IGAD

ICPALD

IGAD Strategy for Sustainable and Resilient Livestock Development in View of Climate Change (2022 - 2037)

August 2022


THE IGAD MEMBER STATES
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Strategy for Sustainable and Resilient Livestock Development in view of Climate Change in the IGAD Region (2022- 2037)

IGAD CENTER FOR PASTORAL AREAS AND LIVESTOCK DEVELOPMENT (ICPALD)

August 2022

TABLE OF CONTENTS

ACRONYMS

AfDB	African Development Bank
AGDP	Agriculture Gross Domestic Product
ASAL	Arid and Semi-arid Lands
BMZ	German Federal Ministry for Economic Cooperation and Development *(Bundesministerium für wirtschaftliche Zusammen arbeit und Entwicklung)*
CBPP	Contagious Bovine Pleuropneumonia
CCPP	Contagious Caprine Pleuropneumonia
CSA	Climate-Smart Agriculture
CTCN	Climate Technology Centre and Network
EWS	Early Warning System
FAO	Food and Agriculture Organization of the United Nations
FMD	Foot and Mouth Disease
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIZ	German Agency for International Cooperation *(Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH)*
IBLI	Index-based Livestock Insurance
ICPAC	IGAD Climate Prediction and Application Center
ICPALD	IGAD Center for Pastoral Areas and Livestock Development
IDDRSI	IGAD Drought Disaster Resilience Sustainability Initiative
IGAD	Intergovernmental Authority on Development
ILRI	International Livestock Research Institute
IPCC	Intergovernmental Panel on Climate Change
KSA	Kingdom of Saudi Arabia
LITS	Livestock Identification and Traceability System
LVC	Livestock Value Chain
MDAs	Ministries, Departments, and Agencies
MENA	Middle East and North Africa
MS	Member States
NGO	Non-Governmental Organization
OECD	Organisation for Economic Co-operation and Development
OIE	World Organisation for Animal Health *(Office International des Epizooties)*
PAP	Pastoralist and Agro-Pastoralist (systems)

PIA	Priority Intervention Area
PPP	Public Private Partnership
PPR	Peste des Petits Ruminants (pseudo-rinderpest of small ruminants)
RCP	Representative Concentration Pathways
REC	Regional Economic Community
SDG	Sustainable Development Goals
SPS	Sanitary and Phytosanitary
SSA	Sub-Saharan Africa
T	Metric tonne
TADs	Transboundary Animal Diseases
TLU	Tropical Livestock Unit
UNDP	United Nations Development Program,
VC	Value Chain
WB	World Bank

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This Strategy was developed through consultations with IGAD Member States, and was validated on July 5-6 2022, in Addis Ababa, Ethiopia. ICPALD led analytical work and consultation process underpinning the development of the Strategy.

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WORLD BANK GROUP

EXECUTIVE SUMMARY

The Strategy for Sustainable and Resilient Livestock Development in view of Climate Change in the Intergovernmental Authority on Development (IGAD) Region is a holistic and comprehensive plan designed to build a livestock sector resilient to the effects of climate change, while promoting simultaneous growth and sustainable development throughout the region. The initiative to create the Strategy was launched in 2020 as a regional collaboration between IGAD and the World Bank. The Strategy seeks to provide IGAD Member States (MS) with a framework to support the identification and prioritization of policies and actions to enhance the resilience and sustainability of the livestock sector to climate change. It focuses on pastoral and agro-pastoral production systems in Arid and Semi-Arid Lands (ASALs) because they are often the most exposed and vulnerable to the impact of climate change; however, a number of actions described in the Strategy are also relevant to other production systems.

The Strategy reflects the existing priorities expressed in Member States' national policies, consolidating relevant priorities at the nexus of livestock sector development, climate change, and sustainability into a unified, strategic thrust. It also draws upon regional and national stakeholder input, as well as on extensive diagnostic work and modeling to assess the effectiveness of policy interventions aiming at improving the sector's resilience.

The Strategy builds on an analysis of the critical issues related to sustainability and climate change in the IGAD region, as well as the progress achieved within the existing policy framework to address these challenges (section 1). This analysis is the basis for the rationale and justification of the need for the Strategy presented in Section 2, and its goal and strategic objectives that can be found in Section 3. The proposed five priority areas for intervention are detailed in Section 4, drawing on existing knowledge and experiences from the region and in select cases, underpinned with original modeling and analysis. Finally, key needs for strategy implementation are described in the monitoring and evaluating strategy for implementation (Section 5).

The Strategy was developed as a 15-year proposition (2022-2037) for implementation in three 5-year phases, with a design feature of a review at the end of each phase to assess the status, relevance, and effectiveness of implementation and to inform prescriptions for subsequent phases. The Strategy identifies five priority intervention areas:

1. **Mechanisms for climate risk management.** An extensive review of information, data collection, and consultation was conducted to identify effective policies and instruments that can mitigate the impact of climate on livestock production. They include financial instruments for climate risk management, early warning and response, and risk profiling and contingency planning.

2. **Natural resource base and ecosystem services for livestock production.** Most of the impact of climate on livestock is not direct, but indirect, by affecting natural resources that are vital for livestock production, land and water, in particular. Actions in this priority intervention area target rangeland and woodland management, water availability and access, and biodiversity and the control of invasive species.
3. **Livestock production and income diversification along livestock value chains.** Improving livestock productivity has a direct effect on making the sector more resilient, while diversifying income sources within and outside of livestock production. It is also an adaptation strategy. A specific Output in the Strategy, thus, addresses alternative and complementary livelihoods, while the other four Outputs tackle livestock production and productivity at the animal level, through better animal health, improvement of feed production and management, and strengthening marketing of livestock products.
4. **Research, innovation and knowledge management.** This priority intervention will enhance research capacity and knowledge sharing in and between IGAD MSs to accelerate knowledge development and innovation for resilience among stakeholders. It provides an opportunity for regional cooperation and the development of future innovations for longer-term adaptation. Outputs include the support to research, innovation and technology application, and the dissemination of knowledge and information.
5. **Policy alignment, coherence, and coordination for transboundary issues.** The objective is to streamline and improve the alignment of policy action throughout IGAD intraregional boundaries. Outputs include strengthening governance and cross-border coordination mechanisms, as well as policy alignment and coherence.

1. Background and context of Strategy

1.1 Introduction – region, institutions, scope, definitions

Introducing the region and the issues

The IGAD region Member States are Djibouti, Eritrea, Ethiopia, Kenya, Somalia, South Sudan, Sudan, and Uganda. The region is home to substantial livestock resources mainly managed by smallholder farmers, pastoralists and agro-pastoralists (PAPs). The total landmass of the IGAD countries is 5.2 million $km^{2,}$ of which 60 - 70% of the landmass is composed of Arid and Semi-arid Lands (ASALs) characterized by low and erratic rainfall of 500mm per annum. Periodic devastating droughts and flash floods are frequent, largely attributed to climate change and variability. The ASALs are composed of varying combinations of vegetative covers and soils, which are primarily suitable for agropastoralism and transhumant pastoralism.

Livestock production in the region

Eastern Africa contains more than 50% of all African livestock and 9% of the world's cattle (Wollenberg, 2019). In the region, livestock is key to food security and its four channels: availability, accessibility, utilization, and stability. In the ASALS, the potential for crops is limited and pastoral agro-pastoral (PAP) systems are the main means of producing food and sustainable livelihoods (Cecchi et al. 2010). Some estimates indicate that 60-80% of IGAD rural people raise livestock as their main income and provide nutrition to their families (Assefa and Mbugua, 2019). In Kenya's ASAL areas, where 70% of the country's livestock is raised, for instance, 95% of the income of the inhabitants comes from the livestock sector. Livestock contributes directly to food availability and indirectly to food accessibility by generating income.

The IGAD region is Africa's largest livestock exporter; it generates income for herders, traders, processors, and governments. For example, the production and trade of livestock and livestock products play a prominent role in Kenya's economy, where the sector produces 42% of the agricultural GDP. Similarly, it contributes 40% and 20% to the agricultural GDP of Ethiopia and Uganda, respectively, (World Bank, 2021).

Among IGAD countries, Ethiopia has the largest cattle population (61.5 million head), while the highest number of sheep and goats (47.3 million) are in Kenya, which also has the highest average ruminant density (0.7 tropical livestock units [TLU]/ha) (Figure 1), although Ethiopia, Sudan, and Uganda are also experiencing growth in the density of ruminant livestock that was already high (FAO 2021). IGAD cattle production systems, in general, generate more income than sheep and goat systems but require more labor and land. Exports of live animals and meat (sheep, goats, cattle, and camels) are mostly to the Middle East and North Africa (MENA) countries, especially to the Kingdom of Saudi Arabia (95%) due to the Haji season. Other export destinations include the UAE, Jordan, Qatar, Egypt, and Libya, among others. Exports of live animals are dominated,

in descending order, by Sudan, Somalia, Ethiopia, and Djibouti, while meat exports are dominated by Ethiopia, Sudan, and Kenya. For example, in 2015, the region exported around 12.62 million head of livestock and 30,000 T of meat to MENA countries alone (IGAD, 2018). Cattle milk and meat produce 50% and 30% of the protein of the ruminant sectors in the IGAD region, respectively (FAO 2021).

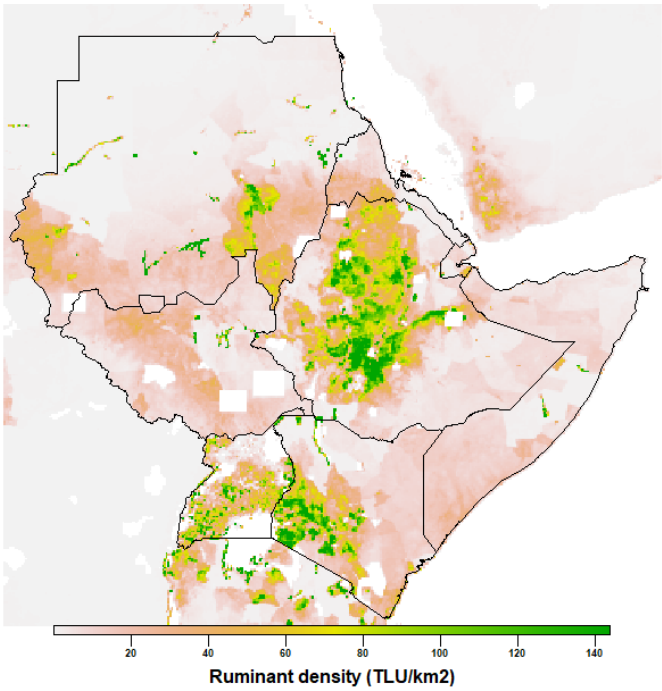

Figure 1: Ruminant Density in the IGAD region

Livestock resources and production systems in the IGAD region

Livestock resources

The primary economic driver of the IGAD Member States is agriculture, with livestock contributing an estimated 57% of the region's Agricultural Gross Domestic Product (AGDP). The contribution of livestock to the economy varies; the highest contribution is in Somalia (70% of AGDP and 40 % of GDP) and the lowest in Djibouti (87.4% to AGDP and 3.1% to NGDP). The region is endowed with an extensive livestock population, especially large and small ruminants (cattle, camels, sheep, and goats), most of which are found in ASALs under agro-pastoral and pastoral systems (Table 1, Table 2).

Table 1: Livestock Population in the IGAD region (millions) and its percentage share in Africa and the World (2020)

Animal Species			IGAD		
Animal spp.	**World**	**Africa**	**No**	**% World**	**% Africa**
Cattle	1525.9	370.9	160.2	10.5	43.2
Sheep & goats	2391.2	907.3	308.7	12.9	34
Camel	38.6	33.6	19.0	49.2	56

Source: FAOSTAT 2021

Table 2: Livestock Population from the IGAD Member States (millions) (2020)

Species	Djibouti	Eritrea	Ethiopia	Kenya	Somalia	S. Sudan	Sudan	Uganda	Total
Cattle	0.29	2.13	70.29	21.65	4.82	13.78	31.75	15.54	**160.28**
Sheep and goats	0.98	4.22	95.37	61.36	23.65	32.54	73.17	17.45	**308.78**
Camels	0.07	0.38	1.63	4.66	7.33	-	4.891	-	**19.02**
Total									**488.09**

Source: FAO STAT 2021

Livestock production systems in ASALs

Pastoral System

This depends on the mobility of livestock, sometimes with herder families, depending on seasonal pasture and water availability. The mode of migration varies depending on the need and culture, with traditional structures and institutions predominant throughout the region. Some communities migrate with entire families and herds; others stay in villages with small livestock, while the larger animals migrate with the herders. This mobility enables pastoralists to access water, grazing and browsing. Their mobility represents a resiliency response to the changing climate and terrain (Kaufman et al., 2019).

Agro-pastoral system

These types of livestock systems are found along main rivers that cut across pastoral areas and highland-lowland interfaces. The pastoralists mainly practice livestock keeping, with rare migration of livestock from their permanent base, while their crop farming is either rain-fed or irrigated. Agro-pastoralists may also practice beekeeping, poultry, and fodder production.

Other livestock systems

The other major livestock production methods in the IGAD region are semi-intensive urban dairy systems and mixed (crop-livestock) systems (Robinson et al, 2007), in which semi-extensive methods – where livestock are fed crop residues, green fodder, and purchased feed – are also common. Intensive and semi-intensive systems such as high-density dairy systems and zero-grazing cattle are present and are important contributors to the market availability of animal-sourced protein in urban areas (Robinson et al., 2011a). Intensive and semi-intensive livestock systems are poised for the fastest growth, in particular for dairy, in response to projected future demand for

animal-sourced products. However, these systems are highly reliant on external inputs and are particularly vulnerable to disruptions due to climate change, such as heat stress, drought-related feed shortages, and disease. (Megersa et al., 2014; Abate and Angassa, 2016; KImaro et al., 2018).

Emerging constraints to the livestock sector

The Intergovernmental Panel on Climate Change (IPCC) has identified the IGAD region as one of the most vulnerable in the world to climate change (Otieno and Anyah, 2013). Livestock production in the ASALs of the region occurs against a backdrop where climate uncertainty is the rule, rather than the exception. As such, livestock herders have developed strategies (including through migration, destocking, and emergency wells) over hundreds of years to cope with natural disasters such as droughts. However, climate change is altering the risk landscape—with increasing temperatures, frequency of droughts, floods, pest and disease outbreaks—placing burdens on livestock farmers, governments, and other industry participants to develop new strategies to adapt and manage risks (Melissa et al., 2017). Furthermore, livestock is a significant emitter of greenhouse gases (GHGs) contributing to climate change (Robinson et al., 2011b).

