

# CCARDESA

Centre for Coordination of Agricultural Research and Development for Southern Africa



## RESEARCH AND DEVELOPMENT PRIORITIES IN KEY AGRICULTURAL COMMODITIES IN SOUTHERN AFRICA

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## EXECUTIVE SUMMARY

The Centre for coordination of agricultural research and development for Southern Africa, (CCARDESA) revised its list of regional agricultural research and development priorities through a five-day write shop, that was held in Johannesburg, South Africa, from 25 to 29 September 2023. The revised priorities will guide the revision of CCARDESA's long-term strategy and medium-term operational plan. A multidisciplinary team of 18 experts from 11 SADC countries was assembled to address global and regional developments in crops, livestock, forestry, fisheries, and aquaculture as well as cross-cutting issues such as gender, health, nutrition, poverty, climate change, and the environment.

The team reviewed a document entitled: Research and development priorities in key agricultural commodities in southern Africa, which had been developed for CCARDESA in 2012. They identified gaps, and brainstormed new areas for research. They also discussed key challenges and opportunities facing the agricultural sector, and potential research questions and topics. The team then established sector-specific criteria for ranking the key research focus areas and research questions in order of priority. Based on this work, they drafted a new set of priorities for CCARDESA. The team noted that the main challenges faced by the agriculture sector in the SADC region are poverty reduction, climate change, access to finance, access to markets, low productivity, and limited technology adoption. These challenges impact the sector's ability to contribute to economic growth, poverty reduction, and food security. The team noted that to address these challenges, agricultural research and development in the SADC region needs to be anchored on the following five pillars:

- **Knowledge, Technology, and Innovation Systems:** developing and disseminating knowledge, technology, and innovation to improve productivity and sustainability.
- **Infrastructure Development:** developing physical and digital infrastructure to support production and trade.
- **Marketing and Trade Development:** developing markets and trade systems to support production and trade.
- **Finance and Credit:** developing financial and credit systems to support production and trade.
- **Environment and Climate Change:** developing strategies and technologies to mitigate and adapt to the impacts of climate change.

The team further noted that CCARDESA's research priorities must also adhere to the following eight guiding principles: sustainability, mainstreaming of gender, youth, and marginalized groups, health and nutrition sensitivity, climate change adaptation and mitigation, multisectoral engagement and participation, evidence-based policy, ethics and intellectual property rights, and recognition of the importance of indigenous knowledge systems.

For crops, it was determined that the main areas of research that should be prioritized include breeding for quality and improved seeds, controlling pests and diseases, improving soil fertility and water management, addressing impacts of climate variation on crop production, improving market access, and capacity building for farmers.

Among the priority research areas for livestock were improving livestock breeds, characterization, evaluation and selection of indigenous livestock breeds, pest, and disease control, improving animal nutrition through formulating feeds from plants and agricultural waste, and improving access to markets and intra-regional trade.

Some key research priorities for the forestry sector include inventorying non-timber forest products and eliminating their threats, identifying, and developing appropriate agroforestry practices and technologies for smallholder farmers, improving productivity of plantation forests, and quantification of carbon sequestration and storage capacity of different forest types to effectively implement carbon trading and credits protocols.

For fisheries and aquaculture, some of the research areas that need to be prioritized are stock assessments, genetic improvement programs on farmed species, development of alternative sources of protein in fish feed, value addition on products of fisheries and aquaculture, addressing water pollution, conducting assessments for improved fish quality, improving marketing and distribution networks, addressing the impacts of invasive species, and studying the impacts of climate change on aquatic biodiversity.

Among the main research priorities on crosscutting issues are: how to sustainably increase public investment in research and development, technology development and agricultural extension, determining the critical infrastructure investments required to sustainably operationalize the Africa Continental Free Trade Area, determining policy frameworks and regional cooperation mechanisms that are necessary to promote the development of regional value chains based on countries' comparative advantages, identifying policies and investments required to sustainably harness and

increase private sector financing in agriculture in the region and understanding how SADC can enhance its capacity to develop a pipeline of bankable climate finance projects?

It is recommended that CCARDESA's long-term strategy and medium-term operational plan must be aligned with these revised research and development priorities and guiding principles. CCARDESA should work with SADC member states to mobilize resources to implement the revised research and development priorities. CCARDESA should facilitate collaboration among SADC member states to promote regional agricultural research and development. Finally, CCARDESA should promote the adoption of research findings by farmers and other relevant stakeholders.



## **ACRONYMS AND ABBREVIATIONS**

AfCFTA	Africa Continental Free Trade Area
AICCRA	Accelerating Impacts of CGIAR Climate Research for Africa
ARD	Agricultural Research and Development
AR4D	Agricultural Research for Development
CAADP-XP4	Comprehensive Africa Agriculture Development Programme ex Pillar 4
CCARDESA	Centre for Coordination of Agricultural Research and Development in Southern Africa
CGIAR	Consortium of International Agricultural Research Centres
CIFOR	Centre for International Forestry Research
CPR	Common Property Resources
FAO	Food and Agriculture Organization of the United Nations
FLEGT	Forest Law Enforcement Governance and Trade
FSRP	Food Systems Reliance Program
FES	Forest Ecosystem Services
GCCA+	Global Climate Change Alliance Plus
GDP	Gross Domestic Product
IKS	Indigenous Knowledge Systems
M&E	Monitoring and Evaluation
MTOP	Medium Term Operational Plan
NTFPs	Non-Timber Forest Products
RAP	Regional Agricultural Policy
RISDP	Regional Indicative Strategic Development Plan
SADC	Southern African Development Community
SDG	Sustainable Development Goal
SFM	Sustainable Forest Management
UNEP	United Nations Environment Programme

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## **1.0 INTRODUCTION**

The Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) is a subsidiary organization of the Southern African Development Community (SADC) that was established in 2010 by SADC Member States. Its mandate is to coordinate agricultural research in Southern Africa and to promote technology generation, dissemination, and adoption. CCARDESA's goal is to contribute to improved regional food security and livelihoods.

In 2012, CCARDESA commissioned a study that developed its research and development priorities in key agricultural commodities in southern Africa. These priorities informed the framing of CCARDESA's strategies and themes, including its Long-Term Strategy (2020-2029) and Medium-Term Operational Plan (2021-2025). These priorities were aligned to the key SADC policies and strategic documents, such as the Regional Indicative Strategic Development Plan (RISDP), the Regional Agricultural Policy (RAP), the Comprehensive Africa Agriculture Development Programme (CAADP), and the Malabo Declaration.

As one of its key portfolios, CCARDESA is implementing the Comprehensive Africa Agriculture Development Programme EX Pillar 4 (CAADP-XP4) Programme on Agricultural Research and Innovation. The project is funded by the European Union's "Development Smart Innovation through Research in Agriculture" (DeSIRA) initiative and the International Fund for Agricultural Development (IFAD). The CAADP-XP4 programme runs from 2019 to 2024 and it supports a science-led and climate-relevant agricultural transformation in Africa. The program aims to strengthen the capacity of CCARDESA to deliver on its Agricultural Research for Development (AR4D) mandate and to collectively support African countries in implementing relevant programs of the Comprehensive Africa Agriculture Development Programme (CAADP). It does this through (i) inclusive regional and international partnerships, (ii) production and exchange of climate-relevant agricultural knowledge, (iii) effective communication, monitoring, and evaluation, (iv) promotion of the systemic and effective use of science, knowledge, and innovation, and (v) representation of the Sub-Regional and National Organizations at Continental level.

Considering the need to incorporate new global and regional developments, and important cross-cutting issues such as gender, health and nutrition, poverty, climate change, and the environment, CCARDESA revised its list of regional agricultural research and development priorities. This was done through assembling a multidisciplinary team of experts from the national agricultural knowledge

and innovation systems in the SADC region. The team comprised experts in agronomy, fisheries and aquaculture, forestry, livestock and in crosscutting issues including biodiversity, climate change, and agricultural economics. The task was performed through a five-day write shop, held in Johannesburg, South Africa from 25 to 29 September 2023. A facilitator was selected from among the experts based on previous experience in facilitating similar write shops and his responsibility was to lead the process and consolidate the final document.

CCARDESA's revision of its regional agricultural research and development priorities was a timely and important initiative. It sought to ensure that CCARDESA's work was aligned with the latest global and regional developments, and that it addressed the most pressing agricultural challenges facing Southern Africa. The write shop provided an opportunity for experts from across the region to come together and share their knowledge and insights, and to develop a set of priorities that would guide CCARDESA's work in the years to come.

### **1.1 Objectives**

The purpose of the write shop was to assist CCARDESA in revising its long-term strategy by identifying current priority issues that needed to be considered in the regional research agenda for crops, livestock, forestry, and fisheries.

The specific objectives of the write shop were to:

- Review the 2012 regional research priorities report, and to:
- Draft a new regional research priorities report for CCARDESA covering crops, livestock, forestry, and fisheries sectors based on current policy imperatives at regional and global levels.

### **1.2 Approach**

The team of experts employed the writeshop process to develop the 2023 priorities for research and development (R&D) in agriculture for the Southern African region. The process involved group discussions and plenary discussion sessions. The experts represented five sectors: crops/agronomy, fisheries and aquaculture, forestry, livestock, and crosscutting issues. They came from eleven (11) SADC countries namely: Botswana, Eswatini, Lesotho, Malawi, Mauritius, Mozambique, Namibia, South Africa, Tanzania, Zambia, and Zimbabwe.

The experts started by reviewing the report on research and development priorities in key agricultural commodities in Southern Africa (Mudhara et al., 2012). Experts worked in five groups, representing the five sectors, and assessed whether the priorities set in 2012 were still relevant in the present time.

They also identified any gaps and brainstormed on new areas for research and development in 2023. This was a parallel group session where each group focused on the sections corresponding to their respective areas of expertise. The findings of each group were then presented and discussed in plenary, which allowed all participants to comment and make suggestions for improvement on each group's work.

The next group session focused on key challenges and opportunities faced by the agricultural sector in southern Africa. Groups also discussed potential research questions and topics that could help address the challenges. Where possible, the groups also specified the time frames for the suggested research projects and countries where the research projects could be implemented. The results of these discussions were then presented and discussed in plenary.

In the final parallel group sessions, the groups established sector-specific criteria for ranking the key research focus areas and research questions in order of priority. These were also presented and discussed in plenary.

Based on the outputs of all the group discussions and plenary sessions, participants began to work on a draft document, with new priorities for CCARDESA as of 2023.

## 2.0 CONCEPTUAL FRAMEWORK

### 2.1 Key challenges faced by the agriculture sector in the SADC region

The agricultural sector in SADC countries faces several challenges that impact its ability to contribute to economic growth, poverty reduction, and food security. Some of these challenges are:

- **Poverty reduction:** The Southern African region is facing formidable economic challenges on issues such as poverty reduction, food security, employment creation, increased farm productivity, the sustainable use of natural resources, land reform, and human capital development.
- **Climate change:** The agricultural sector in SADC countries is vulnerable to the effects of climate change, such as droughts, floods, and extreme weather events, which can reduce crop yields and threaten food security.
- **Access to finance:** Farmers in SADC countries often lack access to finance, which limits their ability to invest in their farms and improve productivity.
- **Access to markets:** Limited access to markets and poor infrastructure can make it difficult for farmers to sell their products and obtain fair prices. There is also limited trade among member states despite the existence of instruments such as the Africa Continental Free Trade Area (AfCFTA) which seeks to significantly boost intra-Africa trade, particularly trade in value-added products and trade across all sectors of Africa's economy.
- **Low productivity:** Low productivity is a major challenge facing the agricultural sector in SADC countries. This is due to a lack of investment in research and development, poor infrastructure, and limited access to inputs such as seeds, fertilizers, and irrigation.
- **Limited technology adoption:** Small-scale farmers in SADC countries often lack access to modern technologies that can improve productivity and reduce post-harvest losses.

### 2.2 Towards a solution

The key challenges facing the agricultural sector in SADC can be broadly classified under the following five pillars, which can form the framework for setting priorities for agricultural research and development in SADC countries. The pillars are:

1. **Knowledge, Technology, and Innovation Systems:** This pillar focuses on the development and dissemination of knowledge, technology, and innovation to improve agricultural

productivity and sustainability. It includes research and development activities, capacity building, and knowledge sharing among stakeholders.

2. **Infrastructure Development:** This pillar focuses on the development of physical infrastructure, such as roads, irrigation systems, and storage facilities, to support agricultural production and trade. It also includes the development of digital infrastructure, such as information and communication technologies, to improve access to information and markets.
3. **Marketing and Trade Development:** This pillar focuses on the development of markets and trade systems to support agricultural production and trade. It includes the development of value chains, market information systems, and trade policies that promote regional and international trade.
4. **Finance and Credit:** This pillar focuses on the development of financial and credit systems to support agricultural production and trade. It includes the development of financial products and services, such as insurance and credit that are tailored to the needs of smallholder farmers and agribusinesses.
5. **Environment and Climate Change:** This pillar focuses on the development of strategies and technologies to mitigate and adapt to the impacts of climate change on agriculture. It includes the development of climate-smart agriculture practices, such as conservation agriculture and agroforestry, and the promotion of sustainable land use practices.

These pillars cut across all sectors of the agricultural economy and are crucial in setting priorities for agricultural research and development in the region. Prioritizing crosscutting issues is vital for promoting social nexus issues, including women, youth and vulnerable groups empowerment, climate justice, poverty alleviation, and conserving the rights of socially and economically vulnerable groups (Donkor, 2023). In addition, climate change adaptation needs to be mainstreamed across multiple sectors, and greater policy coherence is essential (England et al., 2018). Gender equality is also central to ensuring that the formulation, deliberation, adoption, and implementation of regional protocols, strategies, policies, and programs are undertaken in a manner that does not marginalize sections of the population (SADC, 2022). Therefore, addressing these crosscutting issues is essential for sustainable agricultural development in southern Africa.

The pillars are interlinked and collectively carry the potential to address the key challenges facing agriculture in SADC countries, such as low productivity, limited access to markets and finance, and

vulnerability to climate change. By developing a long-term strategy that prioritizes these pillars, CCARDESA can effectively contribute towards improved regional food security and livelihoods. The interconnections among the pillars and their potential collective contribution to improved regional food security and livelihoods is depicted in the conceptual framework in Figure 2.1, below. Further discussion of these pillars and their associated research priorities are the subject of Chapter 7 of this document.

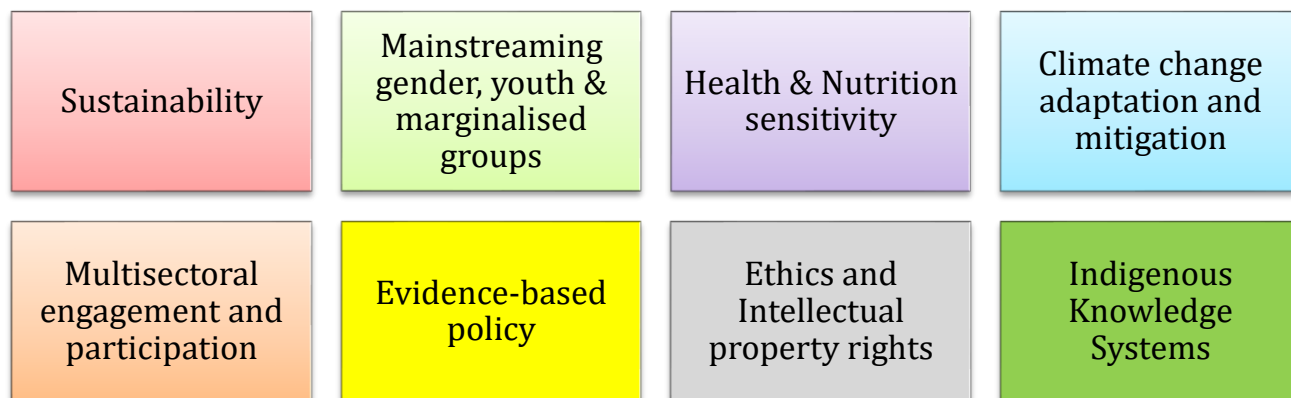


**Figure 2.1.** Conceptual framework depicting how the five pillars are interrelated and how they can collectively contribute to improved food security and livelihoods in the SADC region.

