources; additives including mycotoxin-binders and alternatives to antibiotic growth promotes, among others; plus, other ingredients that improve feed intake, palatability, digestibility and nutrient-use efficiency of feeds, and animal product quality and safety.
- Analysis of the climate change problem and use of adaptive climate-smart technologies in livestock feeding, feed processing and water provision including clean drinking water.

Key Focus Areas for Actions, Investigations and Interventions

The identified KFAs will enhance accessibility of feed and water resources and efficiency of their use in the livestock sector. The list is not exhaustive especially since each country, based on its own priorities and specific context such as agroecological zones and farming systems, could identify additional KFAs.

1. Applying practices that increase access to water for livestock

Water and feed are the two critical determinants that ensure survival of livestock in dry areas and during droughts. The distribution and type of water points and watering schedules are major elements of range use. In the region, pastoralists and their livestock have been kept in mobility, which is dictated largely by water and feed availability. When it comes to

provision of water to livestock, traditional practices have often involved unrestricted livestock access to rivers and seasonal surface water ponds, pans and dams used to provide water for livestock and feeding
of livestock within reach of these water resources. Unrestricted livestock access causes disturbance and pollution resulting in environmental degradation and loss of productivity near the water points. There is need to develop and apply strategies, approaches, and methods for sustainable use of water resources that keep a balance among natural resources. Adequate availability of clean drinking water for the animals is a requisite for enhancing the efficiency of use of feed resources, increasing livestock productivity and maintaining animal health. Besides, pastoralists often share water with their livestock and vice versa. Hence, any projects to supply livestock water should also have provision for humans to access safe water. Joint working of the agriculture/livestock and irrigation ministries to increase availability of water, including clean drinking water for livestock would be highly fruitful. In addition, national irrigation masterplans should give due importance to clean water availability for livestock.

2. Enhancing the use of feeding strategies that increase efficiency use of low-quality roughages including grazing biomass during emergencies

In Eastern African countries, livestock is fed mainly on low guality roughages, including natural grazing and crop residues, such as cereal straws and/or stoves, sugarcane by-products and other similar feeds. All of which contain large quantities of ligno-cellulosic material. These feeds are deficient in protein, energy, minerals and vitamins. In addition, at certain times of the year, the quality of grazing biomass deteriorates substantially due to seasonal influences; and livestock productivity consequently declines. In many cases, lactation ceases, unless supplements are offered. Addition of foliage from tree leaves or supplementation with oilseed meals, vitamins and minerals; and use of compound feeds and mycotoxin binders and other feed additives can improve the utilization of low-quality roughages mainly through the supply of critical nutrients such as nitrogen, vitamins and minerals to the rumen microbes. A business approach to fermentation technologies that implements urea-ammoniation of straws and inoculation of microbes to low-quality roughages in a large scale, holds better chances of success than application of these technologies by individual farmers. Likewise, urea-molasses multi-nutrient technology has been found to be more sustainable when the blocks were produced by a cooperative or commercial units for use by farmers compared to the use of the blocks produced by individual farmers. A concerted efforts to promote feeding strategies based on these technologies (implemented as a business entity) to enhance utilization of low-quality roughages are required urgently..

3. Development and promotion of feeding strategies for the droughts

The use of multi-nutrient blocks in the rangelands also enhances the nutrient availability from low-quality grazing biomass, especially during droughts. Besides, during droughts only biomass available on the rangelands is the browse species. They remain green despite scarcity of water. However, these are not normally consumed by livestock due to the presence of high levels of tannins (polyphenolics) in them. These polyphenols can be inactivated by an inert compound, polyethylene glycol (PEG) - also termed as browse plus. A number of studies have shown increases in the utilization of browses, leading to increased livestock productivity when PEG was given to animals. The context-specific development of PEG-based feeding strategies and their application during droughts will enable the use of biomass in the form of browses available in situ, preventing or decreasing the transportation of bulky and costly feeds from outside to the drought-affected areas. Use of such browse enhancers could possibly be exploited for making efficient use of Acacia and Prosopis leaves as animal feed. Salt-rich browses such as Atriplex also survive in droughts. Consumption of such salty bushes along with cladodes of cactus (another drought tolerant plant) by animals could also save them during droughts. The multi-uses of cactus (pharmaceutical, health and cosmetic products, among others) have potential to open new avenues for business development in the region.

