2019

National Feed Resources Dev

2019 -2030

National Feed Resources Development Strategy

2019 – 2030

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Contents

Executive Summary

Ethiopia has a huge livestock resources having 59.5 million cattle, 30.7 million sheep, 30.2 million goats and 56.53 million poultry where more than 90% of them are indigenous breeds (CSA, 2016/17), playing vital role in the livelihood of smallholder farmers and pastoralists/agro-pastoralists, and to the country's economy at large. However, the country is not benefiting much from the sector due to various systemic bottlenecks, the main one being the lack of sufficient quality feed to support optimum livestock production. Feed both in terms of quantity and quality is in short supply.

There have been various efforts by different governmental and non-governmental organizations to address the bottlenecks of livestock production associated with feed supply both in terms of quantity and quality. These were done in terms of various support such as involvement in the development of various feed resources, support through extension activities, training of development agents and farmers or pastoralists/agro-pastoralists, and the like. As such various training and extension materials for feed resource development have been prepared by different bodies. However, such efforts have been scattered and a compressive strategy for the production, handling and enhanced utilization of the various feed resources in the mixed crop livestock system on the one hand and on rangeland rehabilitation and management in the pastoral/agro-pastoral system on the other appears to be lacking.

The development of feed resources and their efficient utilization demands a clear strategy that guides the proper way of feed production, management and utilization; and rehabilitation of rangeland resources to make the feed sub-sector a marketable commodity that could have a positive impact on livestock production. A situation analysis that scanned existing challenges and opportunities, the available resources, relevant past and on-going development and research activities, national development goals, institutional capacity and policy framework has been undertaken. Important strategic issues and interventions related to natural pasture, cultivated forage, crop residues, compound feed and rangeland development were identified. Strategic issues pertains to weak institutional capacity and investment; weak and/absence of

tailor made extension and market information system; weak vertical and horizontal value chain integration for livestock feed marketing; low availability of inputs and small scale machineries; lack of sustainable feed and water supply in the rangelands (drought prone areas); lack of adequate knowledge; absence of proper adaptation and mitigation of climate variabilities and change; and lack of well-articulated enabling policy and regulatory frameworks. This strategy is recognized the importance of paying due attention to sustainability, gender, food, nutrition, climate change, extension and monitoring and evaluation issues

Institutional roles and responsibilities of national and international organizations in line with the strategic interventions were identified. The time frame for implementation of the strategic interventions has been shown to range from short (0-2 years) to medium (3 to 7 years) and long term (8 to 12 years).

Moreover, the expected output of the strategy is to resolve the current disorganized feed development, conservation and utilization initiatives in which feed development interventions needs to understand the trade-offs and synergies between increasing productivity and impacts in the ecological basis of natural resources. This includes giving due attention to equity issues taking into account and mainstreaming the interests of smallholder farmers, women and the youth. This important to make sure that the livestock sector contributes its fair share in transforming the national economy while ensuring the welling of local livelihoods. The strategy also strongly advocates for broader human development and animal welfare, by giving due emphasis for the incorporation of human and animal nutrition in feed development interventions at all levels. Finally, the strategy calls for effective monitoring, evaluation and learning mechanism, supported by digital dashboard and data base, to track short term and long term targets set in the strategy.

1. Introduction

1.1. Background and Rationale

Animal agriculture in Ethiopia is a source of livelihood of several millions of smallholder farmers, agro-pastoralists and pastoralists. In Ethiopia there are a total of 58.7 million cattle, 63.1 million, small ruminants 11.3 million equines, 1.4 million camel and 56.1 million poultry excluding the non-sedentary areas of Afar and Somali Regional States (CSA, 2018), making the country leading in Africa (FAO, 2009). The official estimate for the Ethiopian livestock sector contribution to the agricultural GDP stands at 35%; while taking in account recent productivity figures, livestock population, non-food contribution of livestock sector and cross border trade effects, the contribution of the livestock sector to the agricultural GDP goes up to 47% (IGAD, 2012).

The Ethiopian government in its growth and transformation plan has identified livestock sector as a new source of economic growth in the second Growth and Transformation Plan (GTP II) and beyond. The rationale in using livestock sector as growth driver emanates from the unexploited potential of the sector, its potential contribution to export led economic growth and the wide range of agro-industries to be created along the path of market led economy and commercialization. Realizing this potential, the Ethiopian Ministry of Agriculture has developed Livestock Master Plan (LMP) for attaining surplus production of 2.151 billion liters' milk, 14.3 billion eggs, and 452 thousand tons of chicken meat by 2028 compared to the base year of 2014/15 (LMP, 2015).

The feed sub-sector is central for all livestock commodities and is a key pillar of livestock growth and transformation from various perspectives. From production point of view, animal production is essentially a conversion of feed into animal product. From economic point of view about 70 percent of the cost of animal production is feed cost suggesting economic feasibility of animal agriculture is mainly a function of quantity or quality of feed and the science of feeding. Additionally, animal feed is a point of convergence and critical commodity which all livestock

production competes for and it is a major pillar towards ensuring economic, social and environmental goals of livestock production at a macro level (Makkar, 2016).

From the livestock sector analysis of the livestock master plan and recent estimates of feed balance in Ethiopia (Makkar, 2018), attainment of targets set in the master plan demands modernization of the feed supply in various production systems. In the mixed-crop livestock production system, the major feed resources are grazing pasture and crop residues, which are limited in quantity and quality. In the lowland pastoral and agro-pastoral set up the range resources are the major feed resources which is challenged by low productivity, declining biodiversity and frequent drought. The production of cultivated forage and formula feed in Ethiopia are not yet brought to the desired level to augment the aforementioned basal feed resources. Against this scenario, the biophysical and socio-economic situations in Ethiopia clearly suggest the presence of huge potential for modernizing the feed sub-sector through strategic intervention tackling the key bottlenecks hampering the development of the sub-sector.

In the mixed crop livestock production system, crop residues and grazing pasture basal feed resources can be augmented by production of high quality cultivated forage crops and strategic supplementation using concentrate feeds and/or agro-industrial by-products. In the lowland pastoral and agro-pastoral set up, the current low productivity of range resources can be intervened through improved range management/rehabilitation and irrigated forage development. Additionally, the emerging commercial livestock production can be improved though enhanced production and utilization of formula feeds. In addition to the domestic demand, the huge demand of feed in Eastern and Northern African countries estimated at 2.9 billion USD per year (Demise, 2018) clearly indicates Ethiopia's strategic location to take an advantage of feed export market potential. Thus, the animal feed sector as input to livestock production and as a commercial commodity deserves strategic attention to make its best use. Realizing this scenario, it is felt essential to develop this strategic document to modernize the Ethiopian feed sector.

1.2. Vision

Achieve national feed security and commercialization of feeds for domestic and export markets though building vibrant and sustainable animal feed industry by 2030.

1.3. Mission

The mission of this strategy document is to ensure supply of adequate, quality and affordable feed and development of competitive animal feed industry through technological, institutional and policy support.

1.4. Goal

This strategy is intended to contribute to the country's macro level economic, social and environmental goals pertaining to; (i) ensuring feed security and commercialization; (ii) ensuring food and nutritional security; (iii) sustainable supply of raw materials for agro-industries and import substitution; (iv) expanding the bases for the country to gain foreign earnings from agricultural exports; and (v) increasing livelihood resiliency and environmental sustainability while reducing vulnerability to and exacerbation of climate change.

1.5. Objectives

The overall aim of this strategy is to facilitate technology/knowledge transfer and utilization of innovative approaches, which contribute for adequate and sustainable supply of quality/safe feed for attaining the desired productivity, product quality, sustainability and competitiveness of the feed and livestock industry in Ethiopia. The specific objectives are:

(1) To put in place the necessary enabling environments (human and physical capacity, institutional and policy framework) for efficient and effective undertaking of the desired tasks related to feed resource development, utilization and commercialization.

