Dialogue on Commercialization of Climate-Smart Agricultural Technologies, Innovations and Management Practices in Eastern & Central Africa

Ben Ilakut | Julian Barungi | Joshua Okonya | Moses Odeke | John Recha

Workshop Report

CGIAR | AICCRA
Accelerating Impacts of CGIAR Climate Research for Africa

Dialogue on Commercialization of Climate-Smart Agricultural Technologies, Innovations and Management Practices in Eastern & Central Africa

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Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA)

March 2022

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IFAD
Investing in rural people

ASARECA
Transforming Agriculture for Improved Livelihoods

CAADP XP4 PROGRAMME

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About AICCRA reports

Titles in this series aim to disseminate interim climate change, agriculture, and food security research and practices and stimulate feedback from the scientific community.

About AICCRA

The Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) project is supported by a grant from the International Development Association (IDA) of the World Bank.

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ACRE	Agriculture and Climate Risk Enterprise
AEAS	Agricultural Extension and Advisory Services
AFAAS	African Forum for Agricultural Advisory Services
AFSTA	Africa Seed Trade Association
AGRA	Alliance for a Green Revolution in Africa
AICCRA	Accelerating the Impact of CGIAR Climate Research for Africa
AIS	Agricultural Innovation System
APPI	Agricultural Policy Practice Index
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
ASBPP	African Seed Biotechnology Partnership Platform
ASSCO	Arab Sudanese Seed Company
AUC-CAAPD	African Union Commission on Comprehensive Africa Agriculture Development Programme
CAADP	Comprehensive Africa Agriculture Development Programme
CABI	Centre for Agriculture and Bioscience International
CCAFS	Climate Change Agriculture and Food Security
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
CFU	Conservation Farming Unit
CGIAR	Consultative Group for International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIS	Climate Information Service
COMESA	Common Market for Eastern and Southern Africa
CORAF	West and Central African Council for Agricultural Research and Development
CSA	Climate Smart Agriculture
CV	Commercial Village
DRC	Democratic Republic of Congo
EAC	East Africa Commission
EADRAC	Eastern Africa Dairy Regulatory Authorities Council

ECCAS	Economic Community of Central African States
ECOWAS	Economic Community of West African States
EU	European Union
FAA	Fish Amino Acid
FBC	Fana Broadcasting Corporate
FMD	Foot and Mouth Disease
FPEAK	the Fresh Produce Association of Kenya
GFE	Grain and Flour Enterprises
GHG	Green House Gasses
HRDC	Hybrid Rice Development Consortium
ICPAC	IGAD'S Climate Prediction and Applications Centre
ICRAF	International Centre for Research in Agroforestry
IFAD	International Fund for Agricultural Development
IGAD	Intergovernmental Authority on Development
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute
ISABU	Burundi’s National Agricultural Research Institute
ISF	International Seed Federation
JICA	Japan International Cooperation Agency
KALRO	Kenya Agricultural and Livestock Research Organization
KBC	Kenya Broadcasting Corporation
KCEP	Kenya Cereals Enhancement Programme
KCSAP	Kenya Climate Smart Agriculture Programme
KEPHIS	Kenya Plant Health Inspectorate Service
KTN	Kenya Television Network
MFIs	Micro-Finance institutions
MoA	Ministry of Agriculture
MoU	Memorandum of Understanding
NAAIAP	National Accelerated Agricultural Inputs Access Programme
NAKIS	National Agricultural Knowledge and Information Systems
NARIs	National Agricultural Research Institutes
NGOs	Non Governmental Organizations
NMG	Nation Media Group of Kenya
NPCK	National Potato Council of Kenya
NPTC	National Performance Trial Committee

NVRC	National Variety Release Committee
OPV	Open Pollinated Varieties
PPP	Public-private partnership
PSF	Private Sector Federation – Rwanda
PWDs	People with Disabilities
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
SADC	Southern African Development Community
SDGs	Sustainable Development Goals
SMEs	Small and medium-sized enterprises
SPS	Sanitary and phytosanitary
STAK	the Seed Trade Association of Kenya
SWE	Seaweed extract
TARI	Tanzania Agricultural Research Institute
TASAI	The African Seed Access Index
TBT	Technical Barriers to Trade
TIMPs	Technologies, Innovations and Management Practices
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USSD	Unstructured Supplementary Service Data
WTO	World Trade Organization

1. BACKGROUND

The Association for Strengthening Agricultural Research in Eastern and Central Africa (ASARECA) recognizes the critical role that the private sector, research organizations, farmer organizations, policy makers, extension workers and media play in scaling up and commercialization of climate-relevant TIMPs. However, the adoption and use of several new agricultural technologies by smallholder farmers remains relatively low in the region resulting in low production (crop yields) on farms, poor quality and high postharvest losses. Reducing the yield gap of improved crop varieties for instance requires concerted efforts of both the technology innovators and those involved in its dissemination and regulation. Based on the foregoing, ASARECA organized a dialogue on the commercialization of climate-relevant agricultural Technologies, Innovations, and Management Practices (TIMPs) in Eastern and Central Africa for the private sector, climate scientists, research organizations, policy makers, extension workers, and media to discuss commercialization of climate-relevant TIMPs**.**

ASARECA is implementing the Comprehensive Africa Agriculture Development Programme ex-pillar IV (CAADP-XP4). Implementation of this 5-year Project started in 2019 and is part of the European Union's (EU) Development Smart Innovation through Research in Agriculture (DeSIRA) initiative. The project is expected to deliver five (5) key outputs namely: (i) Strengthened capacities of ASARECA and partner organizations in competencies required for successful implementation of the CAADP-XP4 project; (ii) Multi-stakeholder partnerships for innovation established and in operation; (iii) Policies in support of climate-relevant agriculture and food systems transformation formulated, investments increased, advocacy and market linkages strengthened; (iv) Knowledge management and communication systems for decision-making and sharing of innovation and advocacy related to climate-relevant agriculture transformation established; and (v) Enhanced planning, coordination, monitoring, evaluation, learning, and reporting**.** Under output 2, 2.1.4 the project aims at developing strategies for engaging with the private sector and designing mechanisms for its operationalization.

Relatedly, ASARECA is implementing the Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) Project in partnership with the Alliance of Bioversity International and CIAT. The project is funded by the World Bank and aims to strengthen the technical, institutional, and human capacity needed to enhance the transfer of climate-relevant information, decision-making tools, and technologies in support of scaling efforts in IDA-eligible countries in Africa. The project focuses on 4 major components namely: (i) knowledge generation and sharing through the development of climate-informed agricultural advisory services and decision-making tools; (ii) strengthening partnerships for delivery of climate-smart innovations in agriculture; (iii) validating climate-smart agriculture innovations through piloting; and (iv) project management. Specifically, under AICCRA, the workshop contributes to activity 2.3.3 which focuses on building the capacity of public and private sector next users to support the implementation of CSA technology packages in focus countries and activity 1.3.2 which focuses on strengthening digital climate advisory services.

Objectives of the workshop

The overall objective of the dialogue was to promote the commercialization of climate-relevant agricultural TIMPs in Eastern and Central Africa.

1.1 SPECIFIC OBJECTIVES

1. To raise awareness of the CAADP-XP4 and AICCRA projects
2. To identify and document the digital climate advisory capacity gaps among farmer organizations, the private sector, and policymakers
3. To facilitate dialogue between policymakers and private sector partners in enhancing integration of national (e-) extension system for widespread dissemination
4. To discuss with the private sector, agree and document the best bet climate-smart priority agricultural TIMPs with regional importance and for commercialization and scaling
5. To discuss and agree with the private sector on strategies to commercialize and scale out the prioritized TIMPs
6. To discuss with key stakeholders, the barriers and mechanisms for addressing barriers to the exchange of TIMPs in ECA.
7. To establish an Agricultural Technology and Innovations Commercialization Platform for ECA.

1.2 EXPECTED OUTPUTS OF THE WORKSHOP

1. Increased visibility of CAADP-XP4 and AICCRA projects within the region
2. Digital climate advisory capacity gaps identified and documented
3. Recommendations on how to integrate e-extension in national agricultural extension services discussed & documented
4. List of best-bet agricultural TIMPs of regional importance and possibility of commercialization and scaling by private sector identified and documented
5. Strategies for commercializing and scaling prioritized TIMPs by the private sector discussed and documented
6. Business cases (profitability/ gross margin analysis/ return on investment) for the best bet technologies presented
7. Mechanisms for addressing barriers to the exchange of TIMPs within ECA were discussed and agreed upon
8. Agricultural Technology and Innovations Commercialization Platform for ECA established

Methodology

The dialogue was held in Nairobi, Kenya, and facilitated by ASARECA Secretariat & KALRO staff. It was conducted through presentations, group work and plenary discussions. Simultaneous interpretation will be available for the French and English languages.

Target Participants

The dialogue targeted the private sector, farmer organizations, policymakers, extension workers, climate scientists, research organizations and media from ASARECA's 14 member states namely: Uganda, Kenya, Tanzania, Rwanda, Burundi, Ethiopia, Eritrea, South Sudan, Sudan, Central African Republic, Republic of Congo, Cameroon, Madagascar, and the Democratic Republic of Congo.

2. HIGHLIGHTS OF KEY MESSAGES AT THE START OF THE WORKSHOP

2.1 OPENING SESSION

Presentation on CAADP-XP4 Project and its focus on climate-smart agriculture

The CAADP-XP4 Programme aimed at **s**trengthening the capacities of Ex-Pillar Organizations to deliver on their AR4D Mandate. The programme focused on (i) capacity strengthening and (ii) climate-relevant research and innovation.

Of specific relevance to the *Dialogue on Commercialisation of Climate-Smart Agricultural Technologies, Innovations and Management Practices in Eastern and Central Africa,* was Output 2 of the CAADP-XP4 Programme on Enhanced Multi-Stakeholder Partnerships. The specific activities in this regard were to:

Activity 2.1.2: Convene periodic meetings for inclusive existing CSA platforms at the regional level and support them at the national level for identified CSA platforms, and undertake continuous advocacy activities to catalyse institutionalization of climate-relevant AR4D

Activity 2.1.3: Develop strategies for engaging with the private sector and designing mechanisms to operationalize the strategies including holding dialogues with the private sector on the commercialization of prioritized technologies, innovations and management practices and catalyse adoption of CSA technologies and innovations.

Activity 3.3.1: Convening policy dialogues at sub-regional levels on CSA, climate-relevant issues and interregional trade and market access, including convening workshops for climate scientists to enhance their negotiation ability in CoP and UNFCCC meetings.

Some of the capacity strengthening areas under the Programme included: (i) Policy analysis and formulation; (ii) harmonization of policies and standards; (iii) partnerships, collaboration and coordination; (iv) monitoring, evaluation, reporting and learning; (v) fiduciary processes and (vi) resource mobilization.

Direct beneficiaries of the CAADP-XP4 Programme

1. The National Agricultural Knowledge and Information Systems(NAKIS)
2. Private sector
3. Farmer organisations
4. Extension services

Indirect beneficiaries of the CAADP-XP4 Programme

1. Resource-poor and smallholder farmers, agro-processors, and rural youth
2. Women agri-entreprenuers
3. Individual producers and producer organizations/groups
4. Cooperatives, agricultural training centres, and research institutions
5. Regional Economic Communities with the ECA sub-region

2.2 HIGHLIGHTS FROM REPRESENTATIVE OF THE PRIVATE SECTOR ON THE ASARECA BOARD OF DIRECTORS

The private sector is key in the economic development of Eastern and Central Africa due to its role and engagement in the entire agricultural value chains. No sustainable development and poverty reduction can take place without the participation of the private sector. Therefore, the engagement of the public sector, agriculture value chain stakeholders, researchers, farmers, and consumers provides the potential to leverage resources for sustainable economic development.

The private sector plays various roles that are in the best interest of farmers through: (i) advocacy for simplification of standards for the smallholder farmers, (ii) providing training to framers, (iii) promotion of uptake TIMPs, (iv) ensuring a proactive approach to access TIMPs from where they are based. Therefore, it needs support from the public sector, especially in areas such as infrastructure development, and involvement in sharing feedback on critical policy issues.

The highlight of the role of the Private sector in easing Sanitary and Phytosanitary (SPS) related trade barriers regionally and internationally

Sanitary and Phytosanitary (SPS) measures are laws, rules, standards, and procedures that governments employ to protect humans and avoid unnecessary trade barriers. According to the World Trade Organization (WTO), SPS and the Technical Barriers to Trade (TBT), measures have become more prominent concerns for agricultural exporters and policymakers. The concerns include whether SPS and TBT measures such as labelling, packaging requirements, certification and inspection procedures, product specifications, and marketing of biotechnology might be used to unfairly discriminate against imported products or create unnecessary obstacles to trade in agricultural commodities.

The importance of the private sector in Sanitary and Phytosanitary (SPS) and Trade (TBT) measures

The private sector plays the following roles in SPS and TBT:

1. Protection of human and animal health from the risks arising from additives, contaminants, toxins, or disease organisms in food, drink, and feedstuff.
2. Protection of plant and animal life from pests, diseases and disease-causing organisms.
3. Prevention from the introduction of fruit flies and foot and mouth disease (FMD).
4. Protects a country from damage caused by entry, establishment or spread of pests, import bans on products from specific producing areas, and import bans on production inputs.
5. Prevention of consumer fraud during shipping and financial documentation, standards of identity and measurement, etc.