### 2.3 Guiding Principles

To be effective and equitable, CCARDESA’s research priorities must not only be anchored on the five pillars described above, but they must also adhere to the following eight guiding principles as illustrated in Figure 2.2.





**Figure 2.2** Guiding principles for CCARDESA’s research and development initiatives

### 2.3.1 Sustainability

Sustainability is a key concept in agricultural research and development, especially in the southern African region, where the challenges of climate change, food insecurity, poverty and environmental degradation are acute. Sustainable agriculture aims to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. It also seeks to enhance the productivity, profitability, and resilience of farming systems, while minimizing the negative impacts on natural resources and human well-being.

In the southern African region, agricultural research and development plays a vital role in promoting sustainable agriculture, by generating and disseminating knowledge, technologies and innovations that address the specific needs and contexts of farmers and other stakeholders. Some of the key areas of focus include improving crop and livestock varieties, enhancing soil health and fertility, managing pests and diseases, reducing post-harvest losses, diversifying income sources, strengthening value chains and markets, and empowering women and youth. By considering sustainability in agricultural research and development, the southern African region can achieve food security, poverty reduction, environmental conservation, and social inclusion, while contributing to the global goals of sustainable development.

### 2.3.2 Gender, youth, and vulnerable groups mainstreaming.

Gender, youth, and vulnerable groups mainstreaming is the process of integrating the perspectives and needs of these groups into the design, implementation, monitoring and evaluation of agricultural research and development (ARD) activities. This is important for the southern African region, where

agriculture is a key source of livelihoods, food security and economic growth, but also faces multiple challenges such as climate change, land degradation, poverty, and inequality. By mainstreaming gender, youth and vulnerable groups, ARD can ensure that its outcomes and impacts are inclusive, equitable and sustainable, and that no one is left behind. Mainstreaming can also enhance the participation, empowerment, and innovation of these groups, who have valuable knowledge, skills and potential to contribute to ARD.

### *2.3.3 Health and nutrition-sensitivity*

Health and nutrition sensitivity in agricultural research and development means considering the impacts of agricultural interventions on the health and nutritional status of the target population, especially the most vulnerable groups such as women and children. In the southern African region, where food insecurity, malnutrition, and chronic diseases are prevalent, health and nutrition sensitivity are crucial for achieving sustainable development goals. By considering health and nutrition sensitivity, ARD can enhance the availability, accessibility, and quality of diverse and nutritious foods, reduce the exposure to environmental and occupational hazards, and promote healthy lifestyles and behaviours among farmers and consumers.

### *2.3.4 Climate Change adaptation and mitigation*

Climate change poses a serious threat to the food security and livelihoods of millions of people in the Southern African region. The impacts of climate change, such as increased temperatures, droughts, floods, and pests, can reduce crop yields, damage soil quality, and increase the vulnerability of farmers to shocks and stresses. Therefore, it is essential to consider climate change adaptation and mitigation in agricultural research and development in the region. Adaptation refers to the actions that farmers and other stakeholders can take to cope with the effects of climate change, such as adopting resilient crop varieties, diversifying income sources, and improving water management. Mitigation refers to the actions that can reduce greenhouse gas emissions from agriculture, such as enhancing soil carbon sequestration, reducing deforestation, and promoting low-emission technologies. By integrating adaptation and mitigation in ARD, the region can achieve multiple benefits, such as improved food security, reduced poverty, enhanced environmental sustainability, and increased resilience to future climate risks.

### *2.3.5 Multisectoral engagement and participation*

Multisectoral engagement and participation is a key factor for enhancing the impact and sustainability of agricultural research and development in the southern African region. This approach involves the collaboration and coordination of various actors and stakeholders from different sectors, such as public, private, civil society, academia, and farmers' organizations. By engaging and involving multiple sectors in the design, implementation, and evaluation of agricultural R&D activities, the following benefits can be achieved:

- Improved relevance and responsiveness of ARD to the needs and priorities of the end-users and beneficiaries, especially smallholder farmers and rural communities.
- Increased ownership and commitment of the partners and participants to the ARD agenda and outcomes, leading to better uptake and scaling of innovations and technologies.
- Enhanced synergies and complementarities among the different sectors, resulting in more efficient use of resources, reduced duplication of efforts, and improved coordination and alignment of policies and strategies.
- Strengthened capacities and capabilities of the various actors and stakeholders to engage in ARD processes, fostering a culture of learning, innovation, and adaptation.
- Increased opportunities for cross-sectoral learning, knowledge sharing, and networking, facilitating the exchange of experiences, best practices, and lessons learned.

Therefore, considering multisectoral engagement and participation in ARD is essential for addressing the complex and interrelated challenges facing the agricultural sector in the southern African region, such as food insecurity, poverty, climate change, environmental degradation, and social inequality.

### *2.3.6 Evidence-based policy*

Evidence-based policy making is a crucial aspect of agricultural research and development in the southern African region. This is because the region faces many challenges such as climate change, food insecurity, poverty, and environmental degradation, which require effective and context-specific solutions. By using evidence from rigorous and relevant research, policy makers can design and implement policies that are informed by the best available knowledge, and that address the needs and priorities of the stakeholders. Evidence-based policy making can also enhance the accountability, transparency, and legitimacy of the policy process, and foster a culture of learning and innovation in the agricultural sector.

### *2.3.7 Ethics and Intellectual property rights*

Ethics and intellectual property rights are important aspects of agricultural research and development in the southern African region. Ethics refers to the principles and values that guide the conduct and decision-making of researchers and developers, while intellectual property rights protect the ownership and use of their innovations and outputs. Both ethics and intellectual property rights aim to ensure that agricultural research and development is done in a responsible, fair, and beneficial way for the stakeholders involved, such as farmers, consumers, governments, and the environment. Some of the ethical issues that may arise in agricultural research and development include animal welfare, environmental impact, social justice, cultural sensitivity, and informed consent. Some of the intellectual property rights that may apply to agricultural research and development include patents, trademarks, trade secrets, plant breeders' rights, and geographical indications. By adhering to ethical standards and respecting intellectual property rights, agricultural researchers and developers can foster trust, collaboration, innovation, and impact in the southern African region.

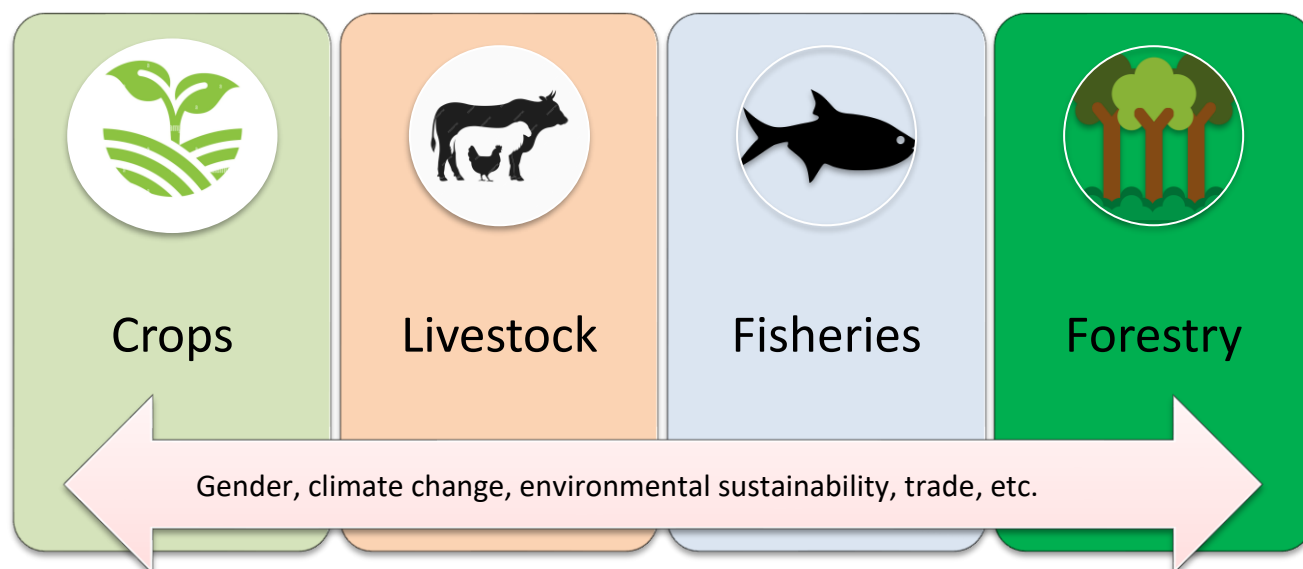
### *2.3.8 Indigenous Knowledge Systems*

Indigenous knowledge systems (IKS) are the local and traditional ways of understanding and interacting with the natural and social environment. They are often based on centuries of experience and adaptation, and reflect the values, beliefs and worldviews of the communities that hold them. IKS can offer valuable insights and innovations for agricultural research and development (ARD) in the Southern African region, where many farmers face challenges such as climate change, land degradation, food insecurity and poverty. By considering IKS in ARD, researchers and practitioners can:

- Respect the rights, dignity and culture of the local people and foster their participation and ownership in the ARD process.
- Enhance the relevance, effectiveness, and sustainability of the ARD interventions by building on the existing knowledge, skills, and practices of the farmers.
- Promote the conservation and revitalization of the rich biodiversity and cultural diversity of the region, which are essential for food security and resilience.
- Facilitate the integration and complementarity of different knowledge systems, such as scientific, indigenous and farmer knowledge, to create synergies and innovations for solving complex problems.

## 2.4 Key agricultural commodities in the SADC region

Crops, livestock, fisheries and aquaculture, and forestry are key agricultural commodities in the SADC region. Furthermore, there are some issues that affect all these four sectors i.e., cross-cutting issues and these include mainstreaming of gender, youth and marginalized groups, climate change, environmental and social sustainability, and trade. A diagrammatic presentation of these key commodities is shown in Figure 2.3. It is important to ensure that CCARDESA's research and development agenda fully addresses all these components. The crop sector is the main source of food, employment, and income in the region, despite many challenges affecting the sector, including the effects of climate change, rampant land degradation, and competing priorities for resources such as rapid population growth and rising urbanization that mount pressure on agriculture to deliver food and raw materials beyond the current crop productivity levels.



**Figure 2.3** Key agricultural commodities in the Agricultural sector in SADC.

In the SADC region, at least 10 million poor people are entirely dependent on livestock, and more than 40% of the human population is to some extent dependent on livestock (Thomson et al., 2013). The livestock sector accounts for about 40% of agricultural GDP in Africa, ranging from 30 to 80% in individual countries, but rarely gets more than 5 to 10% of agricultural investment and consequently is under-performing (Malabo Montpellier Panel Report, 2020). The sector faces challenges such as climate change, low productivity, and lack of efficient and effective animal disease control, among others (Gosling et al., 2020).

Southern Africa's forests provide significant benefits in terms of timber and wood as well as non-timber forest products and an array of ecosystem services, not to mention supporting millions of livelihoods across the subregion (FAO, 2015). The forests of Southern Africa comprise a multitude of forest types and ecosystems, ranging from mangroves to rainforests, dry and humid ecosystems and are home to an incredible wealth and diversity of fauna and flora.

The fisheries and aquaculture sector employs a total of about 3.3 million people in the Southern African Development Community (SADC) region, which is equivalent to about 1% of the SADC population (SADC FANR, 2019). It accounts for an estimated 3.5% of the SADC region's gross domestic product (World Bank, 2020) and fish can play an important role in improving Southern Africa's food security and nutritional status, as more than 100 million people in the region eat fish regularly (SADC FANR, 2019).

The SADC Regional Agricultural Policy (RAP) provides an overarching policy framework for the region's agriculture sector, defining common agreed objectives and measures to guide, promote, and support actions at regional and national levels in the SADC agricultural sector towards the attainment of the SADC Common Agenda. The RAP aims to enhance sustainable agricultural production, productivity, and competitiveness, improve regional and international trade and access to markets of agricultural products, improve private and public sector engagement and investment in the agricultural value-chains, and reduce social and economic vulnerability of the region's population in the context of food and nutrition security and the changing economic and climatic environment.

These key agricultural commodities form the backbone for setting priorities for research and development for the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA). CCARDESA is a regional organization that aims to promote agricultural research and development in the SADC region. The organization focuses on developing and implementing research programs that address the region's agricultural challenges, including climate change, food insecurity, and poverty reduction. The organization's research areas are aligned with the SADC RAP and include:

- Enhancing sustainable agricultural production, productivity, and competitiveness
- Improving regional and international trade and access to markets of agricultural products
- Improving private and public sector engagement and investment in the agricultural value-chains

- Reducing social and economic vulnerability of the region's population in the context of food and nutrition security and the changing economic and climatic environment

Overall, CCARDESA's research programs cover a range of agricultural commodities, including crops, livestock, fisheries and aquaculture, and forestry. The organization works closely with national agricultural research institutions, universities, and other stakeholders to develop and implement research programs that address the region's agricultural challenges and contribute to the achievement of the SADC RAP objectives.

## **3.0 RESEARCH, LEARNING AND DEVELOPMENT PRIORITIES FOR CROPS IN SOUTHERN AFRICA**

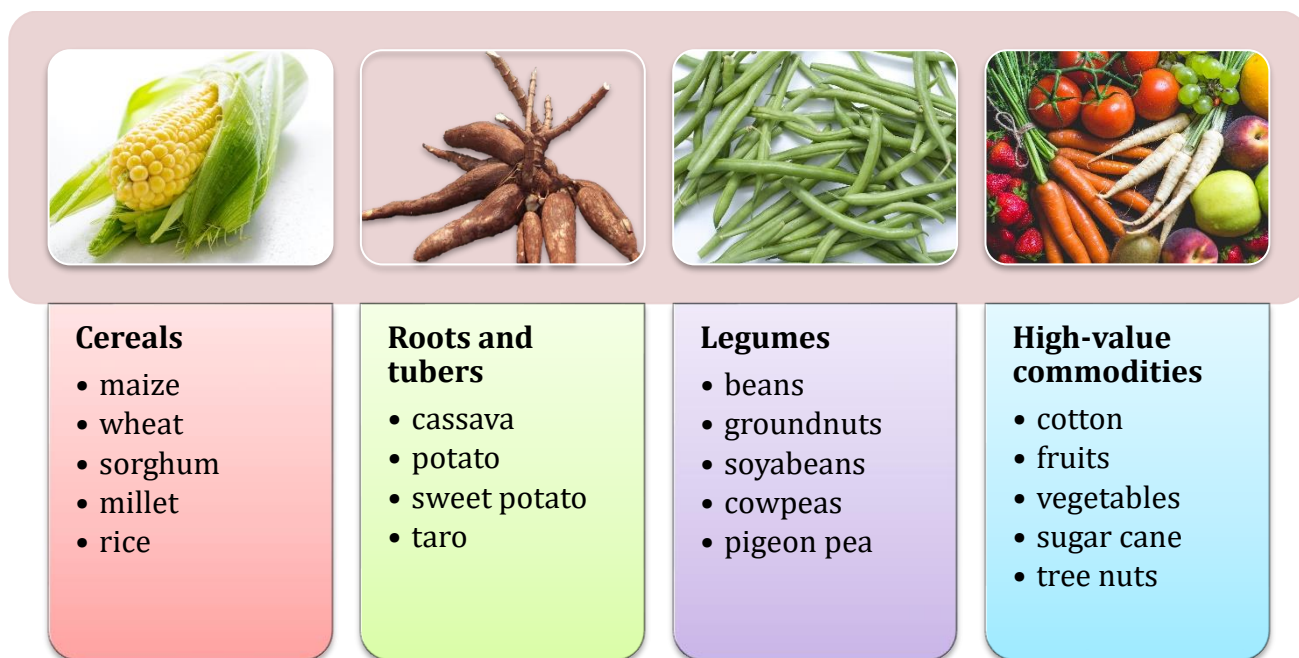
### **3.1 Background**

Crop production plays a crucial role in the economic development of the Southern African Development Community (SADC) region. The SADC Regional Indicative Strategic Development Plan (RISDP 2020-2030) highlights the importance of the crop sector in the region's economic development. The SADC Regional Agricultural Policy (RAP) provides an overarching policy framework for the region's agriculture sector, defining common agreed objectives and measures to guide, promote, and support actions at regional and national levels in the SADC agricultural sector towards the attainment of the SADC Common Agenda. Crops are the region's main source of food, employment, and income despite many challenges affecting the sector, including the effects of climate change, rampant land degradation, and competing priorities for resources such as rapid population growth and rising urbanization that mount pressure on agriculture to deliver food and raw materials beyond the current crop productivity levels.