(2) To avail the required technical support for production of adequate, quality, safe and affordable feed that would contribute to realization of sustainable and rapid development of the country through building the feed and livestock industry

(3) To provide national framework and to create institutional linkages for participatory demonstration and popularization of feasible, socially acceptable and environmentally sustainable technologies and best practices in feed production and utilization.

(4) To put in place effective guiding document for national coordination of feed development endeavors to support growth and transformation of the Ethiopian feed and livestock industry.

1.6. Scope

This strategy focuses on enhancing production and utilization of feeds in the mixed crop livestock system, pastoral/agro-pastoral system and commercial livestock production. Under these systems, the target groups taken into account by this strategy document include smallholder farmers, pastoralists and agro-pastoralists, commercial farmers, and commercial feed producers, processors, input suppliers and service providers. In terms of animal category, this strategy document encompasses both ruminant and mono-gastric animals (Poultry and fish) feeding management systems that will enhance the productivity of the animals.

1.7. Guiding principles

This strategy will be guided by the following important and governing principles.

- Aligning with the development policy and plans of the country
- Demonstrating transparency, accountability, inclusiveness, and gender equity
- Enhancing competitiveness of feed development program through capacity building and harnessing application of proven technologies and best practices that leads to meet the national standards

- Capitalizing on fundamental knowledge globally available and make good uses of experiences and practices from other countries in the tropical region and move in a catch up approach in availing information and technology to users
- Establishing and sustaining collaborative relationships with relevant organizations (national and international), sectors (crops, natural resources, social science), inter and intra-disciplines
- Integrating value chain and innovate systems perspectives for ensuring competitiveness of the feed industry which would serve as spring board for enhancing productivity, product quality, safety, market efficiency and environmental sustainability of the feed and livestock sub-sector
- Accountability to clients and users and encouragement of a vibrant public private partnership in animal feed development and utilization
- Participatory planning, implementation, and monitoring and effective technology transfer
- Creating favorable environment of stakeholders for long term engagement and shared responsibility

2. Situation analysis

2.1. Development Goals of the Feed Sector

In GTPII it is planned to increase the animal feed production from 73.3 million tons in 2014/15 to 233.69 million tons by 2019/20. Improvement of communal grazing land will increase from 1.32 million hectares in 2014/15 to 5.09 million hectare by 2019/20. Improvement in private grazing land will increased from 59.5 thousand hectares in 2014/15 to 160.7 thousand hectare by 2019/20. The inspected number of commercial feed producers based on Inspection Guideline that meet the requirements of feed Safety and Quality will increase from 40% in 2014/15 to 90% by 2019/20. Overall, the amount of annual and perennial forage seed production will increase from 2.2 thousand tons in 2014/15 to 8.9 thousand tons by 2019/20. Assessment of the progress made y 2010 EC on total feed production indicates achievement of

109.5 million tons against 143 million ton planned for the year. This suggests the need for enhanced engagement to reach the set GTP II targets, where the feed strategy could be instrumental in this regard. The livestock commodity targets of the GTPII that requires enhanced feed supply are indicated in Table 1.

Table 1. Development Goal of the Livestock sector according to the GTPII plan

Production type / sub-sector	**Unit of measure**	**Baseline year target (2014/15)**	**GTP II target for 2019/20**
Meat from cattle, goat, camel and poultry	thousand tons	1,321	2,097
Milk from cow, goat and camel	million litres	5,304	9,609
Skins and hides	million	22.4	35.6
Eggs	million	163	3,938
Honey	thousand tons	60.7	123.9
Wax production	thousand tons	5.7	8.6
Silk cocoon	tons	3	22.8
Fish	thousand tons	51.2	95.6

2.2. Current development and research strategies and programs

2.2.1. Inventory of National Development/Research Strategies and Programs

There are different national development and research initiatives that are strongly related to the current national feed development strategy. These initiatives have direct or indirect bearing on the Ethiopian feed sub-sector development endeavours. Brief highlights of these initiatives are described below.

GTPII Plan: Livestock is a focus of the GTPII plan in both the mixed farming and pastoral agro-pastoral areas. The sector was identified as one of the main drivers of the economic growth and development. According to the GTPII document, the livestock sub-sector is expected to bring about radical change in both sedentary agriculture and pastoral areas. Key development actors in livestock include smallholder farmers, pastoralists and agro-pastoralists, and the private sector. The livestock development endeavours are planned to ensure

productivity improvement of the sector aligned with the CRGE strategy of the country. Enhancing productivity and quality of livestock products planned to be destined for industry inputs and export diversification was given special emphasis in the GTP II document. The competitiveness, quality and productivity enhancement schemes are expected to be facilitated through proper development and dissemination of available technologies, implementing extension system, and the scaling up of best practices. In terms of improving supply of quality feed, the document highlighted increased target for feed production through development of communal grazing land and rangeland, increased number of fodder producers, increased forage seed production, increased agro-industrial by-products and these tasks are aligned with this current strategy development objective.

Agricultural Growth Program (AGP): Initiated in 2010, AGP has been working to accelerate the release of livestock technologies, in shopping and adoption of technologies, demonstrating available technologies released by the research system, and develop demand-driven agricultural technologies tailored to specific agro-ecologies and socio-economic conditions of the farming community. Group based extension activities dealing with livestock production issues and market/marketing needs has been planned by the program. Interventions aimed at improving the smallholders' access to improved livestock production services have been a focus of the program for implementation. Technology adoption and generation in livestock (improved dairy, forage and poultry technology piloting) has been planned. In livestock a total of 132 pre-extension demonstration activities for released technologies, and construction work of 17 livestock primary market centers were planned for implementation as part of the program activity.

Livestock Master Plan (LMP): Developed in 2015, the LMP sets out investment interventions to transform the livestock sector through better genetics, feed and health services, which, together with complementary policy support could help meet the GTP II targets for key livestock value chains for i.e., poultry, red meat, and dairy. Proper investment is estimated to lead to

poverty elimination of approximately 2.36 million livestock keeping households, helping family farms move from traditional to improved market-oriented systems and adding to agricultural GDP. In terms of the animal feed sub-sector, increase in public investment in rehabilitating range and pasture lands to improve feeding management and enhancing the promotion by the GoE extension services of improved feeding were among the key identified areas of intervention. Moreover, policy issues like the promotion of the establishment of more private-sector flour and oil mills to encourage the production of additional feeds from agro-industrial by-products by introducing protective policies against flour and cooking oil imports; the promotion of land leasing including land under irrigation; and the provision of tax incentives and subsidized leasing rates to private entrepreneurs; the promotion of feed efficiency through the removal of the double-imposition of VAT and excessive customs duties on feed mill ingredients; and the introduction of quality control measures were the recognized areas for intervention to enable the feed sub-sector contribute to realization of the set targets.

Policy and Investment Framework (PIF): The PIF is a 10-year road map (2010-2020) that provides a strategic framework for the prioritization and planning of investments to drive Ethiopia's agricultural growth and development. The PIF recognizes livestock as an important household asset for livelihood. The PIF is planned to achieve a sustainable increase in agricultural production and productivity, to accelerate agricultural commercialization and agro-industrial development, to reduce degradation and improve productivity of natural resources, and to achieve universal food security and protect vulnerable households from natural disasters. Productivity gains were planned to close the large gap between leading farmers and the majority, via up-scaling proven and appropriate agricultural technologies supported by a revitalized agricultural research and extension system, combined with improved supply channels for farm inputs. Improved animal husbandry and nutrition particularly using farming systems based fodder production technology are among the focus areas of investment. Better rangeland management including the use of exclusion areas, forage development and drought preparedness are also targeted areas for investment.

Agriculture and Rural Development and Ethiopia's Agricultural Extension strategies: These strategies recognize increasing productivity in smallholder agriculture as a top priority, which demand appropriate livestock technologies to be disseminated through a strong agricultural extension system. The strategies identified key pillars and interventions to integrate best practices and innovations for effective delivery of extension services to smallholder farmers to transform the Ethiopian agriculture.