Scope and focus of the Strategy

This Strategy is relevant to all livestock in the IGAD region, but it is primarily focused on ruminants (cattle, sheep, goats) and camels in PAP production systems, given their particular vulnerability to the effects of climate change. This focus also aligns with the majority of livestock traded, internally and internationally, in the IGAD region originating from pastoral and agro-pastoral systems.

The focus of the Strategy is on policies and interventions that directly and indirectly enhance the sustainability and resilience of livestock disruptions in the region.

Defining resilience

There are multiple definitions of resilience in the sustainable development and food systems literature, all of which revolve around the notion of a system's capacity to withstand, adapt to, and recover from a disturbance and or transform. For instance, the IPCC defines resilience as: "The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation" (IPCC, 2014). For the purposes of this Strategy, resilience is defined as, *"the capacity of livestock production systems to cope with and adapt to disturbances and shocks associated with or worsened by climate change, to restore production and income after such disturbances and shocks, and to transform the livestock production systems to be more able to adapt to these climate change associated events".*

Core capacities for building resilience

There is consensus in the resilience literature that three core capacities need to be developed to build resilience into food systems: the capacity to absorb the impact of an adverse event, the capacity to adapt in response to risk, and the capacity to transform to minimize future risks (OECD, 2020a).

Absorptive capacity relates to herders' ability to cope and respond to adverse events in the short run. It can be enhanced through the adoption of prevention strategies that reduce the exposure to adverse events and build absorptive capacity of producers and other actors, through strategies that mitigate the impact of such events, and through coping strategies that lower the impact of risky events that have occurred (OECD, 2020b;; OECD, 2011). For example, an early warning system could enable the use of risk prevention and mitigation measures (e.g., by allowing herders to move their stock to areas that are less affected by adverse conditions and by acquiring feed supplies to sustain production as well as accelerate livestock off-take to reduce pressure on available resources).

Adaptive capacity relates to the ability of producers (pastoralists and agro-pastoralists) to make incremental changes to their methods of production in response to changing conditions "to continue functioning without major qualitative changes in function or structural identity" (Mitchell, 2013). This could involve actions to enhance the resilience of current and future production systems. For example, building a deeper, diverse, and more resilient feed base without dramatically changing production methods. In addition, a coping strategy could involve using savings, insurance, and off-farm income to meet households' consumption during the time it takes to rebuild their herds and restore income from livestock to previous levels.

Transformative capacity enables the creation of a fundamentally new system when ecological, economic or social structures make the existing system untenable" (Mitchell, 2013). The transformation will typically require a longer time frame than adaptation. Examples of transformation could entail a change from extensive grazing to mixed crop-livestock farming, a shift from rainfed to irrigated feed production, or even an exit from agriculture. Transformation can also occur at the post-farm level, such as reconfiguring value chains to take advantage of market opportunities (Kates, Travis, and Wilbanks, 2012).

Resilience in the context of livestock in the IGAD region

The issue of resilience is particularly important for the PAP systems that are the focus of this strategy because the long production cycles of ruminants, particularly cattle, result in long recovery times for herds from events that cause significant animal mortalities. For example, it can take decades for cattle herds to recover completely from a succession of severe droughts (Godde et al., 2019). In addition, these systems are more vulnerable to climate change because they are in dryer areas where extreme

climate events such as droughts are more frequent and intense in their variability. They are less able to cope because they implicate already poor populations and rely strongly on natural resources that are directly impacted by climate change. The high frequency of droughts in the IGAD region means that the cumulative effect of climate-change-associated events has resulted in the declining household livestock assets, resulting in reduced food security and declining prosperity.

Enhancing the absorptive capacity of PAP populations of measures to limit exposure and mitigate initial losses from adverse events, such as droughts, floods, and disease outbreaks, can generate substantial livelihood benefits over significant periods of time in the form of avoided losses.

At the same time, governments may need to be open to the prospect that livelihoods could be better served by a more radical transformation of the sector, including exit from agriculture, if climate change renders some production systems, in some areas, unsustainable.

Resilience metrics

The definition of resilience is narrowed to fit the scope of the Strategy and aligns with existing IGAD approaches to improving the region's resilience to climate-related impacts, including the IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI) and IGAD Regional Climate Change Strategy (IRCCS). Based on this approach, four theoretical metrics for measuring resilience are:

1. Length of time from the onset of a disturbance or shock to the loss of livestock numbers, production, and income.
2. Length of time during which livestock numbers, production, and income are compromised due to the shock or disturbance.
3. Total losses of livestock numbers, production, and income due to the shock or disturbance.
4. Extent to which livestock numbers, production, and income recover to previous levels.

1.2 Situation analysis

Background to livestock and climate-change trends and challenges in the region

Macroeconomic and production trends

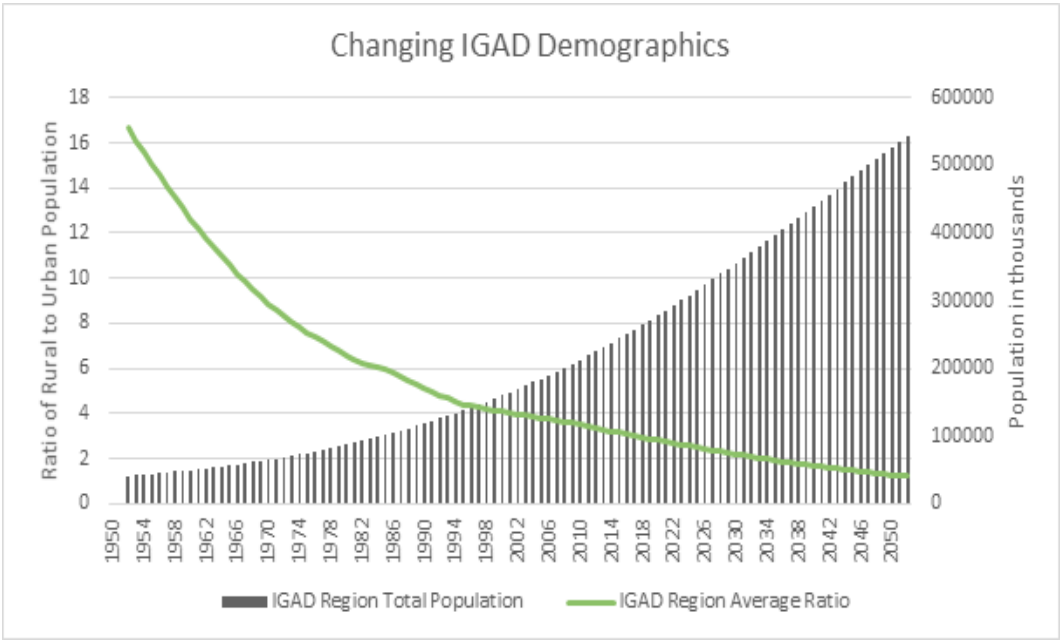

Figure 2: IGAD region population vs urbanization (United Nations, 2018)

Meat and milk production have both grown ten-fold over the past half century in the IGAD region (Figure 3) (FAO 2021), responding to the rising demand for animal-sourced protein to consume domestically or for export. The growth in domestic demand has been primarily driven by the rapidly changing demographics and economies of the IGAD region over the past 50 years. The population has grown seven-fold since 1950, and continued migration from rural areas to urban centers has changed the population distribution within the region (Figure 2). The IGAD average GDP has likewise seen a complete transformation by growing sixteen-fold over this period (World Bank 2021). This economic growth can be primarily attributed to the growth of the agriculture and service sectors. However, the economic benefits are unevenly distributed (the bottom 20% of the population only receives 6.5% of the total income, AfDB 2021), making certain populations even less able to cope with climate change. A stark spatial dichotomy exists between service-industry and agriculture-sector occupations; many rural poor are amongst the populations most vulnerable to climate change as they depend on agriculture – livestock production – as their primary source of livelihood (Robinson et al., 2011a; AfDB 2021).

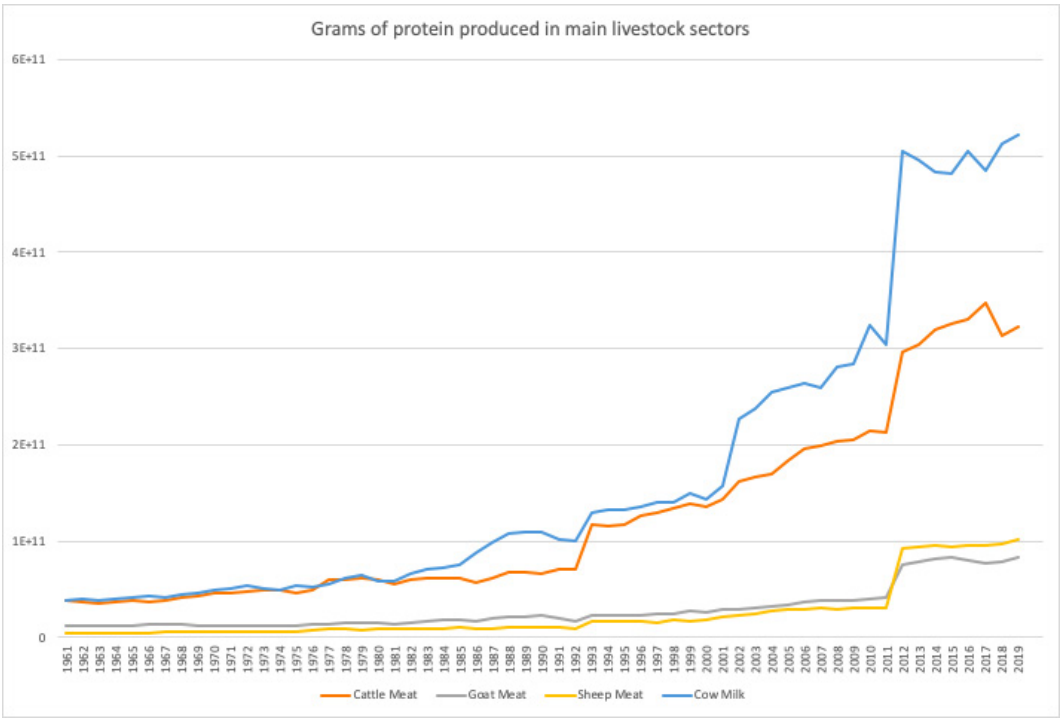

Figure 3: Grams of protein produced by main livestock categories in the IGAD Region

Current trends of a growing population, increased urbanization, and rising per capita incomes are projected to continue and accelerate. These trends will sustain the growth in demand for livestock products. The demand could increase beyond the production threshold of the region by 2050 e.g., in Kenya, Uganda, and Ethiopia (Thorton et al 2019b, 2019c, 2019d), partly due to reduced productivity from the effects of climate change, as well as from higher demand from the changing demographics. This increased demand from both internal and external consumers could result in higher prices for animal-sourced products and higher income for those along the livestock value chain. However, the increase in revenue is hardly guaranteed; there is a clear challenge for IGAD's current and future livestock food systems sustainably to intensify livestock production to meet internal and external demand while maintaining the land's provisioning capacity. Animal products provide high-quality proteins and bioavailable micronutrients that can be key to preventing undernourishment, especially during childhood. Livestock can cope with drought by moving and utilizing a range of feed resources (as well as mobilizing body reserves, assuming these have been previously built up).

The trading of livestock in the IGAD region addresses internal and international export demand. Regional meat exports have risen five-fold since the 1970s, in contrast

to the two-fold growth in meat imports (FAOSTAT 2021) over the same period. Official exports of livestock and livestock products primarily go to the Middle East and North Africa (MENA) region. For example, ten (10) million head of live animals and 41,000 T of meat products were exported to MENA in 2017 (IGAD 2018). Exports are projected to increase as external demand grows from existing trading partners, and new trading blocs begin accepting IGAD-sourced livestock and animal-sourced products. The expansion of markets primarily relies upon the ability of IGAD countries to grow and maintain production under changing climate.

Climate trends

The IGAD region has seen an increase of 1.5°C with no significant change in the amount of precipitation since 1960 (Girvetz et al., 2019). The yearly rainfall pattern typically consists of a bimodal distribution of two wet seasons punctuated by two dry seasons. Drought and flood events have been increasing in both frequency and intensity in the IGAD region (Figure 4).

The average temperature is projected to grow by an additional 1-2°C by 2050 for the IGAD region under the IPCCC Representative Concentration Pathways (RCP, corresponding to scenarios of greenhouse gasses [GHG] concentration in the atmosphere) 2.6, RCP 4.5, and RCP 8.5 scenarios (Gebrechorkos et al., 2019). While over 80% of climate models have agreed that this region will increase in precipitation levels by 2050 (Girvetz et al., 2019), numerous droughts during the rainy seasons have been observed and are increasing in frequency and intensity (UC Louvain and Guha-Sapir, 2020). This "East African Climate Paradox" (Rowell et al., 2015) explains why expected seasonal rainfall occurs during extreme rainfall events that cause widespread flooding over short periods. While the prevalence and intensity of droughts will generally increase, variability will also exist throughout the IGAD region (Haile et al., 2020).

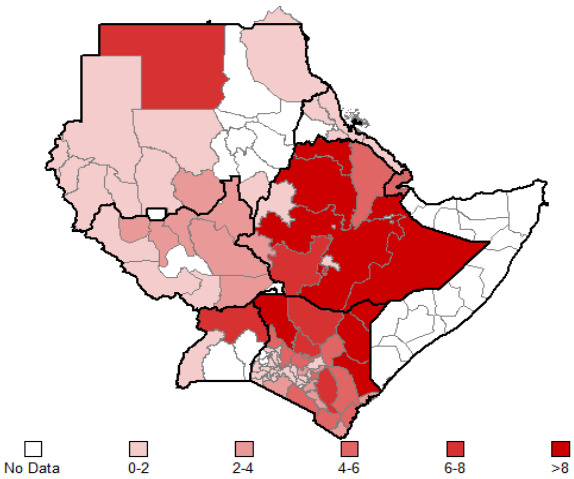

Figure 4: Number of drought events recorded from 1964 (EM-Dat database, 2019)

The zones most susceptible to drought are likewise more vulnerable to high climate variability and increased temperature during growing seasons (Thorton, 2019a). This will, in turn, have numerous effects on natural forage and agricultural productivity throughout the region.

Climate change impacts on livestock production

Livestock production is strongly impacted by climate change through direct (heat stress) but mostly indirect effects on water and feed availability and quality and diseases (FAO, 2013, Figure 5). Heat stress can lead to altered metabolism and increased mortality, but also to decreased fertility, feed intake, and productivity (Das et al. 2016). Heat stress has already substantially affected livestock production in the region (Rahimi et al., 2021), especially in areas already prone to drought, such as the ASALs used by pastoralists for livestock grazing (Ongoma et al., 2018). Besides direct effects such as heat stress, a significant impact of climate change and drought on livestock production is through a decrease in yield and quality of forage (including natural pastures).