4. Promoting biomass collection and processing accompanied by value addition and balanced ration formulation

Overcoming challenges of collection and conservation of excess biomass that is useful as animal feed can be technological, institutional, legal, logistical, socio-economic and policy related. Briefly, for technological challenges such as unavailability of machines or devices used for the densification of feeds is common. Densification machines for converting cereal straws, grasses, cultivated forages into pellets or blocks are not manufactured in Eastern Africa. Impetus being given in the area of agriculture mechanization in several Eastern African countries must not ignore feed resource harvesting and densification and chopping machines, among others. Feed technologies, such as silage and haylage making, densification of biomass into pellets and blocks that reduce roughage feed bulk need to be introduced. This will help, reduce transport and storage costs and increased nutrient availability. Apart from the named positive outcomes, the densification approaches will also provide opportunities for value-addition by incorporating oilseed cakes and other agro-processing based by-products, vitamins, and minerals, among others. A balanced feed can be delivered to animals and feeding time is decreased for farmers when the compressed biomass is used as feed.

5. Making use of available guidelines for feed and forage supplementation

Feeding of animals using balanced diets is key to increasing livestock productivity, decreasing greenhouse gas emissions from the livestock sector and enhancing resource use efficiency. For example, experiments conducted in India and Ethiopia have shown that feeding of a balanced diet decreased feed cost by 10 percent and methane emission by 15 percent, with concomitant increase in income of farmers. Knowledge and skills on assembling balanced diets using available feed ingredients is sadly lacking. In view of these, manuals and training programmes on preparation and feeding of balanced diets to dairy animals and meat producing animals must be developed. The use of densified feeds, other novel feeds, minerals, vitamins and other additives need to be covered in these manuals and training programmes.

6. Enhancing feed availability through reduction in feed wastage

Studies conducted recently in Kenya, Uganda, Sudan and Somalia have demonstrated a huge wastage and loss of feed resources. Some of the reasons for these losses are improper storage, burning in the field, improper harvesting and feeding practices, among others. The losses can be reduced by using feeding troughs, chopping fodder and total mixing ration; prevention of crop residue burning; and storage of feeds under roof cover, among others. Wastage of agro-industrial by-products could take place because of fungal infestation due to improper storage conditions. Mycotoxins produced by fungus decrease animal intake, impair animal immunity and reproductive efficiency, decrease animal productivity and also make animal products unsafe of human consumption. An example is the presence of aflatoxin M1 (a metabolite of aflatoxin B1 present in feed) in milk, which is carcinogenic. High fungal-infestation of feeds such as agro-industrial by-products and silage leads to their rejection and elimination, having negative environmental and economic impacts. There are substantial losses in wholesale vegetable and fruit markets. Some of these can be converted into animal feed through silage and block making.

Strategic Objective 3:Value Addition and Agri-feed Business Development

The Objective statement is:

Develop and strengthen agri-feed businesses.

The objective aims to enable and sustain appropriate financial and technological environments that promote animal feed value chains development, deliver high-quality, safe feeds to livestock producers and animal source foods to consumers at affordable prices. All these while promoting increased regional and international trade in livestock feeds and livestock products. Formulation and implementation of policies to strengthen value chain development is an integral part of this Strategic Objective, as is for all other Specific Objectives.

Goal. To support livestock feed value chain actors to develop and strengthen animal feed and related technical and business skills in Eastern Africa to produce and distribute quality products for the livestock industry markets locally, regionally and internationally at competitive prices.

Strategic Outcomes

Outcome 1: Enhanced agri-feed business expertise and skills developed through capacity building among livestock feed and forage-seed value chain actors in Eastern Africa countries.

Outcome 2: Improved technical support services provided to value addition enterprises, including small and big feed processing, forage seed production, packaging, storage and distribution entities and agricultural equipment manufacturers.

Outcome 3: Better empowered actors (producers, processors, marketers, associations) undertaking animal feed including forage-seed related innovations.

Outcome 4: Enhanced marketing and trading in cost-effective, accessible, and high quality and safe feeds achieved in multiple locations in countries in Eastern Africa.

Outcome 5. Improved integration of feed development with feed-related innovations and market-oriented livestock production system.

Outcome 6. Incentives for investments in animal feed agribusinesses sustainably promoted.