Ethiopian Institute of Agricultural Research (EIAR): EIAR has developed national research strategy documents for the period of 2016-30 for nine commodity oriented programs (Dairy, Beef, Sheep, Goats, Camel, Poultry, Fish, Apiculture and Sericulture) and three cross cutting thematic area programs (Feeds and nutrition, Range and Animal health). The strategies focus on generation of appropriate technologies, pre-extension demonstration and national coordination of research engagement. The strategies were drawn within the context and in conformity with national and global emerging trends while taking advantage of the current and emerging opportunities. The strategies were framed in alignment with the Global and Nation development goals and programs.

2.2.2. Institutional capacity and policy framework

The contribution of the livestock sector to the national economy was not well understood for long, resulting in weak policy support to the livestock sector. However, recent studies indicate a reasonable potential of the livestock sector in improving the national economy and local livelihoods if supported by favorable policy interventions (Gelan et al, 2012). Evidences for this include the presence of Feed Resource Development Directorate within the Ministry of Agriculture and the establishment of Veterinary Drugs and Animal Feed Administration and Control Authority (VDFACA). Moreover, efforts made to fill the necessary staff at the federal and regional levels, and allocation of one livestock extension agent among the three extension agents in each Kebele is a step forward for providing necessary support to the livestock and feed sub-sector. While these are important progresses in realizing the huge potentials of the national

livestock resources for socio economic growth, the livestock sector in general and the feed industry in particular should receive due attention it deserves in terms of institution and policy.

The feed sector development in pastoral areas has been the major component of the different pastoral development initiatives. The interventions constitute livestock feed development through irrigation and the rehabilitation of degraded rangelands (Makkar *et al*., 2018). The feed developed in the pastoral areas is planned to be used for commercialization as well as fodder bank establishment that can serve as emergency feeding during drought.

As part of the conservation-based agricultural development strategy, construction of soil and water conservation structures; area enclosures linked with cut-and-carry system of forage supply; community grazing land management; and small-scale irrigation schemes have been carried out contributing to the national feed resource supply.

2.3. Strength, Weakness, Opportunity and Challenges (SWOC) Analysis

The Ethiopian feed resources development over the years had its own strengths and weaknesses to build on present scenario for future improvement. Strengths and weaknesses are the internalities of the present situation of the feed sector within the country. Opportunities and challenges are the externalities of the future situation. The SWOC analysis is intended to identify strategic issues of attention to formulate the strategic approaches for the Ethiopian feed sector development. Detail analysis of strengths, weaknesses, opportunities and challenges (SWOC) of the feed sector improvement is indicated in Table 2.

Table 2. Summary of the strengths, weaknesses, opportunities and challenges assessed from the perspectives of the External and Internal factors

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
General			
Capacity building			
• Human capacity: Increasing number of feed, forage and rangeland expertise • Physical capacity: Some physical capacity in feed, forage and rangeland management such as feed processing plants, laboratories, market facilities, ICT and other infrastructures	• Limited number of expertise in critical areas such as improved feed production, processing, feed safety and quality analysis, and feeding systems • High turnover rate of human capital • Low motivation of experts at different levels • Inadequate infrastructure and laboratory facilities	• Various higher learning and ATVET colleges opened with feed, pasture, fodder and rangeland programs • Government commitment to improve the livestock sector in general and feed resources in particular • Presence of research and development governmental and non-governmental institutions that can generate and promote technologies	• Limited incentive for public servants • Insufficient financial investment for capacity building
Coordination and linkage			
• Presence of national framework and discussion forum for planning and reporting of federal and regional activities • Presence of some coordination mechanisms such as ADPLAC, Research and Extension Forum,	• Limited functionality of existing forums • Weak linkages in planning and reporting between federal and regional offices	• The presence of federal and regional structures to support effective coordination and linkages •	• Absence of binding policy framework for coordination and linkage within government, and among government and non-government actors

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
REDFS, NGO platforms, pastoral taskforce, pastoral development forums	• Absence of particular platform for coordination of feed related issues		• Limited financial mechanism for facilitation of coordination platforms
Extension system			
• Availability of FTCs and livestock development agents at Kebele level	• Poor investment in livestock extension implementation • Inadequate skill of extension agents • Limited tailor made technologies to each agro-ecology • Absence of specialized extension system for livestock	• The involvement of higher learning institutions and community based services for extension • The growth of market-oriented production system demanding improved extension services	• Public nature of extension provision • Limited private sector engagement in extension provision
Monitoring and Evaluation			
• Presence of M & E operational structure at different levels	• Absence of effective M & E systems (monitoring, evaluation and feedback measures)	• The move for result based and digitalized M & E and learning system	• Infrastructure to support and align modern M & E system at different levels
Enabling policy and regulatory frameworks			
• Government interest in developing the livestock sector in general and the feed sector in particular	• Absence of supportive policy initiatives such as tax reliefs, and investment incentives • Lack of strong regulatory capacity (human, physical,	• Existence of related policy instruments such as the livestock master plan, feed	• Negative perception on environmental impacts of livestock

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
● The establishment of VDAFACA that support the regulatory wing	financial and regulatory guidelines) ● Absence of tailor made policy initiatives to support pastoral and range development	research strategy, beef development strategy	
Natural Pasture in crop-livestock mixed production System			
● Availability of improved grasses and forage legume species suitable for natural pasture improvement for different agro-ecologies ● Availability of improved natural pasture production, conservation and utilization options	● Weak research and extension in generation and promotion of natural pasture technologies ● Limited effort in replacement of unproductive natural pastures with improved forage species	● High demand for livestock and livestock products and the need for intensification ● Availability of pasture production options in integration with Natural resource management	● Shrinkage of grazing lands mainly due to expansion of crop lands and increasing population pressure ● Absence of proper land use plan
● Availability of diversified native forage genetic resources adaptable to different agro-ecologies	● Loss of important indigenous forage species due to overgrazing and natural pasture degradation ● Limited effort on collection, characterization, improvement and multiplication of native forage species with high feed potential	● Existence of international and national collaborations for accessing genetic materials ● Existence of various GO and NGO and international Initiatives on degraded land protection and improvement	● Absence or limited focus on native forage biodiversity conservation, improvement and multiplication

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
● Availability of good traditional practices for management and utilization of private and community grazing lands	● Weak application of traditional good practices in the development and use of communal pasture lands ● Limited attention and awareness on the importance of traditional practices as an entry point for interventions ● Absence of tailor made market oriented livestock production system	● Existence of traditional institutions for management of community grazing land resources	● Population pressure, conversion of grazing lands to crop lands, and environmental change
Cultivated Forage crops			
● Availability of recommended and quality improved grass, forage legume and browse species with their production packages	● Limited forage seed and planting material supply ● Poor extension services on forage development ● Absence of tailor made market oriented livestock production system ● Limited research and extension linkages	● Availability of suitable agro-ecologies for forage production under irrigation and rain-fed conditions ● High demand for livestock and livestock products ● Increasing demand for quality livestock feeds in the local and export market ● Government initiatives for sustainable forage intensification	● Land shortage ● Absence of seed certification and marketing system for forage seeds ● Lack of incentives for forage seed production investment ● Lack of compelling evidence and knowledge on the comparative economical benefit and role of cultivated forages ● High investment requirement for improved livestock production (market oriented)

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
● Availability of irrigation potential for forage development in high livestock production potential areas	● Limited awareness on economic benefit of forage production under irrigation compared with other food crop production	● Can be used as an opportunity for job creation to women and youths	● High investment cost for irrigation schemes
● Have different options/ strategies of integrating forage crops with other systems of complementarity effect (integration with natural watershed management and intercropping with tree and food crops)	● Limited linkage with crop and NRM sector ● Weak extension efforts to scale up best forage integration practices (intercropping forage with coffee, maize, enset, etc) ● skill gap by farmers and extension agents with regard to integration of forage and food crops	● current high national focus on natural resource conservation ● Crop livestock integrations contribution to the efforts on global climate change effects ● production of high quality forage for livestock	● lack of directives and guideline for forage food crop integration ● limited application of laws and by-laws in utilization of developed forage species in watersheds
● Forage crops could be produced as a commercial crop for local and export market	● low investment and engagement of investors in forage production and marketing	● High demand and attractive prices for feed resources	● lack of incentives, ● poor marketing supports in the local and export markets
● High efforts have been made on demonstration and promotion of recommended/released cultivated forages in high potential areas	● limited scope in area and available forage technologies ● poor extension system specific to forage production	● availability of more efficient technology demonstration or information exchange mechanisms	● inadequate and ineffective capacity of development workers