Pest, diseases, and natural resource use

Climate change tends to favor pathogens, parasites, and vectors for the emergence of new diseases; it also decreases disease resistance in animals. Livestock-based diseases continue to impact the provisioning capacity of livestock systems throughout the IGAD region, especially as the relative populations of both humans and livestock are on the rise. Peste des Petits Ruminants (PPR), Foot and Mouth Disease (FMD), Contagious Bovine Pleuropneumonia (CBPP), rabies, anthrax, and brucellosis have all been identified as posing high disease risks within the human-livestock interface (IGAD, 2017; Pieracci et al., 2016). Climate change will continue to affect livestock by enabling the emergence of novel diseases and promoting their spread (FAO, 2009). The movement of livestock across national boundaries increases the spread of these diseases due to the poor enforcement of harmonized veterinary practices and traceability systems throughout the region. While ICPALD encourages a supportive system for seasonal mobility of livestock, the disease burden of animals moving throughout the region has impacted the export market potential due to poor meat hygiene handling practices and live animal disease concerns (IGAD, 2017).

Increasingly extreme weather events enable the increase of another natural phenomenon that poses a clear threat to livestock production: emerging pests, such as desert locusts, whose increased re-emergence in the region has been linked to climate change and extreme rainfall events that create beneficial breeding conditions (Roussi, 2020).

The agro-ecological zones of the region are facing rapid transformation from factors ranging from degradation to changing land use. Large-scale land acquisition has often been followed by large-scale mechanization, which is linked to a rapid decrease in native vegetation and a proportionate increase in invasive plant species (Sulieman and Elagib,

2012). Forest areas have been increasingly transformed into agricultural land for crop production throughout the region (Otieno and Anyah, 2012). Mixed crop-livestock systems benefit from the growth in cropping land, but pastoralists face increasingly fragmented rangelands for their livestock (Habtamu et al., 2018).

The increasing population pressure on rangeland ecosystems has resulted in long-term degradation of vegetation quality (Pricope et al., 2013). Invasive species such as Prosopis Juliflora that are inedible by livestock have developed throughout the rangeland systems (Linders et al., 2020). This quadruple threat of reduced vegetation quality, unpalatable invasive species, reduced precipitation, and increasing population has led to a continuing shift in traditional livestock management practices (Figure 5). The species composition of pastoralist herds is shifting from primarily cattle to a mix of camels and small ruminants. The decrease in water availability has increased the concentration of pastoralists around limited climate-proofed groundwater, increasing the rate of inter-and intra-community violence (Barnett and Adger, 2007; Döring, 2020; Kassahun et al., 2008; Thomas et al., 2020).

Livestock is impacted by climate change but also contributes to it through GHG emissions. On a global scale, the sector represents 14.5% of total anthropogenic GHG emissions (Gerber et al., 2013). In the IGAD region, the majority of these emissions come from enteric fermentation, where methane is emitted from ruminants as part of their digestive process (Otte et al., 2019). Enteric emissions from ruminants in the IGAD region alone produced .311 gigatons of CO2-eq in 2018 (FAO, 2021). The relatively low efficiency of the region's livestock sector in converting feed into animal-sourced products has been pointed to as a source of high emissions per unit of product – although global methods and data are often not well adapted to analyzing locally specific breeds and production systems. By improving the production efficiency of the livestock sector, the relative rate of GHG emissions per unit of animal-sourced product can be reduced (Gerber et al., 2011). The production efficiency can be improved with numerous approaches, including community-based breeding (CBB), market linkages enhancing off-take of lower production animals, disease control, improved feed, and others (Mottet et al., 2017). However, this transition must be approached with caution as low-emission development can inadvertently lead to concentration of the livestock sector and unequal distribution of the sector's income to the region's rural and vulnerable people (Crane et al., 2020). By combining these multiple approaches to sustainable intensification while practicing proper governance and restoration in the arid and semi-arid regions of IGAD, there is significant potential for climate change mitigation through livestock (Davies et al., 2015).

1.3 Policy progress in building resilience to climate change and mitigating GHG emissions in the livestock sector

This section provides an overview of data and information collection undertaken in the 7 MSs regarding i) the extent to which climate change —adaptation and mitigation— objectives are integrated into agriculture and food and nutrition security policies and frameworks, and vice versa; ii) the strengths and gaps of the policies and frameworks; iii) potential entry points for actors, including international development partners, for building a more resilient livestock sector; and iv) the broad level of coherence between adaptation, mitigation and development policies to identify potential conflicts and synergies.

Global and regional commitments

IGAD MSs are signatories to international protocols that are relevant to climate change:

The UN 2030 Agenda Sustainable Development Goals (SDGs)

The SDGs – especially Goal 13 – compel states to take urgent action to combat Climate Change and its impacts. Goal 15 calls for the protection, restoration, and promotion of sustainable use of terrestrial ecosystems, sustainably managing forests, combating desertification, halting and reversing land degradation, and halting biodiversity loss.

The United Nations Framework Convention on Climate Change (UNFCC) of 1992

The Convention was designed to regulate the issue of climate change at the international level. Its ultimate objective is to stabilize GHG concentrations in the atmosphere at a level that will prevent anthropogenic interference in the climate system to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened, and enable economic development to proceed sustainably.

IGAD MSs are signatories to both the UNFCCC and the Paris Protocol, which both oblige them to address climate change challenges through policy formulation and implementation. Responding to commitments under Articles 4 and 12 of the UNFCCC, IGAD MSs developed and submitted National Communication to UNFCCC, comprising a national GHG inventory system, assessments of vulnerability and adaptation to climate change, and recommendations for adapting to and mitigating climate change.

Regional policies

Over recent decades, IGAD, as with other institutions, has developed and, to varying degrees, caused to be implemented strategies and other policy efforts at the regional level for Eastern Africa. Some of these address climate change and livestock-sector development, with significant crossover between them.

Regional climate change strategies

Regional climate change policy efforts in Eastern Africa include the East African Community Climate Change Master Plan (EAC-CCMP, 2011-2031), the East Africa Climate Change Strategy (EACCS, 2015-2016), the IGAD Regional Climate Change Strategy (IRCCS, 2023-2030), the African Union Climate Change Strategy (AUCCS, 2015- 2035), and the IGAD Drought Disaster Resilience and Sustainability Initiative (IDDRSI) Strategy 2019-2024.

The IGAD IRCCS 2023-2030 was developed by IGAD's Climate Prediction and Application Centre (ICPAC). Its mission is "To support climate change adaptation and mitigation actions in the region through enhanced coordination and cooperation as well as mainstreaming climate change into regional and national development frameworks."

The IDDRSI Strategy 2019-2024 aims to support the implementation of IDDRSI to end drought emergencies in the region. It is the second IDDRSI Strategy iteration, the first's (2013-2017) having been developed as part of the establishment of IDDRSI in the wake of the devastating 2010-2011 drought in the Horn of Africa. The current IDDRSI Strategy establishes eight "Priority Intervention Areas" of livestock-related interventions, including: Rangeland management and pasture development, Securing livestock mobility and transboundary (regional and cross-border) trade, Livestock production and productivity, and Transboundary disease control & strengthening pharmaceutical systems.

Regional livestock sector strategies

Regional policy efforts in the area of livestock sector development include the East African Community Livestock Policy (2016), IGAD Animal Health Strategy (2017-2022), Regional Strategic Framework: Rangeland Management in Arid and Semi-Arid Lands of the IGAD Region (RRMSF, 2020), and IGAD Protocol on Transhumance (2020).

The regional strategies created by IGAD have been well received by the MSs and integrated into their respective policies and legislative frameworks. The IRCCS and the IDDRSI strategy provide consistent and clear guidance on livestock that are coherent with IGAD's Animal Health Strategy, the RRMSF, and the IGAD Protocol on Transhumance. However, these strategies do not contain key sections developing a holistic resilience and adaptation to climate change for the livestock sector throughout the IGAD region in a degree of detail that enables MS to employ financial and capacity-building mechanisms. In particular, these strategies lack sufficient technical mechanisms in these strategies that the MS could use.

National climate change policies

Seven IGAD MSs have submitted Intended Nationally Determined Contributions (NDCs) and National Adaptation Programmes of Action (NAPAs) under the United Nations Framework Convention on Climate Change (UNFCCC). Notably, all 7 refer

to livestock as a priority sector in their NDCs and NAPAs and include livestock sector targets for adaptation, resilience, mitigation, and natural resources issues related to other aspects of sustainability. In addition, four MSs (Djibouti, Ethiopia, Kenya, and Uganda) have developed national climate change strategies, which include livestock sector priorities and targets. For example, the Uganda National Adaptation Plan for the Agriculture sector (2018) has the overall objective to increase the resilience of Uganda's agricultural sector to the impacts of climate change through coordinated interventions that enhance sustainable agriculture, food and nutritional security, livelihood improvement, and sustainable development. In Somalia, the National Development Plan (NDP; 2020-2024) recognizes the imperative to build the resilience of communities to climate-driven disasters, especially droughts and floods. In Djibouti, the National Climate Change Strategy (Strategie Nationale Sur Les Changements Climatiques - SNCC) was developed in 2016 and sets the axes and rules for programs that will be defined by the institutions in charge of adaptation to climate change and fighting against its anthropogenic causes.

While these climate change policies are robust and coherent in their aims, a significant obstacle to their implementation is the lack of institutional capacity, both in available funds for the proposed interventions and staff for relevant MS institutional bodies. Moreover, many of the policies have prioritized adaptation and resilience over mitigation, particularly in the sections pertaining to livestock. Additionally, the lack of regional consistency reduces the impact of these policies, despite the fact that many of the threats and opportunities created by climate change are common throughout the region.

National agriculture and livestock policies

IGAD MSs have also developed national strategies, policies, and plans specific to the agricultural sector. Many of these provide detailed policies and interventions for enhancing the resilience of crop and livestock sectors to climate change (for example, the Kenya Climate Smart Agriculture Strategy 2017-2026). Plans specific to the livestock sector are present, for example, in the Ethiopia Livestock Master Plan and the Ugandan National Adaptation Program Action (NAPA) Implementation Strategy, 2007. The National Climate Change Policy (NCCP) for Somalia has already been endorsed by the cabinet. Most of the policies are in implementation, while others are still in draft, such as those in South Sudan and Somalia. All form the legislative basis on which the policies are built.

An overarching focal point of these policies is the sustainable intensification of the crop and livestock sectors. While broad goals and priorities are often clear for building adaptation and resilience, these policies sometimes lack specificity in regard to climate change mitigation. Specifically, the rebound effect from a policy-driven reduction in production costs or increase in market access could result in rapid sector growth in livestock numbers and GHG emissions. This sector growth could negate any mitigation

potential from other policy interventions. Some policies, such as establishing water access points, can lead to further environmental degradation in the absence of associated policies, such as pasture management and fodder provision. Additionally, a common theme throughout these policies is the recognized need for additional research and development of climate-smart agriculture knowledge to be implemented at various scales.

These sector policies and plans typically identify a combination of policy measures and technical adaptation options that have been identified according to multiple criteria, including their potential to alleviate climate change impacts, reduce poverty, and, in some cases, cost-effectiveness. Although these plans are soundly based, they tend to position policy and technical options at the same level and do not always provide a clear link between them. This lack of policy-to-intervention continuity reduces the capacity of relevant implementing bodies throughout the Member States.

National policies on climate change and the livestock sector

All IGAD MS have developed various strategies, policies, plans, and programs with priority activities for addressing key challenges at the nexus of climate change and livestock sector development. They have done so with varying breadth and depth, with few examples of cross-sectoral policy documents targeting livestock and climate change challenges together. Most MS, however, have developed sectoral policy documents aimed primarily at either climate change or agricultural development (including livestock) challenges. See Table 3 for an overview of relevant, national policies and what is currently known about their strengths, weaknesses, and implementation status.

Table 3: Assessment of National Policies related to resilient and sustainable livestock development in view of climate change.

	Climate change Policies						Agriculture & Livestock Policies						Natural Resource Sustainability Policies					
	Strength of activities and targets related to resilient and sustainable livestock in view of climate change																	
	Activities		Targets		Impl. Status		Activities		Targets		Impl. Status		Activities		Targets		Impl. Status	
	A/R	M	A/R	M	A/R	M	A/R	M	A/R	M	A/R	M	A/R	M	A/R	M	A/R	M
Djibouti	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟠	🟡	🟠	🟢	🟠	🟡	🟡	🟡	🟡	🟡	🟡
Ethiopia	🟢	🟡	🟢	🟡	🟡	🟡	🟢	🟢	🟢	🟢	🟡	🟢	🟢	🟡	🟢	🟡	🟡	🟡
Kenya	🟢	🟢	🟢	🟢	🟢	🟢	🟢	🟡	🟢	🟡	🟡	🟡	🟡	🟠	🟡	🟠	🟡	🟠
Somalia	🟢	🟡	🟢	🟡	⚪	⚪	🟢	🟢	🟢	🟢	🟡	🟡	🟡	🟠	🟡	🟠	⚪	⚪
S. Sudan	🟡	🟠	🟢	🟠	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	⚪	⚪
Sudan	🟢	🟡	🟢	🟢	🟡	🟡	🟢	🟠	🟢	🟠	🟠	🟠	🟢	🟠	🟢	🟠	🟢	🟠
Uganda	🟢	🟢	🟢	🟢	🟢	🟠	🟢	🟠	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡

Impl. (implementation), A/R (adaptation/resilience), M (mitigation).
Strong (🟢), moderate(🟡), weak (🟠), unknown (⚪)

Based on this review of national-level policies, critical gaps in enhancing the contributions of the livestock sector to adaptation, resilience, mitigation, and other sustainability outcomes can be identified:

- Inadequate awareness-raising and information provided about climate change impacts;
- Policies and instruments, such as index-based insurance and feed and fodder banks, are inadequate in some MSs;
- There is a lack of coherent action and monitoring of management, conservation, and rational use (including for water and biodiversity), as well as improved fodder crops and pasture management;
- R&D into resilient and climate-smart production methods and technologies is inadequate;
- There is inadequate capacity and a shortage of institutions to analyze climate change impacts, identify technical solutions to build resilience, and implement policies to promote the adoption of these solutions;
- There is insufficient mainstreaming of adaptation and mitigation measures into national development plans for the sector; and
- No clear institutional framework exists for climate change adaptation in some MSs, which leads to overlapping mandates and responsibilities.