Table 1: Challenges facing the private sector and recommendations

Challenges facing the private sector	**Recommended remedies**
Delays in processes and high transport costs in moving from one regulatory office to the other seeking regulatory documents	• Adoption of an online application system for the issuance of SPS documents. • Enhancing awareness via trade portals. • Creation of a one-stop shop at the borders for acquiring export or import documents
Harmonized sanitary and phytosanitary requirements	• Domestication of regional SOPs • Ensuring uniform infrastructure and human capacity • Domesticate international and regional treaties • Implementation of proficiency tests and laboratory audit schemes internally
Lack of awareness of SPS regulations among small-scale traders	- Raising awareness among traders on SPS regulatory requirements through various forms of media
Lack of risk-based inspections and poor generation of timely results.	- Promotion of coordinated risk-based inspections - Capacity building in risk assessment
Delay and Congestion in transit	- Ensure customs operate 24 hours

2.3 HIGHLIGHTS FROM THE STATEMENT OF THE ASARECA EXECUTIVE DIRECTOR

ASARECA has redefined its niche and set clear priority areas of focus to remain relevant in transforming agriculture in the sub-region. The redefined niche is a product of the re-articulation of areas of comparative advantage to offer high-quality research products and services.

The rebranded, refreshed and repositioned ASARECA therefore, understands that agricultural transformation requires an integrated delivery approach across assorted partnerships with governments, development partners, private sector and implementing partners in Member Countries; seeks to enhance sustainable agricultural transformation, sustained economic growth and inclusive AR4D by ensuring significant improvement in value for money in the delivery of products and services; seeks to support attainment of economies of scale and scope in the conduct of priority regional research and by significantly reducing duplication and misalignment of efforts and resources; and endeavours to strengthen partnerships to tackle cross-border challenges.

The mandate of the rebranded, refreshed and repositioned ASARECA

The mandate of the rebranded, refreshed and repositioned ASARECA is to:

1. Identify regional research priorities and opportunities through credible, authentic and participatory strategic visioning.
2. Commission, broker and manage strategic research partnerships to address identified regional priorities in the most effective, efficient and synergetic ways.
3. Nurture pathways for on-time delivery, spillover and scaling up of regional agricultural research results to deliver agricultural outcomes & impact.
4. Mobilize, allocate and manage regional AR4D investments for the generation of regional agricultural research public goods and services.
5. Monitor and evaluate returns on AR4D investment and repackage lessons and best practices for informed decision-making.

ASARECA's major areas of investment in Member Countries

The following are major areas of ASARECA's investment in member countries:

1. Generation, dissemination and uptake of technologies, innovations, and management practices of priority commodities along selected value chains.
2. Enhancing capacity strengthening and partnerships development and systemic, organizational, and individual level.
3. Coordinating policy analysis, advocacy, and reforms.
4. Enhancing access to national and regional markets.
5. Mitigating effects of climate change.
6. Facilitating communication, information & knowledge management.

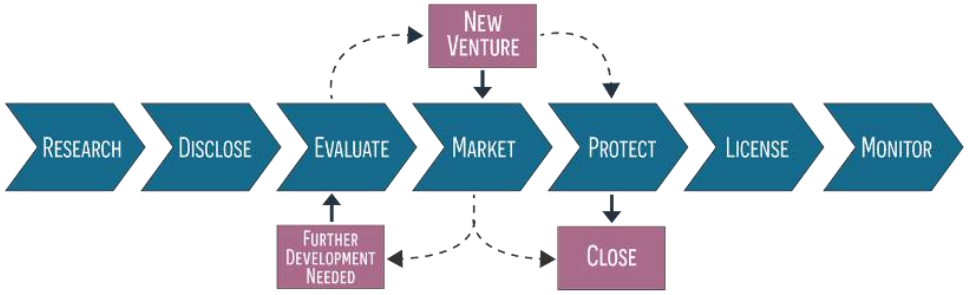
Major Interventions with RECs

1. Coordinated rationalization & harmonization of policies, laws, regulations, and procedures for key agricultural sectors in ECA.
2. Supported the establishment of: (i) the Eastern Africa Seed Committee (EASCOM); and (ii) the Eastern Africa Dairy Regulatory Authorities Council (EADRAC).
3. Participated in seed trade harmonization regulations in COMESA.
4. Coordinated development of 1st Regional Variety Catalogue for bean, maize, pigeon pea, sorghum, sunflower and wheat.
5. Facilitated policy harmonization for a variety of releases, including one-season testing to ease dissemination across borders.
6. Supported the establishment of Regional Seed Standards with 23 rationalized and harmonized standards for cassava, potato and sweet potato approved by the EAC.

Why ASARECA is keen on the Commercialisation of TIMPs

Commercialization is the process of bringing new products or services to market. Broadly, commercialization entails production, distribution, marketing, sales, customer support, and other key functions that are critical to achieving the commercial success of the new product or service.

ASARECA's role in the commercialization processes



In commercialization processes, ASARECA;

1. Facilitates processes to fast-track the coordination for the release and adoption of TIMPs for commercialization across countries.
2. Links the private sector to national regulatory agencies by providing them with relevant platforms and contacts.
3. Profiles the private sector agencies that are already commercializing the TIMPs.
4. Make follow-ups by engaging with the Private Sector partners that are likely to commercialize the TIMPs.

This workshop report provides useful information that will be used by ASARECA to conduct further studies to develop market profiles of the TIMPs.

2.4 HIGHLIGHTS FROM WELCOME REMARKS AND OFFICIAL OPENING BY DIRECTOR GENERAL KALRO

The Dialogue on Commercialization of Climate-Relevant Agricultural Technologies, Innovations and Management Practices in Eastern and Central Africa in Nairobi was well aligned with a new forward-looking vision for strengthening engagement with the private sector towards achieving the Sustainable Development Goals (SDGs) and the Malabo Declaration targets. KALRO was one of 10 National Agricultural Research Institutes (NARIs) that founded ASARECA in 1994, and the organization's membership has recently grown to 14 NARIs. Over the past 28 years, ASARECA in partnership with KALRO has jointly implemented several AR4D projects in Kenya that have resulted in several outputs, such as:

1. Trained and well-equipped staff in policy analysis, formulation, and advocacy.
2. Effective monitoring and tracking of climate-relevant policies using the Agricultural Policy Practice Index (APPI) tool.
3. Successful and progressive regional dialogues and implementation of key climate-smart agriculture innovations.
4. Drafted successfully funded joint proposals to address the emerging AR4D issues.
5. Successful CSA technologies dissemination in Kenya and the region

Climate Smart Agriculture's (CSA) integrated approach was important in addressing climate change-related challenges in increased agricultural productivity, resilience, and climate change mitigation. CSA encompasses a wide array of practices, technologies, and approaches, necessitating the participation of a diverse range of stakeholders spanning from the public, private

and development spheres. Strengthening synergies between public agencies, development partners and private enterprises to continuously address the challenge of agricultural productivity and food security in this region is key.

Potential TIMPS that will make our agricultural systems more climate-smart can be grouped into two main categories:

1. TIMPs that facilitate climate-smart production practices at the farm level. These include TIMPs around crop varieties, livestock and fish breeds; soil health management; water management; energy management, among others.
2. Products and services that improve value chains, systems and the enabling environment around farmers and agribusinesses. These include insurance; climate information services and agro-advisories; access to credit and financial services, among others.

Climate information, advice and market-data services have helped farmers to gain more understanding of their environment and markets, leading to better choices in land management practices and better marketing decisions. In the region, there has been an increased demand for improved meteorological data, market data and advisory services. For example, Kenya launched an electronic voucher subsidy program which leverages agro-dealer networks as a more efficient distribution mechanism. With this, the government targeted improved seeds and other agricultural inputs with a clear CSA linkage and guarded against counter-productive practices such as the over-application of harmful fertilizers due to subsidies.

KALRO desires to strengthen private sector engagement in commercializing climate-smart agricultural technologies and innovations, and this dialogue was a significant step forward in this direction. By championing CSA initiatives in the region, ASARECA is fulfilling the mandate of convening, coordinating and catalysing institutionalization of climate-relevant AR4D work in the ECA region.
Mobilizing the capacities and resources of the private sector is essential for achieving the SDGs. This is probably nowhere more evident than in the global agri-food systems, where the private sector plays such an important role. The private sector is a strategic partner; offering innovative tools, resources, knowledge, and technologies that are critical for transformation towards healthy and sustainable agri-food systems, protecting the environment, and determining the production and consumption of food. Therefore, a broad array of private sector actors, from farmers, including smallholders and family farmers, foresters, livestock herders and fishers to micro-, small, and medium-sized enterprises (MSMEs) and large companies as well as financial institutions are instrumental to drive these efforts.

While countries within the region have all taken initial steps to prioritize CSA within national agendas and recognise their progress to date, much remains to be done across the region to ensure the successful implementation and monitoring of such initiatives, as well as to develop new, inclusive policies which contribute to a more enabling environment for CSA uptake. Some of the measures aimed at increasing CSA uptake include input subsidy programs; tax incentives; streamlining land tenure and property rights; payment for ecosystem services, among others. Fiscal incentives and direct product subsidies can promote the uptake of selected CSA technologies e.g. import duty exemptions have increased farm mechanization in Kenya and the tax exemption on solar technology has spurred the growth of this green energy.

Despite the abundance of TIMPs within the region, adoption has been low. The adoption of new and available TIMPs is a function of science, economics and human behaviour. The nexus between the farmer, researcher, input suppliers, private sector, policymakers, extension service providers and the markets, needs to be well understood. The workshop provided an opportunity to broadly look at the importance of factors facilitating the adoption of technologies, and the stakeholders involved. These included increased research and development; increased agricultural stakeholder awareness and capacity; the presence of robust dissemination channels; land tenure rights; increased access to financial services; active participation of development partners and farmer organizations; and enabling policies with incentives and disincentives; among others. For example, farmers would invest in TIMPs if they expect the investment to be profitable, of course with the right education, information, and motivation. If these benefits will go to stakeholders outside agriculture, farmers will have no incentive to adopt them.

To spur the exchange and adoption of TIMPs within the ASARECA region, we require some consistency and coherency in our policy frameworks. This may require ASARECA to facilitate continuous dialogues to look into setting clear goals for CSA in the region, defining research and development priorities, and targeting and implementing policy measures at the appropriate level. To achieve the SDGs, there is a need for more ideas, innovation, and strategic partners. Joint, coherent, and decisive action is needed now.

2.5 PRESENTATION ON THE AICCRA PROJECT AND ITS FOCUS ON CLIMATE SMART AGRICULTURE

The Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) Programme is a mechanism through which the One CGIAR and the World Bank are collaborating to respond to some Agriculture-related challenges in Africa. The Project focuses on:

- Accelerating Impacts of CGIAR Climate Research for Africa (AICCRA) over a period of three years in six countries.
- Land, soil and crop Data Hub Project for EA under DeSIRA over four years in three countries.
- Legume-based Sustainable Agroecological Intensification under DeSIRA over five years in four countries.
- Strengthening Adaptive Capacity of Livestock Systems in ESA under ACIAR for five years in three countries.
- Generation and packaging knowledge, innovations and technologies to enhance delivery to the National Agricultural Research Systems.

AICCRA ESA – its objectives

1. Maximize climate information services (CIS) and Climate Smart Agriculture (CSA) knowledge, innovations, and technologies spillover – via One CGIAR and multi-actor partnerships with National Public and Private Sector, Regional Climate Prediction Centers (ICPAC), Research, Extension and Educational Networks (ASARECA, CCARDESA and RUFORUM) to achieve outcomes in IGAD/SADC member states.
2. Generation/Packaging/sharing of knowledge/tools to address critical gaps in CIS and CSA provision, and to promote large-scale intra-regional adoption including S-S learnings.

3. Strengthen capacity and partnership delivery – education-research-extension continuum - to anticipate climate risks, and accelerate prioritization, bundling and uptake of best-bet adaptive measures.
4. Validate/contextualize CIS and CSA technologies, link bundled packages to transfer systems for scaling, and improve beneficiaries' and end-users access to ag-advisories for decision-making.

AICCRA ESA components:

1. **Component I:** Focuses on knowledge generation, technology and service sharing, development of integrated national ag-data hub; co-development of climate, weather, soil, crop, livestock and management information, including a focus on GSI national ag-data hubs; strengthening of ag-extension systems and digitally-enabled integration; contextualizing CIS, ag-advisories and disseminating CSA packages widely to partners and end-users; identifying constraints and policy options for broad-scale CIS, ag-advisory and CSA adoption.

2. **Component II: Partnerships and capacity for delivery**
   Focuses on building capacities of CSA next users on CSA technologies and practices; strengthening national platforms to support adoption at scale; enhancing capacities for Next-gen weather forecasting, data generation, visualization and archiving; promoting cross-regional and South-south learning.

3. **Component III:** Focuses on CIS and CSA technology promotion, delivery and inclusive access; scaling strategies for validated and customized CIS and CSA packages in priority value chains; increased access to CIS, ag-advisories and CSA packages in priority value chains; enhancing the NARES capacity on CIS and CSA co-development; and influencing national policies, strategies and programs.

Discussion: Highlights on discussion on AICCRA Project and its focus on climate smart agriculture

1. On the issue of expanding training for NARES and the private sector in the digitalization of climate data, AICCRA in collaboration with ASARECA, plan to undertake training in climate change risks and other identified areas. Besides, ASARECA is interested in harmonizing collaboration and activities in foresight analysis.

2. Regarding modalities for setting up national data hubs, the architecture of the national agricultural data systems should be informed by national partners. In addition, AICCRA plans to source expertise and technology from Asia and Europe to customise technologies to national needs.