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
● Availability of feed crops for mono-gastric/ poultry like maize and soybean	● low availability and quality of mono-gastric feed ingredients	● high demand for poultry feed ingredients like maize and soybean ● increasing demand for poultry and poultry products ● intensification of poultry production	● limited incentives for investment, land, taxation, credit ● limited market linkage
Crop Residue			
● Increase in area and productivity of crop agriculture	● Lack of proper collection, management and utilization ● Limitation in feeding value	● Commercialization of crop residues ● There are emerging technologies to enhance crop residues as livestock feed (TMR, densified block)	● Trade-offs in the use of crop residues for other alternative uses. ● The burning of sesame crop residue
● The ability of improving the feeding value of crop residues	● Low adoption of improved technologies	● The presence of proven and emerging technologies to improve feeding value of crop residues	● Lack of skill, knowledge and awareness of farmers and the extension system to treat crop residues ● Lack of input (chopper, urea, baller, EM) supply for better utilization of crop residues ● Labor demanding nature of some of the crop residue treatment technologies.

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
● Crop residues can easily be stored and manged with minimal input	● Little attention given to improve, conserve and utilize crop residues ● Lack of knowledge on the potential of crop residues as livestock feed	● The presence of proven and emerging technologies to conserve crop residues (densified block) ● Utilization and commercialization of crop residues can be improved through proper handling and storage	● Wastage of crop residues associated with free access of livestock to the resources, and lack of proper packaging and storage mechanisms ● Low nutrient density and bulkiness of the feed resource demanding lager storage areas
● Crop improvement schemes can improve the potential of crop resides	● Lack of focus of crop improvement research schemes in improving the crop residue nutritive value	● Potential for developing crop varieties with improved crop residue nutritive value	● Focus is on grain yield ● Limited linkage of crop and livestock researchers for the development of food and feed based crop varieties
● Information is available on nutritional profile of crop residues	● Lack of proper ration formulation and level of different crop residue utilization as feed for livestock	● TMR can be formulated based on recommended rate of inclusion of crop residues	● Limited research outputs on the inclusion rate of crop residues
Compound feed (agro-industrial by-products, premix and feed additives and formulated feed)			
● High potential for increased domestic production of compound feed and ingredients	● Lack of proper marketing channel for feed ingredients and compound feeds ● Low production level of compound feed	● Emerging trend on value addition of agricultural commodities ● Macro-economic policy supporting investment and commercialization	● Sustainable and adequate supply of feed ingredients ● High cost of ingredients and compound feed ● Limited direct and efficient market linkage of ingredient

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
	● Underutilization of some potential feed resources (fish offal, sugar cane byproducts, brewery byproducts). ● Limited knowledge on ration formulation for differ animal species ● Inadequate policy support ● Limited financial support for investment in the area	● Emerging trend in intensification of livestock production demanding quality feeds ● Escalating cost of basal diets that lead to the relative profitable alternative use of compound feed	producers and compound feed producers ● Limited technical capability to support production of formula feeds, and utilization of agro-industrial by-products ● Absence of domestic production and reliance on importation and high cost of premixes and feed additives
● Government support to reduce feed cost by removing VAT	● Lack of prompt action or policy support on taxation of ingredients and compound feed ● Lack of compelling evidence for tax exemption on feed and feed ingredients	● Attention received by government policy to transform the livestock sector	● Unregulated price of feed ingredients and compound feed ● VAT and multiple taxation on feed ingredients and compound feed
● The presence of public institution with functional extension system in place	● Lack of actors' convergence /platform to develop the feed value chain ● Lack of awareness creation	● The presence of research extension linkage that can support the extension system ● The involvement of the private sector in feed production that can provide extension support	● Lack of strong research and extension support on wider use of agro-industrial by-products and formula feeds
● The move towards exporting agricultural products after value addition	● Exporting agricultural products without value addition	● Emerging trend on value addition of agricultural commodities	● Agro-industries are running below their capacity because of shortage

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
	● Lack of investment, experience and capacity on processing of agricultural products	● Macro-economic policy supporting investment and commercialization	of raw materials, which affect compound feed processing. ● Feed companies are operating below capacity
● The presence of an institution to regulate feed quality and safety ● The presence of emerging initiative to establish database in livestock	● Limited human and analytical capacity for regulatory services ● Lack of mandatory feed standards for quality and safety ● Lack of capacity and experience to regulate feed quality and safety ● Lack of comprehensive statistics on national feeds	● The growing demand for quality feed associated with enhanced interest to invest and work in livestock production ● The emerging regional and global agenda in the supply of quality and safe livestock products ● The export market that demands ensuring delivery of safe livestock products	● The absence of standardized rations ● Lack of quality assurance both for feed retailers and compound feed processors ● Under developed feed regulatory services ● Limited institutional and human capacity to generate and document national feed statistics to guide research and extension engagement
● Potential of the country for indigenous minerals sources that may serve as a base for investment	● Reduced feed quality that can generated the required performance due to inadequate supply of minor nutrients	● Presence of huge demand for quality feed ● Presence of encouraging policy framework for investment	● Lack of domestic production of premixes and feed additives
Rangeland bio-physical resources			

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
● Vast potential rangeland resources Support millions of pastoral and agro-pastoral population ● Biodiversity significance ● Source of high quality food and export revenue ● Source of eco-tourism ● Ability to be relatively resilient despite numerous pressures imposed	● The potential resource not properly quantified and is also undervalued ● Declining rangeland condition and cover (% in poor condition) ● Lack of reserve feed for drought and critical season ● Shortage of water points at strategic locations ● Lack of proper understanding about rangeland and pastoral livelihood by policy makers	● Availability of research centres and research strategy in different pastoral and agro-pastoral areas ● Availability of undergraduate and graduate programs ● Presence of pastoral and agro-pastoral standing committee in the house of parliament ● Presence of different offices at national and Region levels ● Changing government attitude towards pastoral and agro-pastoral production systems	● Climate change and variability/ ● Erratic and low rainfall; high evapotranspiration ● Allocation of vast area of rangeland for non-pastoral use (rangeland shrinkage) ● Lack of clear policy on rangeland and land tenure system
Rangeland grazing management			
● Availability of indigenous knowledge and institutions	● Weakening of traditional institution, rules, regulations, norms, etc. ● Lack of proper understanding about rangeland and pastoral livelihood by policy makers ● Declining rangeland management practices ● Land degradation (e.g., vegetation, soil,)	● Availability of some scientific knowledge on grazing systems ● Availability of research centres and research strategy in different pastoral and agro-pastoral areas ● Availability of undergraduate and graduate programs ● Availability of different projects in rangeland management	● Climate change and variability ● Allocation of vast area of rangeland for non-pastoral use (rangeland shrinkage) ● Lack of clear policy on rangeland and land tenure system ● Restriction of mobility ● Expansion of alien herbaceous and woody species ● Inter and intra clan conflicts

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
	● Lack of adequate knowledge on ecosystem approach ● Shortage of applicable rangeland technologies / grazing systems technologies	● Presence of different international, national and regional offices	
Rangeland rehabilitation, restoration and conservation			
● Availability of indigenous knowledge and institutions in rehabilitation, restoration and conservation ● Availability of some manpower, facilities, scientific knowledge base ● Availability of best practices in RL rehabilitation by government and non-government organizations	● Fragile environment which requires proper management ● Lack of proper understanding about rangeland and pastoral livelihood by policy makers ● Land degradation (e.g., vegetation, soil,) ● Biodiversity erosion ● Lack of appropriate pastoral training centres in different pastoral areas in regard to RL ● Knowledge gap about the current status of rangelands ● Decline in forage biomass ● Poor and inefficient extension system ● Lack of adequate knowledge and regulatory framework on the four fundamental process of ecosystem (water cycle, mineral	● Availability of research centres/research strategies ● Availability of undergraduate and graduate programs ● Availability of different project in rangeland management ● Presence of different international, national and regional offices	● Climate change and variability ● Lack of clear policy on rangeland and land tenure system ● Restriction of mobility ● Expansion of alien herbaceous and woody species ● Inter and intra clan conflicts