2. Rationale and justification of the Strategy

2.1 Rationale and need for a regional strategy

The management of catastrophic events caused or worsened by climate change, such as severe droughts, floods, and disease outbreaks, is beyond an individual farmer's or the market's capacity to cope. IGAD MSs have, thus, actively engaged in formulating plans to mitigate and adapt to climate change's adverse effects, which have largely contributed to increased frequency of droughts, the emergence of desert locusts and other pests, and re-emerging livestock diseases such as Rift Valley Fever in the region. Regional efforts have been taken to build resilience to climate change and achieve growth and sustainable development in the region's most versatile development paradigm ever designed and implemented under the IGAD Drought Disaster Resilience Sustainability Initiative (IDDRSI) framework. All countries have developed a National Adaptation Programme of Action (NAPA) detailing their vulnerability to the impacts of climate change and the actions they plan to take to alleviate these impacts. Seven of the eight countries have developed Nationally Determined Contributions (NDCc), which are non-binding national plans highlighting climate actions, including climate-related targets for greenhouse gas (GHG) emission reductions, policies and measures aimed at reducing emissions, taking into account their domestic circumstances and capabilities. The livestock sector is included in the IGAD all countries' national adaptation and mitigation plans. In addition, several countries are supporting the adaptation of private sector agricultural value chain actors through capacity building, promoting and implementing climate-smart agriculture (CSA) practices and innovations: the promotion and bulking of drought-tolerant crops, water harvesting for crop production, index-based insurance (crop and livestock), conservation agriculture, agro-forestry, and integrated soil fertility management, among others.

Due to the lengthy production cycles of ruminants, long time frames are needed for herds and livelihoods to recover from adverse events that cause significant losses of animals. Hence, prevention of these losses can have substantial and long-lasting livelihood benefits throughout the region. In practice, and despite related plans and policies, government responses to such adverse climatic events have tended to be mostly reactive, with an over-reliance on ad hoc disaster relief.

The Strategy outlined in this document will serve as a link between adoption, adaptation, and transformation for building resilience to climate change. It supports the layering, integrating, and sequencing of investments to further the objectives of each priority intervention area.

2.2 Key policy challenges and opportunities

Defining the roles and functions of governments and the private sector

To determine the appropriate role of governments in providing policy support for

resilience, it is necessary to consider the different layers of risk that farmers experience. For example, normal variations in weather and market prices can be primarily managed by farmers with only small policy responses from the government. The case for wholesale government intervention is stronger for catastrophic events that affect many farmers over a large area – such as systemic droughts, highly contagious disease outbreaks, or widespread flooding - because it is often beyond the capacity of an individual farmer or the market to manage these events. Therefore, these less frequent and systemic events are likely to lead to market failures in risk management (OECD, 2021).

While there is greater justification for government intervention where there are market failures, the government can contribute positively to managing all layers of risk by providing an enabling environment to increase the efficiency with which farmers and other private sector actors can manage risks, including through the provision of public infrastructure, R&D and extension, and by removing barriers that hinder market functioning and creation. This includes the provision of regulatory frameworks that enable the development of commercial risk management products, including credit, insurance, and other banking services (OECD, 2021).

In situations where market failures cause an under-provision of risk management products, such as insurance, governments may justify entering into risk-sharing arrangements with the private sector to provide more efficient risk management services, including subsidizing the costs of providing these services to farmers. However, this needs to be handled carefully to ensure that the subsidies do not lower incentives for farmers to develop their own risk management strategies or crowd out private markets. Concerns over whether the subsidization of risk management products correctly addresses a market failure are less important in situations where such a subsidy replaces an existing subsidized program and provides risk management services more cost-effectively than other options. This may well be the case, for example, for subsidized insurance programs when compared to ad hoc disaster assistance (OECD 2021).

Careful attention is also needed in designing subsidized risk management products to prevent rent-seeking by the private sector. This can inflate the cost of service provision beyond that of services fully funded by governments (Glauber and Dismukes, 2016). Costs associated with rent-seeking can be minimized through the competitive structuring of contracts with the private sector. Symmetric access to government-provided information about agricultural risks can also stimulate the creation and improvement of risk-sharing products' performance more generally (Glauber, 2016).

There is a further case for the government to address market failures that cause the under-provision of public benefits such as improved environmental outcomes. This includes the mitigation of GHG emissions from livestock, as well as maintaining and

enhancing stocks of natural capital that underpin the flow of livestock and environmental goods and services.

Utilizing "no-regrets" policy options

Enabling measures, such as R&D, extension, and the provision of information and regulatory frameworks to stimulate and improve the performance of risk management markets, can be considered as "'no-regret" policies in the sense that they can improve productivity and income, even in the absence of adverse events, in addition to enhancing the resilience capacity of farmers and markets. The same arguments can be made for policies that improve animal health, the natural resource base, and feedstuff resources.

Fortunately, many of the technical measures available for improving the productivity and resilience of livestock in the region have synergistic impacts of lowering GHG emissions, particularly on an emission-per-unit-of-output basis. Accordingly, policies that enhance the adoption of these measures complete the set of "no-regret" policies that align with the sustainable resilience scope of the Strategy.

Enhancing resilience and sustainability through preparedness and "building back better"

Building a more resilient and sustainable livestock sector will require a shift to an ex-ante paradigm that places greater emphasis on measures that reduce risk exposure, increase preparedness, and prevent losses before they occur.

At the same time, ex-post policy responses to adverse events should be framed as opportunities to "build back better" and as more resilient production systems that simultaneously embrace development and environmental improvement objectives. This includes planning transformation in anticipation of future conditions, rather than as reactive responses to crossing ecological thresholds that prevent the continuation of existing production systems.

3. A Strategy for sustainable and resilient livestock in the IGAD region

3.1 Vision

A more resilient, productive, and sustainable livestock sector in the IGAD region for improved living standards and reduced vulnerability to climate change.

3.2 Mission

Mainstream climate change adaptation and mitigation into development plans for the livestock sector.

3.3 Goal and Objectives

Goal and Purpose

Provide the framework to support the identification and prioritization of policies and actions to increase the resilience and sustainability of the livestock sector to climate change impact in the IGAD region.

Specific objectives

The strategy is designed to address the following four, specific objectives:

i. To guide regional and national livestock programs and projects on adaptation and mitigation to climate change;

ii. To promote the integration of climate change adaptation, mitigation, and transformation into livestock development policies at regional and national levels;

iii. To provide the strategic framework of MSs' policy and strategy in relation to climate-resilient livestock development.

iv. To monitor and evaluate the effort of MSs towards the development of the livestock sector resilient to climate change;

4. Proposed Priority Intervention Areas

The identification of priority intervention areas was based on an analysis of data and information collected from the MSs, including consultation with national and regional experts. The collection and analysis of data and information include the review of existing strategies and policies, and ongoing interventions with regard to their potential to contribute to enhancing resilience to climate change's adverse impacts and to natural disasters in the IGAD region. This strategy is also conceived in cognizance of other regional and national strategies such as the IGAD Climate Change strategy and ongoing programming frameworks such as IDDRSI.

This section reflects the key intervention areas consolidated into five overarching priority intervention areas (PIAs). These PIAs were prioritized after consultation with key interviewees and stakeholders, in addition to the policy reviews. They also draw on extensive diagnostic work and specific modeling carried out to assess the effectiveness of policy interventions aiming at improving the sustainability and resilience of the sector (Macleod et al., 2022)

4.1. Priority Intervention Area 1: Mechanisms for climate risk management

Objective and approach: This PIA will improve preparedness and the temporal allocation of resources and income in response to climate shocks by making financial and technical mechanisms available to pastoralists. This requires coordination among public authorities at different levels, communities, and the private sector, along with ex-ante and ex-post policy approaches. Additional funding can be mobilized through public-private partnerships to accomplish this objective.

Output 1.1: Financial instruments for climate risk management enhanced

Formal financial services, including savings accounts, access to credit and loans, and insurance, are important risk management options for herders and actors along the livestock value chain. These services support resilience by allowing farmers to manage their income flows more efficiently over time, including the transfer of surplus income generated during good seasons to protect assets and consumption needs during bad seasons. However, in poor pastoral areas, access to formal banking and financial services is often limited, leaving pastoralists with few options that include costly informal loans to manage production threats from climate change.

The under-provision of financial services is often due to market and policy failure. The provision of regulatory frameworks that enable the development of commercial risk management products, including risk transfer (insurance) and other risk retention (savings and credit) instruments, can address some of these issues.

These instruments can play an important role in helping pastoralists to manage climate risks such as systemic droughts, highly contagious disease outbreaks, or widespread

flooding. However, there is an increasing probability that such events are of a magnitude beyond the capacity of an individual farmer or the market to manage. Therefore, more specialized risk management instruments and additional government support may be needed. These crisis risk financing (CRF) instruments can improve preparedness for natural disasters, including those associated with climate change, by enabling a timely and proactive response for clients and governments and improving cost effectiveness (Poole et al., 2020).

Products may include index-based insurance, incentivized savings, and de-risked emergency credit to prevent the loss of livestock assets through the provision of timely financial support based on triggers. These should have: (i) clear and transparent triggers to unlock financial disbursement, targeting both asset protection and recovery; and (ii) disbursement systems that ensure finance reaches the farmers and pastoralists in a timely and transparent manner.

Index-based livestock insurance (IBLI) is a risk management product that has been successfully piloted in Kenya and Ethiopia to protect the livestock assets of pastoralists during severe drought events. The design and implementation of IBLI involved collaboration between international organizations, local institutions, and private sector partners as part of an ambitious research-for-development agenda since 2008 (Fava et al., 2021; Jensen et al., 2018; Taye and Mude, 2019. It is now apparent from pilot trials that MSs need to scale up IBLI and provide a policy environment that supports the growth of diverse insurance products.

Incentivized savings products constitute a financial mechanism intended to encourage those underutilizing existing saving structures to engage with them and employ their services. The financial incentives could be matched savings or higher interest rates (Wang et al., 2018). Such products could enable pastoralists to keep their savings in more diversified assets and not only in livestock (African Development Bank, 2013).

De-risked emergency credit is a pre-approved financial product that exists to provide rapid funding in the case of an emergency. These products are typically a type of blended private-public funding, where public bodies take on the primary risk of default to attract private funding to this area (OECD, 2020b).

Insurance pools (capital risk pools) represent a mechanism by which a group of countries pool their risk when accessing global capital markets to lower the premium of each country through economies of scale. Lower-income nations have repeatedly used insurance pools on regional scales to insure against disasters, such as the Caribbean Catastrophe Risk Insurance Facility, the Pacific Disaster Risk Financing and Insurance, and the African Risk Capacity (Martinez-Diaz et al., 2019).

Catastrophe bonds are insurance bonds with a high yield rate that pay out if a pre-defined catastrophe occurs. This means that, because of their high rates of interest

paid to investors, they are an attractive instrument in building a body of funds that can be used to fund recovery from a catastrophe if it occurs (OECD, 2011). An insurer issues these bonds to transfer the risk of an insurance payout to the holder of the bonds, who are typically institutional investors. These securities are particularly useful in the context of climate-change related shocks, where the pre-defined impact or includes an index of weather conditions. They have been raised in the past by both private insurance groups and public sector bodies and have been used successfully with climate-related shocks (OECD, 2020b).

Activities supporting Output 1 include:

- Strengthening institutions (policy and legal frameworks) and organization for index-based livestock insurance schemes at national and regional levels through public and -private partnerships (PPPs).
- Support pilot schemes of incentivized savings plans among pastoralist communities and document lessons for potential scale-up.
- Promote the creation of a PPP to develop region- or ASAL-wide insurance pools or catastrophe bonds for MSs.
- Facilitate harmonization of policies across MSs for financing disaster recovery from climate change related events.
- Identify obstacles to private sector development and establish incentive mechanisms in support of climate change risk reducing investments in the livestock sector with a focus on raising awareness about the sector's profitability and incorporating carbon markets for climate change mitigation.
- Document good practices promoting access to finance by pastoralists through appropriate financing products, including facilitating the use of livestock assets as collateral.

Output 1.2: Early warning and response systems strengthened

Drought is a relatively slow onset natural phenomenon in which catastrophic impact can be reduced through a locally tailored early warning system (EWS). Such systems seek to reduce the impacts of hazards, such as drought, by providing predictions of when and where such hazards are likely to present an elevated risk. EWS make predictions based on different types of evidence, including "simple book-keeping procedures of water balance, water balance models, dynamic vegetation growth models, and remote sensing assessments" (Matere et al., 2020). The "early warning information" (EWI) provided by these systems can enable a variety of actors, from individual households, to governments and multilateral institutions, to take pre-emptive action to reduce risk. Early action can reduce the human and financial cost of hazards for more rapid recovery from extreme events (Bailey, 2013; Matere et al., 2013).

Early warning climate systems in the IGAD region

In IGAD MSs, a significant amount of climate information has been generated, and such information is important for climate change adaptation. Moreover, the region has strengthened the dissemination of climate information through the Great Horn of Africa Climate Outlook Forum (GHACOF), hosted by the IGAD Climate Prediction and Application Center (ICPAC), which holds three Forum meetings a year. Some of the Forum output is shared with mainstream stakeholders, including policymakers, extension officers, farmer groups, and pastoralists, includes predicted onsets and any forecast deviations that may arise

National meteorological departments from all MSs scale down such information to national and subnational levels. ICPAC has developed other early warning tools such as the East Africa Hazards Watch, which tracks extreme events such as drought, cyclones, pests (desert locust), heavy rainfall, floods, or crop failures that are increasing in frequency and intensity due to climate change (ICPAC 2021).

Effects of EWS on livestock performance

The effect of an EWS will depend on the actions taken by actors in response to the information provided. For example, an EWS could facilitate commercial destocking by enabling animals to be sold in better condition and providing more time to arrange sales and (if needed) loans to traders. An EWS could also be used to enable the timing of forage planting or rangeland restoration activities to be adjusted to improve their performance. The possibility of linking a predictive livestock early warning system (PLEWS) with IBLI is raised by Matere et al. (2020).

The main benefit of EWSs is that they can reduce the impact of a hazard by enabling an early response. Evidence shows that early responses are much more cost-effective than later emergency responses (Cabot Venton et al., 2012). However, there is often a gap between information provision and its use; any EWS needs to build engagement with end users in three main areas: users' perceptions of how information fits with their needs; the interplay between new and existing knowledge; and the level and quality of interaction between producers and users. In order to realize the potential benefits of an EWS, decision-makers need to access, understand and effectively act upon the information they provide. Institutional coordination and stakeholder engagement are required for an effective EWS.

Activities supporting Output 1.2 include:

- Assessing capacity and infrastructure gaps at a national level to allow full operation of integrated livestock EWS.
- Providing capacity building support for full operationalization of early warning tools such as Animal Feed Balance Sheet (AFBS), Pictorial Evaluation Tools (PET),

Predictive Livestock Early Warning System (PLEWS), Predictive Rangeland Forage (PRF), and meteorological services.