### **3.2 Status and Existing Best Practices**

The SADC region is known for its diverse agricultural production, with crops being the main source of food, employment, and income. The major crops grown in the SADC region include maize, wheat, sorghum, millet, rice, cassava, potatoes, sweet potatoes, soybeans, sunflower seeds, peanuts, cotton, and tobacco. Maize is the most important staple crop in the region, with South Africa being the main producer. Other important crops include wheat, which is mainly produced in South Africa, North Africa, and the highland zones of Ethiopia and Kenya, and cassava, which has expanded tremendously in western and central Africa. The region also produces a significant amount of cotton, which is an important cash crop. The experts grouped the main crops grown in the southern Africa region under the following categories: cereals, roots and tubers, legumes, and high value commodities. The compositions of the categories are as indicated in Figure 3.1.





**Figure 3.1** Categories of main crops grown in the SADC region.

### 3.2.1 Cereals

According to the SADC Regional Crop Development Programme (RCDP 2019), the crop sector accounts for 61 percent of the agricultural GDP in the region, and cereals are the main source of food, employment, and income for most of the population. However, cereal production faces many challenges, such as climate change, land degradation, low productivity, market access barriers and policy constraints. The RCDP 2019 provides a framework to stimulate and increase cereal production, productivity, and competitiveness, as well as improving market access for cereals and their products. The RCDP 2019 is aligned with the objectives of the SADC Regional Agricultural Policy (RAP 2014), which aims to provide a legally binding instrument for regional cooperation in agriculture and natural resources management. Some of the cereals produced in the SADC region include maize, sorghum, millets, rice, and wheat. Sorghum and millet account for 23 percent of the cereal production in the SADC region and are more resilient to drought and pests than maize. However, maize is still the dominant cereal crop in the region, accounting for 80 percent of the total cereal area harvested. Maize production varies across countries and seasons, depending on rainfall patterns, input availability, prices, and policies. In 2021, favourable rainfall led to improved cereal production over most of the region, with South Africa, Zambia and Zimbabwe recording maize surpluses. However, some parts of the region were affected by cyclones, floods, and locusts, which damaged crops and infrastructure. Cereal production policies in selected African and Asian countries can provide some lessons for the

SADC region. For example, policies that promote subsidies to farmers, introduction of new higher yielding crop varieties and market access have been effective in enhancing cereal production and food security in countries such as China, India, Kenya, and Nigeria.

### *3.2.2 Roots and tubers*

Roots and tubers are important crops in the Southern African Development Community (SADC) region, with African countries contributing roughly 23% to the world production of root and tuber crops (FAO, 2003). In Africa, roots and tubers are generally grown in countries located in the Sub-Saharan zones, notably in Nigeria, Ghana, Côte d'Ivoire, Benin, Cameroon, Central African Republic, Democratic Republic of the Congo (D.R.C.), Tanzania, Mozambique, Angola, Uganda, Malawi, Madagascar, and Rwanda (FAO, 2003). Root and tuber crops are an essential component of food security in rural as well as in urban areas in developing countries. They are also a source of cash for many farmers, often the poorest ones. Cassava and sweet potato are the main root and tuber crops produced in the SADC region. However, the production of root and tuber crops in the SADC region is still facing challenges such as low yields, pests and diseases, and lack of access to markets. Root and tuber crops have the potential to contribute significantly to the economy of the SADC region since local production of root and tuber crops is the more stable way of improving livelihoods, increasing food security, and contributing to more long-term and sustainable economic growth in Sub-Saharan Africa.

### *3.2.3 Legumes*

Food security remains a significant challenge in the SADC region, with one-third of all households still exposed to food insecurity (SADC, 2022). Legumes have the potential to improve food and nutrition security in the region due to their cultural linkage with the regional food habits of the communities, nutritionally rich food, untapped genetic diversity, and adaptation to harsh climate conditions and poor marginal soils (Abberton et al., 2022). Here are some key points regarding the status of legume production in the SADC region and their contribution to the region's economy and food security:

- Legumes are true green manure for crops, as they can fix nitrogen from the air into the soil and thus boost the growth of plants grown after them (Ranaivoson et al., 2023).

- Growing legumes before cereals and digging their residues into the soil before sowing could provide soils with substantial nitrogen inputs and optimize the use of mineral fertilizers needed to improve cereal crop yields.
- Experiments in Southern Africa are currently focusing on the assessment of "dual" legume crop rotations, where a pulse crop that provides food for farmers (for example groundnuts) is grown along with the green manure.
- The government and private sector can help enhance the market demand of these crops by producing more value-added food products of these legumes for the African population using food technology.
- Legumes are a combination of high-nutrition and high-calorie food, making them nutritional food security crops of poor livelihoods in sub-Saharan Africa.
- The loss of food production due to green manure production could be partially offset by growing a pulse crop that provides food for farmers.
- The cultivation of dual-purpose legumes (producing both pulses and forage) could be one of the key elements of the trade-off required to improve soil fertility.

#### *3.2.4 High value commodities*

The Southern African Development Community (SADC) region is a major producer of fruits and vegetables, which are the main source of food, employment, and income in the region (SADC, 2022). However, the production of fruits and vegetables in the SADC region faces many challenges, including the effects of climate change, rampant land degradation, and competing priorities for resources such as rapid population growth and rising urbanization that mount pressure on agriculture to deliver food and raw materials beyond the current crop productivity levels.

According to a report by the Food and Agriculture Organization (FAO), the productivity of fruits and vegetables in the SADC region is substantially lower than the world average, with an average productivity of 10 tonnes per ha for vegetables, Sahel West Africa, Chad, and Southern Africa lagging

behind the world average by 6.0 metric tonnes. However, climatic conditions in Southern Africa are suitable for year-round production of vegetables and tropical fruits. The agricultural sector in South Africa, is highly diversified and includes the production of all the major grains, oilseeds, deciduous and subtropical fruits, sugar, citrus, wine, and most vegetables. The agricultural sector contributed around 10 percent to South Africa's total export earnings in 2021 at a value of \$12.0 billion, with citrus, wine, table grapes, corn, apples, pears, and wool accounting for the largest exports by value (ITA, 2023). Fruits, nuts, and vegetables are a priority sector in Eswatini, Lesotho, Mozambique, and South Africa, with all four countries having a significant presence of large-scale production (TFSA, 2023).

The production of fruits and vegetables in the SADC region contributes significantly to the region's economy and food security. Fruits and vegetables are a vital source of micronutrients, vitamins, and minerals and are essential components of balanced and healthy diets (Ranaivoson et al., 2023). They are also more profitable per unit volume than staples and command higher profit margins and farm gate prices per unit area of production, especially when access to farmland is limited and labor is surplus. Therefore, the production of fruits and vegetables can be a great income generator and can help alleviate poverty in the region.

### **3.3 Challenges and Opportunities**

The crop production sector in the SADC region faces several challenges that affect its ability to provide food, employment, and income to the region. Some of the main challenges include:

**Climate change:** The effects of climate change, such as droughts and floods, affect crop productivity levels and can lead to food shortages.

**Land degradation:** Rampant land degradation reduces the amount of arable land available for crop production, which can lead to lower crop yields.

**Competing priorities for resources:** Rapid population growth and rising urbanization put pressure on agriculture to deliver food and raw materials beyond the current crop productivity levels.

**Poverty reduction:** Poverty reduction is a formidable economic challenge in the region, and the agricultural sector should perform an essential role in the generation of rural incomes, employment, and food security.

**Sustainable use of natural resources:** The sustainable use of natural resources is a challenge in the region, and the agricultural sector should transfer resources efficiently to other sectors of the regional economy.

**Fragile resource base:** The Southern African region falls largely within sub-humid and semi-arid agro-ecological zones, which are fragile and require careful management to support crop production.

Despite the numerous challenges faced by the agronomy sector in the SADC region, there are several opportunities for improvement. Some of these opportunities include:

**Increasing demand for food:** The region has a growing population, which implies a need for growth in the agricultural sector.

**Promoting climate-smart agricultural initiatives:** Climate-smart agricultural initiatives can help the region adapt to climate change and improve agricultural productivity.

**Improving regional and international trade and access to markets:** Improving trade and access to markets can help the region increase its agricultural exports and generate more income.

**Strengthening research and technology:** Investment in production research and technology can improve crop productivity and alleviate their vulnerability.

**Creating jobs:** The agricultural sector remains a significant source of economic growth and job creation in the region.

**Improving food and nutrition security:** The region can generate, analyze, and disseminate a varied range of information, including information on vulnerability, malnutrition, and food security, to improve food and nutrition security.

**Diversifying crops:** The region can diversify its crops to reduce its dependence on a single crop, such as corn, and improve food security.

To take advantage of these opportunities, the SADC has developed several policies and programs aimed at enhancing agricultural sector performance, such as the Regional Agricultural Policy (RAP 2014) and the Regional Crop Development Programme (RCDDP 2019). The region is also promoting the use of appropriate technologies as an adaptation to climate change through the implementation of

smart agricultural practices. Additionally, there is a need for investment in production research and technology to improve crop productivity and alleviate the vulnerability of crops.

### 3.4 Main Research Gaps

Having identified the main challenges and opportunities faced by the crop production sector in SADC, the group identified key research areas and research questions that can help address those challenges and take advantage of the existing opportunities in the region. One key research area identified was that of availability of quality and improved seeds. It was determined that this area requires research into several topics, including breeding crop varieties based on market demand-led needs, breeding for biofortified and hybrid (millet) varieties with high yielding traits, breeding programs for pest and disease resistant varieties, breeding and multiplication of underutilized indigenous food plants, and breeding varieties tolerant to drought and heat. Biofortification breeding is a trusted approach to improving the nutritional value of crops, and it involves directly breeding for increased micronutrient concentration and/or higher bioavailability. Other areas of research interest are pests and diseases, soil fertility and water management, impacts of climate change on crop production, capacity building and knowledge transfer and market access. These research areas and their associated research questions are summarized in Table 3.1, below.

**Table 3.1.** Main research gaps and key research questions for the crops sector in SADC.

<b>Research Gap (area)</b>	<b>Key research questions or topics</b>
Availability of quality and improved seeds (Breeding)	<ol style="list-style-type: none"> <li>1. Breed crop varieties through market demand-led needs</li> <li>2. Breeding for Biofortified and hybrid (millet) varieties with high yielding traits</li> <li>3. Breeding programs for pest and disease resistant varieties</li> <li>4. Breeding and multiplication of underutilized indigenous food plants</li> <li>5. Breed varieties tolerant to drought and heat</li> </ol>
Pests and diseases	<ul style="list-style-type: none"> <li>• Conduct studies to understand pest and disease dynamics in relation to climate change.</li> <li>• Determine Integrated Pest Management practices packages suitable for specific environmental conditions and specific plants to improve crop production.</li> </ul>
Soil fertility and water management	<ul style="list-style-type: none"> <li>• Identify and evaluate appropriate fertilizer (inorganic and organic) application rates.</li> <li>• Conduct studies on the best agro-ecology (agroforestry) systems</li> <li>• Identify water-use efficient systems</li> </ul>
Impacts of Climate variation on crop production	<ul style="list-style-type: none"> <li>• Study the effect of climate variation on the production performance of specific crops.</li> <li>• Develop early warning systems to support farmers to deal with effect of climate variation</li> </ul>

Limited farmers' knowledge (Capacity building)	<ul style="list-style-type: none"> <li>• Identify barriers to knowledge and technology transfer between researchers and farmers.</li> <li>• Identify farmers' capacity needs and gaps.</li> <li>• Identify effective mechanisms for knowledge dissemination and capacity building.</li> </ul>
Limited access to farming technology and equipment	<ul style="list-style-type: none"> <li>• Identify barriers to access to farming technology and equipment.</li> <li>• Determine the most effective models for increasing farmers' access to farming technology and equipment.</li> </ul>
Market access	<ul style="list-style-type: none"> <li>• Determine barriers to market access and low regional trade in agricultural products.</li> <li>• Determine most effective models for increasing market access and regional trade in agricultural products.</li> </ul>

In addition to the research areas identified above, the group noted that inadequate implementation of existing agricultural legal frameworks, limited value addition technologies, inadequate infrastructure, limited market access, limited access to inputs, and inadequate access to finance and credit facilities are factors that impede crop production in the SADC region. These factors affect the crop production sector as follows:

- **Inadequate implementation of existing agricultural legal framework:** The SADC developed the Regional Agricultural Policy (RAP 2014) aimed at providing a legally binding instrument for regional cooperation in agriculture and natural resources management. However, the implementation of the objectives outlined under the RAP has been inadequate.
- **Value addition technologies:** It was further noted that SADC is promoting the use of appropriate technologies as an adaptation to climate change through the implementation of smart agricultural practices. However, the adoption of value addition technologies is still limited in the region.
- **Infrastructure:** Infrastructure-related limitations that were noted include inadequate transportation, storage, and processing facilities.
- **Market Access:** Limited market access was also highlighted as a significant challenge facing small-scale farmers in the SADC region. This is due to inadequate market information, poor market linkages, and limited access to markets.
- **Limited access to inputs:** Small-scale farmers in the SADC region face challenges in accessing quality inputs such as seeds, fertilizers, and pesticides. This is due to limited availability, high costs, and inadequate distribution systems.

- **Access to finance and credit facilities:** Small-scale farmers in the SADC region face challenges in accessing finance and credit facilities to invest in their farms. This is due to limited availability, high costs, and inadequate financial institutions.

It was noted that addressing these challenges will require a multi-faceted approach that involves improving infrastructure, enhancing market access, promoting the adoption of value addition technologies, and increasing access to inputs, finance, and credit facilities. Additionally, there is a need for effective implementation of existing agricultural legal frameworks to support regional cooperation in agriculture and natural resources management. The proposed solutions are summarized in Table 3.2, below.