3. Regarding the reach and impact of CSA information to farmers, it was noted that there is some progress in reaching farmers. However, there needs to be an assessment of the usefulness, effectiveness and reach of climate weather focus and digital innovations.

4. In terms of learning and collaboration, One CGIAR plans to engage KALRO to learn more about the Ag Observatory, expand API linkages with research and the private sector, and engage with Techno Serve to leverage their experience.

5. On capacity strengthening, it was agreed that, initiatives by ASARECA and AICCRA should build upon existing work capacities, including mainstreaming the Small and Medium-size enterprises to access finance to enable SMEs to support various value chains.

3. DAY ONE: PRESENTATIONS ON BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION

3.1 BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION IN BURUNDI

Burundi's National Agricultural Research Institute (ISABU) has the mandate to: Conduct research in seed production for different crops; research on new varieties to improve adaptability; research in tissue culture technologies; engage in greenhouse production for roots and tubers; manage plant diseases; produce biofertilizers for legume crops; undertake smallscale irrigation for vegetable crop; fodder production technologies; pig breeding; and artificial insemination among others.

Table 2: Best bet CSA technologies ready for commercialisation in Burundi

Priority commodity	Name of CSA Technology or Innovation	Year of release	CSA Attributes	Status of commercialisation	Contacts
Crops					
PDT	Early maturing low-land potato varieties	2019-2020	climate resilience and food security	Lowland ware potato producers	ISABU/Potato team/ 79439473
	The use of Rest Breaking agents (super grow and other technologies) on potato dormancy release	2020-2021	climate resilience and food security	Private Potato seeds producers	ISABU/Potato team/ 79914457
	Disease-free potato minitubers production under greenhouses	2015-2021	climate resilience seeds production and food security	Private potato seeds producers of early generations: ADPR, INYOMYI, SOVERT, AGRINODE, Francois	ISABU Potato team/ 79914457
	Organo-mineral potato fertilization	2021	climate resilience seeds production and food security	Private potato seeds producers; All Farmers	ISABU Potato team/ 79914457
Beans	MAGORORI	2015	Biofortified and early maturing	Commercialised by the seed company	ISABU, bean Team
	RUFUTAMADEN	2015	High market value	Commercialised by the seed company	ISABU, bean Team

	KANEZA	2015	Biofortified and early maturing	Commercialised by the seed company	ISABU, bean Team
Mechanisation					
Multi-crop thresher	Multi-crop thresher	2019	Labour saving	Commercialised by artisans	Pasteur, ETS Kamenge
Value addition technologies					
Bean flour	Bean flour	2019	Rich in nutrients	Commercialized by bean processors across the country	Totahara Regerubuzima, Kaflobe factories

Challenges/barriers for ISABU

1) Low funding
2) Low capacities of staff
3) Facilities and infrastructures are not adapted to specific research.

Strategies for scaling out

1) Collaboration with other NARIs, as well as regional and international organizations.
2) Development and diversification of innovative research
3) Introduction and creation of new varieties/races of different crops/animal
4) Collaboration/dialogue with the private sector on the value chain of new technologies developed

Challenges faced by the Private sector in Burundi

1) No insurance for the agriculture sector
2) Some technologies are so expensive
3) The facilities of public service are idle

Strategies for the private sector

1) Collaboration with ISABU
2) Work in associations/cooperatives

3.2 BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION IN UGANDA

Table 3: Livestock, Fish Climate Smart Technologies

Name of CSA TIMP	Year of release	CSA attributes	Status of commercialization	Contacts of scientists and institutions that developed this technology
Fast-growing Nile Tilapia strains	2016	Faster growth rates at an average of 2.47g per day hence a short production cycle, thus efficient use of resources		NARO-National Fisheries Resources Research Institute
NARO- anti-Helminth (Dewormer)	2017	Efficient use of natural resources. Causes 94% mortality of nematode larvae in 24 hours which ensures normal growth of goats		NARO- National Livestock Resources Research Institute
NARO-Mubende Elite (Goat)	2017	Faster growth, 90% twinning ability and tolerant to diseases		NARO- National Livestock Resources Research Institute
NARO Chicks	2017	High feed use efficiency; higher growth rates (cocks attain 2kg in 4 months whereas hens attain 1.5 kg in 4 months and are tolerant to diseases).		NARO- National Livestock Resources Research Institute
Un-extruded floating insect-meal-based fish feed	2021	Sustainable and efficient use of natural resources	Still under incubation	NARO-NaFIRRI)

Table 4: Mechanization CSAs

Name of CSA TIMP	Year of release	CSA attributes	Status of commercialization	Contacts of scientists and institutions that developed this technology
NARO lightweight Rice Thresher-LWR1	2013	Threshing output 550-700kg/litre with threshing efficiency of 99.9% -The rice thresher is energy efficient and uses 50% energy	-	NARO- Agricultural Engineering and Appropriate Technology Research Center
Biomass Stove	2013	Efficiency in combusting low porosity biomass including agro-wastes saves 2.7-3kg of firewood per hour. The biomass stove uses 50% energy	-	NARO- Agricultural Engineering and Appropriate Technology Research Center
NARO-briquette machine	2017	Increases utilization of wood waste as a source of cooking reducing pressure on forests for fuel wood	-	NARO- National Forestry Resources Research Institute
Compressed Biogas (Alternative for Liquefied petroleum gas)	2020	Fewer methane emissions into the environment; 8 alternative products from bio-slurry e.g. liquid soap, bio-electricity, bio-fertilizer, sulphuric acid, etc.	-	NARO – National Livestock Resources Research Institute
NARO RAMP-2 (Ram pump)	2020	The pump is powered by energy flowing waterfall therefore it is environmentally friendly and has a low operational cost. Enables smallholder farmers along rivers/ streams with waterfalls to produce crops	Not yet, still a prototype	NARO- Agricultural Engineering and Appropriate Technology Research Center

		especially vegetables all year round		
NAROFIK-3-D6 (Fish Kiln)	2020	Reduces the amount of firewood and charcoal required for smoking fresh fish by 50% and significantly reduces smoking time to just 10-14 hours from 48-72 hours taken by the traditional methods of chokiri kilns.	-	NARO- Agricultural Engineering and Appropriate Technology Research Center

Table 5: Value addition and food processing

Name of CSA TIMP	**Year of release**	**CSA attributes**	**Status of commercialization**	**Contacts of scientists and institutions that developed this technology**
NARO-KUMA fuel lighters	2017	Easy and fast to light fuel with minimum smoke; environmentally friendly	-	NARO- National Forestry Resources Research Institute
Bio-degradable nano-surface package from agricultural waste (cassava & banana peels, rice & wheat straws, etc.)		Bio-degradable, environmentally friendly	-	NARO-National Agricultural Research Laboratories, Kawanda
Aflasafe		Aflasafe is a mycotoxin-binding technology that deploys non-toxigenic fungi to control aflatoxin contamination in cereals and pulses	-	IITA & NARO - (NaCRRI) & NaLIRRI

3.3 BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION IN KENYA

In Kenya, some of the TIMPs are strong on adaptation and mitigation. There are many CSA TIMPs in KALRO, probably several hundred across various value chains and also agricultural production systems. The CSA TIMPS are a product of collaborative research with other NARS, CGIAR centres and the Private sector. The issue of attribution and co-ownership of patents often emerges at the stage of dissemination. Most of the technologies are complementary and cannot stand alone.

Table 6: Priority commodities climate-smart technologies ready for commercialization in Kenya

Name of CSA TIMP	**Year of release**	**CSA attributes**	**Status of commercialization**	**Contacts of scientists and institutions that developed this technology**	**Name of CSA TIMP**
Beans	KAD 02 - Nyota		- Drought tolerant; Early maturing – 65-70 days; - Yields 15% more yield than other varieties; - Micronutrient-rich bean, high grain iron content; - High zinc grain content; cooks fast; 1.4-2.2T/Ha	KALRO	
Green grams	Ndengu Tosha	2017	- Early maturing (65 –70 days); - High yielding – 1.8-2.3Tons/Ha; grows in a wide range of climatic conditions – 0-1600 masl; - Heat and drought tolerant; temp range 25- 350C; 400-550 mm rainfall.		
Maize	KDH414-05-09 (Ukamez-1 to 5) variety	2019	- Drought tolerant; 3.6-4.5 months; - Three-way Hybrid; resistance to GLS, MSV; - Good ear cover; good husk cover; 3.5-9.5Tons/Ha		

Name of CSA TIMP	Year of release	CSA attributes	Status of commercialization	Contacts of scientists and institutions that developed this technology	Name of CSA TIMP
Rice	IR-05N221 - Komboka variety	2015	- Irrigated and rain-fed lowland ecosystems; - Aromatic paddy Rice: good milling quality; - Moderate tolerant to some RYMV and blast disease strains; 2.5-3 months; 4.0-6.7Tons/Ha		
Beef/Dairy	Use of Probiotics to improve feed efficiency	2022	- Enhance nutrient absorption – normal microbes can't do this; - Reduces methane emission – contribute to mitigation; - Improves immunity and health - contributes to adaptation and productivity		
Poultry	KARI Improved Indigenous Chicken (KC 1 and 2)	2018	- Growth rate faster (4-4.5) to egg production, others 8 months; - 2kgs by 4 months; 250-280 eggs/ year – others 80-100; - well adapted to many climates		
Pastures	Brachiaria spp. Var. Toledo, Piata, MG-4 and Basilisk	2021	- High-quality feed, increase livestock productivity and also improve farmers' income and livelihoods; - Milk production 15-40%; drought resilient; water efficient; deep root system – carbon sequestration; highly digestible – low methane production; can convert nitrogen		

Name of CSA TIMP	Year of release	CSA attributes	Status of commercialization	Contacts of scientists and institutions that developed this technology	Name of CSA TIMP
			into nitrates - mitigation		
Soil health	Nutrient Scanner		- Supports farmers with instant, on-the-spot monitoring of nutrients in the soil, feed and leaf.; - Checks for NPK and pH values – soil health and fertility – right decisions concerning inputs, crops and planning. This service has mitigation potential	AgroCARE	
Water management	Solar irrigation kits - RainMaker2		- Intelligent solar-powered irrigation solution; - Household energy needs; solar energy for irrigation;		Sun Culture
Maize	Aflasafe KE01™	2020	- All-natural biocontrol product; - Drastically reduces aflatoxin accumulation in maize; - Cost-effective providing high returns on investment and health benefits; reduces aflatoxin by 80% to 99%		

3.4 BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION IN ETHIOPIA

Ethiopia pursues agricultural intensification, diversification, and commercialization as the engine of economic growth and development. Ethiopia also mainstreams a climate-resilient green economy strategy to achieve food security and poverty alleviation. This direction is based on three pillars namely: productivity, adaptation, and mitigation. EIAR plays a key enabling role in CSA transformation efforts, through technologies, knowledge, and information to various users.

Table 7: Priority commodities climate-smart technologies ready for commercialization in Ethiopia

Commodity	Name of CSA TIMP	Year of release	CSA attributes	Status of commercialisation
Teff	Kora	2014	Yield, DD resistance, maturity days	Commercialised
	Tesfa	2016	Yield, DD resistance, maturity days	Commercialized
	Estube,	2019	Yield, DD resistance, maturity days	Commercialized
Maize	Bako hybrids	2013	Yield, DD resistance, maturity days	Commercialized
	Melkessa-1	2015	Yield, DD resistance, maturity days	Commercialized
Wheat	Hidase	2014	Yield, DD resistance, maturity days	Commercialized
	2014		Yield, DD resistance, maturity days	Commercialized
	Ogolcho	2015	Yield, DD resistance, maturity days	Commercialized
	Deka	2020	Yield, DD resistance, maturity days	Commercialized
Sorghum	Assosa	2015	Yield, DD resistance, maturity days	Commercialized
	Argiti	2017		Commercialized
	Jiru and Bonsa	2017		Commercialized
Malt Barley	HB 1963			Commercialized
	Ibon			Commercialized
Livestock breed improvement and diversification,	Crossing, Selection	2014	Milk and beef productivity	Commercialized
Forage development:	DZF-552 (alfalfa)	2014		Commercialized
	Temesgen (copea)	2014		Commercialized
	Sweet blue Lupin	2014		Commercialized

Commodity	Name of CSA TIMP	Year of release	CSA attributes	Status of commercialisation
	Pigeon pea	2014		Commercialized
Poultry on farm	Koekoek	2015		Commercialized
Fish fingerlings and feed		2015		Commercialized
Two-wheel tractor models DF15 DF 12		2013	Less cost	
Manual lime spreader		2017	Manageable at the household level	Commercialized
High-capacity maize Sheller released in 2016, reclaims soil acidity		2016	Reclaim soil acidity	Commercialized
Metal silo released		2015	PHL	Commercialized
Front pack six-row teff planter		2017	PHL	Commercialized
Rice milling machine		2018	Market	Commercialized

Table 8: Strategies for commercializing TIMPs in Ethiopia

Strategies for engagement of the private sector to commercialize CSA TIMPs	Suggestions on how to operationalize this strategy
Public-private partnership	Contract, out-grower
Innovation platforms	Strengthen informal business, upgrade local arrangements
Strengthen farmers based organizations	Capacity building and networks
Enhancing MFIs	Opening access to seed money
Enhancing infrastructure (irrigation, mechanization, input/output marketing)	Institutional incentives

3.5 BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION IN SOUTH SUDAN

Agriculture is the backbone of South Sudan's economy and directly affects the livelihoods of more than 90 % of the population. While South Sudan's agriculture faces acute low productivity, there is very little research conducted in agriculture. The research directorate in the Ministry of Agriculture promotes the breeding, adaptation and adoption of new and improved crop varieties.