- Assessing vulnerability and expanding EWS scope to other risks such as floods, conflicts, zoonotic and other animal diseases.
- Promoting the exchange of lessons on services, activities and investments, technologies and tools that enhance information flows from higher to community levels and bridge the gap between information provision and information use. This will include data collection, analysis and sharing (e.g., data platforms), dissemination and packaging of information (e.g., dashboards) to provide easy-to-use information to communities.
- Facilitating and strengthening institutional coordination to enhance the use of information generated by EWS and coordinate action at different stages of climate shocks, such as destocking, timed forage planting and mobilisation of feed reserves.
- Support inclusive sensitization and training to ensure equitable access to, and use of EWS information among end-users, and particularly among women and youth.

Output 1.3: Risk profiling and contingency planning strengthened

Risk profiling (RP) is the process of identifying which areas, people, and processes are more prone than others to disruption or impact from climate change related effects. Many of these risks are multidimensional and compounded in their impacts. National governments need to work with their respective constituencies to identify which risks pose the greatest threats to their livelihoods, including how they see themselves and such risks in the context of their own environment. Through clear communication, ex-ante action can be taken in coordination with other actors to identify vulnerable areas best (Sullivan-Wiley et al., 2017).

Contingency planning (CP) is the act of building safeguards and mechanisms that both reduce the risk of climate-related impacts and underpin recovery from these impacts. Holistic CP requires the application of a resilience lens to risk management by private and public stakeholders. By acting ex-ante to decrease risks and prepare for climate change related impacts, stakeholders can build resilience into the livestock sector.

When conducting CP, the scale, the source of risk, and the time frame of the risk determine which stakeholder needs to lead the resilience strategy. For instance, regularly occurring, small, and local risks should be the main focus of individual livestock producers. However, the government can encourage the development of human capital and increase the uptake of resilience-building practices, even then. Large, rarely occurring, and systemic risks must be the responsibility of the government to address (OECD, 2020a).

Contingency planning and risk profiling can significantly reduce the impact of climate shocks. Public bodies and private stakeholders can build resilience into their shares of the livestock sector by considering the scale, source of risk, and its timeframe. Information dissemination in advance of a climate shock has been shown to reduce its impact significantly. This and other multi-actor resiliency mechanisms need to have been pre-planned in order to remove any obstacles to an effective and efficient response.

Activities supporting Output 1.3:

- Undertake comprehensive climate change risk assessment, including mapping of risk hotspots by considering socio-economic and other infrastructures.
- Provide regional strategic frameworks for contingency plans for climate change related impacts in the livestock sector.
- Strengthen coordination and cooperation among traditional, indigenous, and sub-national decision-making bodies and MS ministries in the undertakings (RP and CP).

4.2. Priority Intervention Area 2: Natural resource base and ecosystem services for livestock production

Objective and approach

This PIA aims to enhance and increase access to natural resources to build capacity to absorb climate shocks. This requires adequate technical and financial resources to be dedicated across relevant agriculture, forestry, and other land use (AFOLU) sectors. Experience gained from implementing the East African Community Livestock Policy (2016), IGAD Regional Strategy Volume 1: Framework (2016- 2020), and the Regional Strategic Framework: Rangeland Management in Arid and Semi-Arid Lands of the IGAD Region (RRMSF, 2020) will be essential in implementing this priority. The livestock production methods of the IGAD region depend heavily on the provisioning capacity of the region's natural resource base, such as rangelands, water sources, woodlands, natural biomass used as feed, wild biodiversity, and genetic diversity. However, the overuse of some of these resources and the impacts of climate change, such as repeated droughts, have disrupted the natural cycles to create harmful effects on the productive capacity and resilience of the livestock sector. Therefore, in order to build a sustainable and resilient livestock sector in the face of climate change, it is essential to invest in building up the natural resource base and promote its sustainable use for adaptation and mitigation strategies.

Output 2.1: Rangeland and woodland management enhanced

In pastoral systems, natural vegetation represents the bulk of the feed supply. Natural feed resource shortages and poor quality (e.g., contamination by non-palatable species) are among the main resource issues facing the livestock sector in the IGAD region

(Matere et al., 2020). Access to rangeland resources is a major contributor to conflict in pastoral areas. This Output is designed to enhance the supply of natural feed biomass while cultivated feed (including improved pastures) is addressed in PIA 3. Improved rangeland management has dual objectives: contributing to livestock productivity, and climate change mitigation through carbon sequestration (below and above ground).

Activities supporting Output 2.1:

- Map and profile regional rangeland natural feed resources in MSs to establish a baseline, including a comprehensive agroecological zone assessment to identify previously underutilized feed sources.
- Demonstrate the elasticity of rangeland biomass productivity through improved management, compared to business as usual, and estimate the impact on productivity gains and capacity for carbon sequestration using models and case studies.
- Support MSs in the creation and annual updating of regional feed and livestock inventories, with a focus on the availability of and accessibility to feed (rangeland productivity, forage production and diversity, harvesting, conservation, and storage).
- Identify policies and incentives to promote rangeland restoration (e.g., reseeding, soil conservation), sustainable grazing management, and pasture improvement (growing legumes in the rangeland to improve quality).
- Promote the establishment of fodder banks, particularly emergency ones, and the communal harvesting, conservation and marketing of fodder with a focus on ASAL and the involvement of women and youth.
- Promote ways of improving feed production from rangelands, fodder banks, and communal harvesting by enriching grassland with legume plants.
- Work towards a system for grading and certification of fodder and pasture seed to enhance regional trade.
- Develop systems of emergency feedstock management, including logistic and transborder movement, for use in times of feed stress.
- Promote cross-border, regional and international trade in animal feed, fodder, and pasture seed.
- Enhance system and governance institutions for communal rangeland resource management built on local traditions and practices.

Output 2.2: Water availability and access improved

The frequency and intensity of rains throughout the IGAD region have changed significantly due to climate change, although climate models show enhanced annual rainfall over most of the ASALs of the Horn of Africa. Pastoralists are traveling more

frequently and for longer distances to access water. The change in water provisioning has reduced the carrying capacity of arid and semi-arid landscapes and hastened the rate of land degradation and erosion. The arid and semi-arid lands of the IGAD region are particularly prone to disruptions in water supply, where climate-proofed boreholes and other infrastructure are increasingly relied upon to provide water for livestock (Kassahun et al., 2008; Thomas et al., 2020).

Activities supporting Output 2.2

- Establish a mapping and profiling of water resources and a water balance assessment and analysis of ASALs in the region to inform sustainable water use.
- Support and provide capacity to the MSs to undertake annual updates of water inventories, with a focus on water availability and accessibility to livestock.
- Using public resources and PPPs, develop surface and underground climate-proofed water storage and withdrawal facilities (e.g., dams, borrow pits, valley dams, boreholes).
- Develop sustainable management plans for water, rangeland and other resources along pastoral mobility corridors with public resources and PPPs.
- Promote micro-scale irrigation programs to support agro-pastoralists in irrigated pasture production, especially through water harvesting.

Output 2.3: Regional biodiversity preserved, and invasive plant species managed

The extensive livestock production methods in the IGAD region rely primarily on the natural vegetation, which is an ecosystem that crosses international borders. In the arid and semi-arid environments of the region, pastoralism is the main form of livestock rearing as it enables herd mobility as a form of risk management and takes advantage of the high spatial heterogeneity in herbaceous biomass production and water sources available (Notenbaert et al., 2012). Responsible grazing of rangelands by pastoralists is one of the most productive long-term uses of the land (Neely et al., 2009). A positive relationship has been established between livestock and plant biodiversity in the grasslands of East Africa.

However, fragmentation of rangelands, coupled with over or under grazing of the biomass and expansion of invasive plant species, can lead to severe degradation of the rangeland and loss of biodiversity. Invasive plant species can be both a cause and a consequence of degradation as they take advantage of degraded and less diverse grassland ecosystems and are spreading into the rangelands, reducing the amount of palatable forage available for livestock (Ng'weno et al., 2010; Notenbaert et al., 2012). By reducing ecosystem degradation through promoting biodiversity and reducing the impact of invasive plant species, the provisioning capacity of rangelands can be improved to promote the resilience of the livestock sector in the region.

Activities supporting Output 2.3

- Map and profile cross-border biodiversity resources and invasive species distribution, including hotspots (of biodiversity, invasive species, and degradation).
- Develop a regional program and encourage MSs to invest in sustainable management, monitoring of rangeland biodiversity, and invasive species management in the ASAL.
- Support good practice and knowledge exchange among MSs for the management and utilization of invasive species as a way of control and for final eradication.
- Integrate local and indigenous practices of biodiversity protection into MSs policies, including the protection of mobility corridors and grazing reserves for pastoralists, as well as enabling payment for environmental services by land stewards, such as pastoralists who preserve biodiversity and reduce the advance of invasive species.

4.3. Priority Intervention Area 3: Livestock production and income diversification along livestock value chains

Objective and approach

This PIA has the objective of enhancing integration between sustainable livestock production and diversifying income from other, complementary livelihoods. By improving productivity and market access, the objective is both to support livestock producers' resilience to climate change impact and to promote diversification of income from other sources. Additionally, the sector's impact on the natural resource base will be reduced with destocking, improved access to animal feed, reduced losses through mortality and production, improved household financial income, and improved restocking capacities.

Output 3.1: Animal production and productivity enhanced

This Output aims to increase livestock productivity of milk, meat, and hides and skins through improved animal husbandry practices, breed management and animal nutrition. By sustainably enhancing livestock production and quality, it is possible to increase productivity per animal, which will also help in mitigating GHG emissions and, by extension, climate change.

Activities supporting Output 3.1:

- Promote the adoption of drought-tolerant and disease-resistant animal breeds, including through community breeding programs.
- Promote the adoption of high-yielding and fast-maturing improved animal

breeds suitable for the ASALs context thus contributing to reduced GHG emission intensity.

- Promote improved fodder production technologies (including solar-powered small-scale irrigation, rain-fed, and zai pits) and fodder conservation and transformation technologies and innovations (including densification, hay baling, briquettes) to produce conditioned animals for market.
- Promote market-oriented livestock production, including timely and strategic offtake among the pastoral communities to allow feed and forage budgeting.
- Promote livelihood diversification, e.g., bee keeping, pig and poultry production.
- Strengthening ASALs breeding and multiplication centers to support pastoralist and agro-pastoralist in rebuilding their herds after a disaster.

Output 3.2: Feed production and access improved

Feed resource shortages and poor-quality feed are among the main issues facing the livestock sector in the IGAD region (Matere et al., 2020). The subject of feed resources has been extensively covered in the FAO-IGAD strategy, East Africa Animal Feed Action Plan (FAO, 2019). This was the first regional animal feed resources strategy to be created in Africa (Opio et al., 2020), and provides an excellent action plan on how IGAD MSs can work together to deal with this sectoral issue. Animal feed, such as concentrate, is a key component in the conditioning of animals for market, but it is lacking in PAP areas.

Activities supporting Output 3.2:

- Promote private sector entrepreneurship and investment in the production of feed and fodder, utilizing relevant production technologies (solar energy based small scale irrigation, rain-fed irrigation, zai pits) and processing and conservation technologies (e.g., densification, hay baling, briquettes).
- Support the development of feed value chains, including processing and marketing, as well as the adoption of good fodder storage practices to avoid losses.
- Promote cross border, regional and international trade in animal feed and pasture seed.
- Conduct a comprehensive agroecological zone assessment to identify previously underutilized feed sources.
- Create a digital marketing linkage platform to increase commercialization of products.

Output 3.3: Alternative and complementary livelihoods in the livestock sector promoted

Many factors, including anthropogenic forces and climate change effects, undermine the resilience of livestock holders to shocks and other changes, thereby increasing vulnerability and dropout. In order to reduce the vulnerability of pastoralists due to their high dependency on livestock herding, support is needed to enhance access to other sources of livelihood like bee-keeping, artisanal mining, processing of gums and resins, and the utilization of wild products such as aloe vera and certain invasive plant species. Other complementary livelihoods in the livestock sector, such as poultry keeping, aquaculture, and breeding of nutritional larvae for poultry, among others, can also be exploited. These alternative and complementary activities can support income diversification and support the resilience of pastoralists and, indeed, other forms of livestock producers.

Activities supporting Output 3.3:

- Map out available alternative and complementary livelihoods in PAP areas and other livestock production systems and determine the best way to develop them.
- Facilitate the development of or strengthen common interest groups, or small and medium enterprises, interested or engaged in alternative or complementary livelihoods and support them based on the needs identified in the mapped report.
- Facilitate development of identified complementary livelihood products through technical and resource support, including business incubation centres.
- Develop market studies of identified wild products and their viability through institutional and financing support.
- Facilitate participation and display of alternative livelihood products in domestic and international trade fairs as market promotion.
- Facilitate south-to-south learning tours for cross-learning.

Output 3.4: Animal disease management strengthened

Several OIE-listed diseases, including transboundary animal diseases (TADs), are detrimental to livestock production in the IGAD region, affecting livelihoods and the regional economy at large. TADs are diseases that have had a direct impact on international market access and their control and management require cooperation among IGAD countries.

Livestock systems are highly susceptible to changes in severity and distribution of diseases, pests, and parasites as a consequence of climate change (Dineshsingh et al.,

2014). This has contributed to re-emerging diseases such as Ebola, Marburg, and Rift Valley Fever (RVF), among others, that have been experienced in the recent past and have significantly affected Eastern Africa's development processes. New and improved surveillance and control systems are required to limit the impacts of these re-emerging diseases and pests on production and trade.

Activities supporting Output 3.4:

- Strengthen cross-national veterinary institutional coordination capacities of disease surveillance, reporting, and response to resist emerging animal diseases and pests.
- Strengthen animal disease diagnostic capacities, quality vaccine production capacity, and facilities through recruitment and training of existing staff in diagnostics, laboratory investigations, epidemiology, and ecosystem health.
- Establish strong veterinary preventive medicine and animal health institutions by expanding national veterinary laboratories and databases to improve livestock efficiency and increase their resilience to new risks, including those resulting from climate change.
- Support animal emerging disease studies in the context of climate change and build mechanisms for risk communication.
- Strengthen cross-border coordination and cooperation on animal health and sanitary measures by upgrading the signed Memorandums of understanding (MoUs) among IGAD countries to protocol levels.

Output 3.5: Livestock marketing strengthened

Facilitating livestock offtake and the marketing of live animals and animal products can improve the livestock sector's resilience by easing destocking, mitigating pressure on available natural resources, limiting feed costs, increasing household income, and enabling swift restocking after a disaster (IUCN, 2010). A major obstacle to livestock markets is herders' poor market orientation. Animals are taken to the market based on cash needs without concern for the market's needs and target weight. Timely offtake has contributed to building resilience to climate change impacts. Improving veterinary infrastructure, animal health (including strategies for controlling transboundary diseases), and feed will improve access to regional and international markets. Better market access will also require investment in value chain development and infrastructure, including markets, transport, border control, and traceability.