Context. Strong opinions exist among governments and external development partners that reforms are urgently needed in the agri-business sectors in sub-Saharan Africa, especially within the livestock agri-business sub-sectors. The animal feed sector particularly needs urgent attention in as far as reforms go. It is widely recognized that agro-industrial by-products are being wasted and not properly utilized as animal feed. Feed additives such as vitamins and minerals are hardly used, and feed resources are particularly vulnerable to contamination causing far-reaching implications for animal and human health and welfare. There is need to put in extra efforts to reduce or eliminate these risks and wastages. Value addition remains an unrealized goal in many situations because of high cost and lack of ingredients. Another suggested reason for the slow development of the agri-business in some countries is inadequate or poor value chain analysis in the animal feed sector. "The animal feed value chain involves the full range of activities required to bring a feed product to livestock, passing through different phases of production, processing and delivery. The value chain analysis encompasses the physical, social and economic enabling environment. It is also a market-focused analysis of collaboration among different stakeholders who produce and market value-added feed products. Feed value chain analysis is essential to an understanding of markets, their relationships, the participation of different actors, and the critical constraints that limit the growth of the feed sector (and hence livestock production) and consequently the competitiveness of smallholder farmers or pastoralists" (FAO-IGAD)7.

Inadequate human and institutional capacities are one among the many causes of inefficiencies in the animal feed sectors. Consequently, support to agri-feed business development through capacity building among livestock feed value chain actors, support advocacy linking prospective actors to credit as well as to markets, inputs and extension services, are seen as important avenues to address the shortcomings in the feed industry. In practical terms, providing technical support services to value addition enterprises, including cottage industries engaged in feed and forage-seed production, processing, packaging, storage and distribution would be wise so as to strengthen the animal feed sector. These supporting efforts would lead to increased number of avenues that can be used to channel human and technical inputs including innovations into the feed sector, and thus transform it to a more effective, efficient and vibrant sector.

Main challenges. The main challenges in the domain of value addition of animal feeds, and promotion of agri-businesses that support the value addition and marketing of the value-added feeds include:

- Absence or lack of guidelines and standards for value addition and weak regulatory institutions, which lack capacity to develop guidelines and standards and to implement them.
- Unregulated importation of animal feeds from other continents and free distribution of feeds during emergencies that serve as disincentives to local value addition and manufacturing efforts.

- Inconsistent supply of ingredients needed for feed manufacturing and value addition.
- High import costs of pre-mixes and lack of their manufacturing in Eastern African countries.
- Weak funding base for agri-businesses in the feed value addition sector.
- Weak technical skills and inadequate funding in integrating feed-processing and other feed related innovations into the feed production sector.
- Weak trade agreements with neighbouring countries and lack of harmonised regulatory standards among countries in the region.
- Inadequate frameworks to support the private sector in the feed and forage seed value chains.
- Inadequate transportation-related infrastructure.
- Distortion of feed markets due to free distribution of feed during emergencies, and no action taken so far to discourage the free distribution

Opportunities. Identified opportunities are as follows.

- Emerging and expanding market opportunities for the value-added animal feeds.
- Emerging value chain-based agri-businesses in the animal feed sector.
- Availability of manuals and training courses for improving capacity of regulatory authorities.
- Increased interest in the use of cultivated forages in dairy and meat sectors, and emerging forage seed production and distribution value chains.
- Shift in thinking to discourage free distribution of feed during emergencies and opt for development-oriented pathways that enhance availability of feed during emergencies.

Strategic actions

The following strategic actions would contribute to achieving outputs and outcomes of the Strategic Object 3.

- Promote agri-feed business development in countries in the region through capacity building of livestock feed and forage-seed value chain actors, and strengthen advocacy that supports linking of prospective actors to credit and producers to markets.
- Provide improved technical support services to value addition enterprises, including small and big feed and forage seed processing, packaging, storage and distribution entities and agricultural equipment manufacturers.

- Provide services that empower actors (producers, processors, marketers, associations) undertaking animal feed including forage-seed related innovations.
- Enhance capacity of national and regional institutions that direct, champion and advocate for best policies and practices to deliver quality and safe feed and water to livestock, especially during emergencies, to discourage free distribution of feed and enhance sustainability of animal feed businesses.
- Formulate policy and guideline that regulate free distribution of feeds and forage seeds and also enhance sustainability of animal feed businesses.
- Identify incentive mechanism and support its enforcement to stimulate private sector engagement in the feed processing business.