Table 9: Best-bet climate-smart technologies ready for commercialization in South Sudan

Name of TIMPS	**Year on release**	**CSA attributes**	**Name of CSA TIMP**
Palotaka1H (Maize hybrid)	2015	Medium maturity (75 – 80 days), high yield, tolerance to foliar diseases and pests and tolerance to drought as well. Wide range of soil adaptation.	Dr. Luka Awata
AGRAC116 (Cowpea)	2016	Early maturity, high yield, and tolerance to foliar diseases and pests. Big in size and white in colour.	Dr. Tony Ngalamu
AGRAC216 (Cowpea)	2016	Early maturity, high yield (), tolerance to aphids, thrips and bacterial blight. Small size and white in colour	Dr. Tony Ngalamu
AGRAC316 (Cowpea)	2016	Early maturity, high yield () and tolerance to drought, foliar diseases, pests and brown rust. Small size and brown in colour	Dr. Tony Ngalamu
YEIPA2 (Groundnut)	2018	Medium maturity, high yield and tolerance to foliar diseases and pests	Nancy Lino
SESO3 (Sorghum	2012	Medium Maturity, High Yield And Tolerance To Drought, Foliar Diseases And Pests	Victor Bennet
MAAG191 (Common beans)	2019	Early maturity, high yield and tolerance to foliar diseases and pests	Susan Ayot
PAYE1	2015	Medium maturity, high starch content and tolerance to foliar diseases	George Tadu
Irrigation (Farrow system), adapted from old Sudan Water harvest (small scale)		Been practised since old Sudan (Dr. Adam Juma)	Been practised since old Sudan (Dr. Adam Juma)

Name of TIMPS	Year on release	CSA attributes	Name of CSA TIMP
Fruit processing Mango Juice	2016	Commercial, but a shortage in the provision of mangoes.	Egyptian company

Challenges to commercialization

1) Limited funds for the research directorate to multiply foundation seeds.
2) Limited fund for seed companies to upscale some of these technologies.
3) The government does not prioritise capital investment infrastructure.

3.6 BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION IN RWANDA

The Rwandan agricultural sector is highly vulnerable to climate and weather-related risks including: prolonged droughts (especially in the eastern and south-eastern regions); erratic rains, floods, hailstorms and mudslides (particularly in the northern and western regions). Therefore, CSA practices are deliberately deployed to cause important adaptation and productivity benefits to agriculture in Rwanda.

The key areas of CSA adaptation in Rwanda include:

1) Investing in land husbandry, water harvesting, and hillside irrigation to increase resilience to climate change, reduce water erosion and soil loss, halt land degradation, and increase land productivity.
2) Development and commercialisation of early maturing, fertilizer use efficient and drought resistant crop varieties.
3) Creating radical terraces to control soil erosion and improve soil fertility resulting in greater farm productivity
4) Agroforestry practices reduce soil erosion, increase crop yield and carbon sequestration and provide options for the production of green manure and fruits.
5) Irrigation to increase crop and land productivity.
6) Increased and promote usage of early maturing, drought-tolerant crop varieties that are also resistant to various pests and diseases.
7) Rapid and clean multiplication of cassava, potato and Banana
8) Maize drying innovations
9) Application in bio-control: Production and use of entomopathogenic nematodes.
10) Cow and Swine semen collection, conservation and distribution
11) Valley dams for reserving water for livestock
12) Zero grazing, which is a very important climate change adaptation.
13) Use of improved climate-smart forages to produce fodder during drought.
14) Silage making for animal feed and forages.
15) Capacity building for forage seeds production at farmers' fields.
16) Haymaking and fodder storage.

Strategies for commercialization of CSA

1) Mainstreaming CSA technologies into national policies and strategies.
2) Harmonization of the CSA policies across the region
3) Engaging the private sector in all processes of climate change adaptation and mitigation for opportunities discovery
4) Advocacy for financial support from development partners, philanthropies, and government
5) Creating awareness during farmer field schools and workshops
6) Documenting and publishing available CSA technologies.
7) Providing incentives to CSA champions who volunteered to utilise CSA technologies
8) Strengthening the CSA alliance through the establishment of platforms for CSA technologies.

3.7 BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION IN THE SUDAN

Table 10: List of 10 Climate-smart technologies/innovations available in Sudan commercialized or ready for commercialization

Commodity or TIMP **Crops**	**Year of release**	**CSA attributes**	**Status of commercialisation**	**Contacts**
Climate-smart innovation package for enhancing Rain-fed groundnut productivity	2018	- Climate-smart, nutrition and gender-insensitive package : - Early maturity (85 days) - Terminal drought tolerance - Inter-cropping - Water harvesting package suitable for marginal rain-fed areas (< 350 mm) - NPK Fertilizer micro-dose - Chemical weed control - Highly nutritious - Gender-sensitive crop for both small-scale and large-scale mechanization scenarios	RANS for agriculture and investment. 00249912315654	Dr Elgailani Adam Abdalla Elgailani_ers@ hotmail.com
Climate-smart innovation package for enhancing	2018	- Climate-smart, nutrition and gender-sensitive package : - Early maturity (55 days)	RANS for agriculture and investment. 00249912315654	Dr Elgailani Adam Abdalla Elgailani_ers@ hotmail.com

Commodity or TIMP Crops	Year of release	CSA attributes	Status of commercialisation	Contacts
Rain-fed cowpea productivity		- Drought tolerance - NPK Fertilizer microdose - Inter-cropping - Water harvesting package suitable for marginal rain-fed areas (< 350 mm) - Clay and light soils - Chemical weed control - Highly nutritious - Gender-sensitive crop for both small-scale and large-scale mechanization scenarios		
Climate-smart innovation package for enhancing Rain-fed sorghum productivity	2000	- Climate-smart, nutrition and gender-sensitive package : - Early maturity (85 days) - Drought tolerance - NPK and urea Fertilizer microdose - Inter-cropping - Water harvesting package suitable for marginal rain-fed areas (< 350 mm) - Clay and light soils - Chemical weed control - Highly nutritious - Gender-sensitive crop for both small-scale and large-scale mechanization scenarios	RANS for agriculture and investment. 00249912315654	Dr Elgailani Adam Abdalla Elgailani_ers@hotmail.com
4 Aerobic rice (water-saving & drought tolerant) varieties	2010	- Adoption of innovative water-saving techniques is essential for maintaining food security, due to increasing water scarcity under the changing climate	Public	Khalid A. Osman Agricultural Research Corporation (ARC), Sudan WNRS Kosti P.O Box 123

Commodity or TIMP Crops	Year of release	CSA attributes	Status of commercialisation	Contacts
		scenario. Also, water saving in rice farming through different approaches and adoption of any of these practices will transform into conserving a larger quantity of water, since huge quantities of fresh water are used in rice cultivation.		khalrice@gmail.com +249123788103 +249911399162
Dry-direct seeding rice practices In irrigated upland areas.	2014	- Dry direct seeding rice can be applied in rain-fed and irrigated upland areas. It's a crop establishment practice where seeds are sown directly into the dry soil. Which were helping farmers address the high labour cost in rice production, to increase resilience by reducing water consumption. to reduce climate change impacts.		Khalid A. Osman Agricultural Research Corporation (ARC), Sudan WNRS Kosti P.O Box 123 khalrice@gmail.com +249123788103 +249911399162
New Sesame varieties 1/ Um Shagara 2/ Gedarif Assessment of New Promising Sesame Cultivars for The Central Rain Land and	2003	- Um Shagara is a medium maturing variety; - Gedarif 1 is a medium to late-maturing variety	Seed Companies	Mohamed Elhassan Ahmed, Musa Babiker Taha and Khalafalla Ahmed A khalafallali@yahoo.com

Commodity or TIMP Crops	Year of release	CSA attributes	Status of commercialisation	Contacts
Irrigated System.				
New Sesame variety named El Gezeoli Proposal for the Release of New Elite Sesame Genotypes for Rain-fed.	2012	- El Gezeoli is a medium-maturing variety	Seed Companies	Khalafalla A. Ali and Mohamed Elhassan Ahmed khalafallali@yahoo.com
Extending of sesame sowing date up to the end of July Response of three improved sesame (Sesamum indicum L.) varieties to sowing dates under rain-fed conditions north of Gedarif.	2013	- Considering the late starting of rainfall		Khalafalla, A. Ali., M. E. Ahmed and A. H. AbuAssar khalafallali@yahoo.com
Recommendation of 12.5 Kg Urea/feddan Effect of nitrogen and phosphorus fertilizers on growth and yield of sesame	2015			Ali E Toum Hassan, Khalafalla A. Ali and Ibrahim A. Eldukheri khalafallali@yahoo.com

Commodity or TIMP Crops	Year of release	CSA attributes	Status of commercialisation	Contacts
(*Sesamum indicum* L.) under rain-fed Gedarif State				
Sowing date of faba bean Organic fertilizer of faba bean Butana AG-8	2017		Abedlhadi Mozamil (0922656572) Bakri Ahmed Ali (0912416699)	Aza Hamad Abdella Hamad azahamad16@yahoo.com 0918310546
	2017		Abazer Mostafa (0994337158) Abelrahim Hussien (0122992048)	Aza Hamad Abdella Hamad azahamad16@yahoo.com 0918310546
	2008	- Yes early maturing	Yes, the Arab Sudanese Seed Company (ASSCO)	Dr/ Ibrahim N. Elzein
	2009	- Yes early maturing	Yes, the Arab Sudanese Seed Company (ASSCO)	Prof/ Abdalla E.Mohammed Abdallahassan2002@yahoo.com
Parbahani chakti Water harvesting techniques (chisel, tide ridges/ terraces) Fertilization Ammonium Nitrate 45kg/fedd	2022	- Yes high Iron and Zinc, contribute to human health for children and women	Yes, the Arab Sudanese Seed Company (ASSCO)	Dr/ Mohammed H. Mohammed Phone : +249115063284 E.mail elgadahamza@yahoo.com
	2004	- Yes, conserve soil moisture, improving crop		Prof / Mekki A. Omer

Commodity or TIMP Crops	Year of release	CSA attributes	Status of commercialisation	Contacts
		productivity and soil physical properties		
	2014	- Yes, improve yield and soil properties		Prof/ Ali E.hassan Alimusa125@ yahoo.com
DAP 16 kg/fedd+30kg urea/fedd	2014	- Yes, improve yield and soil properties		Prof/ Ali E.hassan Alimusa125@ yahoo.com
TSP + 40kg urea/fedd	2009	- Yes, improve yield and soil properties		Prof/ Ali E.hassan Alimusa125@ yahoo.com
Urea 40kg/fed for the north Gedarif area	2008	- Yes, improve yield and soil properties		Prof/ Ali E.hassan Alimusa125@ yahoo.com
Plant spacing for varieties AG-8, Butana and W. Ahmed	2019	- Yes, Maintain soil moisture and increase crop yield		Prof/ Ali E.hassan Alimusa125@ yahoo.com
Sowing by row planting and green ridging	2010	- Yes, improve soil's physical characteristics and remove weeds		Prof/ Ali E.hassan Alimusa125@ yahoo.com
Mixed cropping cowpea+sorghum	2007	- Yes for water retention and Striga control		Prof/ Ali E.hassan Alimusa125@ yahoo.com
Plant density of the varieties AG-	2007	- Yes, optimized crop yield		Prof/ Ali E.hassan Alimusa125@ yahoo.com

Commodity or TIMP Crops	Year of release	CSA attributes	Status of commercialisation	Contacts
8, Butana and W.Ahmed Seed dressing (Apron star and Gauchu) Wad elbasheir faris Dhana chakti		- Yes, controlling insects/diseases best		Salah M. Eltayeeb +249122268240
	2012	- Yes early maturing	Yes, the Arab Sudanese Seed Company (ASSCO)	Dr/ Gailani A. Abdalla elgailaniers@hot mail .com
	2018	- Yes early maturing	Yes, the Arab Sudanese Seed Company (ASSCO)	Dr/ Adam M. Ali alkabashe@gmail.com
	2022	- Yes high Iron and Zinc, contribute to human health for children and women	Yes, the Arab Sudanese Seed Company (ASSCO)	Dr/ Adam M. Ali alkabashe@gmail.com
Water harvesting techniques (chisel, tide ridges/ terraces) Fertilizer micro-dosing (NPK) Seed priming Seed dressing (Apron star)	2004	- Yes, conserve soil moisture, improving crop productivity		Prof / Mekki A. Omer
	2010	- Yes, improve yield and soil properties		Prof/ Abdelrahman k. Osman +249918092678
	2010	- Yes enhance seed germination		Prof/ Abdelrahman k. Osman +249918092678
		- Yes, control insects and diseases as well as improve seedling vigour		Salah M. Eltayeeb +249122268240
Plant population(int		- Maintain soil moisture and increase crop yield		Dr/ Hassan O. Ahmed