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
	cycle, community dynamics and energy flow) ● Carbon stock depletion if degradation continues		
Adaptation and mitigation of climate variabilities and change			
● Presence of some meteorological stations and associated advances in climate services ● Presence of research staff and research strategy ● Availability of IK on climate forecast and adaptation strategies ● High potential for mitigating climate change (carbon sequestration) if properly managed	● Lack of proper focus on range related climate ● Lack of appropriate early warning indicators and forecasting capabilities ● Shortage of meteorological stations and facilities ● Shortage of appropriate adaptation and mitigation strategy	● Availability of research centres/research strategies ● Availability of undergraduate and graduate programs ● Availability of different projects in rangeland management and climate related issues ● Presence of different international, national and regional offices ● Good understanding of the federal government on issues of climate	● Lack of proper understanding on climate, rangeland, livestock and pastoral issues at global level. ● Land degradation and shrinkage (e.g., vegetation, soil,) ● Restriction of mobility ● Weakening of traditional institution, rules, regulations, norms and etc ● Lack of adequate rangeland technologies
Market and extension system			
● Availability of different government and non-government advisory service providers ● Availability of market infrastructure	● Weak pastoral advisory service provision ● Weakness in distribution and functionality of market infrastructure ● Inadequate investment in market, advisory services, and	● Recognition of the importance of market and extension service delivery by government and non-government actors ● Availability of ICT tools and infrastructures	● Lack of clear policy on rangeland and land tenure system

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
● Emerging opportunities for livestock feed marketing	general infrastructure in pastoral areas ● Lack of proper understanding about rangeland and pastoral livelihood by policy makers ● Weak vertical and horizontal value chain integration for livestock feed marketing ● Weak market information system ● Subsistent orientation of the pastoral production system	● Government effort for improved infrastructure and social service provision	
Cross cutting issues for sustainable feed strategy			
Social dimensions, gender and youth			
● Presence of national gender and youth strategy in agriculture and mainstreaming documents and working groups	● Implementation gaps in mainstreaming gender and youth issues	● Governmental and non-governmental organizations are interested in mainstreaming gender and youth in their development planning ● Presence of government directives	
Human dimensions, food and nutrition security			
	● A focus on quantity of feed production, at the expense of nutritional quality	● Global and national commitment for nutrition sensitive agriculture	● High population growth and degradation

Internal Environment		External Environment	
Strength	Weakness	Opportunity	Challenge
● Increasing attention to nutritional aspects of feed production and utilization			
Environment and climate change			
● The presence of strategic directions in building climate smart green economy	● Lack of attention in targeting climate change and mitigation ● Lack of tailor made livestock extension	● Global and national focus given to climate change and green economy ● Donors and development partners interest in sustainable production systems	● Absence of financial alternatives to pursue sustainable pathways

2.4. Bench marking

Ethiopia is endowed with vast potential livestock resource but the economic advantage attained from this sector is minimal. The livestock potential would contribute to the level expected if feed related key constraints are alleviated. Despite research and development efforts made to improve the feed sub-sector in the country, progress made so far has not been to the desired level. To fill this gap and move in a catch-up approach, it is necessary to capture global experiences in the sub-sector in terms of bench marking. The bench marking is intended to identify best bet practices in feed resource development and setting the desired targets to be achieved under Ethiopian context. For this purpose, feed specific bench marking has been done for major categories of feed resources.

Comparable settings in terms of agro-ecology, livestock and/or feed resource development history, progress made so far in feed resources development that can be adopted to Ethiopian condition, and level of utilization of the different feed resources that are used in Ethiopia have been used as a basis for selecting countries for bench marking. Accordingly, Brazil and India for cultivated forage and natural pasture development, South Africa for compound feed production, India for crop residue proper utilization, and South Africa, Australia and Botswana for rangeland development have been bench marked. Details of comparison of Ethiopian and bench marked countries are indicated in Tables 3 to 6.

Table 3. Natural pasture and cultivated forage production comparison of Ethiopia and the bench marked countries (Brazil and India)

Status/Best Practice	Indicator	Unit	Ethiopia	Brazil	India
Natural Pasture					
Production base	Contribution to country's feed source	%	56% natural pasture (Grazing)	90 % pasture lands	18% Grasslands
	Total Area	Million hectare	61-65	160-190	10.2
Average productivity of native pastures/grasslands	Lowlands	DM ton/ha	1	-	2.2-5.0
	Highland and mid-altitude freely drained soils	DM ton/ha	3		
	Highland and mid-altitude fertile areas	DM ton/ha	4–6		
Average productivity of improved grazing pastures	-	DM ton/ha	10-15 (at research level)	15-20	4-5 fold of native grasslands
Carrying capacity	-	animal per hectare per year or hectare per animal	1.5 - 3 LSU (adult dairy cows weighing 3000 Kg) per ha in 1985; No reference data for current carrying capacity of natural pasture	2.5 ha per animal in 2001; 1.0 ha per animal in 2006; Stocking rate increases 2.3 percent annually between 2014 and 2024	-

Cultivated Forage					
Production base	contribution to country feed supply	%	0.32	62 % of the pastureland	28
	Area coverage	million hectare	-	116 (62% of pastureland)	9.4 (4.4% of cropped land)
	Average productivity	DM ton/ha	10-15 (at research level)	15-20	12.0 to 23.4
	Management System and utilization	Status	Customary	Modest to intensive forage systems	Modest to intensive forage systems
Advisory services and regulatory capacity	Advisory	Status	Underdeveloped advisory service	Demand driven or supply driven	Harness advancement in the information technology
	Variety release and seed certification mechanism	Status	Under developed	Well developed	Well developed
Policy support	Seed/planting material supply system	Status	Lack of incentives and higher level policy support for production of forage seeds/planting materials	Opportunistic to highly specialized/	Opportunistic to highly specialized
	Research and Extension support	Status	Lack of focus and attention to carry out collaborative activities	Market oriented, Strong government and other development actors support	Market oriented and attached to information technology (utilizing suitable ICTs).
	production and marketing of quality forage and forage seed	Status	Under developed marketing system	Well developed and efficient marketing system for input and output (small and big seed farms exist)	Producers assisted by Seed corporation and National Dairy development board of India to market surplus certified seeds

Table 4. Compound feed production comparison of Ethiopia and the bench marked country (South Africa)

Status/Best Practice	Indicator	Unit	Ethiopia	South Africa
Industry base and capacity	Annual production of compound feed	Million ton	0.061	11.74
	Feed processing plants	Number	60	
	Production capacity	Status	Working under capacity	Working with full capacity
	Diversity	Category	Limited to private and farmers' union feed companies	Supported with integrated feed production (commercial livestock integrated commercial feed production)
	Number and level of Expertise	Status	Dominated with Junior experts with very limited industry experience	A number of world-class nutritionists who have years of experience in the industry Keeping abreast of international developments in the science of animal nutrition
	Equipment	Status	Traditional feed processing facilities	Modern and state-of-the-art facilities and equipment for feed processing/ration formulation
	Ingredient supply	Status	Insufficient and expensive	Reliable, affordable domestic supply with excess for export
Advisory services and regulatory capacity	Advisory	Status	Underdeveloped advisory service	Effective and capable advisory service
	Feed standard and regulation	Status	Under developed and emerging regulatory landscape	Well developed and strictest self-regulations to ensure safe feed for safe food are produced at all times
Policy support	Ingredient supply	Status	Lack of focus and absence of higher level policy support for streamlining domestic production of feed ingredients, premixes and feed additives	Focused and strong commitment of government in domestic production of feed ingredients and domestic production of premixes and feed additives
	Research and extension support	Status	Lack of focus and government attention in public service to the commercial feed industry	Strong public support
	Market	Status	Under developed marketing system	Well developed and efficient marketing system for input (ingredient) and finished product