Key Focus Areas for Actions, Investigations and Interventions

Some KFAs that promote animal feed value chains development by putting in place appropriate policy, financial and technological environments are presented below.

1. Instituting value chain analysis

After an assessment of competing value chains and appropriate prioritization process has taken place, the selected value chain should be characterized and mapped, based on the predefined objectives and scope of intervention. This involves elements like; defining overall size of a value chain; identifying the pathways from source to end-market(s); measuring how costs rise as the product moves along the value chain; considering the market chain's previous and potential development over time; and identifying the value chain comparative advantage and areas of potential growth for sales or profitability, as well as its resilience toward economic and environmental shocks. The analysis should also seek to better understand the value chain's governance, its economic, social and environmental sustainability, and the incentives and capacities of value chain actors.

2. Identifying business opportunities in animal feed value chains

Identification of business opportunities for animal feed value-chains is an important step towards reinforcing the resilience, through developing sustainable feed and forage supply chains. It involves the entire supply chain development from sourcing of feedstuff, storage, processing to handling the feeds. Several factors affect the opportunities for business development and operation in the sector, for example the cost of production of raw materials and subsequent prices of finished feed products, availability of raw materials for feed millers and finished products for end users, the quality of raw materials affecting the quality of finished products, among others. Identification of incentive mechanisms for

establishment of new feed processing businesses and expansion of the existing ones, and their implementation; and alleviation of impediments for the private feed businesses such free distribution of feeds would help making the feed sector vibrant in the region.

3. Strengthening linkages of fodder production to markets

In Eastern Africa, a number of issues shape the way fodder producers, market actors and supporting markets do business and secure their livelihoods. Linkages of the input and output markets is a key element in the fodder markets. Strengthening of the forage-seed value chain is vital. The key supporting services affecting fodder producers in the region at the micro level are the financial services, extension services, and information systems such as radio, SMS and smart phone applications that reinforce production and post-harvest handling. Key to this is to organise fodder producers into cooperatives or producers and building their capacity on production and marketing. To re-enforce the marketing linkages of the fodder producers within a country and a region and also explore the use of fodder conservation innovations.

4.Identifying, mapping and sharing of good practices, innovations and success stories from existing animal feed producers and processors

There are a number of good practices that could be up-scaled or out-scaled. These can be done through organizing animal feed knowledge sharing events using the existing IGAD established regional animal feed platform, to document lessons and good practices in animal feed interventions across countries. At the national and regional levels, farmers (agro-pastoralists) field school approach could be used, which promotes learning from farmers-to-farmers and helps adopt methodologies or business models that work in their settings.

Some of the practices that need to be promoted include, densifying feed into bales, pellets, multi-nutrient blocks using pelletizers, compressors and moulding machineries.

Strategic Objective 4: Transformation Dimensions

The Objective statement is:

Develop and strengthen institutional, policy-formulation and-research and human capacities on feed production and feeding. It aims to provide support to institution, technology and human capacity developers, and to policy and legislation making entities, for the transformation of the animal feed, water and related sectors, to meet the expanding needs of the livestock industry in Eastern Africa. It also aims at building the existing institutions, building new institutions that work on feeds and feeding issues.

Goal. To put in place clear operational guidelines, policies and legislations that promote investments, technology development, knowledge management and extension mechanisms aimed at minimising the constraints in the animal feed and water, and promoting the cross boarder sharing of feed and water resources.

Strategic Outcomes

Outcome 1: Enhanced capacity of institutions in IGAD and EAC member countries that are directly involved in livestock feed research, development and control to allow them to more effectively support the development of a vibrant feed sector catering for the need of different livestock species and production systems.

Outcome 2: Enhanced private sector participation in the feed and forageseed value chains and other efforts linking producers and processors to credits and financing instruments.

Outcome 3: Improved support to national and RECs efforts in building capacity and skills among all actors along the livestock value chains, including producer, processor and management associations at national apex bodies at subregional levels.

Outcome 4: More empowered and capacitated institutions directing, championing and advocating for best policies and practices in animal feed production (including ensuring feed quality and safety), animal feeding and livestock water use in Eastern African countries, including cross boarder sharing of feed and water resources.