Commodity or TIMP Crops	Year of release	CSA attributes	Status of commercialisation	Contacts
er and intra row spacing) 75x50 cm Dry sowing before rainfall onset Modification and evaluation of a row crop planter for a mixed cropping system		under light and sandy soil		
		- Enhanced early crop establishment		Dr/ Sawsan. K.hassan +249911106052
	2011, Meeting No 51 (29 Dec.2011)	- Seeding two crops in the same row simultaneously. - Increasing the land value and reducing the risks associated with a single crop - Improve crops yields	Not yet	
Design, development and testing of water harvesting in rows planters (WaHIP) for marginal rain-fed areas	2012, Meeting No 52 (21 June 2012)	- It is used for seeding sorghum in the bottom of the ridges for soil moisture conservation in marginal rainfed areas. - It improved sorghum yield. - It is technically feasible, economically profitable and socially acceptable.	Draot Agric. & Public Health Services, Gedarif, Sudan. General manager: Abdelhamid Salih Mohamed Email: eldroat@hotmail.com eldroatagroservices@hotmail.com Tel: +249912343343	Lotfie A. Yousif lotfie.yousif@yahoo.com Telephone: +249123176834 +249121355569 (WhatsApp)
Modification of a seeder for in situ water harvesting and tree seeding	2013	- A seeder for constructing ditches and putting tree seeds in the furrows was developed. - It harvested rainwater and regulated the spacing between tree seeds (Hashab and Talih) in the bottom of the ditch for forest plantations. - It saved many tree seeds and it was economically feasible	Not yet	Lotfie A. Yousif lotfie.yousif@yahoo.com Telephone: +249123176834 +249121355569 (WhatsApp)

Commodity or TIMP Crops	Year of release	CSA attributes	Status of commercialisation	Contacts
		compared to the traditional tree seeds seeding method.		
Modification of a seeder for in situ water harvesting and tree seeding	2013,	- A seeder for constructing ditches and putting tree seeds in the furrows was developed. 2. It harvested rainwater and regulated the spacing between tree seeds (Hashab and Talih) in the bottom of the ditch for forest plantations. 3. It saved many tree seeds and it is economically feasible compared to the traditional tree seeds seeding method	Not yet	lotfie.yousif lotfie.yousif@yahoo.com Telephone: +249123176834 +249121355569 (WhatsApp)

3.8 BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION IN TANZANIA

TARI works in 17 centres across the country researching various crops and related technologies. The main mandate of TARI is to develop and disseminate appropriate technologies, innovations and good agricultural practices for increased productivity, production, and profitability.

Table 11: List of 10 Climate-smart technologies/innovations available in Tanzania commercialized or ready for commercialization

Commodity	Name of CSA TIMP	Year of release	CSA attributes	Status of commercialisation	Contacts
Maize	UHS 401	2014	- Optimal production; Altitude 500-1500m; - Maturity: 91 days at medium altitude and 158 days at high altitude level;	Not commercialized	Ready for commercialization

Commodity	Name of CSA TIMP	Year of release	CSA attributes	Status of commercialisation	Contacts
			Tolerant to Maize Streak Virus (MSV); Tolerant to Grey Leaf spot; Tolerant to drought		TARI Uyole, Dr Anord Mushongi, 0753358712
	WE 3117, WE 3102, WE3113	2014	- Optimal production (4-9t/ha); Altitude 0-1500m; - Maturity: 120 – 130 days; Resistant to Leaf rust, Leaf blight and Maize streak virus diseases; - Tolerant to drought, It is a three-way hybrid	Not commercialized	Ready for commercialization TARI Ilonga Ismail Ngolinda, 0754447871
	T105	2016	- Optimal production; Altitude 600-1500m; - High yielding; - Tolerant to grey leaf spot; Tolerant to drought	Not commercialized	Ready for commercialization TARI TUMBI, Dr Atugonza Bilaro, 0655763022
	WE 5135, WE 5141, WE 7133, WE 7118,	2019	- Tolerant to MLND and drought, High yielding, optimal production altitude Low to mid-altitude up to 1500 masl. - It is a three-way hybrid	Not commercialized	Ready for commercialization TARI Ilonga Ismail Ngolinda, 0754447871
	UH6305	2020	- High grain yield; Potential in its areas of adaptation (7-10), High grain yield potential; - Early maturing variety; - Large cob size and two cobs per plant; Strong stalk and Medium height 1200-2000	Not commercialized	Ready for commercialization TARI - Uyyole

Commodity	Name of CSA TIMP	Year of release	CSA attributes	Status of commercialisation	Contacts
2. Sunflower	TARI-ILO2019	2020	- High yielding, OPV varieties (1.5-2t/ha); - High oil content (35%); Early maturity; optimal production; - Altitude Low to mid-altitude up to 0-2000 masl	Ready for commercialization	TARI Ilonga, Frank Reuben, 0759703615
	TARI-NAL2019	2021	- High yielding, OPV varieties (1.6 -2t/ha); - High oil content (35%); Early maturity; - Optimal production; - Altitude Low to mid-altitude up to 0-2000 masl	Ready for commercialization	TARI Ilonga, Frank Reuben, 0759703615
3. Sorghum	TARISOR1	2020	- Drought resistant; - Bird resistant; - Tolerant to Striga spp; Yield 3.6t/ha; days to maturity 112; Mid to high altitude (800-1500m)	Ready for commercialization	TARI Tumbi Dr Emmanuel Mrema; 0786371964, email: mremaemmanuel1977@gmail.com
	TARISO2	2021	- Drought resistant; Bird tolerant - Tolerant to Striga spp, Yield 3.2t/ha; days to maturity 110 - Grows at medium and high altitudes (800-1500m)	Ready for commercialization	TARI Tumbi, Dr Emmanuel Mrema; 0786371964, email: mremaemmanuel1977@gmail.com
Mechanisation Farm Machinery	Tractor ripping hire service provision model	2018	- Minimum tillage - -In situ rain	Ready for commercialized	TARI Uyole and Conservation Farming Unit(CFU)

Commodity	Name of CSA TIMP	Year of release	CSA attributes	Status of commercialisation	Contacts
Oxenization	Ox-ripping	2018	- Minimum tillage	Ready for commercialized	TARI Uyole; Dr Mlengera, and Conservation Farming Unit(CFU)
Postharvest	Multi-Crop Thresher (MCT)	2017	- Reduced human farm workload; - Reduced cost of casual labour	Commercialized	Commercialized to Imara Tech, P.O. Box 11105, Arusha, TZ, +255 752 750 122 / www.imaratech.co / info@imaratech.co
Grapes and Horticulture crops	Walk in Solar Tunnel Drier	2018	- Eco-friendly practice - Preserve the quality of products (sensory, nutrients	Ready for commercialization	TARI Makutupora FELISTA MPORE; Tel: 0759051134; mporefelista@yahoo.com

3.9 BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION IN ERITREA

NARI is mandated to work in the following areas: Natural resources management; genetic resource research, engineering research, livestock research, crop improvement research, administration and finance division, biotechnology research, food science research and technology.

Released Agricultural Innovations at NARI (MoA) related to CSA:

1) Improved crop varieties after successful research studies and achievement of the standard requirement of the regulatory services especially for maize, sorghum, pearl millet, wheat, barley, potato and some others
2) Development of tissue culture crop seeds for banana, potato and date palm
3) Modernization of food technologies i.e for value-added local foods and fruits
4) Integrated crop and livestock production
5) Dairy production and processing on a forage base, avoiding any growth promoters (mostly organic)

New CSA Technologies:

1) Production and promotion of liquid fertilizers
2) Fish amino acid (FAA)

3) Seaweed extract (SWE) is completely organic. It became effective and productive as a vegetable.

Large-scale operation of FAA and SWE

For larger production and processing of fish, a machine (fish chopper), was developed and can chop 10quintals of fish per/hour and all the needed materials for fermentation purposes are also available. This machine is also able to produce 10,000litres/month of biological liquid fertilizers which were tested by the national laboratory for plant and animal health for safety. Additionally, there has been increasing in the production and promotion of Compost (organic fertilizer) and Biopesticides. There has been a mass production trial on entomopathogenic fungi Metarhizium acridum and used in controlling desert locusts and grass hoppers.

Strategies for these new technologies:

1) Collaborate with international organizations for scaling up for on-ground practical ones
2) Preparation of business plan and socio-economic studies
3) Transforming the technologies to progressive commercial farmers/cooperatives
4) Provision of technical advice and quality assurance by the line ministry

3.10 BEST-BET CLIMATE SMART TECHNOLOGIES READY FOR COMMERCIALIZATION IN THE DEMOCRATIC REPUBLIC OF CONGO

The Democratic Republic of Congo (DRC) Agricultural Potential

In DRC, 80 million hectares of land is available and accessible for use in agriculture, forest and savannahs. This country is also a world reserve of the biosphere, only 2nd after the Amazonia (Brazil). The diversity in climate and soil variability results in diversified agricultural production, with an enormous hydrographic network (lakes and rivers) being the sources of water for irrigation and hydro-electric energies.

Constraints to DRC Agriculture

- Climate adversity is evidenced by irregularity and distribution of rainfall and alternating scenarios of drought and floods.
- Irrational exploitation of natural resources.
- Low genetic potential and gain for crops varieties, livestock and fishes
- Lack of basic agricultural infrastructure

Crop Production

The following key systems are being utilised in DRC: Use of improved varieties (short-cycle and/or drought- and/or disease-resistant varieties); improved production systems; localized irrigation (drip or micro diffuser); sowing management (reseeding, over-seeding, false sowing, dry sowing, change of sowing date); valuing underused and/or neglected crops

Livestock Production

The following key systems are being utilised in DRC: Introduction of improved breeds, crossing with locals for good resistance to diseases; establishment of feeds reserves for the dry season (hay, silage, etc.); use of new feeds sources (shrub legumes, rice straw, etc.); crops of resistant fodder varieties: Bracharias, Kikuyu grass; seasonal livestock mobility practice.

Fishes Production
The following key systems are being utilised in DRC: Fish farming in tanks and basins; introduction of short-cycle fish strains (tilapia); above-ground bins (BHS); floating cages and fish pens; fertilization of fish ponds; diversification and valorisation of new fish specie

Forestry
The following key systems are being utilised in DRC: Plantations/reforestation (state, communal or large-scale, including mangroves using mangroves and fast-growing species; improved management practices (ploughing, mowing, thinning, control of animal and plant pests) of plantations and forest parks; Alleys cropping/agroforestry (annual crops between rows of trees; domestication and planting of local fruit species adapted to the climate

Development of added value chains
The following measures are underway to develop value chains in DRC: Manufacture and promotion of new agri-food products (precooked beans, composite porridges for children, biscuits, cakes, jams, fruit juices, vinegar, pineapple alcohol, etc.); use of new sources of organic matter for domestic energy (rice husks, palm kernel shell, sawdust); traditional improved cookers; steamer for local dishes (e.g. Ablo); solar dryers; manufacture and promotion of the feed mill (Poultry, livestock, fish).

Table 12: Ten best bet CSA technologies for DRC

Crop	**SCA (Varieties**	**Release year**	**Attributes**	**Commercialization**	**Scientist/Institution**
Crops Production: 4 Technologies under commercialization					
Biofortified Maize (OPV) SAM4-VITA 2016 Precocity	SAM4-VITA	2016	- Precocity - FAW tolerant	FERKAL FAS BIODEV	Antoine LUBOBO (CIAT Harvest Plus) Luciens NYEMBO (UNILU)
biofortified Beans (bush)	Hm 21-7	2014	- Precocity - Drought tolerant	EDMAR FERKAL	Antoine LUBOBO (CIAT Harvest Plus) Telesphore MIRINDI (INERA)
Biofortified Beans (climbing	CODMM LB 059	2018	Diseases and pest resistant	EDMAR FAS	Antoine LUBOBO (CIAT Harvest Plus) Telesphore MIRINDI

					(INERA
QPM maize	Mudishi 1	2017	- Precocity - FAW tolerant	FERKAL	Aman MBUYA (INERA
Crops Production :3 Technologies ready for commercialisation					
Maïs Biofortifié (OPV)	PVA Syn 13	2020	- Precocity - FAW tolerant		Antoine LUBOBO (CIAT Harvest Plus) Luciens NYEMBO (UNILU) Aman MBUYA (INERA)
Haricot Biofortifié (Nain	CODMLB 104	2021	- Precocity - Drought tolerant		Antoine LUBOBO (CIAT Harvest Plus) Telesphore MIRINDI (INERA)
Haricot Biofortifié (Nain)	HARLUB 20	2018	- Diseases and pest resistant - Precocity		Antoine LUBOBO (CIAT HarvestPlus) Telesphore MIRINDI (INERA)
Fisheries production (3)					
Tilapia	Tilapia Kipopo 2	2018	- Precocity	FERKAL	André Kabey (INERA) Auguste CHOCHA (UNILU)
Clarias	Clarias BEZHU 1	2017	- Precocity	FERKAL	August CHOCHA (UNILU)
Lates mandachoharius	Manda-Chocha 202	2021	- Diseases/ pest tolerant or Resistant	BEZHU	Beauchet MNDA (UNILU)

Strategies for the commercialization of CSA technologies

1) Contracting Agro dealers, Aggregators, seed and grains Producers, Fingerlings Producers, Fish Producers
2) Networking producers to research, private sector, agro-dealers, processors, vendors of feeds/foods, agricultural inputs and technologies

3) Granting of credits repayable in seeds and fry after production
   Product Diversification / Specialization (Local, National and International Market) promotion and marketing Activities through demonstration plots, Agricultural fairs (Seeds, seeds, agri-food products, fry)
4) Promotional and credit sales.