**Table 3.2.** Main challenges and proposed solutions for the crops sector.

<b>Challenge</b>	<b>Proposed solutions</b>
Inadequate implementation of existing agricultural legal framework	<ul style="list-style-type: none"> <li>• Engage with different governments to strengthen implementation of agricultural legal framework</li> </ul>
Value addition technologies	<ul style="list-style-type: none"> <li>• Identify crops with potential for value addition.</li> <li>• Support acquisition of equipment for crop value addition.</li> </ul>
Infrastructure	<ul style="list-style-type: none"> <li>• Support establishment of storage facilities.</li> <li>• Establish fertilizer blending facilities</li> </ul>
Market Access	<ul style="list-style-type: none"> <li>• Explore the potential of establishing marketing centers at borders.</li> <li>• Capacity building to farmers for identifying demanded crop.</li> <li>• Encourage formation of farmer cooperatives</li> <li>• Improve Roads networks</li> </ul>
Limited access to inputs	<ul style="list-style-type: none"> <li>• Provision of agricultural inputs subsidy schemes</li> </ul>
Access to finance and credit facilities	<ul style="list-style-type: none"> <li>• Engage government and financial institutions to provide affordable loans (short-, medium-, and long-term).</li> <li>• Create credit facilities.</li> </ul>

### **3.5 Priority Areas of Investment in Research, Development and Learning**

The group made the following key considerations for setting priorities for research in crop production in the SADC region:

- **Sustainable agricultural production:** The SADC RAP aims to enhance sustainable agricultural production, productivity, and competitiveness. Thus, research priorities should



focus on developing sustainable agricultural practices that can improve crop productivity while minimizing the negative impact on the environment.

- **Plant pests and diseases:** Research should focus on developing effective strategies to control pests and diseases both within member states and at transboundary levels.
- **Market access:** There is a need to improve regional and international trade and access to markets for agricultural products. Research priorities should focus on developing crops that are in high demand in the region and internationally, as well as improving market access for crops and their products.
- **Climate change:** The crop sector in the SADC region is facing many challenges because of climate change. Research priorities should focus on developing crops that are more resilient to climate change and developing sustainable agricultural practices that can mitigate the negative impact of climate change on crop production.
- **Capacity building:** Research priorities must focus on developing programs that enhance the capacity of farmers, researchers, and other stakeholders in the agricultural sector.
- **Gender sensitive development:** Research priorities must focus on developing programs that can improve the participation of women, youth and other marginalized groups in the agricultural sector and address inequalities.

Based on the above-mentioned key considerations, the group ranked the research areas and research questions as shown in Table 3.3. The research priority ranks range from 1-6, with one being the highest priority and 6, being the lowest priority.

**Table 3.3.** Ranking of research areas and research questions in the crops sector for SADC

<b>Research Gap (area)</b>	<b>Key research questions or topics</b>
1. Availability of quality and improved seeds (Breeding)	<ol style="list-style-type: none"> <li>1. Breed crop varieties through market demand-led needs</li> <li>2. Breeding for Biofortified and hybrid (millet) varieties with high yielding traits</li> <li>3. Breed varieties tolerant to drought and heat</li> <li>4. Breeding programs for pest and disease resistant varieties</li> <li>5. Breeding and multiplication of underutilized indigenous food plants</li> </ol>
2. Pests and diseases	<ol style="list-style-type: none"> <li>1. Conduct studies to understand pest and disease dynamics in relation to climate change.</li> <li>2. Determine Integrated Pest Management practices packages suitable for specific environmental conditions and specific plants to improve crop production.</li> </ol>

3. Soil fertility and water management	<ol style="list-style-type: none"> <li>1. Identify and evaluate appropriate fertilizer (inorganic and organic) application rates.</li> <li>2. Conduct studies on the best agro-ecology (agroforestry) systems</li> <li>3. Identify water-use efficient systems</li> </ol>
4. Impacts of Climate variation on crop production	<ol style="list-style-type: none"> <li>1. Study the effect of climate variation on the production performance of specific crops.</li> <li>2. Develop early warning systems to support farmers to deal with effect of climate variation</li> </ol>
5. Market access	<ol style="list-style-type: none"> <li>1. Determine barriers to market access and low regional trade in agricultural products.</li> <li>2. Determine most effective models for increasing market access and regional trade in agricultural products.</li> </ol>
6. Limited farmers' knowledge (Capacity building)	<ol style="list-style-type: none"> <li>1. Identify barriers to knowledge and technology transfer between researchers and farmers.</li> <li>2. Identify farmers' capacity needs and gaps.</li> <li>3. Identify effective mechanisms for knowledge dissemination and capacity building.</li> </ol>

In conclusion, it is important that for crops, CCARDESA prioritizes the following areas of research and development in its long-term strategy: availability of quality and improved seeds, pests and diseases, soil fertility and water management, impacts of climate variation on crop production, market access, and capacity building for farmers. These areas are critical for enhancing food security, resilience, and livelihoods of smallholder farmers in the region. By investing in these areas, CCARDESA can contribute to the sustainable development goals and the African Union's Agenda 2063.

## **4.0 RESEARCH, LEARNING AND DEVELOPMENT PRIORITIES FOR FISHERIES AND AQUACULTURE IN SOUTHERN AFRICA**

### **4.1 Background**

Fisheries and aquaculture are two distinct but related concepts. Fisheries are concerned with the catching, processing, and selling of fish or shellfish from the wild. In contrast, aquaculture is the controlled cultivation and harvesting of aquatic populations, including fish, shellfish, and aquatic plants, in freshwater and marine environments. Aquaculture is also known as "fish farming," and it involves the natural or controlled cultivation of aquatic organisms. Fisheries are solely related to catching wild fish or raising and harvesting fish through aquaculture or fish farming. Aquaculture is a science that involves all aspects of marine life, including the production and marketing of shrimps, oysters, and other animals. Another difference between the two is that pearls are products that are only obtained through aquaculture and not through fisheries. While both fisheries and aquaculture are essential to the sustainability of fish and aquatic products, they have different approaches to achieving this goal.

The Southern African Development Community (SADC) region has abundant marine and inland water bodies that support fishing and associated enterprises, with interconnected trade corridors that span the Atlantic and Indian Oceans. These systems are essential for thriving aquatic food systems that benefit over 308 million people in the region. The region's fisheries sector generates a variety of benefits, including food and nutritional security, livelihoods, employment, exports and foreign currency, and biodiversity natural capital assets that are of global significance (SADC, 2022).

Currently, the 16 SADC countries have two large marine ecosystems (LMEs) with rich transboundary fisheries resources, including tuna, hake, squids, octopus, horse mackerel, abalone, shrimps, prawns, and lobsters. The interior land-locked regions are also home to several transboundary lakes, such as Malawi, Kariba, Tanganyika, and the Zambezi Basin, with commercial species including Nile perch, carp, tilapia, Kapenta, and catfish. These natural water bodies supply more than 95% of fish from a diversified capture fisheries sub-sector (notably small-scale artisanal and large-scale industrial), which had been stagnant at around 2.3 million tonnes annually but has recently increased to 3.7 million annually (SADC, 2022).

Despite the resource abundance, the total production of fish in the SADC region is very low, below 4 million tonnes, which is about 3% of global production (SADC FANR, 2019). Aquaculture production

in the SADC region has increased significantly over the last 15 years, with a range of different candidate species produced using several production systems that require different levels of expertise and technology.

Given the increasing demand for fish and fish products, and stagnant and/or declining supply from capture fisheries both regionally and globally, there is significant potential for further growth of the SADC aquaculture sector. In recognition of this potential, the SADC Regional Aquaculture and Action Plan (RASAP) (2016-2026) was developed with the overall goal to increase the contribution by aquaculture to local, national, and regional economic growth and trade.

## **4.2 Status and existing best practices**

The fisheries sector in the SADC region contributes an average of about 2% to the SADC GDP, with total average exports worth about USD 152 million and average imports of USD 100 million. Per capita fish consumption in the region is 11kg per person, which constitutes an average of 16% of the total animal protein intake and 5% of the total protein intake (SADC, 2022; SADC FANR, 2019). The SADC Protocol on Fisheries aims to ensure that levels of fishing effort do not exceed those commensurate with the sustainable use of fish resources. The SADC region has seen an increase in aquaculture production, with Zambia, Malawi, and Zimbabwe leading the way. In 2020, the SADC region reported an increase in aquaculture production to 100,950 metric tons, up from the 92,773 MT produced the previous year (Oirere, 2022). According to Hara et al. (2017) South Africa and Namibia are the largest fish trading nations in the SADC, followed by Mauritius, Tanzania, and Angola. Whereas Namibia and Tanzania are largely exporting countries, South Africa imports nearly 50% of the volume of its exports. Mauritius is the largest importer of fish in the SADC, followed by Angola and South Africa (Hara et al., 2017). Zimbabwe has potential to be the region's biggest fish producer since it holds about 60 % of the dammed water in the region and has the largest freshwater fish farm in Africa (Mapakame, 2019).

## **4.3 Challenges and opportunities**

### *4.3.1 Fisheries*

The fisheries sector in the SADC region faces several challenges that affect its contribution to the economy, food security, and nutrition. Some of the key challenges include limited technical skills and technologies, limited funding, fish diseases, overfishing, negative ecosystem impacts, degradation of critical coastal habitats, climate change, and illegal, unreported, and unregulated (IUU) fishing. The region's demand for fish far outweighs its local production, and the current per capita consumption of

fish in the region is lower than the recommended global per capita consumption. The fisheries sector is vital to the blue economy, and there is a need for countries to work together to address the challenges facing the sector. A detailed description of the key challenges discussed by the group is provided in Table 4.1.

**Table 4.1** Challenges faced by the fisheries sector in SADC countries.

<p><b>Migration of fishers in small-scale fisheries:</b></p> <ul style="list-style-type: none"> <li>• This can lead to conflicts between local fishers and migrant fishers, as well as non-compliance with fisheries regulations.</li> <li>• Additionally, the influx of fishers from other countries can put pressure on local resources and lead to environmental degradation.</li> </ul>
<p><b>Invasive species (weed and animal):</b></p> <ul style="list-style-type: none"> <li>• Invasive species can compete with native fish for food and habitat and can also introduce diseases and parasites.</li> <li>• This can have a negative impact on fish stocks and the livelihoods of fishers who depend on them.</li> </ul>
<p><b>Limited access to markets:</b></p> <ul style="list-style-type: none"> <li>• Small-scale fishers often have difficulty accessing markets, which can limit their income and make it difficult for them to invest in sustainable fishing practices.</li> </ul>
<p><b>Limited value-added products:</b></p> <ul style="list-style-type: none"> <li>• Most fish caught in SADC is exported as raw material, which means that the country is not getting the full economic benefit from its fishery resources.</li> <li>• There is a need to develop more value-added fish products, such as canned fish and fish fillets, to create more jobs and generate more income for the countries.</li> </ul>
<p><b>Overfishing and overcapacity (fishing investment):</b></p> <ul style="list-style-type: none"> <li>• Overfishing is a major problem in many SADC countries.</li> <li>• This is due to several factors, including the use of illegal fishing gear, the lack of enforcement of fisheries regulations, and the increase in fishing capacity.</li> <li>• Overfishing can lead to the depletion of fish stocks and the collapse of fisheries.</li> </ul>
<p><b>Multispecies nature of fisheries:</b></p> <ul style="list-style-type: none"> <li>• Many fisheries in SADC are multispecies, meaning that they target a variety of different fish species.</li> <li>• This can make it difficult to manage fisheries sustainably, as it is important to consider the impact of fishing on all the species in the ecosystem.</li> </ul>
<p><b>Climate change and degradation of the aquatic environment:</b></p> <ul style="list-style-type: none"> <li>• Climate change is having a negative impact on fisheries in SADC, through changes in water temperature, sea level rise, and the increased frequency and intensity of extreme weather events.</li> <li>• Additionally, the degradation of the aquatic environment through pollution and habitat loss is also impacting fish stocks.</li> </ul>
<p><b>Limited decentralization and devolution of power leading to non-compliance with laws and regulations:</b></p> <ul style="list-style-type: none"> <li>• In some SADC countries, there is limited decentralization and devolution of power to local communities.</li> </ul>

<ul style="list-style-type: none"> <li>• This can make it difficult to enforce fisheries regulations and ensure that fishers are complying with the law.</li> </ul>
<p><b>Pollution - water, soil erosion, plastics, sewage systems:</b></p> <ul style="list-style-type: none"> <li>• Pollution from water, soil erosion, plastics, and sewage systems can have a negative impact on fish stocks and the quality of fish products.</li> </ul>
<p><b>Migration of fishers in small-scale fisheries:</b></p> <ul style="list-style-type: none"> <li>• This can lead to conflicts between local fishers and migrant fishers, as well as non-compliance with fisheries regulations.</li> <li>• Additionally, the influx of fishers from other countries can put pressure on local resources and lead to environmental degradation.</li> </ul>

#### 4.3.2 Aquaculture

The aquaculture sector in the SADC region is facing several challenges that affect its contribution to the economy, food security, and nutrition. Some of the key challenges include environmental damages associated with climate change and overfishing, habitat destruction, increased coastal development, and market expansion, and the dramatic effect of climate change on aquaculture markets. The sector is looking for innovative approaches to reduce environmental effects and make fishing more sustainable. The SADC Regional Aquaculture Strategy and Action Plan (2016-2026) identified securing adequate resources as a key challenge upon which the success of the sector depends. Adoption of innovative technologies and best farm management practices is key for boosting aquaculture productivity and profitability. The domestication and implementation of the SADC regional plans, including the Aquaculture Strategy, Aquatic Animal Health Strategy, and Regional Value Chain Priority Action Roadmap, will promote regional cooperation that could lead to greater trade in fish products and help to achieve regional integration. The detailed challenges associated with the aquaculture industry as discussed by the group are provided in Table 4.2.

**Table 4.2.** Challenges of the aquaculture industry in SADC countries

<p><b>Limited number of fish species in aquaculture:</b></p> <ul style="list-style-type: none"> <li>• Most aquaculture in SADC is focused on a small number of fish species, such as catfish, tilapia, and trout.</li> <li>• This lack of diversity makes the sector more vulnerable to shocks, such as disease outbreaks and market fluctuations.</li> </ul>
<p><b>Poor quality of seed (fingerlings):</b></p> <ul style="list-style-type: none"> <li>• The quality of seed (fingerlings) used in aquaculture is often poor.</li> <li>• This can lead to low survival rates and poor growth performance.</li> </ul>
<p><b>Low quality feed:</b></p> <ul style="list-style-type: none"> <li>• The quality of feed used in aquaculture is often low.</li> <li>• This can lead to poor growth performance and increased susceptibility to disease.</li> </ul>

<p><b>Fish diseases and biosecurity:</b></p> <ul style="list-style-type: none"> <li>• Fish diseases are a major challenge for the aquaculture sector in SADC.</li> <li>• This is due to several factors, including the lack of biosecurity measures, the use of poor-quality seed and feed, and the high prevalence of fish diseases in the region.</li> </ul>
<p><b>Limited information on carrying capacity:</b></p> <ul style="list-style-type: none"> <li>• The carrying capacity of many aquaculture systems in SADC is not known.</li> <li>• This can lead to overstocking, which can lead to poor water quality, disease outbreaks, and fish mortalities.</li> </ul>
<p><b>Climate variability and environmental degradation:</b></p> <ul style="list-style-type: none"> <li>• Climate change and environmental degradation are also posing challenges for the aquaculture sector in SADC.</li> <li>• Climate change is leading to more extreme weather events, such as droughts and floods, which can damage aquaculture facilities and infrastructure.</li> <li>• Environmental degradation is leading to the loss of aquaculture habitat and the pollution of water resources.</li> </ul>
<p><b>Pollution - water, soil erosion, plastics, sewage systems:</b></p> <ul style="list-style-type: none"> <li>• Pollution from water, soil erosion, plastics, and sewage systems can have a negative impact on the health of fish and the quality of aquaculture products.</li> </ul>
<p><b>Invasive species:</b></p> <ul style="list-style-type: none"> <li>• Invasive species also pose a challenge for the aquaculture sector in SADC.</li> <li>• Invasive species compete with native fish for food and habitat and introduce diseases and parasites.</li> </ul>

#### 4.4 Main research gaps

##### 4.4.1 Fisheries

Having identified the key challenges of the fisheries sectors in the region, the group identified the key research areas that are necessary to address the challenges, and these are summarized in Table 4.3 below.