Outcome 5: Accelerated creation of conducive policy and legislation environments and of policies aligned with agriculture and livestock development policies, for the livestock feed ingredient and feed production industries at national and subregional levels by relevant government agencies and RECs. Context. Several technical, socio-economic and policy constraints limit the degree and the scope to which animal feeds could be developed and water harvested for livestock to overcome the shortages and quality of these resources. Some of the challenges and constraints in the animal feed development and processing are weak human capacity (and even where human capacity exists, operational challenges and misplaced priorities prevent them from implementing their mandates), low investments in the feed sector including forage-seed production and distribution, inadequate standards and legislation, and low uptake of technologies in part due to weak extension services. Of the proposed solutions to overcome these constraints and challenges is the formulation and implementation of sound policies. The importance of sound policies is that they stimulate private sector investment in the animal feed sectors, and at the same time address animal feed quality and safety standards, and the enforcement of legislations that back feed safety. Broader benefits achieved from favourable policies and effective strategies include improved access of the poor to markets as a catalyst for rural poverty reduction. This can be achieved by improving their business management and marketing skills, and ensuring that they have the knowledge and technologies required to meet feed quality and sanitary standards. Furthermore, it is recommended that harmonizing, simplifying, and improving animal feed regulations and standards for feed value chains in Eastern Africa, through regulatory and policy reforms, will help to strengthen markets and improve competitiveness by making it easier for the value chain actors to manage regulatory responsibilities and access key inputs, especially safe and quality feed ingredients.

Main challenges. The main challenges to successful transformation of feed resources to high quality and safe feeds for diverse range of livestock species and their physiological stages, include:

- Low investments in institutions' technical innovation outreach platforms.
- Weak and poor infrastructure for feed manufacturing and delivery.
- Lack of feed processing machineries, equipment and tools.
- Lack of appropriate feed regulations and enforcement mechanisms including associated laboratory support.
- Weak research and extension to support feed and forage-seed sector value chain development and value addition.
- Inadequate conducive policy environments to promote private sector investments.
- Poorly implemented or coordinated policies.
- Poor or weak attention to feed quality and safety issues, feed quality and safety legislations and their enforcement

- Conflicts arising through feed and water sharing between livestock farmers and other land users and between domesticated and wild animals
- Challenge in sustaining pastoralism; especially considering some youths are not finding it attractive.

Opportunities. The opportunities offered are presented below.

- Greater appreciation of linkages between safe livestock feeds and safety of animal source foods.
- Growing public-private partnerships in the agriculture sectors in general.
- Improved climate for general agricultural policy reforms that may benefit reformation of animal feed sector.
- Greater awareness of the importance of innovation incubators.
- Leveraging on high-end technological innovations
- Enhanced options to link pastoralism to markets and make them business oriented

Strategic Actions

- Provide support to strengthen research-and-development infrastructure and capacity building in research and teaching institutions.
- Support efforts to improve or expand avenues to channel human and technical inputs from allied fields such as land tenure, toxicology, regulatory affairs, conflict management, agronomy, rangeland development, among others into the feed sector with the aim of making transformation of the sector more effective and efficient.
- Provide support towards smooth transition of traditional pastoralism to business-oriented pastoralism, which may attract youth, besides sustaining the trade.
- Support private sector participation in the feed and forage-seed value chains, including research and development, and other efforts that link producers and processors to credits and financing instruments.
- Improve trade of livestock and livestock products, leading to efficient markets. This acts as a pull for increasing production of animal source foods, resulting in enhanced food security and economic growth in the country and the East Africa region.
- Advocate and support national and regional efforts in building capacity

and skills among all actors along the livestock value chains, including producer, processor and management associations at national apex bodies at subregional levels.

- Support the creation of conducive policy and legislation environment for the livestock and feed industry.
- Support consultative and collaborative processes with stakeholders that alleviates conflicts arising due to sharing of water and feed resources and that synergises sharing of these resources between livestock and wildlife species.
- Strengthen policy research that evaluates effectiveness of the policies in place, to lead to adaptation, strengthening or abandoning of policies and to promote cross country learnings on policy issues.

Key Focus Areas for Actions, Investigations and Interventions

Some KFAs that provide support to institutions, including those involved in human capacity development and policy and legislation formulation, to make the animal feed sector vibrant and efficient are given below. As for other strategic objectives, the focus areas are not exhaustive.