Discussion: Highlights on Best bet climate-smart technologies

Regarding breeder seed

1) Both NARO and ISABU use the system of advance booking, which enables the institutes to determine how many breeders seed to produce per season; ISABU transfers breeder seed directly to the private sector.
2) In NARO the reward system for breeders is based on varieties released with high potential for commercialization as opposed to numbers released.
3) KALRO has a commercial seed unit, including livestock seed. The unit has contracts with the private sector to commercialize the seed.
4) KALRO has also set up an extension system, which connects with researchable areas in the counties using established feedback mechanisms.
5) Tanzania is piloting the digital apps, which enable farmers to submit seed demand. This best practice has been successfully implemented in Asian, where requests/demands for seed are done through a digital system a year in advance. This model is recommended for adoption in Eastern and Central Africa.

As regards engagement of multiple value chain actors

1) In Uganda the breweries have been engaged at the stage testing flour for brewing properties.
2) In ISABU the private sector actors have demanded to be involved in the development of technologies of their interest. For example, the private sector has been engaged at the stage of pre-cooked coffee been in the value addition process.
3) In Rwanda, efforts are being made to showcase technologies to the private sector to get them off the shelves through experimental fields, involving farmers and the private sector in breeding work.

Benefits of formally signing up with private sector for commercialization

1) It encourages market focused product development.
2) It helps to ensure good seed quality
3) It enhances traceability through the inclusion of identification numbers such as the case of NARO identification number in Uganda.
4) In NARO, seed companies pay royalties, which supports research.

Experience on collaboration with extension

1) In Uganda, NARO zonal agricultural research institutes conduct adaptive research and conduct technology promotion programmes involving the extension system and the farmers.
2) In Kenya, KALRO has set up KALRO Seed, a private arm, which deals with the promotions and dissemination of seed. To ensure high level of standards and compliance, KALRO undergoes the process of certification of through the official entity, KEFIS. KALRO also undertakes baselines, before release of seed, which forms a basis for evaluation.

4. DAY TWO DISCUSSIONS ON BEST BET CLIMATE RELEVANT AGRICULTURE TECHNOLOGIES

4.1 TEN BEST BET INNOVATIONS FOR ADAPTATION IN AGRICULTURE

Some of the best bet innovations for adaptation in agriculture available at ILRI can be summarised in the following categories:

1. **Agroforestry and associated benefits**

- It diversifies farming systems both ecologically and economically, which increases the resilience of soils, livelihoods and landscapes.
- Tree shade increases animal production by reducing heat stress in silvopastoral systems.
- Tree shades also reduce bare soil evaporation and improve the water use efficiency of crops, hence enhancing better use of water during drought periods.
- Diversifies livelihoods through tree products.
- In terms of the environment, trees on farms enhance the low-carbon development pathway by increasing carbon storage in biomass vegetation, in soils, and through the production of substitutes for products that have higher emissions.

2. **Aquaculture and associated benefits**

- Increases farmers' adaptive capacity.
- Diversifies income for farmers, which enables them to increase resilience in the face of shocks.
- Fish ponds can act as water reservoirs that help buffer against drought.
- Fish ponds provide income and food in regions less suitable for crops and livestock.
- Contributes to dietary diversity and the widespread challenge of undernutrition.
- In environmental terms pond farming of tilapia, a species that feeds low in the food chain, ensures production with a low carbon footprint, hence mitigating the carbon footprint associated with the growing demand for animal foods.

Smallholder aquaculture: A case of Northern Province, Zambia

World Fish and partners in northern Zambia are building the capabilities of smallholder farmers in fish farming, improving productivity through the use of local feeds and fertilizers, and improving the diversity of fish production systems through the introduction of small nutritious fish into ponds. The following are innovation highlights in this case:

1) Research has improved the hatchery production of a local tilapia species (Oreochromis tanganicae), as well as identified potential nutrient-rich small species for aquaculture.
2) Farmers have begun calling these aquaculture systems 'relish ponds'. They grow a diverse range of small, indigenous, nutrient-rich fish species on a diet of algae, bacteria, microbes, and detritus for use as a 'relish' (to accompany starch-based staples).
3) Research shows that certain small species are robust and resilient to local wetland conditions, grown in mixed systems with tilapia for sales and income.

3. **Stress tolerant varieties and associated benefits**

- Increased yields and income contributes to overall increased farmers' livelihoods, food and nutrition security and welfare.

- Tolerance to other emerging threats such as pests and diseases.
- Propagation of salinity-tolerant and drought-tolerant rice varieties present pathways of low-carbon development.
- Short-maturity varieties have reduced flooding periods and thus, the amount of methane emitted per season.

Challenges

1) Slow varietal replacement.
2) Massive range of farm environments, and the need to be able to tailor new varieties, seed systems, and crop management practices that complement them.

Drought tolerant maize for Africa and associated benefits

- For the past decade, the Bill and Melinda Gates Foundation and USAID have invested in stress-tolerant maize for Africa. Investments have focused on three main areas: (i) improving breeding, (ii) strengthening the seed sector, and (iii) reducing bottlenecks associated with adoption.
- Over 200 varieties have been released across 13 countries in sub-Saharan Africa, which has the potential to generate income through both yield gains and reduced yield variability.
- Most importantly, breeding for stress tolerance has not been at the expense of yield. Stress-tolerant maize yielded approximately 20% more under stress-prone conditions, with no yield penalty in favourable years/environments leading to a reduction in year-to-year yield variability.

4. Smallholder dairy and associated benefits

1) Improved fodder species (both grasses and trees), which helps to diversify the fodder source, and stabilize ecosystem services
2) Improved ability of soil to retain water, more resilient to dry periods.
3) Increased incomes, leading to resilience to climate shocks
4) Improved grazing management increases carbon sequestration in the soil and manure management efforts also reduce emissions from the sector.

Challenges

1) Low awareness about techniques for improved local breeding management.
2) Underdeveloped feed and fodder value chain, which limits access by many smallholder farmers access to inputs.

A case of the East Africa Dairy Development (EADD) project on mainstreaming climate actions

- Launched in 2008 in a partnership between Heifer International, ICRAF, ILRI, TechnoServe and African Breeding Systems and funded by the Bill and Melinda Gates Foundation, the EADD focused on developing the livestock sector in the East African region, by providing better business delivery services, including chilling and processing, production of inputs and providing market access through local business hubs.
- Phase 1 covered 179,000 smallholder families
- Phase-2: started in 2014, while additional 136,000 smallholder families, adopted climate-smart agriculture as an overarching objective, primarily focusing on reducing GHG emissions intensities through improving livestock productivity.

5. Alternate wetting and drying systems and associated advantages

1) Reduces the amount of water required for rice production and enables farmers to produce more rice even in the dry season.
2) Reduces methane emissions produced by anaerobic archae and provides applications for reducing water use and greenhouse gas emissions.
3) Reduces uptake of arsenic in contaminated soils.

Challenges

1) Packaging with other technologies
2) Unequal distribution of benefits
3) Weed growth may increase under more aerobic conditions.
4) Required changes in behaviour/ Perception.

A Case of alternate wetting and drying in the Angat-Maasim River Irrigation System, Philippines

- The Angat-Maasim River Irrigation System (AMRIS) encompasses ca. 26,800 ha of the rice area in two provinces of the Philippines.
- After positive results from the pilot sites in terms of GHG reduction and acceptance by farmers, AWD has been further out-scaled in the area within a national agricultural development program (FSSP—Food Staples Sufficiency Program) with the main implementer PhilRice.

6. Solar-powered irrigation and associated advantages

1) Solar irrigation lowers costs compared to running petrol-powered pumps.
2) Secures farming against climate shocks.
3) Increases groundwater use and eases surface flooding by allowing greater natural recharge Increase in net farm income
4) Limits the carbon footprint of fossil fuel-based groundwater irrigation.

Challenges

1) Low consumer awareness.
2) Solar pump manufacturers have little or no incentive to innovate on product design due to high capital subsidies.

7. Digital agriculture and associated benefits

1) Tailored advice shared with millions of farmers.
2) Integrating more data and digital tools into agriculture to boost productivity has several potential ancillary benefits.
3) Efficiency in the use of inputs can increase the value derived from farming a unit of land, reducing incentives to convert more land to agriculture.
4) Increased productivity per unit of land.
5) Equips farmers with more tools to adapt to climatic shocks or dramatic market shifts.
6) Encourages efficient input use matched to climatic trends hence reducing carbon footprint.
7) Increased data has highlighted the benefits of mixed cropping and agroforestry systems in terms of sustained productivity.

8) Improved incomes and nutrition.

Challenges

1) The vast majority of smallholder farmers live in remote areas, where good, fast internet is a challenge.
2) Agriculture system actors may have little experience leveraging the richness of the digital economy in their countries.
3) Limited access to good quality data from providers of climate services and farm locations

A case of digital agriculture in Zimbabwe

- Econet Wireless, Zimbabwe's largest telecommunications company, is spurring a data revolution in the country's agriculture sector.
- The company offers, among other things, network connections, mobile banking, and the EcoFarmer mobile platform.
- EcoFarmer provides farmers with membership in the Zimbabwe Farmers' Union as well as crop and livestock farming tips, index-based crop insurance, and funeral insurance coverage.
- At USD 1 per month and accessible through a basic mobile handset, currently, over 700,000 farmers are registered for EcoFarmer, but Econet is expanding its services to include 'Dial-a-Mudhumeni' (for agricultural advice) and to give farmers access to loans.

8. Climate-informed advisories and associated benefits

- Contributes to the resilience of rural communities in risk-prone regions.
- Helps countries in transitioning to resource-efficient and low-carbon approaches by supporting more efficient use of nitrogen fertilizers.
- Facilitates climate-sensitive decision options for farmers and the institutions that serve them.

Challenges

1) Gaps in the capacity of farmers and other agricultural decision-makers to access, understand and act on the information.
2) Gaps in the capacity of NMS to provide actionable information.
3) Gaps in historic meteorological records.
4) Gaps in the translation of climate information into agriculturally relevant information and advisories.
5) Gaps in the institutional and governance arrangements are needed to sustain the co-development of climate services.

A Case of scaling up climate information and advisory services for agriculture in Rwanda

Rwanda Climate Services for Agriculture, funded by USAID and led by CCAFS and partners, aims to support the transformation of Rwanda's farming communities and economy through climate services and improved risk management. It is developing the capacity of the Rwanda Meteorological Agency to provide high-resolution climate information (historic, monitored and predicted) tailored to the needs of agriculture. The capacity to use climate services to manage risks is being enhanced through the joint development of tools with government agencies, and through training for agricultural extension personnel. The initiative has facilitated 50,000 farmers in 14 of

the country's 30 districts to assess and adjust their farming and livelihood strategies based on climate information.

9. **Weather index-based agricultural insurance and associated benefits**
    - Allows farmers to increase their savings.
    - Allows access to more credit, and invests more in inputs.
    - Enhances adoption of improved production technologies.
    - Insurance increases the confidence of credit providers to lend to smallholder farmers.
    - Increases the number of draught animals.

Challenges

1) Limited Data availability; Good weather and crop data are needed.
2) Limited farmer understanding; Many farmers are not familiar with insurance practices.
3) Regulatory environment

A case of East Africa and Agriculture and Climate Risk Enterprise (ACRE)

ACRE (Agriculture and Climate Risk Enterprise) is the largest index insurance program in the developing world in which farmers pay a market premium and the largest agricultural insurance program in sub-Saharan Africa. It acts as an intermediary between insurance companies, reinsurers and distribution channels/aggregators (e.g. microfinance institutions, agribusiness and agricultural input suppliers). ACRE offers a wide range of products including insurance linked to agricultural credit from Micro-Finance institutions (MFIs); and a product that links insurance to a replanting guarantee by a seed company. Currently, it supports over 200,000 farmer clients in Kenya, Tanzania and Rwanda.

Insured farmers have invested 19% more in farm productivity, resulting in 16% more earnings compared to their uninsured neighbours

10. **Scaling up financing for climate change adaptation in agriculture and associated benefits**

The success of adaptation actions in agriculture relies not only on technological innovations, but supporting institutional, policy, and investment environments, which help innovations reach scale rapidly. New fit-for-purpose business and financial models are an area for innovation to support the scaling up of proven technological innovations. The key areas of focus include mobilizing private adaptation finance; impact investment; blended finance; mainstreaming climate-resilient practices into financial institutions and investors' operations

Advantages

- Help rapidly scale up investments in the sector
- Help investors learn to assess and manage climate risks
- Allows investing in new business opportunities.

Disadvantages

- Limited inclusion: Business and financial models tend to benefit smallholders with more resources rather than the poorest of the poor.
- Capacity constraints: Developers limit their ability to engage with investors and average on available financial opportunities.

4.2 THE ROLE OF THE PRIVATE SECTOR IN THE COMMERCIALIZATION OF MAIZE IN TANZANIA: THE CASE OF QPM-AIS

Introduction

As a food crop maize contributes about 42% of the protein consumption. The QPM AIS initiative undertook research and innovation leading to the release of varieties with high-quality protein. The initiative used the agricultural innovation system (AIS) in scaling out/ up QPM technologies to enhance adoption and impact on food and nutrition security and incomes.