Table 5. Crop residue production and utilization comparison with the bench marked country (India)

Status/Best Practice	Indicator	Unit	Ethiopia	India
Production base, management and utilization of crop residues as livestock feed	Annual production of crop residue	Million ton	50	500
	Management and utilization	Status	Traditional management and utilization	Efficient collection, processing and enhanced utilization
	Number and level of expertise	Status	Dominated with Junior experts with very limited practical experience	A number of world-class experts in research, extension, higher education
	Equipment	Status	No feed processing facilities and machineries	Modern and state-of-the-art facilities and equipment for processing of crop residues
Capacity and working culture	Human capacity	Status	Limited human capacity	Well trained, specialized and required critical mass in research and extension undertakings
	Institutional capacity		Limited institutions	Diverse institutions (Research, higher learning, Extension and Private companies)
	Coordination	Status	Piece meal approach, fragmented and un-coordinated	Effective national coordination, sharing of tasks, responsibility and focused engagement through all Indian Coordinated projects
Knowledge and technology base	Knowledge /Technology base and best use practice	Status	Limited knowledge and technology	Well-developed knowledge and technological base (Treatment, TMR and densified block)
Advisory and extension services	Extension	Status	Underdeveloped extension support	Effective and capable extension services
	Advisory	Status		Diverse advisory service (public and non-public)
Commercialization	Private sector involvement	Status	No private sector involvement	Strong involvement of private sector and commercialization crop residue based feed technologies
Policy support	Research and extension support	Status	Lack of focus and government attention in public service to the commercial feed industry	Strong public support
	Market	Status	Under developed marketing system	Well developed and efficient market for delivery of input supply, machineries and finished product (crop residue based feed)

Table 6. Rangeland development comparison of Ethiopia and the bench marked countries (South Africa, Australia and Botswana)

Indicators	**Countries**			
	Ethiopia	Botswana	South Africa	Australia
Rangeland area (km^2) and % of the total mass	624850 (62.5%)	256,000 km^2 (45.17%)	889480.2 (72.71%)	5765138 (75%)
Rangeland condition (vegetation cover, increased in moisture content; enhanced wildlife and plant diversity, etc)	Poor*	Improved**	Improved	Improved
Livestock productivity (meat)				
Quality of life of livestock producers	Declined	Improved	Improved	Improved
Reference	PADS (2005) Kidane (2006) MFPDA, WB and IFAD, 2018		Meissner et al. (2013)	Sanjari et al. (2008) Sherren et al (2012)

3. Strategic Issues and Interventions

3.1. Natural pasture improvement

In Ethiopia, the major feed source (56%) for ruminant animals comes from natural pastures (green fodder/grazing) (CSA, 2018). The total grazing land is 2,017,601 hectares (11.5 % of all land uses) (CSA, 2018). The natural grazing areas in the country are managed as a community resource and some private grazing lands are also available. However, grazing lands in the country are declining due to competition for land from the food sector coupled with urbanization and economic growth (industrialization). The existing native pastures are also low in productivity. Annual pasture yield assessments on the highlands and mid altitude areas have shown 1 to 2 tons/ha (Lulseged and Alemu, 1985). In the drier lowlands, the yield is much lower, about 1 ton/ha. According Zinash et al. (1995) the natural pasture in the highlands is just adequate for live weight maintenance and weight gain during wet seasons and would not support maintenance for the rest of the year. Land degradation, poor grazing management and drought due to climate change is leading to forage and water scarcity and putting at risk the forage biodiversity of natural pastures in the country. Therefore, key interventions to enhance productivity of natural pasture is necessary and are listed in Table 7.

3.2. Cultivated forage

Improved forage crop production is a feasible, appropriate, and sustainable feed source for livestock. In Ethiopia, the overall average productivity of improved fodder crops per unit area has been found to exceed the productivities of seasonally rested and continuously grazed native pastures by about 3 fold and 10 fold, respectively (Fekede *et al.,* 2015). However, area coverage of cultivated forage crops is insignificant in the country due to various reasons. The success of forage development also depends upon the establishment of a sound forage seed production system. However, lack of incentive for investment and engagement in forage and forage seed production and the absence of a forage seed certification and marketing system in the country is resulting to low supply of quality seed for forage cultivation, putting substantial pressure on

quantity and quality of feed resources in the country. Thus, towards ensuring adequate supply of feed resources through cultivation of improved forage crops, strategic interventions are needed and the list of which are indicated in Table 7.

3.3. Crop residues

In views of the expansion in area and diversity of crops grown, substantial quantities of various types of crop residues of great importance as livestock feed are being produced in Ethiopia. The management, utilization and commercialization of crop residues as livestock feed have not been properly undertaken and there have been limited development intervention in this line. Therefore, different strategic issues with concomitant strategic interventions to ensure efficient management and utilization of available crop residues have been identified (Table 7) to make crop residues positively contribute towards enhancing the feed industry and the transformation of the livestock sector in the country. It is believed that with proper intervention and management, crop residues can become a marketable commodity.

3.4. Compound feed

Development of the feed sector for enhancing the production and utilization of compound feed is key to the transformation of the feed sub-sector specifically and to the livestock sector in general. Increasing supply of quality compound feed requires interventions that will enable availability of feed ingredients or inputs for the production of adequate and quality compound feed not only for domestic use but also for export. Potential availability, management and utilization of different alternative feed ingredients available in different geographies for the production of compound feed is an intervention area to boost supply of formulated feed at affordable cost. In addition to the quality, ensuring the safety of compound feed is key to be competitive in the feed industry and for safe production and delivery of livestock products. The domestic availability and supply of premixes, mineral supplements and feed additives is crucial for the production of quality feed. This therefore demands interventions that will enhance investment towards domestic production of such feed ingredients. Therefore, different strategic issues deserving intervention to ensure supply of adequate, quality, safe and affordable

compound feed are among the forefront agenda in subsequent feeds and nutrition interventions for the transformation of the feed and the livestock sector in the country (Table 7).

3.5. Rangeland development

The key strategic issues that need due attention in rangeland development are grouped in different thematic areas. The thematic areas are rangeland biophysical resources; grazing management and institutions**;** rangeland rehabilitation, restoration and conservation; and adaptation and mitigation of climate variabilities and change**.** It is indicated in GTPII and LMP that there will be an improvement in livestock production and productivity for local consumption as well as export market particularly from the livestock resources of the pastoral and agro-pastoral areas. Thus, improving the production and productivity of the rangelands will be taken into account. Thus, the development interventions to be undertaken in each thematic area are given in Table 7.