1. Assess status of feed quality and safety laboratories and strengthen infrastructure and capacity including establishment of new laboratories

The region is facing new challenges, for example: increase in severity and frequency of droughts and locust infestations; heat stress on animals, soils and plants; increase in mycotoxin, pesticide and pesticide residue, heavy metal, antimicrobial levels in feeds, among others. To address problems that arise due to these ongoing changes and to enhance the quality of students graduating from the education institutions, well equipped laboratories and well-trained human manpower are must. Research and teaching institutions lack laboratory facilities and human capacity to address emerging issues in the feed sector and to provide support to the feed industries in introducing innovations. It is therefore important to assess the status of the existing laboratories and upgrade them with respect to laboratory equipment and personnel training. If need be, engage new institutions to conduct research and development work in the feed area.

2. Assessing the existing mechanisms for feed quality and safety control, proposing improvements, and implementing them

Quality and safety control for animal feeds is crucial for the livestock industry as it ensures that the intended feed meets international quality and safety standards. Knowledge of the infrastructure and human skills available in the country as well as at the sub-national levels would be necessary for proposing improvements needed to enforce the quality and safety standards. Some countries like Kenya and Ethiopia have feed safety and quality standards and regulations. Efforts have already gone into enhancing capacity in these areas including traceability of feeds in Ethiopia by FAO and United States Agency for International Development (USAID). In 2018, under the leadership of Veterinary Drug and Animal Feed Administration and Control Authority (VDFACA), Ethiopia has formulated directives for 'Feed risk assessment, management and communication'. Lessons can be learnt from these experiences in the region. Implementation of the directives and regulations require strong support from the laboratories. Good feed regulatory mechanism should also be in place..

3. Supporting the development of harmonized regional feed and forage quality and safety standard certification procedures

Countries need to identify their gaps for compliance with international standards such as the sanitary and phytosanitary standards (SPS), toxicity norms, and CODEX Alimentarius feed safety and quality requirements. The Code of Practice for Good Animal Feeding approved by the Joint FAO/WHO Codex Alimentarius Commission need to be followed and harmonised by respective countries. Given the direct links between animal feed and safety of foods of animal origin, it is essential that feed production and manufacturing are considered as an integral part of the food production chain. Within Eastern African region and at a local level within a country, there is a need to harmonise official feed quality and feed safety certifications that are in compliance with the international standards. Creation and/or strengthening of country and regional hubs to support and provide quick and affordable feed quality and safety analyses services should be put into consideration. To begin with, laboratories currently performing feed quality and safety analyses in the sub-region should be identified, upgraded through provision of technical and material support and possibly made regional reference laboratory.

4. Supporting national institutional building and policy development and research

Failure of the technology in meeting producers' expectations, lack of participatory approach in technology development and absence of producercentred research and extension programmes have been identified as major factors contributing to low technology adoption. The limited partnership among stakeholders (government, private sector actors and farmers) and the lack of long-term commitment of key players contributed to low adoption of feed technologies including those relating to cultivation of improved forages and their efficient use. Key factors that influence the adoption of improved forage production technologies are, availability of land, land tenure system, degree of market orientation, and income of producers. Evidence-based animal feed policy making requires reviewing of the agricultural and livestock sector policies and in particular analysis of constraints and opportunities of the animal feed industry including benefit-cost of such policies on economy of the country, natural resources and the environment. Policies should promote increased participation of the private sector, provide a conducive environment for adopting good manufacturing practices and to follow feed quality and safety standards, promote and stimulate a competitive animal feeds industry, provide a conducive fiscal and regulatory basis for the growth of the industry, and put in place suitable institutional framework and infrastructure for delivery of support services.

Research on policy issues is vital to understand which policies are working and which not, and the reasons for their success, partial success, or failure in generating the desires impact. This will pave way for development of more effective polices and for cross-country policy related learnings.

5. Promoting and advocating public-private partnerships

Partnerships between public and private sectors, and where appropriate multistakeholder partnerships, would bring remarkable improvements in producing quality and safe animal feeds. Opportunities for investment are enormous. Therefore, promotional and advocacy activities are required for developing effective partnerships. In terms of geography, local, national and regional partnerships will be useful to ensure that sufficient and quality feeds are available at all times. Depending on the context, the model of multi-stakeholder partnerships could be more useful at national and regional levels, and a more targeted public-private partnerships at a local level. Capacity development approach could help to ensure that capacities are built at individual, organizational and policy levels