**Table 4.3** Main research topics for addressing the challenges in the fisheries sector.

<b>Challenge</b>	<b>Research topics or questions (estimated duration and location)</b>
Overfishing and overcapacity (fishing investment)	<ul style="list-style-type: none"> <li>• Stock assessment studies (3 years, SADC)</li> </ul>
Multispecies nature of fisheries	<ul style="list-style-type: none"> <li>• Understanding the organizational structures of fishing &amp; trading for each priority fisheries in SSF sector (5 yrs)</li> <li>• Stock assessment</li> <li>• Catch Assessment</li> <li>• Gear assessment</li> </ul>
Climate change and degradation of aquatic environment	<ul style="list-style-type: none"> <li>• Determination of socio-ecological drivers of ecosystems changes (Modeling, social studies, fishing pattern studies, resilience studies) (5 years, SADC)</li> </ul>

Limited decentralization and devolution of power leading to non-compliance to laws and regulations	<ul style="list-style-type: none"> <li>• Assessment of power dynamics (3 years, SADC)</li> <li>• Co-managerial studies and community participation</li> </ul>
Pollution – water, soil erosion, plastics, sewage systems	<ul style="list-style-type: none"> <li>• Environmental and social Impact assessment</li> <li>• Water body carrying capacity.</li> <li>• Zonation of critical habitats (3 years, SADC)</li> </ul>
Migration of fishers in small-scale fisheries (conflicts, in-compliance, environmental degradation)	<ul style="list-style-type: none"> <li>• Impacts of migration on fisheries and governance processes (3 years, SADC)</li> </ul>
Invasive species (weed and animal)	<ul style="list-style-type: none"> <li>• Impacts of invasive species on biodiversity, economy &amp; livelihoods (3 years, SADC)</li> </ul>
Limited access to markets	<ul style="list-style-type: none"> <li>• Needs assessment for improved fish quality, marketing &amp; distribution networks.</li> <li>• Value chain studies (production to consumption)</li> </ul>
Limited value-added products	<ul style="list-style-type: none"> <li>• Fisheries certification and eco-labelling of specific fisheries</li> <li>• Integrated action research through engagement of private sector</li> </ul>

#### 4.4.2 Aquaculture

Likewise, the research questions for addressing key challenges for the aquaculture sector are summarized in Table 4.4 below.

**Table 4.4** Main research questions for addressing challenges of the aquaculture sector.

<b>Challenges</b>	<b>Research topics or questions (estimated duration and location)</b>
Limited number of fish species in aquaculture	<ul style="list-style-type: none"> <li>• Research on suitability of indigenous fish species for aquaculture (5 years, SADC)</li> </ul>
Poor quality of seed (fingerlings)	<ul style="list-style-type: none"> <li>• Genetic Improvement Programmes, targeting growth parameters (10 years, Malawi, Zambia, Mozambique, South Africa)</li> </ul>
Low quality feed	<ul style="list-style-type: none"> <li>• Alternative protein source for fish feed</li> <li>• Formulation of fish feed (5 years, SADC)</li> </ul>
Fish diseases and biosecurity	<ul style="list-style-type: none"> <li>• Studies on fish diseases and risk management</li> <li>• Mapping/zonation</li> <li>• Biosecurity studies on cultured fish species (2 years, SADC)</li> <li>• Genetic Improvement Programmes for disease resistance (10 years)</li> </ul>



Limited information on carrying capacity	<ul style="list-style-type: none"> <li>• Carrying capacity studies for water bodies (2 years, SADC)</li> <li>• Mapping suitable areas for water-based aquaculture (2 years, SADC)</li> </ul>
Climate variability and environmental degradation	<ul style="list-style-type: none"> <li>• Impacts of climate change and climate variability on aquatic biodiversity (5 years, SADC)</li> <li>• Resilience and adaptation studies</li> </ul>
Pollution – water, soil erosion, plastics, sewage systems	<ul style="list-style-type: none"> <li>• Water quality studies (5 years, SADC)</li> <li>• Carrying capacity studies for water bodies (2 years, SADC)</li> <li>• Mapping suitable areas for water-based aquaculture (2 years, SADC)</li> </ul>
Invasive species	<ul style="list-style-type: none"> <li>• Mapping and impact assessment on aquatic biodiversity (3 years, SADC)</li> <li>• Alternative uses of invasive species</li> <li>• Genetic Improvement Programmes (GIP)</li> </ul>

## 4.5 Priority areas of investment in Research, Development and Learning

### 4.5.1 Fisheries

It was determined that research on fisheries in the SADC region should prioritize the following areas: overfishing and overcapacity, multispecies nature of fisheries, water pollution, limited access to markets, and invasive species.

Overfishing and overcapacity are major challenges facing the fisheries sector in the region, and research should focus on developing effective management strategies to ensure the long-term productivity of fisheries.

The multispecies nature of fisheries in the region requires a holistic approach to management that considers the different types of gear and levels of fishing effort.

Water pollution is a growing concern that threatens the health of aquatic ecosystems and the sustainability of fisheries.

Limited access to markets is a major constraint for small-scale fishers, and research should focus on developing value chains and improving market access.

Invasive species are a threat to the biodiversity of aquatic ecosystems and the sustainability of fisheries, and research should focus on developing effective control measures.

By prioritizing research in these areas, the SADC region can ensure the long-term sustainability of its fisheries and the benefits they provide to local communities and the global economy. Table 4.5 presents

the research questions for the fisheries sector ranked in order of priority, starting with those of highest priority. Research areas are in columns and the research questions are in the rows.

**Table 4.5** Priorities for research on fisheries in the SADC region.

	<b>Research Area Rank 1</b>	<b>Research Area Rank 2</b>	<b>Research Area Rank 3</b>	<b>Research Area Rank 4</b>	<b>Research Area Rank 5</b>
	Overfishing and overcapacity	Multispecies Nature of fisheries in SADC	Water Pollution	Limited access to markets	Invasive species
Research Topic Rank 1	Stock assessment studies	Stock assessments	Marine/freshwater Spatial Planning (MSP)/zonation	Assessment for improved fish quality, marketing & distribution networks	Impacts of invasive species on biodiversity, economy & livelihoods
Research Topic Rank 2	Alternative livelihoods e.g., water-based aquaculture	Organization of Fishing and trading in different fisheries	Water body Carrying capacity for fish and aquatic plants.	Value addition of fish and fishery products	Alternative use of invasive species
Research Topic Rank 3	Value addition of fish and fishery products	Catch Assessments	Environmental and social Impact assessments	Certification and eco-labelling of fish and fishery products	
<b>Total Budget</b>	USD 60M	USD 30M	USD 25M	USD 80M	USD 20M

#### 4.5.2 Aquaculture

It was determined that research on aquaculture in the SADC region should prioritize the following areas: feed and nutrition, breeding and reproduction, fish disease and biosecurity, climate change, and introductions/translocations.

Improving feed and nutrition is essential for producing healthy fish, reducing environmental impacts, and providing nutritious seafood. Breeding and reproduction research can help improve the genetics of farmed fish, leading to better growth rates, disease resistance, and other desirable traits.

Fish disease and biosecurity research is necessary to prevent and control disease outbreaks, which can have devastating effects on aquaculture production.

Climate change is a growing concern that threatens the sustainability of aquaculture, and research should focus on developing adaptation and mitigation strategies.

Finally, introductions/translocations research is necessary to prevent the spread of invasive species, which can have negative impacts on aquatic ecosystems and aquaculture production.

By prioritizing research in these areas, the SADC region can ensure the long-term sustainability of its aquaculture industry and the benefits it provides to local communities and the global economy. Table 4.6 presents the research questions for the aquaculture sector ranked in order of priority, starting with those of highest priority. Research areas are in columns and the research questions are in the rows.

**Table 4.6** Priorities for research in aquaculture in the SADC region.

	<b>Research Area Rank 1</b>	<b>Research Area Rank 2</b>	<b>Research Area Rank 3</b>	<b>Research Area Rank 4</b>	<b>Research Area Rank 5</b>
	Feed and Nutrition	Breeding and reproduction	Fish disease and biosecurity	Climate change	Introductions/translocation
Research Topic Rank 1	Alternative sources of protein in fish feed	Genetic improvement programmes – growth and nutrition indices	Studies on fish diseases and risk management	Impacts of climate change on aquatic biodiversity	Genetic Improvement Programme
Research Topic Rank 2	Cost – benefit analysis of feeding regimes in different production systems	<i>In situ</i> conservation of the indigenous fish species (MPA) or <i>in situ</i> gene banks	Mapping/zonation	Resilience and adaptation studies	Mapping and impact assessment
Research Topic Rank 3			Biosecurity studies on cultured fish species	New culturable aquatic species (temperature and pollution)	Alternative uses of invasive species

Research Topic Rank 4			Genetic Improvement Programmes for disease resistance		
<b>Total Budget</b>	USD10 million	USD30 million	USD35 million	USD15 million	USD10 million

## **5.0 RESEARCH, LEARNING AND DEVELOPMENT PRIORITIES FOR FORESTRY IN SOUTHERN AFRICA**

### **5.1 Background**

Forests are important for the SADC region, which has 41% of its land area covered by natural forests. These forests provide many benefits, such as timber, non-timber products, wood energy, wildlife habitat, tourism income, and ecological services. They also support the livelihoods and well-being of most rural people in the SADC region. However, forests and rangelands are vulnerable to climate change and need to be adapted to its impacts. The SADC Climate Change Strategy and Action Plan is a regional framework that aims to enhance the adaptation of key sectors, including forestry, to climate change. The forestry sector also contributes to economic development, employment, and food security in the region.

Climate change affects the agricultural sector in the SADC region in various ways. It reduces and alters the rainfall patterns that the sector depends on, making it harder to plan and manage crops and livestock. It also increases the risks of droughts, floods, pests, and diseases that can damage or destroy agricultural production. The forestry sector, on the other hand, contributes to the region's economy, employment, food security, and human well-being in many ways. It provides timber and non-timber products, wood energy, and tourism revenue. It also helps to mitigate climate change by storing carbon and conserving forest ecosystems. Therefore, sustainable forest management is essential for the region's environmental, social, and economic well-being.

Industrial forest plantations and natural forests are the main sources of wood in southern Africa. Most countries in the region inherited these plantations from colonial administrations, who established them to meet the demand for industrial timber, create jobs and protect natural forests from overexploitation. However, some countries still have large areas of natural forests that can be used for commercial purposes. These include the Democratic Republic of Congo (DRC), Angola, Mozambique, Tanzania, and Madagascar.

### **5.2 Status and existing best practices**

The forestry sector in the Southern African Development Community (SADC) region plays a vital role in providing ecosystem services, mitigating climate change, and supporting the livelihoods of millions of people. However, the sector faces many challenges, such as deforestation, forest degradation, forest fires, illegal logging, and trade barriers. To address these challenges, the SADC adopted the Protocol

on Forestry in 2002, which provides a comprehensive policy framework for sustainable forest management and regional cooperation. The protocol aims to promote the development, conservation, utilisation, and trade on forest resources, while respecting the rights and interests of local communities and future generations. The protocol also supports the implementation of three regional forestry programs: the Regional Cross-border Fire Management Programme, the SADC Support Programme on Reducing Emissions from Deforestation and Forest Degradation (REDD+), and the SADC Regional Forest Law Enforcement, Governance and Trade (FLEGT) Programme. These programs aim to reduce the incidence and impact of uncontrolled forest fires, enhance the capacities of member states to participate in REDD+ initiatives, and improve the governance and legality of forest products in the region. The performance of the forestry sector in the SADC region depends on the effective implementation of these programs and the protocol, as well as on the coordination and collaboration among various stakeholders at national and regional levels.

The group identified the following five areas as key components of the forestry sector in the SADC region:

- Plantation Forests (PFs)
- Non-timber Forest Products (NTFPs)
- Forest Ecosystem Services (FES)
- Agroforestry (Agroecology)
- Natural Forests and Woodlands (NFAWs).

A description of each of these key areas follows.

#### *5.2.1 Plantation forests*

Plantation forests are a type of forest that is planted and managed for commercial purposes, such as timber, pulp, paper, and tannin. In the SADC region, plantation forests cover about 2.3 million hectares, which is only 1.5% of the total forest area. Most of the plantation forests are in South Africa, followed by Swaziland and Lesotho. The main species planted are *Pinus*, *Eucalyptus*, *Acacia* and *Cupressus*.

Plantation forests contribute to the region's economy by providing employment, income, foreign exchange, and raw materials for various industries. According to FAO (2001), the value of wood products from plantation forests in the SADC region was estimated at US\$ 2.8 billion in 1998,

representing 0.7% of the region's GDP. Plantation forests also provide environmental benefits, such as carbon sequestration, soil conservation and biodiversity conservation.

However, plantation forests face several challenges in the SADC region, such as land degradation, deforestation, fire, pests and diseases, climate change and competition with other land uses. To address these challenges, the SADC countries adopted the Protocol on Forestry in 2002, which provides a policy framework for sustainable forest management in the region. The protocol aims to promote cooperation, coordination and harmonization of policies and strategies among the SADC countries on issues related to forest conservation, utilization, and trade.

### *5.2.2 Non-timber forest products*

Non-timber forest products (NTFPs) are goods and services derived from forests that do not involve the harvesting of timber. They include food, medicine, fuel, fibre, handicrafts, ecotourism, and cultural values. NTFPs play a significant role in the livelihoods and economies of the Southern African Development Community (SADC) region, which comprises 16 countries with diverse ecological and socio-economic conditions. According to a recent study by the Food and Agriculture Organization (FAO), the annual value of NTFPs in the SADC region is estimated at US\$ 2.3 billion, accounting for about 2.4% of the region's gross domestic product (GDP). NTFPs contribute to food security, income generation, employment creation, poverty alleviation, biodiversity conservation and climate change adaptation in the region. However, NTFPs face several challenges such as unsustainable harvesting, lack of market access, weak governance and policy frameworks, and inadequate research and development. To address these challenges, the SADC Secretariat has developed a regional strategy and action plan for NTFPs, which aims to promote the sustainable management and utilization of NTFPs for socio-economic development and environmental protection in the region.

### *5.2.3 Forest Ecosystem Services*

Forest ecosystem services are essential for the well-being and development of the SADC region. Forests provide multiple benefits such as carbon sequestration, soil conservation, water regulation, biodiversity protection, and livelihood support. According to the SADC Protocol on Forestry, forests and forestry products contribute to the basic needs of many communities across the region, as well as to the mitigation of climate change impacts. However, forests in the SADC region are under threat from various drivers of deforestation and degradation, such as agricultural expansion, fire, illegal logging, mining, and urbanization. These drivers reduce the capacity of forests to deliver ecosystem services and affect the regional economy. The SADC region has developed several strategies and

programmes to promote sustainable forest management and enhance regional cooperation on forest-related issues. Some of these include the Regional Cross-border Fire Management Programme, the SADC Support Programme on Reducing Emissions from Deforestation and Forest Degradation (REDD+), and the SADC Regional Forest law Enforcement, Governance and Trade (FLEGT) Programme. These initiatives aim to improve forest governance, increase forest resilience, facilitate legal trade in forest products, and generate income from forest conservation. The SADC region also recognizes the inter-linkages between forests and other sectors, such as water, agriculture, energy, biodiversity, and infrastructure. Therefore, it has adopted a cross-sectoral approach to integrate forest ecosystem services into regional development plans. By doing so, the SADC region hopes to achieve its vision of a common future that is based on the sustainable use of natural resources.