Table 7. Strategic Issues and strategic interventions

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
General			
Limited human and physical capacity to implement effective feed strategy	• Short term trainings in business oriented feed, fodder and range production, conservation and utilization • Employing qualified personnel at different levels	• Long term training (MSc and PhD) of experts in business oriented modern feed, fodder and range production, conservation and utilization • Improving laboratory facilities • Improving the use of commercial feed production such as feed harvester and Baler • Improving irrigation facilities for dry season feed production	• Create critical mass in specialization and focus that support commercial feed industry and at household level • Improving the use of commercial feed production such as feed harvester and Baler • Improving irrigation facilities for dry season feed production
Weak and absence tailor made extension system	• Stratification of livestock production and preparation tailor made feed extension • Short term trainings on implementation of feed extension	• Put in place a system of coordination linking feed supply with various livestock inputs • Augment the public extension service with private extension service delivery	• Enhance the role of the private sector in extension service delivery
Weak monitoring, evaluation and learning system	• Developing M & E guidelines to track changes at different levels • Harmonizing feed M & E strategies with existing M & E and learning mechanisms	• Implementation and continuous improvement of M & E guidelines • Developing digital M & E system • Encompass the prevailing regulatory mechanisms for the enforcement of set standards in the M & E system	• Implementation and continuous improvement of M & E guidelines • Developing digital M & E system

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
Lack of well-articulated enabling policy and regulatory frameworks	• Assessment of the impact of large scale agricultural investment on pastoral community and rangeland development • Developing guidelines on integrating development projects such as sugar plantations with feed and range land developments • Identifying regulatory and investment incentive mechanisms for sustainable rangeland development	• Develop and implement favorable policy, regulatory and incentive mechanisms	• Continue implementation of favorable policy, regulatory and incentive mechanisms
Natural pasture improvement			
Presence of increasing competition for land and shrinkage of grazing lands	● Mapping and certification of grazing lands which have comparative advantage for extension interventions ● Development of guideline targeted for grazing land management ● Preparation of land use maps for grazing	● Reduces encroachment of key hay production areas ● Implementation of guideline on communal grazing land management ● Preparation of land use maps for grazing	● Widening and strengthening the source base of hay production in the country ● Use of technologies (over sowing, fertilization, watering, reseeding) to enhance productivity and quality of natural pasture ● Promote the integration of forage development into the current NRM effort

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
Low productivity, poor quality and grazing management of natural pastures	● Identification of agro-ecologic based interventions for natural pasture development ● Raising public awareness on proper animal husbandry and efficient grazing land management and use	● Apply appropriate management practices for renovation of natural pastures ● Develop modalities for sustainable utilization of communal grazing resources (keeping productive animals, resource sharing mechanisms, managing the pasture land, abiding with the bylaws)	● Continue implementation, monitoring and evaluation of interventions for enhanced and intensive production of natural pastures
Shortage of rainfall resulting grazing pasture scarcity	● Capacity building in awareness creation for use of climate smart technologies	● Use of climate smart technologies for grazing pasture production ● Maintain forage reserves (fodder banks) to utilize during forage scarcity	● Continue on implementation
Cultivated forage			
Low adoption and promotion of cultivated forages	● Identification of key determinants of forage adoption ● Identify appropriate strategies and entry points for forage development targeting specific situations ● Development of strong linkage and binding modality between extension, research, investors and other development actors and communities for forage and forage seed production and multiplication	● Identification of niche environment where forage is a competitive enterprise. ● Enhance business oriented forage seed/ planting material production and marketing at small and large scale.	● Support commercialization of forage production at different scales (smallholder and commercial).

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
Increased competition for land between forage and food crop production	● Explore the comparative advantage of forage production or integrating forage with crop production efforts ● Develop modalities for forage production or integration of forage and food crop production	● Integrate forage development into the farming system through promotion of forage species suitable for under-sowing, inter-cropping and relay-cropping ● Promotion of food-feed crops to increase the quality and quantity of available biomass	● Continue implementation and evaluate the impact of the various interventions
Limited irrigation based forage production	● Identify potential areas and high value forage crops for forage production under irrigation ● Devise options for production of high value forage crops under irrigation	● Develop irrigation scheme investment ● Implementation of irrigated forage production	Continue implementation and Evaluation of irrigated forage production
Lack of incentive for investment and engagement in forage and forage seed production	● Develop incentive mechanisms to access land, credits and other inputs for forage and forage seed production	● Make arrangements for contractual forage seed production schemes ● Linking up forage seed producers with farmers and other stakeholders	● Continue implementation and commercialization of forage and forage seed production
Crop residues			
Poor management, utilization and commercialization of crop residues as livestock feed	● Mapping types of crop residue and geographic areas where improvement in handling, management and utilization of crop residues would lead to a bigger impact in feed supply	● Continue wider demonstration and popularization of proven technologies and best practices on handling, management and utilization ● Technology identification, designing for local use and application for wider commercialization of crop residues as livestock feed	● Continues implementing modalities for PPP or for the private sector for commercialization of crop residues as feed

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
	● Developing guidelines for crop residue handling, managing and efficient utilization ● Demonstration and popularization of proven technologies and best practices on handling, management and utilization	● Developing and implement modalities for PPP or for the private sector for commercialization of crop residues as feed	
Low availability of inputs and small scale machineries for greater utilization of crop residues	● Identification of key inputs for crop residues feed value enhancement and developing modality for efficient and sustainable input delivery ● Mapping input sources and creating linkages with service providers ● Linking service providers with users for input delivery	● Continue implementation and draw lessons for wider application	● Continue implementation and put in place full scale engagement of the private sector for enhanced delivery of inputs
Poor biological performance and economic return through improved feed management of crop residue based feeding system	● Developing guidelines for crop residue based feeding system ● Undertake training	● Continue training ● Extension system digitalizing feed information and provide ICT based tailored advisory services	● Continue extension system digitalizing feed information and provide ICT based tailored advisory services
Compound feed			

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
Low volume of compound feed production and supply for domestic and export markets	● Awareness creation and demonstration on the biological and economical importance of compound feed ● Develop modalities and linkages for efficient marketing system and market channel to source feed ingredients and for output markets ● Develop policy option for the supply of quality feed at affordable price	● Continue awareness creation and wider scale demonstration on the biological and economical importance of compound feed ● Creation of linkages between feed ingredient producers, feed processors and users ● Developing PPP model for sustainable production and supply of compound feed ● Diversification of institutional models for the production and delivery of compound feeds	● Develop private sector lead extension system to promote the utilization of compound feed ● Engage diplomatic core offices for navigating export market opportunities
Low availability of inputs for greater production and utilization of compound feed	● Creating an incentive mechanism for the private sector to invest on agro-processing and value addition	● Developing policy framework to provide land and other inputs for enhanced commercial scale production of crops (maize and soybean) targeted for livestock feed	● Continue enhance commercial scale production of crops (maize and soybean) targeted for livestock
Absence of improved data for geographic area based diversification of different feed ingredients for compound feed production	● Creation of national database on geographic area based availability of feed ingredients	● Integration of the list of feed resources with available data on their chemical composition ● Customizing available tools or developing new ones for ration formulation advisory purpose based on available feed resources ● Provision of training on ration formulation ● Implementation of ration formulation for different species of livestock	● Customizing available tools or Implementation continues

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
Absence of standards for safety and quality of feed ingredients and compound feed	● Developing standards for compound feed quality and safety for different livestock species	● Putting in placed required facilities to regulate feed quality and safety ● Capacitating feed producers to put in place internal feed safety and quality check	● Continue implementation
Low incentive mechanisms for domestic production to sell at an affordable price of premixes, mineral supplements and feed additives	● Putting in place policy incentive mechanisms for investment in domestic production of premixes and additives ● Mapping of potential areas for investment	● Undertaking promotional activities to attract investment in domestic production of premixes and additives	● Continue implementation
Rangeland biophysical resources			
Lack of proper quantification of the rangeland resource base including livestock population	● Desk review and planning	● Produce quantified and mapped rangeland resources including the livestock census	● Continue implementation and monitoring changes using advanced technologies ● Use outcomes of monitoring for conserving rangeland resources for better utilization
Lack of sustainable feed and water supply in the rangelands (drought prone areas)	● Pre drought preparation of reserve feed ● Development of irrigation based fodder ● Development/maintenance of watering points at strategic locations	● Development of irrigation based fodder ● Local seed stock maintenance for anticipated rangeland development ● Rangeland development through indigenous knowledge and scientific knowledge ● Development/maintenance of watering points at strategic locations	● Development of irrigation based fodder ● Local seed stock maintenance for anticipated rangeland development ● Rangeland development through indigenous knowledge and scientific knowledge