6. Improving governance of pastoral land

Given the high pressure on land due to increasing population, urbanization, extension of crop production into the marginal lands, and other human activities, pastoralists face unique challenges in securing governance of land tenure. Unclear land tenure and pastoralists rights are giving rise to conflicts among communities, and more dialogue and good governance are needed. Both policy and technical aspects of pastoral land governance need to be addressed. Identifying the status of rangelands and grazing areas and disseminate best management practices is essential. Protection of core drought grazing reserves needs to be secured for the long term in order to ensure pastoralism remains sustainable. Even though the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security (VGGT)8 were adopted in 2012 at a global level and the VGGT Technical Guide on improving governance of pastoral lands9 in 2016, many high-level technical staff working in the field of land tenure are not acquainted with these guidelines and tools to improve governance of tenure. This is a missed opportunity to actively benefit from these international recognized instruments to address the many challenges pastoralists face. Some key activities that could realize this are: (1) development of strategic country action plans to allow for incremental steps to improve consistency of governance arrangements with human rights, so that national laws, policies, strategies and action plans are consistent with the lived experience of people; (2) establishment and strengthening of regional and national multi stakeholder platforms for land related polices and regulations to allow for a participatory process of land policy elaboration and coming together of the civil society and government to regularly exchange ideas and views on the issue of pastoral land governance; (3) supporting land governance policy implementation process in the countries in the region such as identification, systematic demarcation and certification of rangelands; (4) documenting and disseminating good practices for community land use across the region; and (5) supporting capacity building and training for institutions working on pastoral land governance, among others.

7. Providing training on existing technologies, knowledge management and innovations at national level and in targeted areas

Effective training and knowledge sharing on available technologies for sustainable feed production, feed processing, feed safety and quality, increasing biomass for use as feeds during normal and emergency periods would transform the sector at local and national levels. Some feed technologies can help reduce roughage feed bulk and improve the nutrients. Development of contents such as manuals, flyers and training programmes, and identification of trainees and organization of training programmes at local, country and regional levels are vital. In addition, documentation of case studies of successful micro, small and medium enterprises in the feed sector in the region, and facilitation of sharing of experiences across countries would contribute to strengthening of the feed sector.

8. Disseminating feed and forage technologies (including quality forage seed production) and innovations from institutions to communities

Over the years, the dissemination of research outcomes, technologies and innovations stalled due to limited policy support and insufficient linkages between research and extension services. These was worsened by the inadequacy of communication means among extension officers and their front-line workers. Most advisory reports and recommendations were left on bookshelves, seldom reaching the front-line staff who are in actual contact with the beneficiaries. Reports on technologies generated have been arguably not presented in a form that can be readily absorbed by extension officers or beneficiaries. Use of Information and Communication Tools (ICTs) could be boon for dissemination of messages to large audience.

⁸ FAO. 2022. Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security, FAO, Rome, Italy. First revision. Rome. https://doi.org/10.4060/i2801e (this version replaces the first edition released in 2012 to align with new FAO editorial guidelines).

⁹ FAO. 2016. Improving governance of pastoral lands. Governance of Tenure Technical Guide No. 6, FAO Rome, Italy.

7. Gender Balance, Youth Integration, Research and Innovation, Policy Development and Implementation, and Monitoring and Evaluation as Overarching and Cross-cutting Themes to all the Strategic Objectives

In Eastern African countries, women play an important role in rearing livestock. Their involvement at all stages, from participation in the research to training workshops (both as trainees or as trainers) on areas related to almost all activities listed in the four strategic objectives will enhance impact. Likewise, integration of youth in the livestock sector is important. Youth are more inclined towards adopting innovations, new tools and methodologies. These attributes should be kept in mind while conducting research on feed production and feeding strategies, to enhance youth participation. Likewise, the needs of women should be taken into consideration for interventions targeted toward them. Some examples being the use of light-weight equipment and approaches that reduce drudgery. While organising trainings for women, taking into consideration their daily schedule and workload would make it easy for them to attend. The tools and processes should be selected in a manner that enhance their use to generate the desired impact. The training should take place near their villages rather than in far of places. Communications on capacity building of the farmers must specifically mention the participation of women and youth, and convincing narrative should be included in the communications to attract them.

A number of innovations geared towards attracting youths to the feed production and processing are possible, as stated under the strategic objectives and actions. Also feed technologies have potential to generate jobs for them.