Activities supporting Output 3.5:

- Conduct studies on a range of markets and strengthen sanitary and phytosanitary (SPS) compliance aligned with the target markets' requirements.

- Support and facilitate countries' efforts to benefit from the African Continental Free Trade Area (AfCFTA) agreement for the trade in livestock and livestock products.
- Promote private sector investment in PAP livestock value chains and marketing infrastructure through PPPs.
- Strengthen extension services to build small and medium enterprise capacity in the livestock sector, with a focus on including indigenous peoples, women, and youth to expand underrepresented groups' access to markets.
- Support and coordinate common regional grading and standards for animal and animal products to enhance trade.
- Promote roll out of livestock identification and traceability systems to enhance compliance with SPS measures imposed by importing countries.
- Strengthen inspection and certification of animal and animal products, and promote the expansion of trade infrastructure, such as markets, feedlots, abattoirs, quarantine stations, and harbors to promote access to external livestock markets.

4.4. Priority Intervention Area 4: Research, innovation, and knowledge management

Objective and approach:

This PIA aims to enhance the research capacity and knowledge sharing in and between IGAD MSs, to accelerate knowledge development and innovation for resilience among production systems and value chains. This will use experience gained in the previous IGAD Regional Climate Change Strategy (IRCCS) from 2016-2020 to streamline capacity building and knowledge sharing with many of the outputs from the current 2020-2030 IRCCS.

Output 4.1: Research, innovations, and technology application supported

The Climate Technology Centre and Network (CTCN) highlighted significant challenges for policy and regulatory environments, capacity building, and financing for climate change resilience and adaptation in the region (CTCN 2019). This was also reflected in the CTCN technical assistance requests made by African countries, which included a focus on climate-smart agriculture policies, land restoration and management, and strong overarching demand for capacity building.

Technologies are vital to addressing climate change. In the 4th UNFCCC synthesis report on technology needs identified by Non-Annex I Parties (UNFCCC 2020), the African region had adaptation technology needs in the agriculture (45%) and water (36%) sectors as priority areas. One key example of this is the potential to develop

further and better use National Meteorological Services in MSs. These can provide early warning information on high-impact weather and extreme weather events such as floods and droughts for the protection of life and property, and conservation of the natural environment.

Interventions will support research and development capacity that contributes to building resilience to climate change for livelihood advancement and sustainable development.

Activities supporting Output 4.1:

- Assess key research institutions supporting the development of livestock resilience technologies, innovations, and management practices; evaluate opportunities to strengthen the level of integration of climate change issues into their programs and identify gaps to be addressed.
- Support transdisciplinary and co-production research programs that take into account indigenous and science-based knowledge of the climate resilience of livestock systems and, more generally, of food systems.
- Strengthen livestock related research and education centers and support work program alignment with priorities of the resilience agenda.
- Foster cooperation between regional organizations (African Union, IGAD, East African Community …) to facilitate the transfer of research and technologies.
- Support the networking of national and regional drylands collaborative, adaptive, and applied Research Centers.
- Strengthen connections between research and policy work to help make more evidence-based decisions when developing policies and measures.
- Promote research and research networks on innovative EWS and underlying models and data.
- Support research and build the evidence base on the impact of climate change on natural rangeland.

Output 4.2: Knowledge and information dissemination strengthened

Climate change science is continuously evolving, and new information and knowledge in support of monitoring mechanisms, as well as coping and long-term adaptation strategies, are continuously being developed at national, regional, and global levels. These knowledge products do not necessarily find their way to potential users, especially those at the forefront of climate change impacts, especially farmers and PAP communities. Technical gaps thus affect the region's ability to address climate change issues effectively. These gaps include (i) a disconnect between climate science and indigenous knowledge, and policy and practice; (ii) lack of data and models to inform

decisions when developing climate action plans; and (iii) inappropriate knowledge management practices due to inadequate coordination between the mandated institutions and the institutions that provide actionable information to the end users of the climate information services. These constraints can partly be addressed via climate change adaptation Indigenous Knowledge Management (IKM) networks that encompass the co-production and dissemination of easily understandable and implementable knowledge products for the intended beneficiaries.

For meaningful transformational change to occur, tailor-made capacity-building and advocacy programs are needed that (i) recognize the need for enhanced awareness of climate change; (ii) provide the requisite information, tools, guidance, and knowledge products; and (iii) influence changes in the mindsets of decision-makers with regard to mainstreaming climate change in policies and practices.

Activities supporting Output 4.2

- Assess information and knowledge gaps that constrain climate-resilient development planning and compromise the timely delivery of solutions to address climate change impacts when they occur.
- Strengthen IKM networks and other forms of knowledge and information management networks to collect and generate information and approaches relevant to climate change adaptation and mitigation, and disseminate these to potential end users.
- Strengthen coordination and cross-learning mechanisms on climate change adaptation and mitigation efforts within and outside the region (South-South cooperation)

4.5. Priority Intervention Area 5: Policy alignment, coherence, and coordination for transboundary issues

Objective and approach:

This PIA aims to streamline and improve the alignment of policy action for improved livestock sector resilience across the IGAD intraregional boundaries. It requires MS collaboration to support investments and governmental action in the transboundary zones. The IGAD Protocol on Transhumance (2020) provides the legislative framework on which this PIA is based.

Output 5.1: Governance and cross-border coordination mechanisms strengthened

Implementation of the strategy will involve IGAD MSs, partners and stakeholders, through a range of intervention scenarios relying on different methodologies and support frameworks. The strategy will require a robust coordination arrangement to facilitate concerted action and ensure that all stakeholders are informed. Such

an approach will help identify gaps and avoid possible duplication, while enhancing cooperation and synergy, and facilitating concerted intervention.

Activities supporting Output 5.1:

- Map out the actors at different levels and their potential roles in policy programming and implementation: governments, private sector, and NGOs, as well as the multi- and bilateral potential sources of finance for building a resilient livestock sector.
- Identify the strengths and weaknesses of national and regional collaboration platforms, and facilitate capacity building.
- Facilitate partnerships and sharing of experiences among actors involved in the implementation of the strategy.

Output 5.2: Policy alignment and coherence strengthened

Enhancing adaptation and resilience requires collaboration among and between IGAD MSs with relevant non-state actors. The concept of policy alignment and coherence for management of transboundary issues such as natural resources, market access, and transboundary animal diseases (TADs), among others, is core to building a livestock sector resilient to risks associated with climate change and other impacts.

Activities supporting Output 5.2:

- Monitor MS policies with transboundary implications and identify potential policy misalignment and gaps to improve synergies and coordination and avoid antagonistic effects.
- Consider key elements for tracking progress on policy implementation, with a view to developing and supporting national M&E platforms for strategy implementation.
- Assess interlinkages between economic, social, and environmental policies, including the identification of synergies, contradictions, and trade-offs, as well as the alignment and interactions between domestic and international policies
- Assess the contextual factors, i.e., the enablers (that can contribute to) and disablers (that hamper) adaptation to and mitigation of climate change at the regional, national, and local levels and recommend best ways out to build resilient and sustainable livestock.

5. Institutional framework coordination and implementation of the Strategy

The implementation of the Strategy requires a multi-stakeholder partnership approach, consisting of the IGAD Secretariat and its specialized institutions; the Member States government ministries and sub-national level departments; civil society organizations (CSOs); private sector actors; livestock producers; and academia and research institutions. Technical and financial support for the implementation of the Strategy can be solicited from UN agencies, multilateral development banks (MDBs), bilateral and multilateral development partners and private investors. These stakeholders all play an important role in strategy implementation at regional, national, sub-national and community levels.

While most interventions happen at a national level, the IGAD Secretariat through ICPALD will provide programming and coordination of regional-level initiatives. Overall, ICPALD will:

- Ensure alignment with the existing array of strategies (regional and national) and policies;
- Perform programming and coordination of actions that require a regional approach including cross-border and emerging issues;
- Publicize the regional strategic framework and support countries in developing national-level strategy and implementation frameworks;
- Support MSs in programming and prioritizing actions;
- Lead knowledge management, including advocacy, awareness creation, communication, information sharing, and cross-learning;
- Lead capacity development of MSs, as well as mainstream stakeholders in climate change impacts on livestock and other relevant issues; and
- Undertake monitoring and follow up of the regional strategic framework interpretation and implementation at national and sub-national levels.

ICPALD, in close coordination with ICPAC will provide policy guidance to the MSs and help them to make informed decisions and appropriate interventions.

At the national level, the Ministries responsible for agriculture, livestock and climate change, will closely coordinate and support networking and implementation arrangements in situ to ensure coherence and alignment with the regional strategy.

Communities, producer cooperatives, NGOs and private sector will play central role in planning, designing, and implementation of climate change programs and processes. They are crucial in integrating cross-cutting issues such as good governance, transparency, and gender equality. Gender responsive climate policies, mitigation and adaptation

measures should be instituted in all priority implementation areas of this strategy. Civil society organizations and NGOs, together with producer organizations, can also act as an interface to ensure access to information for those on the ground and support outreach, education, and awareness-raising and implementation at local levels.

Academia and research institutions provide empirical evidence and knowledge, trends, and innovation to address the most pressing challenges related to livestock development and climate change, for uptake and informed decision making by MSs, practitioners, and communities.

5.1 Regional Policies, Processes, and Strategic Alliances

IGAD, as a Regional Economic Community (REC) and one of the building blocks of the African Union, will continue to pursue regional coordination and cooperation with major stakeholders. It will, within the framework of its role as a change agent and development broker, continue to sensitize the IGAD MSs, create awareness and mobilize action on a range of issues, including mainstreaming climate change, optimizing mitigation potential, and remain active in international negotiations that fall under the United Nations Framework Convention on Climate Change (UNFCCC).

IGAD will strengthen effective partnerships and alliances to leverage the expertise and other resources needed to attain the objectives of the Strategy. These will include other RECs: the Common Market for Eastern and Southern Africa (COMESA), the East African Community (EAC), Economic Commission of Central African States (ECCAS) through Memorandums of Understanding (MoUs) and capacity development to ensure mutual recognition of national capacities at regional levels.

IGAD and the MSs will develop bankable proposals for resource mobilization and technical assistance from donors such as Multilateral Development Banks (MDBs), the European Commission (EC), bilateral donor agencies including those of EU member states, USAID, Canada, and Switzerland, and implementing partners such as the UN agencies (primarily UNFCCC; the United Nations Convention to Combat Desertification (UNCCD); FAO; the World Food Programme (WFP); the International Organization for Migration (IOM); the International Labor Organization (ILO); and the United Nations Development Programme (UNDP). There will be a need to partner with a large number of stakeholder organizations at different levels in the MSs and internationally to mobilize the technical, financial, and political support necessary for the implementation of the Strategy.

5.2 Implementation timeframe (2022-2037)

Implementation of this strategy will commence immediately after validation by the Member States and will be implemented for a period of 15 years. The strategy implementation will be monitored regularly for revision, when required.

Three phases of five years each are provided for in the implementation framework (Annex C). This will guide implementation of the PIAs based on availability of resources.

5.3 Resource Mobilization

To implement this strategy, resources are needed both at regional and national levels, including costs associated with the establishment and maintenance of the knowledge management and M&E platforms. At the national level, in addition to streaming to already existing initiatives and programs, additional resource mobilization will be needed to buffer the livestock sector from the impacts of climate change and enhance investment for mitigation measures. Resources are also needed for regional activities such as capacity building, development of information and training materials, communications and outreach.

Resource mobilization goes beyond traditional forms of national sovereignty that are increasingly being challenged by the realities of political and transboundary economic interdependence that call for joint efforts at regional and global levels. In shared resource, ecological and economic systems, most efforts fall outside national jurisdictions. Hence, sustainable development can be better achieved through mutually agreed regional approaches.

In this respect, all IGAD MSs are party to several international conventions and initiatives, including the UNCCD and UNFCCC. In addition, they are also members and beneficiaries of a considerable number of regional and international organizations dealing with general political and economic development issues but with varying mandates and geographical coverage.

Resource mobilization strategies at regional and national will include:

- Member States mainstreaming existing human, material, and financial resources for the implementation of the strategy;
- Continuing resource mobilization from bilateral and multilateral donors;
- Strengthening PPPs;
- Member states developing policies that support and promote private sector investment in climate funding;
- Accessing climate funds under national, regional and international processes such as the Global Environment Facility (GEF), the Green Climate Fund (GCF), the Global framework for transboundary diseases (GF-TADS), as well as the Adaptation Fund, for program, regional, and transboundary initiatives;
- Establishing a regional task team of experts from the Member States, coordinated by IGAD, to develop bankable proposals responding to the Strategy to access available funding channels; and
- Developing an action plan to support implementation of the Strategy.

5.4 Monitoring, Evaluation, and Learning

To monitor the implementation of the Strategy effectively, a harmonized regional monitoring and evaluation (M&E) Platform will be established. Results-based monitoring and evaluation will form an integral part of the management of the Strategy, the implementation of which will be based on relevance, effectiveness, impact, coherence, efficiency, and sustainability.

There will be a need to ensure that Strategy implementers collect accurate and complete data before, during, and after each intervention following resource allocation. Existing M&E platforms at regional and national levels will be used in all the IGAD Member States and equipped to follow the progress of Strategy implementation within the framework of available resources, based on set indicators and milestones. The M&E Platform will benefit from establishing a network of IGAD and national M&E Focal Points, charged with the responsibility for monitoring the implementation of the Strategy in the IGAD Member States.

Program Evaluation

Independent evaluators will conduct a mid-term program evaluation to take stock of initial lessons from the intervention and assess progress in achieving its objectives. This also serves as an opportunity to identify appropriate actions related to particular issues or problems in the design, implementation, and management and reinforce interventions that demonstrate potential for success.

A Final Evaluation by independent consultants will be undertaken to focus on results, impact, how, and why they were achieved to inform decisions for continuation, replication, or scaling up. The Final Evaluation will also be used to identify lessons to guide implementation and improve the results of future interventions.

Periodic Progress Reporting

Bi-annual progress reporting will be agreed upon by the M&E Platform and is an integral part of the results-based M&E process. 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.

Learning

The implementation of the strategy will follow a process of adaptive learning that will be achieved through periodic review of implementation as described above and against strategic outcomes. Learning processes could include exchanging or comparing experiences related to relevant interventions between countries or regions. Best practices will be documented and lessons learned will be extracted for scaling up and policy dialogue by Member States.

5.5 Results framework

Based on allocated resources, a Results-Based Monitoring & Evaluation (RBM&E) Framework will be developed to track the implementation of PIAs as well as to help identify challenges and emerging trends associated with climate change affecting livestock in the IGAD region. The RBM&E Framework will assume periodic analysis and reporting, which will give IGAD, the Member States, and stakeholders time to assess results and initiate action where necessary. Indicators will be developed to track implementation for each priority intervention area, as agreed by the M&E platform. A proposed monitoring framework is proposed in Annex A, which will be adjusted when the RBM&E Framework is developed.