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
			● Development/maintenance of watering points at strategic locations
Lack of adequate knowledge on pastoral production system by policy makers	● Awareness creation to and close engagement of policy makers with the community ● Experience sharing of policy makers from similar agro-ecology and production systems ● Policy dialogue	● Experience sharing of policy makers from similar agro-ecology and production systems ● Organization of field days for sharing best bet practices ● Policy dialogue	● Experience sharing of policy makers from similar agro-ecology and production systems ● Organization of field days for sharing best bet practices ● Policy dialogue ● M & E and documentation
Rangeland grazing management			
Weakening of traditional institutions and grazing systems resulting in declining rangeland condition and trend	● Revitalizing institutions, norms, rules, and regulations ● Identification of participatory rangeland rehabilitation and management options	● Develop and/or review guidelines for implementing rangeland rehabilitation and sustainable management ● Implementation of participatory rangeland management options (grazing system, rehabilitation)	● Continue implementation
Limited application of practical grazing system technologies	● Adopt or apply appropriate grazing technologies for different ecosystems and range conditions ● Use of community enclosure with appropriate management	● Adopt appropriate grazing technologies for different ecosystems and range conditions ● Application of holistic approach using community resource base and ecosystem processes (water cycle, mineral cycle, community dynamics)	● Adopt appropriate grazing technologies for different ecosystems and range conditions ● Application of holistic approach using community resource base and ecosystem processes

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
		● Use of community enclosure with appropriate management	(water cycle, mineral cycle, community dynamics) ● Use of community enclosure with appropriate management
Rangeland rehabilitation, restoration and conservation			
Rangeland degradation	● Assessment, delineation and mapping of rangelands based on extent of degradation (light, Mediun and heavy) ● Use of available rehabilitation technologies for bush encroachment and invasive plants ● Use of animal impact tool for range management and rehabilitation ● Use of appropriate soil and water conservation structures and biological interventions suitable for rangeland rehabilitation	● Assessment, delineation and mapping of rangelands based on extent of degradation (light, mediun and heavy) ● Scaling up of available and additional rehabilitation technologies for bush encroachment and invasive plants ● Scaling up of animal impact tool ● Scaling up of appropriate soil and water conservation structures and biological interventions suitable for rangeland rehabilitation ● Conservation and proper utilization of excess available feed resources using appropriate technology (e.g. baling, chopping, silage, treatment of feed resources)	● Implementation continues
Adaptation and mitigation of climate variabilities and change			
Lack of proper focus on range related climate and shortage of meteorological stations and facilities	● Awareness creation ● Capacity development with extensive knowledge acquiring mechanisms (e.g, skill based Training, study tours…)	● Awareness creation ● Capacity development with extensive knowledge acquiring mechanisms (e.g, skill based Training, study tours…)	● Capacity development with extensive knowledge acquiring mechanisms (e.g, skill based training, study tours…)

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
Lack of appropriate early warning indicators and forecasting capabilities	● Upgrade the available early warning indicators to suit the existing situations ● Develop additional early warning indicators and forecasting Capability	● Establishment of meteorological stations at strategic locations of rangelands ● Strengthen development of additional early warning indicators and forecasting capability	● Application of advanced early warning indicators and climate forecasting technologies ● Collaborative effort to establish and maintain meteorological stations and facilities at strategic locations
Lack of knowhow on sustainable adaptation and mitigation strategies	● Identification of appropriate interventions for adaptation and mitigation strategies suitable for different rangelands ● Development of guidelines and training materials	● Application of identified interventions for management of rangelands to enhance carbon sequestration and range productivity ● Rehabilitation of degraded rangelands using adapted native species (e.g., *Cenchrus, chrysopogon*, themeda.) ● Application of soil and water conservation practices ● Use of indigenous knowledge ● Participatory M & E of progress made and compile lessons learnt for future improvement	● Implementation continues
Marketing and extension system			
Weak market information system and limited or absence of market infrastructure for feed	● Assessment and evaluation of the prevailing market infrastructure and information system for animal feed from pastoral to the highland set up	● Enhance stakeholder involvement in market infrastructure and information system	● Implementation continues

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
		● Put in place the desired market infrastructure and information system (ICT based) for feed ● Market analysis and intelligence for exporting feed	
Weak vertical and horizontal value chain integration for livestock feed marketing	● Assessing existing value chain for feed marketing ● Refinement of existing extension services and strengthening the advisory services in feeds ● Development of guidelines	● Scaling up of best bet practices of feed value chain	● Scaling up and wider promotion of best bet practices of feed value chain
Cross cutting issues for sustainable feed production, conservation and utilization			
Gender inequality in feed production, conservation and utilization	• Training and awareness creation for ensuring participation of women & youth along the feed value chain	• Mainstreaming of gender and youth issues along the feed value chain	• Mainstreaming of gender and youth issues along the feed value chain
Limited food and nutrition security considerations in feed production, conservation and utilization	• Short term trainings on food and nutrition security	• Long term trainings on food and feed, nutrition security • Mainstreaming food, feed and nutrition security in feed production, conservation and utilization strategies	• Long term trainings on food and feed, nutrition security • Mainstreaming food, feed and nutrition security in feed production, conservation and utilization strategies
Limited environment and climate change sensitive feed production, conservation and utilization	• Generate information on GHG emission, biodiversity and water foot prints for feed	• Implement climate smart feed production, conservation and utilization activities	• Implement climate smart feed production, conservation and utilization activities

Strategic intervention			
Themes	**Short term (2019-2020)**	**Medium term strategy (2021-2025)**	**Long term strategy (2026-2030)**
	production, conservation and utilization	• Implement mechanisms that reduce carbon, biodiversity and water foot prints for feed production, conservation and utilization	• Implement mechanisms that reduce carbon, biodiversity and water foot prints for feed production, conservation and utilization

4. Roles and responsibilities of institutions

The list of institutions in Table 8 has been identified to play key role in the implementation of this strategy. The roles and responsibilities of the institutions are also highlighted in the table.

Table 8. Roles and responsibilities of institutions to be involved in the implementation of national Feed strategy

No	Institution	Role/ responsibilities
1	Ministry of Agriculture	Approval of the national feed strategy
		Through the animal feed directorate oversea, guide and coordinate the implementation of the strategy
		Prepare guideline for the implementation of interventions identified in the strategy
		Mobilize and allocate financial and physical resources necessary for implementation of the strategy
		Put in place and implement national framework for participatory monitoring and evaluation
2	Regional Bureaus of Agriculture / Livestock, and respective livestock institutions accountable to the Bureaus	Lead and implement the strategy in the region
		Allocate necessary resources for implementation of the strategy
		Compile lesson learnt towards further improvements of interventions from regional perspectives
3	Ethiopian Institute of Agricultural Research and Regional Research Institutes	Undertake technology shopping from global experience and generate and avail impactful technology or knowledge for wider use
		Undertake the pre-extension demonstration and scaling up of proven technologies
		Draw lessons and undertake technology improvement as deemed necessary
4	Higher learning Institutions	Undertake technology shopping from global experience and generate and avail impactful technology or knowledge for wider use
		Undertake the pre-extension demonstration and scaling up of proven technologies
		Draw lessons and undertake technology improvement as deemed necessary
		Involve in capacity building of human resources
		Be part of the regional team in implementation of the strategy
5	Ethiopian Standard Agency	Generation of appropriate standards to implement the strategy
6	Ethiopian Statistics Agency	Generation of statistical information

7	Ethiopian Meat and Dairy Industry Development Institute	Engage in capacity building of private sector
8	Ethiopian Biodiversity Institute	Lead and engage in range and forage biodiversity identification, characterization, conservation and utilization
9	Private sector	Engage in production of feed and inputs (forage seed, feed ingredients, equipment, etc)
10	Ethiopian Animal Feed Industry Association	Coordinate private sector involvement in feed production and marketing
11	Communities	Engage in implementation of the strategy

5. Expected output

The expected output of the feed strategy interventions includes:

- Sustained feed development which increase productivity while maintaining the natural resource base
- Gender and youth issues are mainstreamed at all levels of feed, fodder, compound feed, natural pasture and rangeland program interventions. Hence, women and youth benefited from the feed strategy interventions.
- Human and livestock nutrition issues addressed and contributed for the nutrition issues of the society.
- Climate smart feed development interventions put in place to help local communities adapt to its adverse effects
- Advisory and extension services modernized at all levels to reach out farmers and other beneficiaries with tailored messages that contribute to the development of the feed and livestock sector.

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