Key results

- Enhanced promotion of QPM technologies and innovations in ECA, which made QPM technologies and innovation available through various uptake pathways.
- Quality seed of QPM was produced and sold.
- 2 QPM-based enterprises were developed.
- Capacities for disseminating and scaling up QPM technologies and innovations in ECA were strengthened with stakeholders trained
- Infrastructure for QPM technologies and innovations was developed, promoted and utilised.
- Information on QPM technologies and innovations was made available and disseminated to stakeholders in ECA.
- QPM knowledge products were developed

Key collaborators and partners

- Farmers were involved in seed and grain production
- Village/ward/district extension Services
- Local government, especially district councils
- Ministry of Agriculture
- Private sector actors such as (Tanseed International, Aminata, and International Tanfeeds).
- Agro-processors e.g Grain and Flour Enterprises (GFE), Afri Lishe
- Mass media
- Policymakers
- ASARECA

Role of the private sector

- TANSEED International and AMINATA (Seed Companies) provided foundation seeds to farmers.
- Provided training to farmers on good practices of producing quality seed and post-harvest handling of seed.
- Picked raw seed from farmers, and transported it to their storage facilities where they sorted, and grade, clean, dress and packaged
- Distribute seed to agro-dealers.
- International Tanfeeds-production of animal feed using grain purchased from farmers.

Agro-processors

• Purchase grain to process into flour
• Process flour into other products – porridge, snacks, etc.

• Package the flour for sale on supermarket shelves and other sales outlets (groceries)

Methodology

- Established 2 IPTAs in Gairo and Korogwe Rural districts. Gairo was involved in QPM seed production and distribution, while Korogwe Rural inc was involved in QPM production, processing and Utilization
- On-farm demonstrations
- Field days.
- Training of farmers, extension workers and other stakeholders in QPM technologies, best agricultural practices and business skills.
- Seed and grain production.
- Preparation of different QPM dishes/recipes
- Participation in national agricultural shows such as Nane Nane.
- Enhanced advocacy, policy support and partnership through various promotional activities – MPs, LGAs, and other stakeholders.
- Exploited various opportunities e.g. visits by various groups, institutions, VIPs, farmers etc.

Number and type of demand-driven technologies made available

- Variety-Lishe K1 improved seed, fertilizer, intercropping, sub-soiling-value added-grain, flour and food products.
- More than 8 MT of foundation quality seed of QPM produced and sold
- More than 60 MT of certified seed.
- Producers have linked t food vendors, grain markets, Seed markets, and agro-processors.

Creation of demand and business trade shows and campaigns

Displays of QPM seed, grain, flour and QPM-based food products led to more awareness, increased demand, and increased business opportunities. Different strategies were used for the promotion of QPM such as field days, news media (Radio, TV and local Newspapers), schools, and extension materials including the involvement of senior leaders and policymakers as well as NGOs/CBOs to create effective dissemination. More than five media channels covered these promotional events. During these events, more than 3,000 copies of leaflets with information on the value and benefits of QPM were made available and distributed to stakeholders. The leaflets' information also included accessibility to QPM seed, grain, flour and QPM-based recipes. More than 10,000 people attended promotional activities and more than 20,000,000 obtained information on QPM through news media and colleagues.

Advocacy, policy support and partnerships were created with the international community, national policymakers, the Ministry of Agriculture, the regional administration, local government Authorities, and Non-governmental Organizations (NGOs).

Key achievements

- Seed companies and farmers produced more than 60 tonnes of certified QPM seed for distribution to stakeholders. Farmers earned more than USD 19,000.
- Improved yield of QPM due to improved management practices such as deep harrowing and fertilizer application (2.4-6 MT/ha vs 1 MT/ha).

- Reduction of cost for making snacks by 30% by replacing wheat flour with QPM flour.
- Improved food security, income and livelihood – meals, selling snacks
- Increased demand for QPM for food and income generation.

Lessons learnt

- The commitment of the private sector to commercialization and advertisement for publicity
- Value addition and income generation aspects of QPM were one of the drivers for the adoption and commercialization of QPM technologies
- The grain market for maize does not differentiate maize based on the type and hence sometimes traders may not value QPM.
- The private sector acted as a link to enhance sales of large volumes of seeds as well as off-takers of grain and hence easy to penetrate the whole value chain.

Commercialization of other technologies/innovations

The Multi Crop Thresher (MCT), a post-harvest technology for threshing various crops after harvest was popularised and various partners were trained on how to make the thresher. One partner (Imara Technology Ltd.) went further to modify it to suit client demand. Since 2019, 420 MCTs have been sold.

Roadmap

- ASARECA needs to emphasize intellectual property rights and gain of loyalties.
- Need to emphasize product differentiation for some commodities such as the case of QPM vs other types of maize with the same colour.

4.3 SCALING UP AND OUT TECHNOLOGIES OF QPM MAIZE USING THE AGRICULTURAL INNOVATION SYSTEMS TO ADDRESS FOOD AND NUTRITION SECURITY IN KENYA: EXPERIENCES WITH THE PRIVATE SECTOR

The project aimed to increase production, nutritional benefits, value addition and competitiveness of Quality Protein Maize (QPM) in Kenya due to previously low adoption of QPM technologies among smallholder farmers despite its nutritional benefits. Emphasis was placed on seed production, training, developing and upscaling QPM innovations. Ultimately demand for QPM and related products arising from new market opportunities was increased through (i) Availing seed in the market in partnership with a private see company; (ii) promotion with various stakeholders using the AIS approach and IPTA; (iii) training; (iv) value addition.

Project Objectives

1) Enhance adoption and utilization of QPM technologies using the Agricultural Innovation System
2) Strengthening stakeholder small-scale enterprises (SMEs), especially at market centres. This involved learning and interaction for sustainable small and medium QPM with strong participation of the private sector
3) Support and upgrade the QPM value chain for sustainable adoption and utilization

4) Strengthen the capacity of stakeholders in the application of the AIS framework for scaling up and out QPM technologies.
5) Support information and knowledge sharing for scaling up and out QPM technologies.

Partners, their roles in the project

1) ASARECA was responsible for regional project coordination and management of funding flows.
2) Kenya Agricultural and Livestock Research Organization was in charge of (project management at the country level and the development of breeder seed)
3) Kiini Sustainable initiative was charged with the promotion and support of SMEs using murals in QPM selling shops.
4) The Catholic Diocese of Murang'a dealt with promotion, training and mobilisation.
5) Freshco Seed Company was involved in seed multiplication and distribution to market outlets (agro vets);
6) The agriculture ministry provided extension staff at county levels who did promotion, training and farmer mobilization
7) The smallholder farmers engaged in promotion, mobilization, provision of land for demos, QPM trade and consumption.
8) Small-scale vendors.
9) Mural designers supported content developers.
10) Jua Kali Sector – Fabricators of agro-processing equipment (silos).
11) Hawkers were involved in buying and selling QPM and its products.
12) Microfinance institutions

Modalities of engagement with the private sector

This was mainly through signed agreements, Memorandum of understanding (MoU), offers of business opportunities, contracts and actual sales.

Commercialization of QPM technologies, Innovations and Management Practices

Various modalities/mechanisms were put in place including:

- Sale of seed, thus providing business opportunities to the private companies and agro vets.
- Promotion through the use of murals, and dissemination of QPM information (use of pamphlets and brochures.
- Establishing and strengthening linkages with input dealers to increase access to QPM seed.
- Supporting SMEs through training on value addition to increase access to QPM products such as QPM Flour, cakes and livestock feed.
- Collaboration with the private sector to participate in national and international trade fairs, shows, field days, demos and murals to showcase QPM.
- Use of mass media, especially radio to showcase QPM and associated products and benefits.

Key lessons and success factors

- At the start of the project, there was no breeder's seed, through engagement with the CGIAR (CIMMYT), this was done so easily.
- Engagement of partners in an AIS model improved the adoption of QPM TIMPS
- The use of local vernacular stations and newspapers had a huge impact on the promotion of QPM.

- Trade shows, field days and demos are important avenues for promotion
- The use of agricultural innovation platforms for the promotion of QPM products is a success factor.
- The Commercial Village (CV) approach similar to IPTAs and AIS approaches works.

What did not work well

- The production of breeder seeds was a hazard.
- There are only three QPM varieties, which is a small number.

Other technologies
The Aflasafe product

- Maize varieties: (KDV1 and KDV 6)
- Beans: Nyota and KAT B1
- Bean thresher
- Greengrams (N26, Ndengu Tosha)
- Greengrams thresher
- Cassava: Cassava harvester

Proposed road map for ASARECA

- Develop local, national and regional networks comprising public, private and voluntary organizations.
- Form interdisciplinary teams to work on proposals for engagement with the private sector.
- Undertake capacity building for public and private sector actors in commercialisation linkages.
- Profile all the TIMPS in the region and avail them to the private sector for commercialization.
- Work on policies that impede the movement of products across boundaries.

4.4 STRATEGIES FOR ENGAGEMENT OF THE PRIVATE SECTOR TO COMMERCIALIZE CSA TIMPS: EXPERIENCE OF KENYA LIVESTOCK BREEDERS

Introduction

Kenya Livestock Breeders Association (KLBA) is a Multi-breed registry (studbook) and performance recording service. It provides pedigree records and certification; maintains a national database of pedigree stock; runs the Milk recording Scheme; operates within rules set by farmers, breed societies, and breed standards; and undertakes the selection of traits of economic importance and promotion of best animal husbandry practices.

Table 13: Strategies for engagement of the private sector to commercialize CSA TIMPs

Strategies for engagement of the private sector to commercialize CSA TIMPs	**Suggestions on how to implement**
Create innovative, commercially sustainable models for providing quality extension such as (public events, training and campaigns), and animal products.	• Ensuring that the private sector takes a more active role. • Sharing information with the private sector through channels where no active dialogue is required. • Undertake demonstrations and practical work to enable the trainees to learn by doing.
Establish appropriate policy and regulatory frameworks to attract the private sector towards commercializing CSA TIMPS.	• Supporting non-grant approach for private sector investors within the livestock value chain (e.g., partial loan guarantees, interest rate subsidies, contingent grants). • Rewarding and recognising progressive business models (e.g reducing excise duties and other taxes).
Facilitate information access and feedback. Increase use of ICT.S	• Centralized data repository, adoption of Blockchain Technologies to facilitate cross-referencing
Support and promote capital investment by private sectors in commercializing CSA TIMPS	• Supporting greater access to sustainable financing for private sector companies pursuing innovative technologies and business models that enhance productivity and profitability from the use of CSA TIMPS. • Harness the financial (banks), technological (innovations) and intellectual (experts) capital in the private sector to complement public sector-driven climate responses – Example of Lofte-Kesho (bundling identification, Insurance, performance recording, Credit services.
Establishing partnerships, Open networks and platforms between public-private livestock value chain actors.	• Ensure active approaches to working together with private sector entities to reach specific goals through public and private sector deals. • Open networks (no membership restrictions. • Share best practices amongst participants and provide them with active opportunities
Development and dissemination of TIMPs	• Encouraging innovation in small and medium enterprises through competition, incubation and targeted investment

Table 10: Barriers to commercializing CSA TIMPS

Barriers to commercializing CSA TIMPs	**Proposed Interventions to address the barriers**
• Lack of awareness/information on climate-smart livestock technologies. • Lack of training for empowerment of extension advisory services	• Foster partnerships between the public and private sector actors • Supporting public extension services through training. • Invitro fertilization • Registration and performance recording, use of IT and genomics • Provision of data, and records to inform selection and suitability of breeds.
• Limited capital investments for commercially sustainable models across the livestock value chain. • Limited market infrastructure. • Limited financing	• Harnessing the financial, technological and intellectual capital in the private sector to complement public sector-driven responses. • Providing financial support for innovation and investment by the private sector in new TIMPs.
• Policy and Regulatory Barriers. • Lack of government support incentives, and subsidies. • Inadequate laws, rules and regulations that demand the adoption of CSA TIMPs. • Lack of standards for CSA adoption	• Formulation of policies and regulations that support the commercialization of CSA TIMPS for livestock programs • Incentives and subsidies to livestock breeders for CSA TIMPS eg telemedicine, to have a consultation with a doctor.
• Limited Networks and Engagement Platforms • Lack of associations to exchange information and collectively advocate for the implementation of CSA.	Support the formation of platforms and partnerships focused on the adoption and implementation of CSA adoption and use.
The perception is that CSA TIMPs are a preserve for commercial, large farms and businesses.	• Provide incremental adoption approach where tangible benefits of CSA TIMPS are implemented especially in poor livestock farming setups.

Table 15: Challenges for engagement of the private sector

Challenges in the engagement of private sector	**Proposed Interventions to address the challenges**
Limited knowledge and expertise on CSA for informed investment decisions.	• Provide information from public and academic sources that help them make informed decisions on dealing with climate change impacts. • Partnership with official donors and technical assistance to leverage the expertise of development banks
Limited resources to innovate and invest in CSA TIMPS	• Harness financial, technological and intellectual capital. • Government and development partners should provide opportunities for access to grants and credit services.
The slow pace of policy reform and the lack of supportive legislative and other institutional frameworks	• Targeted and well-designed progressive incentive structures with respect to duties and taxes that recognize the contribution of private-sector investment.