#### *5.2.4 Agroforestry*

Agroforestry is a land use system that integrates trees, crops, and livestock on the same plot of land. It is widely practiced by smallholders in the SADC region, where it contributes to the region's economy in various ways. Agroforestry can potentially improve smallholders' income, increase food security, promote gender equality, and stimulate cultural activities in rural areas. Furthermore, agroforestry can enhance ecosystem services through improved soil structure, increased carbon sequestration and higher water retention. Agroforestry also plays a role in the SADC Strategy for Great Green Wall Initiative, which aims to address drought management, natural resource management, sustainability of rural production systems and diversification of economic activities. However, the status of agroforestry in the SADC region faces some challenges, such as lack of supportive policies, inadequate extension services, limited access to markets and inputs, and climate change impacts. Therefore, there is a need to strengthen the enabling environment for agroforestry development and adoption in the region, as well as to monitor and evaluate its socio-economic and environmental benefits.

#### *5.2.4 Natural Forests and Woodlands*

Natural forests and woodlands cover about 40% of the total land area of the Southern African Development Community (SADC) region, which comprises 16 countries. They provide a variety of ecosystem services and products that support the livelihoods and well-being of millions of people, such as fuel, food, medicine, shelter, fodder, timber, and non-timber forest products. They also host a rich biodiversity of animals and plants, some of which are endangered or endemic, and attract tourists from all over the world. Moreover, they play a vital role in mitigating the effects of climate change by retaining carbon and harnessing soils.



The SADC region has different types of natural forests and woodlands, such as Miombo, Mopane, Acacia, Zambezi teak, Montane and tropical moist forests, and mangroves. Each of these has its own characteristics, challenges and opportunities for conservation and sustainable use. The SADC Protocol on Forestry (2002) provides a policy framework for regional cooperation and harmonization of forest management practices, laws, education, trade, and research. The SADC also supports several programmes and projects to address cross-cutting issues such as forest fires, illegal trade, deforestation, and degradation.

The contribution of natural forests and woodlands to the SADC region's economy is difficult to quantify due to data limitations and methodological challenges. However, some estimates suggest that the direct value of forest products in the region is around US\$ 2.3 billion per year, while the indirect value of ecosystem services is much higher. The forest sector also provides employment for about 7 million people in the region. However, these benefits are threatened by various factors such as population growth, urbanization, land use change, poverty, civil unrest, climate change and invasive species. Therefore, there is a need for more investment, innovation, and collaboration to ensure the long-term conservation and sustainable use of natural forests and woodlands in the SADC region.

### **5.3 Challenges and opportunities**

The forestry sector in southern Africa faces many challenges and opportunities in the context of climate change, socio-economic development, and environmental sustainability. Some of the main challenges include deforestation, land degradation, forest fires, illegal logging, pests and diseases, and lack of access to markets and finance. Some of the main opportunities include increasing demand for wood products, carbon sequestration, biodiversity conservation, ecotourism, and community empowerment. The forestry sector needs to adopt innovative and adaptive strategies to overcome the challenges and seize the opportunities, such as promoting sustainable forest management, enhancing forest governance, diversifying forest products and services, strengthening value chains and partnerships, and investing in research and capacity building. The challenges associated with each of the five subsectors of forestry are depicted in Table 5.1 below.

**Table 5.1.** Challenges facing forestry sector in southern Africa.

<p><b>Non-timber forest Products:</b></p> <ul style="list-style-type: none"> <li>• Limited baseline data on the NTFP resource base</li> <li>• Limited data on the the economic value chain and the flow value of what is harvested.</li> <li>• Unknown rates of extraction and regeneration of stock</li> <li>• Limited knowledge on the potential for domestication</li> <li>• Threats to the NTFPs</li> </ul>
<p><b>Agriculture and Forestry interface:</b></p> <ul style="list-style-type: none"> <li>• Unsustainable land management</li> <li>• Limited knowledge on agroecology</li> <li>• Open land tenure, resulting in poor common property resource management</li> </ul>
<p><b>Forest Ecosystem Services:</b></p> <ul style="list-style-type: none"> <li>• Limited incentives for sustainable forest management</li> <li>• Limited quantification of carbon sequestration by forests</li> <li>• Inadequate implementation of carbon trading initiatives</li> </ul>
<p><b>Plantation forests:</b></p> <ul style="list-style-type: none"> <li>• Limited management of existing plantations</li> <li>• Low valorization of plantation resources/products</li> <li>• Low investment in new plantation</li> </ul>

#### 5.4 Main Research Gaps

The following key research gaps were identified for the Forestry Sector.

**Table 5.2** Key research questions for the forestry sector in SADC.

<p><b>Non-Timber Forest Products:</b></p> <ul style="list-style-type: none"> <li>• What is the NTFPs resource base (resource surveys, mapping)?</li> <li>• What are the economic and the flow values of the products harvested?</li> <li>• What is the rate of extraction and regeneration of stock?</li> <li>• What are the opportunities for domestication of NTFPs?</li> <li>• What are the threats to NTFPs?</li> <li>• What are available Methodologies and Protocols?</li> <li>• What are the Flowering and Fruiting Periods (phenology) of the different species?</li> </ul>
<p><b>Agriculture and Forestry interface:</b></p> <ul style="list-style-type: none"> <li>• What is the extent of unsustainable land management in the agriculture and forestry nexus/interface (crops, livestock, trees, water, etc.)?</li> <li>• What are the drivers of unsustainable land management in different contexts?</li> <li>• What are the existing knowledge and technologies/practices of the Food systems and agroecology?</li> <li>• What are the land tenure institutional arrangements and the associated challenges?</li> <li>• What are the current and potential benefits to communities from CPR?</li> </ul>
<p><b>Forest Ecosystem Services:</b></p>

- What are the quantities of Carbon sequestration/accumulation of the different forest types?
- What are the allometric & growth models for different vegetation types or landscapes?
- How can we structure benefit sharing mechanisms for carbon trading (e.g., skills development, capacity building, business growth, etc.)

**Plantation forests:**

- What are the current management challenges and potential solution to existing plantations?
- What are current investment and potential capacities/levels in new plantation?
- What is the status (quantity, value, etc.) of the existing plantation resources (government parastatal, private, and community)?

### **5.5 Priority areas of investment in Research, Development and Learning**

Forestry research is essential for addressing the challenges and opportunities of sustainable forest management in the region. However, the resources and capacities for conducting such research are limited, and therefore it is important to prioritize the most relevant and feasible research areas. To prioritize the research questions under the forestry sector, four key issues were considered: impact of the research on communities and human livelihoods, impact on the environment, available information on the research areas, and potential duration of the research projects.

Impact on communities and human livelihoods refers to how the research outcomes can benefit or harm the people who depend on forests for their well-being, income, and culture. Research that could enhance the social and economic benefits of forests, reduce poverty and inequality, and promote participatory and inclusive governance was prioritized. Impact on the environment refers to how the research can contribute to the conservation and restoration of forest ecosystems, biodiversity, and ecosystem services. Research that would address the threats of deforestation, degradation, climate change, and invasive species was prioritized. Available information on the research areas refers to how much existing knowledge and data are available to support the research questions and methods. Research that would build on or fill the gaps in the current state of knowledge was prioritized. Potential duration of research projects refers to how long it will take to complete the research and deliver the expected results. Research that could be completed within a reasonable time frame and with a realistic budget was prioritized.

Based on the criteria set above, the group were able to prioritize the research as shown in Table 5.2, below.

**Table 5.2.** Research priorities for the Forestry sector in the SADC region. Both the research areas and the research questions are arranged in order of priority, starting from those of the highest priority to those of the lowest priority.

<p><b>Non-Timber Forest Products:</b></p> <ul style="list-style-type: none"> <li>• What is the NTFPs resource base (resource surveys, mapping)?</li> <li>• What are the economic and the flow values of the products harvested?</li> <li>• What is the rate of extraction (and regeneration stock)?</li> <li>• What are the Threats of the NTFPs?</li> <li>• What are the opportunities for domestication?</li> <li>• What are available Methodologies and Protocols (Stock Mapping)?</li> <li>• What are the Flowering and Fruiting Periods (PHENOLOGY) of the different Species and Subspecies?</li> </ul>
<p><b>Agroforestry:</b></p> <ul style="list-style-type: none"> <li>• What are the existing appropriate agroforestry practices and technologies for smallholder farmers (traditional and contemporary technologies)?</li> <li>• What are the suitable fodder tree species and management practices/technologies for livestock production?</li> <li>• What are the relevant multipurpose tree species for apiculture and aquaculture?</li> <li>• What are the suitable tree species and management practices/technologies for soil restoration (fertility, etc.), and crop production?</li> <li>• What are the appropriate models that can be co-created/co-produced and implemented that integrate trees, crops, animals, aquaculture, and apiculture to enhance ecosystem sustainability and community livelihoods?</li> </ul>
<p><b>Plantation forests:</b></p> <ul style="list-style-type: none"> <li>• What are the current management challenges and potential solutions to existing plantations?</li> <li>• What are current investment and potential capacities/levels in new plantations?</li> <li>• What is the status (quantity, value, etc.) of the existing plantation resources (government parastatal, private, and community)?</li> </ul>
<p><b>Sustainable Forest Management: Carbon Trading and Storage:</b></p> <ul style="list-style-type: none"> <li>• What are the forest Carbon credit and market/ carbon trading protocols especially in the following: <ul style="list-style-type: none"> <li>○ Research in quantification of Carbon sequestration and storage; allometric &amp; growth models for different vegetation types or landscapes.</li> <li>○ Emission factors, negotiating agreements, Structuring benefit sharing mechanisms (skills, capacity, business growth, etc.)</li> </ul> </li> </ul>

In conclusion, the forestry sector in the SADC region faces many challenges and opportunities that require more research and innovation. Among the most urgent and relevant topics are the unsustainable use of non-timber forest products, which threatens the livelihoods and biodiversity of many communities; the agriculture and forestry interface, which offers potential solutions for enhancing food

security, climate resilience and ecosystem services through agroforestry and/or agroecology; forest ecosystem services and sustainable forest management, which are essential for maintaining the environmental and socio-economic benefits of forests; and plantation forests, which can provide alternative sources of wood and fibre while reducing pressure on natural forests. These are the main priorities that CCARDESA should consider in its long-term strategy, as they reflect the needs and aspirations of the SADC countries and their people.

## **6.0 RESEARCH, LEARNING AND DEVELOPMENT PRIORITIES FOR LIVESTOCK IN SOUTHERN AFRICA**

### **6.1 Background**

The livestock sector is a vital component of the economy and food security of the Southern African Development Community (SADC) region. Livestock production contributes to the livelihoods of millions of people in the region, providing income, employment, draught power, manure, social security, and insurance. According to SADC (2022), livestock constitutes an important natural resource for the region, with over 60% of the region's total land area suitable for livestock farming. The region has a rich and diverse livestock population, estimated at 64 million cattle, 39 million sheep, 38 million goats, 7 million pigs, 1 million horses and 380 million poultry (SADC, 2022). These animals are a source of food, skins, fertiliser, traction power, medicine, and other raw materials for the population of the region. However, the livestock sector faces many challenges, such as low productivity, animal diseases, poor market access, lack of infrastructure and information, and climate change. SADC has been implementing various programmes and policies to address these challenges and promote regional integration and trade in the livestock sector.

Livestock production in Africa, especially in the SADC region, is a key research area that aims to enhance sustainability, productivity, and livelihoods. African livestock contributes about 40% of agricultural GDP and constitutes about one-third of the global livestock population, with variations across countries (Balehegn et al., 2021). As the demand for animal-source food (ASF) grows due to population growth, increased incomes, and urbanization in sub-Saharan Africa (SSA), livestock production faces the challenges of food security and climate change, as well as social and economic issues. Therefore, livestock research priorities should focus on new technologies to improve animal health, micro-enterprise funding to add value to livestock products, and market information systems for small-scale farmers (Meltzer, 1995). For example, a study in South Africa revealed that communal livestock farmers needed education and training on animal health and zoonoses (Ngoshe, 2023). Thus, research can support animal agriculture by enhancing livestock productivity and resource efficiency.

### **6.2 Status and existing best practices**

Approximately 100 million people, or nearly half of the region's total population of 235 million, depend on livestock, and the sector contributes up to 40% of agricultural GDP (SADC AIMS, 2023).

However, most SADC countries have not been able to unlock the full potential of their livestock resources due to challenges that constrain access to markets and trade opportunities. These challenges include the presence of trade-sensitive transboundary diseases, weak and under-resourced veterinary services, and lack of appropriate policy and regulatory frameworks (FAO, 2023).

Research on livestock sustainability in Africa has highlighted the need for sustainable livestock production that addresses food security, climate change concerns, social, and economic aspects simultaneously (Balehegn et al., 2021). Indigenous cattle genetic resources play a significant role in livelihood, food, and nutrition security in the SADC region (Mapiye et al., 2020).

The SADC Livestock Unit is working to address some of the key challenges faced by the SADC livestock sector and to unlock the full potential of the region's livestock resources. For example, SADC has implemented various regional programmes and projects, such as the Promotion of Regional Integration (PRINT) in the livestock sector, the Trans-boundary Animal Diseases (TADs) Project, and the Foot and Mouth Disease (FMD) Programme. Moreover, SADC has developed a Livestock Management System (LIMS) to capture and analyse livestock information from different Member States (SADC, 2022). Furthermore, SADC has collaborated with other regional organizations, such as COMESA and ECA, to promote livestock value chains and climate-smart livestock interventions (Svirunai et al., 2023). These initiatives aim to enhance the competitiveness and resilience of the livestock sector in the SADC region.

The group noted that the scope of livestock research needs to be extended to cover pigs, bees, ostriches, rabbits and donkeys. This is in addition to cattle (beef and dairy), sheep, goats, and poultry (broilers and egg layers), which were the previously prioritized in CCARDESA activities.

The group further identified that the following six areas of intervention are still relevant for the livestock sector:

- Animal Breeding
- Marketing
- Agro-Processing
- Pest & Disease Control
- Rangeland & Water Resources Management
- Animal Feeding & Nutrition

### *6.2.1 Animal breeding*

Animal breeding is a key component of improving livestock productivity and resilience to climate change, as well as reducing greenhouse gas emissions intensity. However, the livestock sector in the SADC region faces many challenges that hinder its potential for growth and trade. These include the presence of transboundary animal diseases, weak veterinary services and policy frameworks, lack of value chain development and technical expertise, and low genetic diversity and performance of local breeds. Animal breeding research in the SADC region aims to address these challenges by developing relevant genetic parameters and selection indices for different livestock species, such as cattle, sheep, goats, pigs, and poultry. The research also involves the conservation and utilization of farm animal genetic resources, which are rich and diverse in the region. The research is supported by regional initiatives such as the Promotion of Regional Integration (PRINT) project, the SADC Trans-boundary Animal Diseases (TADs) project, and the SADC Foot and Mouth Disease (FMD) programme. These initiatives seek to enhance regional cooperation and integration in the livestock sector, as well as to improve animal health and food safety standards.

### *6.2.2 Marketing*

The livestock sector faces several challenges, such as low productivity, high disease burden, limited market access and weak policy support. To address these challenges, there is a need for evidence-based marketing and trade research that can inform policy and practice in the livestock sector. Such research can help identify the opportunities and constraints for enhancing the competitiveness and profitability of the sector, as well as the potential impacts of regional integration and trade liberalization on the livestock value chains. The SADC Secretariat, in collaboration with various stakeholders, has initiated several initiatives to promote marketing and trade research for the livestock sector in the region. These include the establishment of a regional livestock policy forum, the development of a regional livestock strategy, the implementation of a regional livestock information system, and the facilitation of regional livestock trade platforms. These initiatives aim to foster dialogue, coordination, and collaboration among the relevant actors in the livestock sector, and to generate and disseminate relevant knowledge and information for policy and decision making.

### *6.2.3 Agro-processing*

The livestock sector faces several challenges, such as low productivity, high post-harvest losses, limited market access and environmental degradation. Agro-processing research is a key strategy to address these challenges and enhance the value addition and competitiveness of the livestock products.