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Annex A: Proposed results framework

This M&E result framework has three primary purposes: to strengthen accountability for the strategy, to stimulate learning and improved performance measurement across the implementing stakeholders, and to facilitate decision-making by the member states, IGAD and other regional and national stakeholders. This result framework would guide the M&E of the strategy implementation. In addition, it would increase the stakeholder's understanding of the strategic goals and objectives, define the results measurement, and articulate the internal and external elements that could affect the strategy's success.

Results monitoring provide routine tracking and reporting of key performance information and tracks indicators that measure progress at each level. The indicators used in the results framework also establish common quality standards for all aspects of the strategic implementation. In the first six months during the pre-implementation stage, IGAD will establish the baseline values and set the indicator targets.

Results chain	Indicators	Baseline		Targets	Sources and means of verification	Assumptions
		Value	Year			
Priority Intervention Area 1: Mechanisms for climate risk management	Number of MSs implementing harmonized policies/regulatory frameworks for climate risk management				National reports, Outcome harvesting reports, Policy implementation frameworks	1. No major climate disaster happens during the period. 2. Security and governance remain stable. 3. Governments & communities see climate risk management as an important part of their development agenda.
	Percentage of pastoralist households with access to index-based livestock insurance (IBLI) schemes.				National reports, Outcome harvesting reports, financial disbursement system reports	
	Percentage of pastoralist households with access to incentivized savings and de-risked emergency credit products to manage production risks from climate change				National reports, Outcome harvesting reports, financial disbursement system reports	
	Proportion of targeted households adopting recognized climate adaptive practices				National reports, Outcome harvesting reports, financial disbursement system reports	
Output 1.1: Financial instruments for climate risk management enhanced	Number of crisis risk financing (CRF) instruments developed and operational				National reports, Outcome harvesting reports, risk financing (CRF) instruments	1. Both national and local governments remain committed to climate risk management. 2. Private and public sectors willing to partner to develop sustainable crisis risk financing (CRF) instruments 3. Pastoralist communities take ownership of adaptation approaches and interventions.
	Number of MSs with functional, clear, and transparent triggers for pastoralists' financial disbursement				National reports, Outcome harvesting reports, financial disbursement reports	
	Number of MSs with functional pastoralists' financial disbursement systems				National reports, Outcome harvesting reports, financial disbursement reports	
Output 1.2: Early warning and response systems strengthened	Number of MSs with a functionally integrated livestock early warning and early action systems				National livestock sector report, monitoring reports	1. Pastoralists can put new knowledge from the capacity-building programmes into practice, 2. Innovative solutions and EWT introduced are adopted or replicated 3. Local government sees the benefit and value of early
	Number of MSs who report having fully operationalized early warning tools				National reports, Outcome harvesting report, Tools	
	Percentage of women, youth, and socially excluded populations utilizing EWS				National reports review reflecting inclusivity in the utilization of EWS, Outcome harvesting, Survey report	

	Time-lapse between early warning information and response				IGAD report, National reports, survey report	warning and early action and is prioritized 4. Political situation will remain favorable for the timely implementation of early warning and early response
Output 1.3: Risk profiling and contingency planning strengthened	Number of MSs implementing regional strategic framework on a contingency plan for climate change-related impacts				National reports, Outcome harvesting, Implementation framework	1. National governments maintain strong relationships with the local government and targeted communities on contingency planning 2. Official recognition of community preparedness plans and subcommittees 3. Local governments and communities understand their responsibility and continue to cooperate
	Number of institutions with the capacity to undertake risk profiling and contingency planning				National reports, Outcome harvesting reports	
	Proportion of decisions based on risk profiling assessments recommendations				National reports, Outcome harvesting reports	
Priority Intervention Area 2: Natural resource base and ecosystem services for livestock production	Number of MSs with known feed supply and demand				Feed balance sheet, national reports, IGAD report	1. Host country governments enforce shared rangeland resources policies and maintain the financial commitment 2) Political commitment by IGAD MSs in identifying and effectively delivering results for natural resource base and ecosystem services for livestock production.
	Number of MSs with adequate emergency livestock feed reserves				National reports, Outcome harvesting reports, feed reserve reports	
	Number of MSs implementing policies and incentives to promote rangeland restoration				IGAD Progress reports, National reports, and policies implementation framework	
	Number of MSs with known livestock water balance sheet				Water balance sheet, national reports, IGAD report	
	Number of pastoral households with access to water in targeted areas				National reports, Outcome harvesting, Survey report	
	Number of communities protecting gazetted livestock mobility corridors and grazing reserves				National reports, Outcome harvesting, Survey report	
Output 2.1: Rangeland and woodland management enhanced	Rangeland vegetation condition index (VCI)				Rangeland monitoring reports from MSs & other development agencies, Survey reports	1. Access to rangeland for pastoralists 2. Weather conditions remain favorable for rangeland production 3. Peace and security will
	Regional rangeland natural feed biomass				Rangeland monitoring reports from MSs & other	

					development agencies, Survey reports	remain favorable during the strategy implementation period
	Change in Carbon Density				Rangeland monitoring reports from MS, Survey reports	
	Number of MSs implementing the recommendations from feed and livestock balance inventory reports				National reports, outcome harvesting reports	
	Volume of trade in animal feed, fodder, and pasture seed (disaggregated by cross-border, regional, and international trade)				National reports, National export statistics, Regional livestock trade reports, FAO & WB Reports	
	Acreage of rangeland in good condition and health				National reports, outcome harvesting reports, Survey report	
Output 2.2: Water availability and access improved	Water consumption per capita (litres)				National reports, outcome harvesting reports, Survey report	1) Political commitment by IGAD MS to securing equitable access to water resources in drought-prone areas 2) Climatic conditions will remain favourable for the construction of surface and underground climate-proofed water facilities
	Number of water infrastructures (surface and underground climate-proofed) operational and sustainably managed at least six months after completion of the investment				National reports, outcome harvesting reports, Survey report	
	Average distance to livestock water sources				National reports, outcome harvesting reports, Survey report	
	Area of land under irrigation (in Hectares)				National reports, outcome harvesting reports, Survey report	
Output 2.3: Regional biodiversity preserved, and invasive plant species managed	Number of regional ecosystem assessments conducted to establish ecosystem health, biodiversity resources, and invasive species				Assessment reports, IGAD reports, National reports, outcome harvesting reports	1. The IGAD MSs will be committed to the management of established invasive 2. Political goodwill in the implementation of the Invasive Species Strategy and Action Plan
	Number of MSs with reviewed Invasive Species Strategy and Action Plan				National report, strategy	
	Annual investment (amount) in sustainable management, monitoring of rangeland biodiversity				National reports, outcome harvesting reports, Survey report	

	and invasive species management in ASAL					
	Land area (hectares) where sustainable land management practices have been adopted for invasive plant species managed				National reports, outcome harvesting reports, Survey report	
Priority Intervention Area 3: Livestock production and income diversification along livestock value chains	Percentage of pastoral households with diversified livelihoods				National reports, outcome harvesting reports, Survey report	1. Smallholder farmers are willing to intensify and diversify their livelihoods. 2. Positive attitudinal changes among pastoral and agro-pastoral communities 3. Program is targeting those households with no diversified livelihoods options 4. Climate conditions remain favourable to pastoral production, and no major epidemic diseases happen.
	Volume of export trade of livestock and livestock products (intra-regional and the Middle East				National reports, National export statistics, FAO & WB Reports	
Output 3.1: Animal production and productivity enhanced	Number of community breeding programs supported with drought-tolerant and disease-resistant animal breeds				Surveys to determine trends in the composition of major genotypes involved in supported community breeding programs	1. Communities willing to participate in the breeding programs 2. Information on genetic distinctiveness used by government and extension services to decide on ex-situ and in-sit conservation strategies 3. Identified unique economically characteristics incorporated into the community breeding programs to ensure the long-term survival of the breeds faced with
	Number of households adopting high-yielding and fast-maturing improved animal breeds suitable for ASALs				Reports of governments research and extension services, Survey	
	Number of households adopting market-oriented production system				National reports, surveys, outcome monitoring reports	
	Percentage of pastoral households with adequate feed reserves				National reports, surveys, outcome monitoring reports	

						extinction 4. Research programs and extension service has trained staff and well managed 5. Active interested involvement in national agricultural research and extension services
Output 3.2: Feed production and access improved	Amount of private sector investment in feed and fodder production				National reports, surveys, outcome monitoring reports	1. The feed production and marketing sector will remain profitable for private sector investment. 2. Communities would be willing to adopt improved feeds 3. Political goodwill and incentives to promote feed and fodder trade
	Percentage of households using improved feed concentrates				National reports, surveys, outcome monitoring reports	
	Volume of trade in animal feed, fodder, and pasture seed (disaggregated by cross-border, regional, and international)				National reports, National export statistics, FAO & WB Reports	
Output 3.3: Alternative and complementary livelihoods in the livestock sector promoted	Percentage of households with diversified income sources				National reports, surveys, outcome monitoring reports	1. Smallholder farmers are willing to intensify and diversify their livelihoods. 2. Positive attitudinal changes among pastoral communities to adopt identified complementary livelihood 3. Program is targeting those households with no diversified livelihoods options
	Number of business incubation centres for identified complementary livelihood products supported that are operation 12 months after investment				Commodity value chain analysis, National reports, outcome harvesting reports	
	Number of value addition initiatives supported and strengthened (disaggregated by livestock and NWFP products)				IGAD progress reports, Outcome monitoring reports, photographs	
	Number of policies and institutional arrangements advocated intensifying and diversifying pastoral livelihoods.				IGAD progress reports, policy documents, National reports	
Output 3.4: Animal disease management strengthened	Number of MSs with the capacity to conduct effective disease surveillance, reporting, and response to prevent emerging animal diseases and pests				IGAD progress reports, National project/VS reports, National/regional lab reports	1. Political goodwill to mobilize resources for responding to disease management 2. Local governments and extension service has trained disease surveillance staff 3. Active interest and
	Number of notifiable diseases reported timely to national epidemiology units				IGAD progress reports, National project/VS reports, National/regional lab reports	

	Number of annual laboratories diagnosed disease outbreaks				IGAD progress reports, National project/VS reports, National/regional lab reports	involvement of animal health staff and extension services
	Number of national laboratories with the necessary capacity (as per regional SMP requirements) to diagnose trade-sensitive diseases				IGAD progress reports, National project/VS reports, National/regional lab reports	
	Number of diseases under active survey programs				National reports, IGAD reports	
	Number of synchronized surveillance and vaccination campaigns facilitated				IGAD progress reports, National reports, Steering and cross-border committees reports	
Output 3.5: Livestock marketing strengthened	Volume of inter and intraregional trade conducted under the AfCTA regime				IGAD progress reports, National reports, FAOSTAT	1. New trade measures do not negatively impact the AfCTA regime2. Political conditions and the macro-economic environment remain stable.3. Outbreak of trade-sensitive animal diseases remain low4. Markets for livestock and livestock products continue to grow, and value chain actors (smallholders) will participate in the market.5. Functional markets6. No new tariff and non-tariff barriers are introduced 7. Willingness of cross-border officials to collaborate8. Low inflation rates9. Stability in exchange rates
	Number of new (alternative) export pathways established				IGAD progress reports, Outcome monitoring reports, National reports	
	Number of animals identified by the national animal identification and traceability system (LITS)				Outcome monitoring reports, National reports	
	Amount of investment in inclusive livestock value chains and marketing infrastructure through public-private partnerships (PPPs)				RLP progress report, international reports	
	Number of MSs actively implementing the IGAD regional livestock grading and standards for animal and animal products				RLP progress report, National report	
Priority Intervention Area 4: Research, innovation, and knowledge management	Perceptions of the stakeholders on the contribution of research, innovations, and technology applications on the improvements in the standard of living, or quality of life of the pastoralists, and economic returns [Qualitative]				Survey reports, literature review	

	Number of MSs with harmonized policies and incentives conducive to research, innovations, and technology application				National reports, policy review reports	
Output 4.1: Research, innovations, and technology applications supported	Number of decisions on climate-smart agriculture policies, land restoration and management that are evidence-based				National reports, decisions review reports	
	Amount of investment in research, innovations, and technology application				National reports, Outcome harvesting reports	
	Number of research networks supported on dryland collaborative, adaptive, and applied research				National reports, IGAD reports	
Output 4.2: Knowledge and information dissemination strengthened	Number of climate knowledge and information sharing platforms established and functional				KMP content developed; KMP	
	Number of indigenous knowledge products produced and disseminated				KM products	
	Number of IGAD share-fair forums organized on climate change adaptation and mitigation				Share Fair report, photographs	
	Number of gender parameters included in the web-based knowledge management platform.				Review of web-based knowledge management platform	
Priority Intervention Area 5: Policy alignment, coherence, and coordination for transboundary issues	Number of aligned and coherent livestock sector policies for management of transboundary issues (natural resources, market access, and TADs) associated with climate change risks and other impacts.				National reports, Outcome harvesting reports	1. Coherent policies to be developed 2. Policy processes will not delay or undermine joint actions 3. Political goodwill to support the policy development processes and implementation
Output 5.1: Governance and cross-border coordination	Number of livestock sector actors with an explicit climate-resilient development policy programming				National reports, Outcome harvesting reports, periodic assessment, and evaluation reports	1. Cross-border actors are receptive to working with IGAD in developing climate-resilient development policies

mechanisms strengthened	Livestock sector actors plan together (identify gaps and avoid possible duplication while enhancing cooperation and synergy) [Qualitative indicator]				IGAD reports, Outcome harvesting reports	2. There will be peace and security for seamless implementation of cross-border coordination of transboundary issues
Output 5.2: Policy alignment and coherence strengthened	Number of MSs with established and functional mechanisms for policy coherence to regional and global policies				National reports, Outcome harvesting reports, review of mechanisms	1. Political willingness to adopt policies, legal frameworks, and mechanisms designed to enhance resilient livestock development 2. Concerned parties will agree to recognize new rangeland protected areas as part of the national conservation areas. 3. There will be no legal impediment to the incorporation of aligned and coherent policies for resilient livestock
	Number of annual reviews of transboundary issues and policies conducted				National reports, Outcome harvesting reports	
	Number of MSs with resilient and sustainable livestock sector [Qualitative indicator]				National reports, Outcome harvesting reports, review of literature and reports	

Annex B: Overview of modeling results for resilience building measures in the IGAD region

Overview

Various measures have been proposed to improve the resilience of PAP systems to drought. Modeling (MacLeod et al, 2022) has helped to understand the effects of four of these measures on the pastoral cattle systems in Oromia, southern Ethiopia:

1. Index-based livestock insurance (IBLI)
2. Commercial destocking with an early warning system (EWS)
3. Rangeland restoration (RR)
4. Fodder planting (FP)

Method

A dynamic model of the Oromia pastoral cattle system was developed for the analysis. At its core is a herd model that calculates the changes in cattle population over time. Feed availability and drought occurrence affect fertility and mortality rates, which, in turn, determine the population and (meat and milk) production. The measures mitigate the effects of drought and help to maintain production and profit.