Furthermore, 'research and innovation' and 'policy formulation and implementation' are needed on all the activities listed under the four strategic objectives and should be integrated into their execution and implementation plans. The roles of research and innovation and of monitoring and evaluation are not only critical for the technical areas but are also of paramount importance in the identification of socio-economic criteria that further adoption of technologies and in formulation and implementation of policies to enhance impact of the activities. Hitherto, little attention has been paid to research on policy (e.g., which ones work and which one doesn't, and why; and as a result, changes required) as well as socio-economic issues, which are important for amplification of impacts of technical interventions. These areas along with research on linkages between increased livestock production and human health in Eastern African settings need strengthening. Monitoring and evaluation, from implementation of activities to assessing their impact, are equally important and should form an integral part of all the feed-related activities.

8. Implementation of the Strategy

The implementation of the Strategy should be in partnership and on regional, national and local levels. National governments should consider tailoring the EAFFS to fit their own priorities and specific context such as agroecological zones and farming systems. The framework provided in this strategy would help countries to develop their national animal feed and feeding strategies. At the country level, the implementation of the strategy may be driven by the ministry responsible for livestock development, involving all actors along the various livestock feed value chains, including producers, processors, marketers and input suppliers and their associations. To move from the strategic statements to the outcome level, national animal feed and feeding, action plans will need to be developed by each country to generate activities with milestones, targets and time frame, outputs and outcomes that will contribute to the achievement of the goals stated in the Strategy. Individual projects can then be fashioned out of the action plans. Updating and detailing out the Regional Animal Feed Action Plan (RAFAP)10, based on this Strategy, is required, to obtain a plan from which country-specific priority programmes and activities can be identified. Participation of subnational units is vital in the development of the national strategy and in realising the goals of the action plans derived from the national strategy.

As a first step, an inventory of studies conducted in the feed area, including different projects implemented by developing partners may help refine actions needed in each country and at sub-regional level. Agood start could be development and implementation of a sub-regional Technical Cooperation Programme (TCP), to start the initiative and push for national projects or a bigger sub-regional project that are of interest to the nations. Activities such as generation of sound feed-related data, for example feed resource availability including agro-industrial by-products, animal feed requirements and feed balance for Ethiopia and Kenya have been completed11, and those for Sudan, Somalia and Uganda are in progress. These activities help fulfilling objectives of this Strategy. The action plan also needs to include a monitoring and evaluation framework with measurable indicators to track progress, identify lessons learnt and use them for future planning and implementation and communication. Realistic budget estimations should also be included. The main challenges are expected to be availability of funds for implementation of the programmes that emanate from this Strategy, and political instability in some countries.

Partnerships that are complementary and create synergy are vital for resourcing funds from donors for the successful implementation of the strategy. The development of this Strategy involved partnerships with several organizations in the Eastern African region. This implies that most of the organizations and institutions within the networks that participated in the development of this Strategy would become players in implementation phase of the programmes at country and subregional levels. Existing partnerships must be strengthened while new ones need to be forged. Effective partnerships, wherein each partner knows its roles and responsibilities, and benefits to be accrued, are the building blocks for success. FAO and IGAD could play an important role in strengthening and fostering partnerships and in assisting the countries to raise funds from donors. In addition, Member States should mainstream existing human, material, and financial resources; mobilize resources from bilateral and multilateral donors; strengthen public-private partnerships for implementation of the Strategy..

9 Monitoring and Evaluation of the Strategy

The time frame of the Strategy is 15-years. Evaluation of the Strategy would take place every 5 years. The five-yearly evaluation should help in identifying appropriate actions that demonstrate potential for success, in addition to addressing issues or challenges in the design, implementation, and management of the Strategy. This would also provide opportunity to adapt the Strategy in case of any new emerging challenges. Feedback consisting of findings, conclusions, recommendations, best practices, and lessons from implementation experience will be used to improve performance, inform relevant policy formulation and decision-making. The learnings from the evaluation findings will also assist in devising implementation strategy for the future.

A final evaluation at the end of 15 years should be undertaken to focus on results, impact, and learnings on what worked and what did not, and why. This would inform decisions for continuation, replication, or scaling up. The final evaluation will also contribute towards identifying lessons to guide implementation and improve the results of future interventions. A comparative assessment of impacts achieved in East African countries as a result of different interventions would add to the learning process. Best practices will be documented, and lessons learned will be extracted for scaling up and policy dialogue by Member States.

10 http://www.fao.org/3/ca5965en/ca5965en.pdf

11 https://www.cabdirect.org/cabdirect/abstract/20203302547

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