Agro-processing research for the livestock sector in the SADC region covers various aspects, such as animal nutrition, health and welfare, product development and quality, processing technologies and equipment, waste management and bioenergy production. The status of agro-processing research for the livestock sector in the SADC region is varied, depending on the country, commodity and institution involved. Some of the achievements include the development of novel products from dairy, meat and poultry, such as yoghurt, cheese, sausages and nuggets; the improvement of processing efficiency and safety through the use of solar dryers, biogas digesters and rapid detection methods; and the promotion of inclusive and sustainable value chains through participatory approaches and policy support. However, there are also gaps and challenges that need to be addressed, such as the lack of coordination and collaboration among stakeholders, the inadequate funding and infrastructure for research and innovation, the low adoption and dissemination of research outputs and the weak linkages with the private sector and consumers. Therefore, there is a need to strengthen the agro-processing research for the livestock sector in the SADC region by enhancing the capacity and networking of researchers, fostering multi-stakeholder partnerships and innovation platforms, increasing investment and incentives for research and development, improving communication and advocacy for policy influence, and scaling up and out of successful technologies and practices.

#### *6.2.4 Pest and Disease control*

Pest and disease control is a crucial aspect of livestock production in the SADC region, as it affects food security, trade and economic growth. According to the SADC Livestock Unit, some of the major challenges in this sector include low productivity, lack of efficient and effective animal disease control, lack of marketing infrastructure, poor market access of livestock products, and lack of availability of information. Some of the trade-sensitive transboundary diseases that pose a threat to the livestock sector are foot and mouth disease (FMD), peste des petits ruminants (PPR), highly pathogenic avian influenza (HPAI), among others. These diseases require concerted regional efforts to prevent entry, control spread and manage them in accordance with the OIE principles of zoning and compartmentalization. The FAO has been supporting the SADC region to strengthen national and regional capacities to deal with these priority plant pests and diseases through the STOSAR project. The project also conducted baseline surveys and assessments on the national status of Sanitary and Phytosanitary (SPS) capacities in the target countries, to identify gaps and constraints within the five technical sectors for SADC (plant and animal health, food safety, fisheries, and forestry). The project aims to enhance food and nutrition security and agricultural productivity in the SADC region by improving SPS systems and facilitating trade.

### *6.2.5 Rangelands and water resources management*

The SADC region is home to some of the most extensive rangelands in the world, which play a vital role in the livestock sector. However, rangelands and water resources in the region are under increasing pressure from climate change, population growth, and economic development. The rangelands are characterized by high variability in rainfall and temperature, which makes them fragile ecosystems. Overgrazing, poor management practices, and climate change have led to widespread degradation of rangelands in the region. This has resulted in a decline in forage production, increased soil erosion, and reduced biodiversity. Water resources in the SADC region are also limited and variable. Climate change is exacerbating water scarcity in the region, with more frequent and severe droughts. This is putting increasing pressure on water resources for livestock production, as well as other human and environmental needs.

Despite the challenges facing rangelands and water resources in the SADC region, there is a growing body of research on sustainable rangeland and water resources management for the livestock sector. This research is being conducted by a range of stakeholders, including universities, research institutes, government agencies, and non-governmental organizations. Some of the key areas of research include:

- **Improved grazing management practices:** This includes research on developing and implementing sustainable grazing systems that can improve forage production, reduce soil erosion, and protect biodiversity.
- **Drought-resistant and salt-tolerant forage species:** This research is aimed at developing and identifying forage species that can withstand the harsh climatic conditions in the SADC region.
- **Water harvesting and storage technologies:** This research is focused on developing and implementing technologies to harvest and store rainwater for livestock use.
- **Livestock-water productivity:** This research aims to improve the efficiency of water use in livestock production.

One of the key challenges facing rangelands and water resources management research in the SADC region is the lack of funding. Governments in the region are often faced with competing priorities, and research funding is often limited. Another challenge is the lack of coordination between researchers and stakeholders. This can lead to duplication of effort and missed opportunities for collaboration. Despite the challenges, there is a growing awareness of the importance of rangelands and water resources management research for the livestock sector in the SADC region. There is a need for

increased investment in research, as well as better coordination and collaboration between researchers and stakeholders.

#### *6.2.6 Animal feeding and nutrition*

Animal feeding and nutrition research in the SADC region has made significant progress in recent years, but there are still several challenges that need to be addressed. Some of the key areas of research include:

- **Development of sustainable and affordable feed resources:** The SADC region is facing several challenges in terms of feed production and availability, including climate change, land degradation, and population growth. Research is needed to develop new and sustainable feed resources, such as improved pasture management, crop residues, and alternative feed ingredients.
- **Improving the nutritional value of feeds:** The nutritional value of feeds in the SADC region is often low, which can lead to animal health problems and reduced productivity. Research is needed to develop methods for improving the nutritional value of feeds, such as through supplementation and fermentation.
- **Reducing feed costs:** Feed costs are a major input cost for livestock producers in the SADC region. Research is needed to develop strategies for reducing feed costs, such as improved feed management and the use of locally available feed resources.
- **Improving animal health and productivity:** Animal health and productivity are closely linked to nutrition. Research is needed to develop feeding and nutrition strategies that can help to improve animal health and productivity, particularly in smallholder farming systems.

### **6.3 Challenges and opportunities**

The livestock sector in the SADC region faces a number of challenges, including the predominance of smallholder farmers, the generally low productivity of indigenous livestock breeds, the prevalence of tropical animal pests and diseases, the low income of consumers, the low use of external inputs, the low level of inter-regional trade, the lack of infrastructure to support production, the low level of adaptive research, the lack of accurate livestock statistics, recurring drought, and the inadequate review of available research findings (Table 6.1).

These challenges can have a significant impact on the productivity and profitability of the livestock sector, as well as the food security and nutrition of the region's population. For example, the predominance of smallholder farmers can make it difficult to access land, capital, and resources, which can limit investment in improved livestock production practices. The generally low productivity of indigenous livestock breeds can reduce the profitability of livestock farming, while the prevalence of tropical animal pests and diseases can lead to losses in livestock productivity and mortality. The low income of consumers can limit the demand for livestock products, while the low use of external inputs can limit livestock productivity.

In addition, the low level of inter-regional trade can limit market opportunities for livestock producers, while the lack of infrastructure to support production can make it difficult for livestock producers to access markets, inputs, and services. The low level of adaptive research can limit the development of new and innovative solutions to the challenges facing the livestock sector, while the lack of accurate livestock statistics can make it difficult to track progress in the livestock sector and to identify areas where intervention is needed. Recurring drought is a major challenge for livestock production in the SADC region, and inadequate review of available research findings can limit the adoption of new technologies and practices by livestock farmers.

Addressing these challenges will require a concerted effort from governments, development partners, and the private sector. Some of the interventions that can be implemented include supporting smallholder farmers, improving indigenous livestock breeds, controlling animal pests and diseases, increasing consumer incomes, increasing external inputs into farming, promoting inter-regional trade, investing in infrastructure, supporting adaptive research, improving livestock statistics, building drought resilience, and reviewing and disseminating research findings.

**Table 6.1** Key challenges faced by the livestock sector in the SADC region.

<p><b>Predominance of smallholder farmers in most SADC member states:</b></p> <ul style="list-style-type: none"> <li>• Smallholder farmers often lack access to land, capital, and resources, which can limit their ability to invest in improved livestock production practices.</li> <li>• Smallholder farmers may also have limited access to markets and information, which can make it difficult for them to sell their products or learn about new technologies and practices.</li> </ul>
<p><b>Low productivity indices of the indigenous livestock breeds:</b></p> <ul style="list-style-type: none"> <li>• Indigenous livestock breeds are often well-adapted to local conditions, but they may have lower productivity than exotic breeds.</li> <li>• This can be due to several factors, including genetics, nutrition, and management.</li> </ul>
<p><b>Prevalence of tropical animal pests and diseases:</b></p>

<ul style="list-style-type: none"> <li>• Tropical animal pests and diseases can cause significant losses in livestock productivity and mortality.</li> <li>• This can be a major challenge for livestock farmers, particularly those with limited resources.</li> </ul>
<p><b>Low income of consumers:</b></p> <ul style="list-style-type: none"> <li>• Low-income consumers may have less disposable income to spend on meat and other livestock products.</li> <li>• This can limit the demand for livestock products and reduce profitability for livestock farmers.</li> </ul>
<p><b>Low external inputs into farming:</b></p> <ul style="list-style-type: none"> <li>• Low external inputs into farming can limit livestock productivity.</li> <li>• This can be due to several factors, including the high cost of inputs, lack of access to inputs, and lack of knowledge of how to use inputs effectively.</li> </ul>
<p><b>Low inter-regional trade:</b></p> <ul style="list-style-type: none"> <li>• Low inter-regional trade can limit market opportunities for livestock producers.</li> <li>• This can be due to several factors, including tariffs, non-tariff barriers, and poor transportation infrastructure.</li> </ul>
<p><b>Lack of infrastructure to support production (roads, ICT, water, energy “factors of production”):</b></p> <ul style="list-style-type: none"> <li>• Lack of infrastructure can make it difficult for livestock producers to access markets, inputs, and services.</li> <li>• This can also make it difficult for livestock producers to manage their businesses effectively.</li> </ul>
<p><b>Low adaptive “need-based” research in the livestock industry due to inappropriate infrastructure:</b></p> <ul style="list-style-type: none"> <li>• Lack of adaptive research can limit the development of new and innovative solutions to the challenges facing the livestock sector.</li> <li>• This can be due to several factors, including lack of funding, lack of skilled researchers, and lack of access to appropriate infrastructure.</li> </ul>
<p><b>Lack of accurate &amp; credible livestock statistics:</b></p> <ul style="list-style-type: none"> <li>• Lack of accurate and credible livestock statistics can make it difficult to track progress in the livestock sector and to identify areas where intervention is needed.</li> <li>• This can also make it difficult to attract investment in the livestock sector.</li> </ul>
<p><b>Recurring drought:</b></p> <ul style="list-style-type: none"> <li>• Recurring drought is a major challenge for livestock production in the SADC region.</li> <li>• Drought can lead to feed shortages, water shortages, and disease outbreaks.</li> </ul>
<p><b>Inadequate review of available research findings:</b></p> <ul style="list-style-type: none"> <li>• Inadequate review of available research findings can limit the adoption of new technologies and practices by livestock farmers.</li> <li>• This can be due to several factors, including lack of time, lack of resources, and lack of awareness of the research findings.</li> </ul>

#### 6.4 Priority areas of investment in Research, Development and Learning

The group considered the following factors when setting priorities for research in the livestock sector in SADC:

- **The needs of smallholder farmers:** Smallholder farmers make up most livestock producers in SADC, so it is important to prioritize research that can help them to improve their productivity and profitability.
- **The prevalence of animal pests and diseases:** Tropical animal pests and diseases are a major challenge for livestock production in SADC, so it is important to prioritize research that can help to control these diseases.
- **The importance of livestock to food security and nutrition:** Livestock play an important role in food security and nutrition in SADC, so it is important to prioritize research that can help to improve the sustainability of livestock production and enhance the nutritional value of livestock products.
- **The impact of climate change:** Climate change is a major threat to livestock production in SADC, so it is important to prioritize research that can help farmers to adapt to climate change and build resilience.
- **The need for innovation:** The livestock sector in SADC needs to innovate to keep up with the changing needs of consumers and markets. It is therefore important to prioritize research that can lead to the development of new and innovative products, technologies, and practices.

Based on the above, the research agenda indicated in Table 6.2 was identified for the SADC livestock sector. The research topics under each sector are ranked from highest priority to lowest priority.

**Table 6.2** Priority Research areas for the livestock sector in SADC

	RESEARCH AREA			
	Animal Breeding	Pests and Disease Control	Animal Feeding & Nutrition	Marketing
Research Topic Rank 1	Characterization, evaluation, and selection of indigenous livestock breeds	Improvement of diagnostic tools for livestock diseases	Evaluation of nutritive values of feed resources available in the region (including agricultural by products)	Evaluation of low levels of inter-regional trade
Research Topic Rank 2	Breeding of selected breeds (crossbreeding: both	Development of early warning systems &	Formulation of feed for optimum production	

	natural, Artificial Insemination (AI) or Embryo transfer)	biological control methods for livestock pests		
Research Topic Rank 3	Monitoring & evaluation of production indices		Improvement of rangelands through introduction of leguminous & grass species	
Research Topic Rank 4	Development & evaluation of composite/suitable breeds for the region			

The group noted that improving the productivity of indigenous livestock breeds is essential for increasing the profitability of livestock farming and enhancing food security in the SADC region. Thus, CCARDESA should support research and development efforts to improve the genetics, nutrition, and management of indigenous livestock breeds. This could involve developing breeding programs to improve the genetic potential of indigenous livestock, developing new feed formulations to meet the nutritional needs of indigenous livestock, and developing improved management practices to reduce animal mortality and improve productivity.

Animal pests and diseases are a major challenge for livestock production in the SADC region. CCARDESA should support research and development efforts to develop early warning systems for animal pests and diseases. This could involve developing new diagnostic tools, developing surveillance systems to track the spread of pests and diseases, and developing models to predict the risk of outbreaks.

The high cost of imported animal feeds is a major constraint on the profitability of livestock farming in the SADC region. CCARDESA should support research and development efforts to formulate animal feeds from agricultural by-products, such as crop residues and agro-industrial by-products. This could involve developing new feed processing technologies and developing new feed formulations that meet the nutritional needs of livestock while also being affordable and accessible to farmers.

The lack of regional trade in livestock products is a missed opportunity for livestock producers in the SADC region. CCARDESA should support initiatives to promote inter-regional trade in livestock products. This could involve harmonizing trade regulations, developing regional value chains, and supporting the development of transport and logistics infrastructure.

## **7.0 RESEARCH, LEARNING AND DEVELOPMENT PRIORITIES FOR CROSSCUTTING ISSUES IN SOUTHERN AFRICA**

### **7.1 Background**

The main crosscutting issues of the SADC agricultural sector were identified in Chapter 2 as follows:

- knowledge, technology, and innovation systems,
- infrastructure development,
- marketing and trade,
- finance and credit, and
- environment, and climate change.

The SADC region needs to invest in research and development to develop new and innovative technologies and practices that can help to improve agricultural productivity, reduce costs, and enhance food security and nutrition. However, the region faces several challenges in this area, including limited funding for research and development, a shortage of skilled researchers, and a lack of coordination between research institutions and farmers.

Although the region is endowed with abundant natural resources, including land, water, and minerals, these resources are under increasing pressure from climate change, population growth, and urbanization. Hence, the region needs to develop sustainable management practices for its natural resources and to invest in infrastructure to support agricultural production, such as irrigation systems, roads, and storage facilities.

The SADC region has a large and growing market for agricultural products. However, farmers often face challenges in accessing markets due to several factors, including poor infrastructure, high transaction costs, and non-tariff barriers to trade. The region needs to develop policies and programs to promote agricultural marketing and trade, both within the region and with the rest of the world.

Access to finance is a major challenge for many farmers in the SADC region. This is due to several factors, including high interest rates, lack of collateral, and complex application procedures. The region needs to develop financial products and services that are tailored to the needs of farmers and to make it easier for farmers to access credit.

The SADC region is vulnerable to several shocks and stresses, including climate change, drought, and pests and diseases. The region needs to develop policies and programs to build resilience to these



shocks and stresses and to adapt to climate change. This could involve investing in irrigation systems, developing drought-tolerant crops, and supporting livestock insurance.

These crosscutting issues are interconnected (Figure 2.1) and need to be addressed in a holistic manner to improve the performance of the agriculture sector in the SADC region.