Results

As an example of the model results, Figure 9 gives the trends in production and profit with the EWS measure. Compared to the no measure situation, EWS leads to large increases in meat and milk production and, consequently, profit. This is due to the way in which the measure changes the herd structure; adult males are sold off, and the revenue is used to maintain calves and females, leading to a greater proportion of cows in the herd.

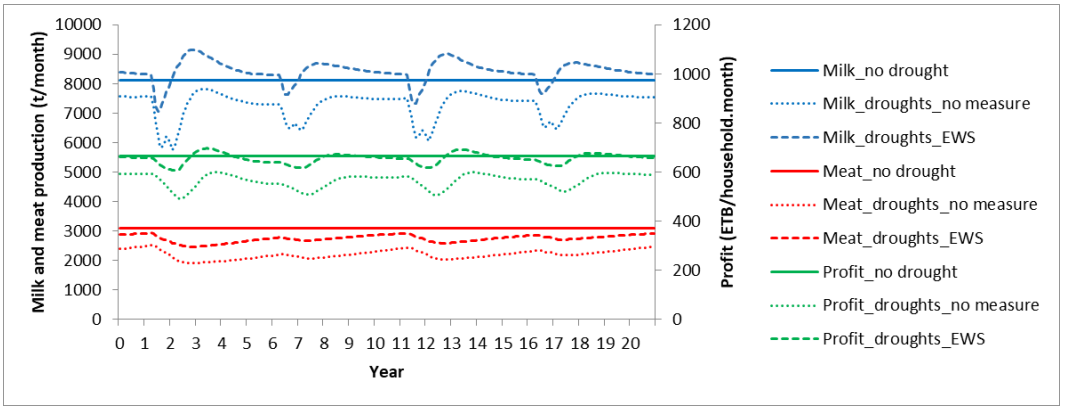

Figure 9: Production and profit with (a) no droughts, (b) droughts but no measure and (c) droughts and EWS.
Note: these are the changes that occur across the whole region when 20% of pastoralists adopt the measure

Change in output

Figure 10 summarizes the changes in output over 5 years with each of the measures. EWS provides the biggest increases (or smallest decreases) in production and profit, due to the way in which it leads to changes the herd size and structure. Fodder planting and rangeland restoration provide moderate increases in production and profit (relative to the no-measure situation) while IBLI provides a significant increase in meat production, but has a smaller impact on milk production and profit.

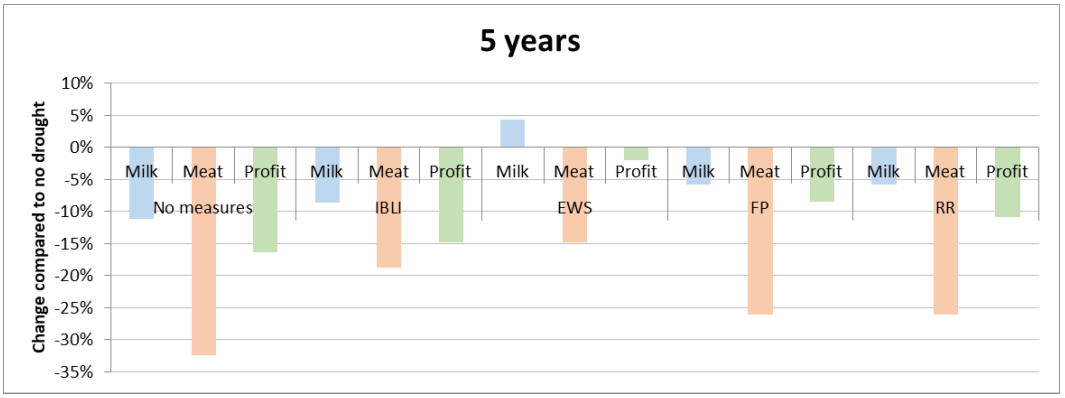

Figure 10: Change in meat and milk production and household profit over five years.

Other measures of resilience

In addition to changes in output, the model can also be used to estimate how the measures affect the time drought takes to have an impact, the duration of the impact and the extent of recovery. A summary of the results shows:

- Relative to the no-measure scenario, IBLI and EWS delay the time to impact significantly. FP and RR have no impact on the time to impact (Annex Table 1).
- As with the time to impact, IBLI and EWS both reduce the duration of the drought's impact, while FP and RR have no effect (Annex Table 2).
- In terms of the extent of recovery IBLI has little effect on milk but increases meat production. EWS enables rapid recovery in milk production, due to the way that income from destocking is used to maintain cows, while FP and RR have little effect (Appendix Table 3).

It should be noted that, while FP and RR do not seem to improve resilience, this is because these results measure changes before and after a drought, rather than with and without a measure. In fact, FP and RR lead to increases in production and profit relative to the no-measure situation, which, in turn, provide scope for improving resilience.

Annex Table 1. Time to impact, i.e. time (in months) between start of drought and 20% reduction in production or profit. ">80%" indicates production/profit does not go below 80%

	Milk production	Meat production	Operating profit
No measure	5	15	>80%
IBLI	12	>80%	>80%
EWS	>80%	>80%	>80%
FP	5	15	>80%
RR	5	15	>80%

Annex Table 2. Duration of impact, i.e. time taken (in months) from the start of drought to return to 90% of pre-drought production levels. ">90%" indicates that production/profit does not go below 90%. "<90%" indicates that production/profit remains below 90% for 60 months

	Milk production	Meat production	Operating profit
No measure	16	<90%	20
IBLI	15	25	21
EWS	7	40	>90%
FP	16	<90%	21
RR	16	<90%	21

Annex Table 3. Extent of recovery, i.e. production/profit 1 year and 5 years after the start of the drought as a percentage of pre-drought production

		Milk production	Meat production	Operating profit
No measure	1 year	78%	82%	85%
IBLI	1 year	79%	95%	87%
EWS	1 year	102%	88%	93%
FP	1 year	77%	82%	85%
RR	1 year	77%	82%	84%
No measure	5 years	96%	87%	93%
IBLI	5 years	98%	98%	98%
EWS	5 years	100%	95%	98%
FP	5 years	96%	87%	90%
RR	5 years	96%	87%	93%

Conclusions

IBLI enhances resilience by enabling farmers to secure the resources to feed their cattle during droughts, thereby reducing the impact on mortality and fertility. Overall, it has a limited effect on milk production but leads to a consistent moderate increase (relative to the no-measure situation) in meat production. IBLI has little effect on profit because the financial benefits of reduced drought losses are largely offset by the costs of insurance premiums. However, the protection provided by IBLI may encourage farmers to shift over time from decision-making focused on risk minimisation to productivity-enhancement, thereby increasing income. Obstacles to uptake include the cost of insurance premiums, relative to anticipated benefits and the technical requirements of IBLI.

Destocking with an EWS reduces cattle mortality and enables animals to be sold in better condition, giving farmers the means to maintain more of their breeding herd and restock more rapidly after a drought. EWS leads to large increases in meat and milk production and, consequently, profit. Implementation may be hampered by inadequate transport infrastructure and lack of holding grounds for cattle. The perceived benefits of large herds (in conferring social status and providing a means to aid post-drought recovery) may make some farmers reluctant to destock.

While IBLI and EWS seek to reduce the impact of acute drought events, fodder planting and rangeland restoration both seek to address the chronic (drought-exacerbated) problem of feed shortage in Oromia by increasing feed supply. In theory, both measures could lead to significant increases in production. However, both require that farmers have the money to pay for the costs of implementing the measure, and that adequate land can be made available.

In order to elucidate the wider pros and cons of the measures, a SWOT analysis was undertaken (Annex Table 4). Ultimately, the heterogeneity of the pastoralist sector means that a range of measures are needed to improve resilience; what works best in one context may be inappropriate in another. It is likely that all of the measures have a role to play in the future.

Annex Table 4: SWOT analysis of modeled interventions

	Strengths	Weaknesses	Opportunities	Threats
Index based livestock insurance	• Reduces impact of drought on meat production • Proven approach • Theoretically financially self-sustaining • Avoids costs of disaster relief • May encourage a transition from risk minimisation to productivity-enhancement • Insurance firms are available	• Cost of insurance premiums • Doesn't increase profit (cost of premium) • Assumes adequate feed can be sourced during droughts when IBLI is scaled up • NDVI-based IBLI has certain technical requirements, so not applicable everywhere • Unwillingness of vulnerable households to take it (cost of premium) • Need to combine IBLI with other tools, or limit payments in case of major impact to prevent insurance company default	• Build on existing schemes • Use discounts to trigger initial uptake, and adjust premiums • Large livestock resource • New data acquisition and management tools to compute and monitor index at fine temporal and geographical resolutions • Promotion of IBLI to target groups	• "challenges in implementing sales of the product at sustainable levels" de Haan (2016, p71) • May threaten informal risk-sharing between smallholders. • Insurance may invite overstocking (Bulte and Haagsma 2021)
Destocking with an early warning system	• Increases production and profits • Encourages proactive behaviour and orderly destocking • Enables maintenance of the breeding herd • Likely to be economically justifiable (de Haan, 2016, p69) • Avoids costs of disaster relief • EWS institutions already in place	• Operationally complex (de Haan, 2016, p69) • Requires adequate transport infrastructure and holding grounds for cattle (Abebe et al. 2008) • Requires resources to establish and maintain an EWS • Some farmers may be reluctant to destock (Smith et al. 2019) • Lack of farmers confidence in EWS due to occasional false alerts • Inadequate dissemination of EWS messages • Doesn't necessarily prevent livestock price drop since both buyers and sellers anticipate drought	• Strengthen infrastructure and livestock export system (Abebe *et al.* 2008) • Allocate holding zones prior to the onset of drought. Abebe et al. (2008) • Use EWS data for other purposes, e.g., emergency interventions, IBLI system, extension work	• Increasingly erratic climate changes may be a challenge for EWS

Fodder planting	• Increases production and profit • Avoids costs of disaster relief (if some income is saved)? • High demand due to increased frequency of drought • Support from government and development partners	• Dependent on availability of suitable land at low/no opportunity cost, may only be feasible on private enclosures • Time taken to recoup initial costs • Willingness/ability of farmers to adopt at scale • Inability to irrigate fodder, and more generally to maintain productivity • Insufficient storage facilities contributing to wastage • Occasionally inadequate demand	• Supply chain development to enable milk and meat to reach consumers • Breed and health improvement to take advantage of higher quality feed • Further investigation is required to establish if adequate land is available • Provide loans to farmer groups to cover initial costs • Participatory approach including all stakeholders? • Donor and government support for commercial fodder production	• Transaction costs and lender risks (Ng'ang'a *et al.* 2020, p34) • Conflict? May further marginalise pastoralists without access to land? • Impact of land use change, e.g. on GHG emissions, biodiversity and water cycles • Increasing frequency of drought due to climate change • Outbreak of desert locusts • Potential land degradation on planted areas, and losses of soil organic carbon
Rangeland Restoration	• Increases production and profit • Only way to restore severely degraded rangelands? (Ng'ang'a et al. 2020, p4) • Avoids costs of disaster relief (if some income is saved)? • Theoretically applicable to a large area of rangeland	• Dependent on the availability and cost of supplementary feed • Time taken to recoup initial costs • Limited property rights discourage investment required (Ng'ang'a *et al.* 2020, p6) • Unregulated deforestation and land degradation in some areas	• Co-ordinate RR with a strategy to increase feed supply? • Provide loans to farmer groups to cover initial costs • Participatory approach including all stakeholders? (IAG 2010, p123) • Payment for Environmental Services for rangeland restoration? • Willingness of government and development partners to support rehabilitation efforts • Co-benefits in terms of carbon sequestration, biodiversity, and water cycles	• Widespread adoption could lead to increased feed prices as this measure entails supplementary feeding • Cattle population increase could result in less productive animals (Ng'ang'a et al. 2020, p35) • Transaction costs and lender risks (Ng'ang'a *et al.* 2020, p34) • Conflict arising from private management of a common asset? • Increasing aridity due to climate change
	Strengths	Weaknesses	Opportunities	Threats

Annex C: Implementation framework and budget

The implementation of the strategy is proposed to be in three phases of five years each, which require strategic planning aimed at resources remobilization from all sources, including member states' national governments, development partners (UN, INGO, etc.), donors (AfDB, WB, IFC, EU, USAID, etc.) and the private sector among others. The estimated budget below is based on the regional scope of the seven member states to be covered, 5-year phase in addition to inflation and experience from ongoing regional/ national programs. These estimates would serve as a guide for the resources required to implement the strategy. The budget guides formulate outputs and activities, allowing better prioritization, figuring out how resources can be allocated when acquired and which outputs/ activities need to be evaluated.

Priority Intervention Areas	Outputs	Estimated budget (USD)- Millions		
		Phase 1 (5 years)	Phase II (5 years)	Phase III (5 years)
PIA 1: Mechanisms for climate risk management	Output 1.1: Financial instruments for climate risk management enhanced	75	50	50
	Output 1.2: Early warning systems strengthened	120	100	100
	Output 1.3: Risk profiling and contingency planning strengthened	80	70	60
Sub-Total		275	220	210
PIA 2: Natural resource base and ecosystem services for livestock production	Output 2.1: Animal feed supply enhanced	120	100	50
	Output 2.2: Water availability and access improved	150	100	50
	Output 2.3: Regional biodiversity preserved, and invasive plant species reduced	100	80	80
Sub-Total		370	280	180

PIA 3 : Livestock production and income diversification along livestock value chains	Output 3.1: Animal production and productivity enhanced	150	100	95
	Output 3.2: Animal disease management strengthened	100	95	95
	Output 3.3: Livestock marketing strengthened	120	100	100
	Output 3.4: Alternative/ complimentary livelihoods promoted	140	85	85
Sub-Total		510	380	375
PIA 4: Research, innovation, and knowledge management	Output 4.1: Research, innovations, and technology application	130	120	115
	Output 4.2: Knowledge and information dissemination strengthened	100	100	100
Sub-Total		230	220	215
PIA 5: Policy alignment and coherence for transboundary issues	Output 5.1: Policy alignment and coherence strengthened	85	75	70
	Output 5.2: Governance and cross border coordination mechanisms strengthened	80	80	80
Sub-Total		165	155	150
Total		1550	1255	1130

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