## 7.2 Status, Challenges and Possible Interventions

### 7.2.1 Knowledge, technology, and innovation systems

The status of knowledge, technology, and innovation systems in the agricultural sector of SADC is mixed. There are some areas of strength, such as the development of new crop varieties and livestock breeds, but there are also some areas of weakness, such as limited investment in research and development and limited access to information and technologies for farmers.

#### Strengths

- **Development of new crop varieties and livestock breeds:** SADC countries have made significant progress in developing new crop varieties and livestock breeds that are more productive and resilient to pests and diseases. For example, the International Maize and Wheat Improvement Center (CIMMYT) has developed new maize varieties that are resistant to drought and striga, a parasitic weed that can devastate maize crops.
- **Use of information and communication technologies (ICTs):** ICTs are increasingly being used to support agricultural production and trade in the SADC region. For example, farmers are using mobile phones to access weather information, market prices, and advice from extension workers.
- **Regional collaboration:** There is a growing trend towards regional collaboration in agricultural research and development in the SADC region. For example, the Southern African Centre for Cooperation in Agricultural Research and Training (SACCAR) supports research and training in a range of agricultural disciplines.

#### Weaknesses

- **Limited investment in research and development:** Investment in agricultural research and development is low in many SADC countries. This is limiting the development of new technologies and practices that could help farmers to improve their productivity and profitability.

- **Limited access to information and technologies for farmers:** Many farmers in the SADC region have limited access to information and technologies that could help them to improve their productivity and profitability. This is due to several factors, including lack of awareness, high costs, and complex technologies.
- **Weak linkages between research and extension:** In some SADC countries, there are weak linkages between agricultural research and extension. This limits the ability of farmers to access the latest research findings and technologies.

### **Possible interventions:**

The following recommendations are made for improving knowledge, technology, and innovation systems in the agricultural sector of SADC:

- **Increase investment in agricultural research and development:** SADC governments need to increase their investment in agricultural research and development. This will help to accelerate the development of new technologies and practices that can help farmers to improve their productivity and profitability.
- **Improve access to information and technologies for farmers:** Governments and development partners need to work together to improve access to information and technologies for farmers. This could involve developing low-cost and easy-to-use technologies, providing training to farmers on how to use ICTs, and promoting the use of ICTs in agricultural extension services.
- **Strengthen linkages between research and extension:** SADC governments and research institutions need to work together to strengthen linkages between research and extension. This will help to ensure that farmers have access to the latest research findings and technologies.

By taking these steps, SADC countries can improve the status of knowledge, technology, and innovation systems in their agricultural sectors. This will help to promote agricultural growth and development and improve food security and nutrition in the region.

### *7.2.2 Infrastructure Development*

The SADC region has invested in several infrastructure projects, including roads, power plants, and irrigation systems. However, there are still significant gaps in infrastructure, particularly in rural areas. For example, the SADC region has a network of over 1 million kilometers of roads, but only about

20% of these roads are paved. This makes it difficult for farmers to transport their products to markets and to access inputs such as fertilizer and seeds. Likewise, the SADC region has several power plants, but there are still frequent power outages which disrupts agricultural production and processing. Several irrigation systems have been developed in the region, but these systems are often outdated and inefficient, leading to water wastage and reduced crop yields. Other important infrastructure for the agricultural sector includes storage facilities, processing facilities, and market infrastructure. There are still significant gaps in this infrastructure in the SADC region.

## **Challenges**

The main challenges facing infrastructure development in the agricultural sector of SADC include:

- **Lack of funding:** Infrastructure development is expensive, and the SADC region needs to mobilize more resources to invest in this area.
- **Limited capacity:** The SADC region needs to develop its capacity to plan and implement infrastructure projects.
- **Poor coordination:** Infrastructure development in the SADC region is often fragmented and poorly coordinated. This makes it difficult to implement large-scale projects and to ensure that infrastructure is compatible across borders.

## **Possible interventions**

The following recommendations are made for improving infrastructure development in the agricultural sector of SADC:

- **Increase funding:** Governments, donors, and the private sector need to increase funding for infrastructure development in the agricultural sector.
- **Strengthen capacity:** The SADC region needs to strengthen its capacity to plan and implement infrastructure projects. This can be done through training and development programs, as well as by attracting skilled professionals to the sector.
- **Improve coordination:** Governments and development partners need to improve coordination of infrastructure development in the agricultural sector. This can be done by developing regional strategies and plans, and by establishing joint implementation mechanisms.

By addressing these challenges, the SADC region can improve the status of infrastructure in the agricultural sector and boost agricultural productivity and economic growth.

### *7.2.3 Marketing and Trade*

Marketing and trade in the agricultural sector of SADC is still developing, but there have been significant improvements in recent years. The SADC region is a net exporter of agricultural products, with exports exceeding imports in 2022. The main agricultural exports from the SADC region include beef, maize, soybeans, sugar, and tobacco. The main agricultural imports from the SADC region include wheat, rice, and dairy products.

Intra-regional trade in agricultural products is relatively low, accounting for around 15% of total agricultural trade in the SADC region. This is due to several factors, including tariffs, non-tariff barriers to trade, and limited transport and logistics infrastructure. However, there have been some recent initiatives to promote intra-regional trade in agricultural products, such as the SADC Regional Agricultural Trade Integration Programme.

The SADC region has several regional and international trade agreements in place that cover agricultural products. These agreements include the SADC Protocol on Trade, the SADC-EU Economic Partnership Agreement, and the African Continental Free Trade Agreement (AfCFTA). These agreements have the potential to boost agricultural trade in the SADC region by reducing tariffs and other barriers to trade.

Despite the progress that has been made, there are still several challenges facing marketing and trade in the agricultural sector of SADC. These challenges include:

- **High tariffs and non-tariff barriers to trade:** Tariffs and non-tariff barriers to trade make it difficult for SADC farmers to access regional and international markets.
- **Limited transport and logistics infrastructure:** Poor transport and logistics infrastructure makes it difficult and expensive to transport agricultural products to markets.
- **Limited access to market information:** Many SADC farmers lack access to timely and accurate market information, which can make it difficult for them to make informed marketing decisions.
- **Limited financial services:** Many SADC farmers lack access to the financial services they need to invest in new technologies and practices, and to market their products.

## **Possible interventions**

To address these challenges, the SADC region needs to continue to invest in infrastructure, improve trade policies, and promote access to market information and financial services for farmers.

### *7.2.4 Finance and Credit*

The agricultural sector is a major contributor to the economies of SADC countries, but it is also one of the most underfinanced sectors. One of the biggest challenges facing the agricultural sector in SADC is access to finance. Smallholder farmers, who make up the majority of farmers in the region, often have difficulty accessing loans from commercial banks. This is due to several factors, including high interest rates, complex loan application procedures, and lack of collateral. There are various factors that contribute to the high interest rates on agricultural loans. One factor is the high risk associated with agricultural lending. Agriculture is a risky business due to factors such as climate change, pests and diseases, and price volatility. Another factor is the lack of competition in the agricultural lending market. Commercial banks often view agricultural lending as a risky proposition and are reluctant to lend to farmers. The loan application procedures for agricultural loans can also be complex and time-consuming. This is because banks often require farmers to provide detailed documentation, such as business plans and financial statements. Many smallholder farmers do not have the resources or the expertise to prepare this documentation. Finally, many smallholder farmers lack the collateral required to secure loans from commercial banks. Collateral is an asset that the bank can seize if the farmer defaults on the loan. Smallholder farmers often do not have any assets that can be used as collateral.

## **Government initiatives**

Several SADC governments have taken steps to improve access to finance for farmers. These initiatives include establishing agricultural development banks, providing loan guarantees, and subsidizing interest rates. However, these initiatives have not been entirely successful. Agricultural development banks often have limited resources and are unable to meet the demand for credit. Loan guarantees can be helpful, but they are often only available to large-scale farmers. Interest rate subsidies can be expensive and can distort the financial market.

Microfinance institutions (MFIs) are another source of finance for farmers in SADC. MFIs provide small loans to individuals and businesses that cannot access loans from commercial banks. MFIs often have higher interest rates than commercial banks, but they have more flexible loan application procedures and do not require collateral. MFIs have played an important role in improving access to

finance for smallholder farmers in SADC. However, they are still not able to meet the full demand for credit from the agricultural sector.

### **Possible interventions**

Governments, development partners, and the private sector need to work together to improve access to finance for farmers in SADC. This will require developing new financial products and services, simplifying loan application procedures, and reducing the cost of borrowing.

#### *7.2.5 Environment and Climate Change*

The status of the environment and climate change in the agricultural sector of SADC is a major concern. The region is already experiencing the effects of climate change, such as increased temperatures, more frequent and severe droughts and floods, and changes in rainfall patterns. These changes are having a significant impact on agricultural production, food security, and livelihoods.

The agricultural sector in SADC faces a number of environmental challenges, including:

- **Land degradation:** Land degradation is a major problem in the SADC region. It is caused by several factors, including deforestation, overgrazing, and unsustainable agricultural practices. Land degradation can lead to reduced soil fertility, increased erosion, and decreased water retention capacity.
- **Water scarcity:** Water scarcity is another major challenge for the agricultural sector in SADC. The region is becoming increasingly arid due to climate change. Water scarcity can lead to crop failure and reduced livestock productivity.
- **Pollution:** Pollution from agricultural activities, such as the use of pesticides and fertilizers, can contaminate water and soil. This can have a negative impact on human health and the environment.

Climate change is also having a significant impact on the agricultural sector in SADC. The region is already experiencing the following climate change impacts:

- **Increased temperatures:** Increased temperatures are leading to earlier crop maturity, reduced crop yields, and increased pest and disease outbreaks.
- **More frequent and severe droughts and floods:** Droughts and floods can destroy crops and livestock and disrupt agricultural production.

- **Changes in rainfall patterns:** Changes in rainfall patterns can lead to crop failure and reduced livestock productivity.

### **Adaptation measures**

Farmers in SADC are adapting to the challenges of climate change and environmental degradation in several ways. These adaptation measures include:

- **Drought-resistant crops:** Farmers are planting drought-resistant crops to reduce the risk of crop failure during droughts.
- **Water-saving irrigation practices:** Farmers are using water-saving irrigation practices, such as drip irrigation, to reduce water consumption.
- **Conservation agriculture:** Farmers are using conservation agriculture practices, such as minimum tillage and crop rotation, to improve soil fertility and reduce erosion.
- **Climate-smart livestock management:** Farmers are using climate-smart livestock management practices, such as improved pasture management and rotational grazing, to reduce the impact of climate change on livestock production.

### **Possible interventions**

The following are some recommendations for helping farmers in SADC to adapt to climate change and environmental degradation:

- Governments should provide farmers with access to drought-tolerant seeds and other inputs that can help them to adapt to climate change.
- Governments should invest in water-saving irrigation infrastructure.
- Governments should promote the use of conservation agriculture practices.
- Governments should support research and development of new technologies and practices to help farmers adapt to climate change.
- Development partners and the private sector should work with governments to provide farmers with access to finance and other resources to support climate change adaptation.

### **7.3 Priority areas of investment in Research, Development and Learning**

The following research priorities were identified for the crosscutting issues in the agricultural sector of SADC.

#### *7.3.1 Knowledge, Technology, and Innovation Systems*

1. How can SADC members sustainably increase public investment in research and development, technology, and extension?
2. What are the constraints to private sector investments in Research and Development, Technology and Extension?
3. How can we effectively utilize Indigenous Knowledge systems and technology in the region?
4. Develop an inventory and create a database of available technologies, innovations and best practices for adoption at scale.

#### *7.3.2 Infrastructure Development*

1. What are the critical infrastructure investments required in the region to sustainably operationalize the AfCFTA?
2. What are the policies and financing modalities required to support infrastructure development in the region to facilitate regional integration and trade under AfCFTA?

#### *7.3.3 Marketing and Trade Development*

1. What policy frameworks and regional cooperation mechanisms are necessary to promote the development of regional value chains based on countries' comparative advantages?
2. Conduct a mapping exercise of SADC countries' comparative advantage in various value chains to contribute to the domestication and operationalization of the AfCFTA in the region.

#### *7.3.4 Finance and Credit*

1. What are the policies and investments required to sustainably harness and increase private sector financing in agriculture, forestry, and fisheries sectors in the region?
2. What are the best practices for financing regional initiatives and commitments?

#### *7.3.5 Environment and Climate Change*

1. How does the region enhance its capacity to develop a pipeline of bankable climate finance projects?
2. What needs to be done to increase the adoption of climate-smart practices and investments in the region?



3. Make an inventory of coping strategies that are increasing household resilience to shocks and how these strategies can be supported and scaled up in the region.
4. What are the policies and strategies for boosting local investments in climate action?

In conclusion, CCARDESA should support research and development in the following areas:

- New technologies and practices to improve farmer productivity, resilience, and profitability.
- Transport and logistics infrastructure, water infrastructure, and energy infrastructure.
- Access to markets for farmers and reduction of trade barriers.
- Access to finance for farmers and reduction of borrowing costs.
- Helping farmers adapt to climate change and reducing the environmental impact of agriculture.

By prioritizing research on these crosscutting issues, CCARDESA can help to promote the sustainable development of the agriculture sector in the SADC region and improve the livelihoods of farmers.

## **CONCLUSIONS AND RECOMMENDATIONS**

The Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) has revised its list of regional agricultural research and development priorities. The following five pillars are crucial for agricultural research and development in the SADC region:

- Knowledge, Technology, and Innovation Systems
- Infrastructure Development
- Marketing and Trade Development
- Finance and Credit
- Environment and Climate Change

All research and development activities of CCARDESA must adhere to the following eight guiding principles:

- Sustainability
- Gender, youth, and marginalized groups
- Health and nutrition
- Climate change adaptation and mitigation
- Multisectoral engagement and participation
- Evidence-based policy
- Ethics and intellectual property rights
- Indigenous knowledge systems

Based on these conclusions, the following recommendations are made:

- CCARDESA should develop a long-term strategy and medium-term operational plan that is aligned with the revised research and development priorities and guiding principles.
- CCARDESA should work with SADC member states to mobilize resources to implement the revised research and development priorities.

- CCARDESA should facilitate collaboration among SADC member states to promote regional agricultural research and development.
- CCARDESA should promote the adoption of research findings by farmers and other stakeholders.

Specifically, CCARDESA should:

- For crops, prioritize breeding for quality and improved seeds, controlling pests and diseases, improving soil fertility and water management, addressing impacts of climate variation on crop production, improving market access, and capacity building for farmers.
- For livestock, prioritize improving livestock breeds, characterization, evaluation, and selection of indigenous livestock breeds, pest and disease control, improving animal nutrition through formulating feeds from plants and agricultural waste, and improving access to markets and intra-regional trade.
- For the forestry sector, prioritize inventorying non-timber forest products and eliminating their threats, identifying and developing appropriate agroforestry practices and technologies for smallholder farmers, improving productivity of plantation forests, and quantification of carbon sequestration and storage capacity of different forest types to effectively implement carbon trading and credits protocols.
- For fisheries and aquaculture, prioritize stock assessments, genetic improvement programs for aquaculture, development of alternative sources of protein in fish feed, value addition of fisheries and aquaculture products, addressing water pollution, assessments for improved fish quality, marketing and distribution networks, addressing the impacts of invasive species, and studying the impacts of climate change on aquatic biodiversity.
- On crosscutting issues, prioritize how to sustainably increase public investment in research and development, technology, and extension; determine the critical infrastructure investments required to sustainably operationalize the Africa Continental Free Trade Area; determine policy frameworks and regional cooperation mechanisms that are necessary to promote the development of regional value chains based on countries' comparative advantages; identify policies and investments required to sustainably harness and increase private sector financing

in agriculture in the region; and understand how SADC can enhance its capacity to develop a pipeline of bankable climate finance projects.

By implementing these recommendations, CCARDESA can play a key role in promoting sustainable agricultural development in the SADC region.

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