Table 11: Strategies to transfer TIMPS across national borders

Strategies to transfer TIMPs across national borders	**Suggestions on how to implement this strategy**
Establish partnerships and alliances to promote CSA TIMPs.	• Develop bilateral agreements on sharing of adopted TIMPs such as regional breed associations to support and promote specific livestock breeds, and joint development and adoption of specific TIMPs.
Develop agreements on the use and sustainability of the CSA TIMPS to be transferred	• Attribution and payment for patented CSA TIMPs. • Ensure sustainability in the adoption of the TIMPs by investing in future development and use.
Creation of knowledge and information sharing platforms of CSA TIMPS	• Development of a knowledge portal for CSA TIMPS

Table 127: Barriers to transfer of CSA TIMPS across national borders

Barriers to the transfer of CSA TIMPs across national borders	**Proposed Interventions to address the barriers**
Mismatch of policy and regulatory frameworks across countries	• Partnerships by governments to establish bilateral collaborations that ensure a common approach in implementing CSA by adopting agreed standards (data sharing protocols, dissemination and use)
Varying social and cultural perceptions/attitudes across counties	• Provide flexibility in the implementation of CSA TIMPS that fits the varying needs of actors across counties. What works for country A may not work for country B
Knowledge and skills mismatch	• Establish a knowledge dissemination mechanism to address different knowledge and skill needs
Limited resources to address different capital investments need to be specified CSA TIMPS	• Provide opportunities for private sector investors to access affordable loans from regional/sub-regional development banks, utilizing a local sourcing model to improve sustainability, productivity and adoption of the CSA TIMPS
Dynamic ecological environment conditions	• Piloting CSA TIMPS and documenting outcomes to inform the development of TIMPS that fit ecological environmental conditions • specific to countries

4.5 CLIMATE SMART TECHNOLOGIES THAT HAVE BEEN COMMERCIALIZED BY THE PRIVATE SECTOR: A CASE OF ETHIO VEG FRU PLC IN ETHIOPIA:

Ethio Veg Fru PLC is a private farm in the Oromia region in Ethiopia in an area of 150 ha with 100ha under production, 40 ha protected forest area and 10ha covered by infrastructure.

Products

- Tomato (Galilya and shanty)
- Onion (Ruset, red wave and neptun)
- Hot pepper (Serande, vigro)

- Cabbage (Gloria)
- Lettuce (Aviram, cartagenes)
- Cauliflower (snow ball, Nevada, agazeen)
- Squash (Amanda, cv 3122)
- Green chilli (Demonia, Red tender)
- Broccoli (Agasi)
- Maize seed multiplication MH 140 and BH661.

Collaboration with research

The farm is undertaking multiplication and screening of maize seeds in collaboration with CIMMYT and the Ethiopian Institute of Agricultural Research for higher yields, drought tolerance, low nitrogen and stress tolerance. The farm is also involved in the registration and transfer of onion seed to the farmers through collaboration with a foreign company (Bejo). The red wave, red nice, and basic onion F1 varieties have been adapted, registered and are being transferred to local farmers.

4.6 CLIMATE SMART TECHNOLOGIES THAT HAVE BEEN COMMERCIALISED BY THE PRIVATE SECTOR: EXPERIENCE FROM THE SEED TRADE ASSOCIATION OF KENYA (STAK)

Introduction

STAK was founded in 1982 with membership covering commodity associations, National Potato Council of Kenya (NPCK), the Cereal Growers Association (CGA), and the Fresh Produce Association of Kenya (FPEAK)

Strategies for commercialisation

STAK works in partnership and collaboration with the Africa Seed Trade Association (AFSTA), the International Seed Federation (ISF), and the Ministry of Agriculture, Livestock, Fisheries and Cooperatives. STAK works with the following regulatory, support and process organisations: Seeds Regulations Committee; National Accelerated Agricultural Inputs Access Programme (NAAIAP); Kenya Cereals Enhancement Programme (KCEP); National Performance Trial Committee (NPTC); National Variety Release Committee (NVRC); Kenya Climate Smart Agriculture Programme (KCSAP); Kenya Plant Health Inspectorate Service (KEPHIS); the African Seed Access Index (TASAI); Kenya Agricultural and Livestock Research Organization (KALRO); Kenya Private Sector Alliance/Agriculture Sector Network; Agriculture sector boards; Ministerial Round Table meeting; Members of Parliament round table; senate round table; Presidential round table; and some CGIAR centres.

Table 18: Climate-smart technologies for commercialisation

Priority TIMPs	Name of CSA TIMP	Year released	CSA attributes	Status of commercialization	Contacts
Bush bean	Kazuri	2021	- Wide adaptability - Medium maturing - Drought Tolerant	Simlaw seed Co. Ltd	Simlaw seed Co. Ltd
Bush bean	Saitoti	2021	- Indeterminate growth habit - Drought Tolerant	No	KALRO KITALE
Bush bean	Tatton Bean	2021	- Low flatulence and acid - High Fe and Zinc - Good for bean flour and bean soup - High yielding - Tolerant to halo blight - Tolerant to Rust - Drought Tolerant	Egerton University	Egerton University
Bush bean	Zebra	2021	- Early maturity - Drought tolerant	Agrosoy seed company	Agrosoy seed company
Finger millet	KAK-WIMBI 5	2021	- Medium maturity - Drought Tolerant	No	KALRO (Dr. Chrispus .O.A. Oduori)
Finger millet	KAK-WIMBI 6	2021	- *Striga*, and lodging resistant - Drought tolerant; - Early maturity	No	KALRO (Dr. Chrispus .O.A. Oduori)
Finger millet	KIS-WIMBI 1	2021	- Drought tolerant; - High yield. - Early maturity	No	KALRO (Dr. Chrispus .O.A. Oduori)
Finger millet	Mavuno	2021	- Resistant to lodging, birds and blast disease - Drought Tolerant	Agrosoy Seed Company	Agrosoy Seed Company

Priority TIMPs	Name of CSA TIMP	Year released	CSA attributes	Status of commercialization	Contacts
Finger millet	Lama Finger Millet	2021	- Early maturity, - High in Ca and Fe - Drought Tolerant	Egerton University	Egerton University
Finger millet	KAK-WIMBI 5	2021	- Medium maturity - Drought Tolerant	No	KALRO (Dr. Chrispus .O.A. Oduori)
Finger millet	KAK-WIMBI 6	2021	- *Striga*, and lodging resistance; - Drought tolerant - Early maturity	No	KALRO (Dr. Chrispus .O.A. Oduori)
Finger millet	KIS-WIMBI 1	2021	- Drought tolerant; - High yield. - Early maturity	No	KALRO (Dr. Chrispus .O.A. Oduori)
Finger millet	Mavuno	2021	- Resistant to lodging, birds and blast disease - Drought Tolerant	Agrosoy Seed Company	Agrosoy Seed Company
Finger millet	Lama Finger Millet	2021	- Early maturity, - High in Ca and Fe - Drought Tolerant	Egerton University	Egerton University
Finger millet	Snapping finger millet green	2019	- Can be harvested by hand - Adaptable to sandy clay soil and loamy soil - Early maturing - Drought Tolerant	Egerton University	Egerton University
Cowpea	Kunde tumaini	2019	- Drought tolerant - Dual purpose (grain and vegetable) - Drought Tolerant	KALRO Katumani	KALRO Katumani
Maize (Early kit)	SC DUMA 441	2019	- Tolerant to Maize Lethal Necrosis (MLND) (score of 1-3 on a scale of 1-9)	SEED CO	SEED CO / CIMMYT

Priority TIMPs	Name of CSA TIMP	Year released	CSA attributes	Status of commercialization	Contacts
			- Drought tolerant hybrid		
Maize (Early kit)	SWARA PLH 457	2019	- Drought tolerant - Early maturing - Good standability - Good husk cover	PEAL AGRO SERVICES	PEAL AGRO SERVICES
Maize (Transitional kit)	SY6250	2021	- Wide adaptation over the region - Excellent ear rot tolerance - Drought tolerant	No	Syngenta E.A Ltd
Maize (Transitional kit)	SY5054	2021	- Wide adaptation over the region - Very good Grey leaf spot (GLS) tolerance - Drought tolerant	No	Syngenta E.A Ltd
Maize (Transitional kit)	SY 4150	2021	- Above-average root lodging resistance - Excellent GLS & Turcicum tolerance - Drought tolerant	No	Syngenta E.A Ltd
Maize (Transitional kit)	SY 6350	2020	- Drought tolerant hybrid - Good ear rot tolerance - Average Turcicum and GLS tolerance, Good common rust tolerance	No	Syngenta E.A Ltd
Maize (Transitional kit)	SY 6450	2020	- Good GLS & Turcicum tolerance - Drought tolerant hybrid	No	Syngenta E.A Ltd
Maize (Transitional kit)	SY 4150	2020	- Excellent GLS tolerance - Average Turcicum blight tolerance - Drought tolerant hybrid	No	Syngenta E.A Ltd

Priority TIMPs	Name of CSA TIMP	Year released	CSA attributes	Status of commercialization	Contacts
Maize (Early kit)	PAN 4M-11	2020	- Good ear rot tolerance - Drought tolerant hybrid	No	PIONEER Hi-Bred ZIMBABWE
Maize (Transitional kit)	P2848W	2020	- Grain-semi flint - Tolerance to MSV and leaf blight - Good husk cover - Good cob placement	No	PIONEER Hi-Bred ZIMBABWE
Maize (Transitional kit)	PAN 4M-23	2020	- Good grain quality - Tolerance to MSV - Drought tolerance - Good cob placement	No	PANNAR SEED
Maize (Transitional kit)	SC 443	2020	- Good grain quality - Tolerance to MSV and leaf blight - Good cob placement - Drought tolerant hybrid	No	Seedco
Maize (Transitional kit)	SC 445	2020	- High tolerance to MLND - Good standability hence less lodging - Highly tolerant to leaf diseases like blight, MSV and - Drought tolerant hybrid	No	Seedco
Maize (Transitional kit)	EASZm-H5-504	2019	- Strong stalks (reduced lodging) - Drought tolerant	No	East African Seed Company Limited
Maize (Transitional kit)	WE6108	2019	- The hybrid is drought tolerant - High yielder under optimum and drought conditions - Resistant to major leaf diseases such as gray leaf spot, turcicum leaf blight & maize streak virus	No	African Agricultural Technology Foundation (AATF)

Priority TIMPs	Name of CSA TIMP	Year released	CSA attributes	Status of commercialization	Contacts
Maize (Transitional kit)	WE6101	2019	- The hybrid is drought tolerant and resistant to major leaf diseases such as gray leaf spot, Turcicum leaf blight and maize streak virus	No	AATF
Maize (Transitional kit)	PLH458	2019	- Drought tolerant - Early maturing - Good standability - Excellent tolerant to grey leaf spot - Good husk cover - Double cobber	PEAL AGRO SERVICES	CIMMYT-ZIMBABWE
Garden pea	Molo super	2021	- Dual purpose both when fresh and dry - Drought tolerant	Simlaw seed co. Ltd	Simlaw seed co. Ltd
Maize(early kit)	P2848W	2020	- Good grain quality - Tolerance to MSV - Drought tolerance	PIONEER Hi-Bred	PIONEER Hi-Bred ZIMBABWE
Groundnut	Egerton GN-1(L)	2019	- Adaptable to sandy clay soil and loamy soil - Early maturing	Egerton University	Egerton University
Groundnut	Egerton GN-2(R)	2019	- Medium seeded - The seed is red in colour - Adaptable to sandy clay soil and loamy soil - Preferable for oil extraction	Egerton University	Egerton University
Pigeon pea	Egerton Mbaazi 3	2019	- Medium seed size - Adaptable to sandy clay soil and loamy soil - Medium maturing - Good rationality	Egerton University	Egerton University
Pigeon pea	Egerton Mbaazi 4	2019	- Medium seed size	Egerton University	Egerton University

Priority TIMPs	Name of CSA TIMP	Year released	CSA attributes	Status of commercialization	Contacts
			- Adaptable to sandy clay soil and loamy soil - Medium maturing - Good rationality		
Sorghum	Kamani	2019	- Drought tolerant	Sorghum	Kamani

4.7 CLIMATE SMART TECHNOLOGIES THAT HAVE BEEN COMMERCIALISED BY THE PRIVATE SECTOR: EXPERIENCE FROM DAL GROUP SUDAN

Introduction

Dal Group Sudan is Sudan's largest, most diversified conglomerate. It undertakes one of the largest milling operations in the region with a 1 million ton capacity a day, produced 1 million litres of drinks daily, employs 5,000 workers drawn worldwide, has trained over 220,00 home bakers at its facilities, works in partnership with global companies such as coca cola, SAP, Buhler, Tetra Pak etc.)

Table 19: CSA TIMPs Within DAL Food Portfolio

Commodity	Name of CSA Technology	Year of release	CSA attributes	Status of Commercialization
Crop				
Wheat, corn & fodder	Under Pivot Irrigation	2014	- Efficient water use, proper fertilization plan and micro-climate control	Commercialized
Groundnuts	Aflatoxin control	2013	- Land utilization	Not commercialized
Wheat and sorghum	Straw baling	2015	- Emission reduction	Commercialized
All	Solar Energy	2017	- Emission and cost reduction	Commercialized
Livestock				

Cattle diary	Fodder production	2013	- Higher yield	Commercialised
Cattle (meat)	Breed improvement	2019	- Higher yield	Not Commercialized
Cattle (Meat)	Farming	2012	- Enhanced production system	Commercialized
Cattle manure	Compost	2012	- Emission and cost reduction	Commercialized

4.8 CLIMATE-SMART AGRICULTURAL TECHNOLOGIES, INNOVATIONS AND MANAGEMENT PRACTICES COMMERCIALIZED BY THE PRIVATE SECTOR IN UGANDA

Table 20:Climate smart technologies for commercialisation in Uganda

Name of CSA technology or innovation	**Year of release**	**CSA Attributes**	**Is the technology already commercialized**	**Contacts**
Crops				
Improved crop varieties (groundnuts, beans, maize, rice, sorghum, finger millet, cowpea, sesame, green gram, pastures)	2015-2019	- Drought tolerance, early maturity, short cooking time, high yielding, water use efficiency	- Exclusive, semi-exclusive and non-exclusive licenses with 13 seed companies - Local Seed Business (LSB) groups	NARO-National Semi-Arid Resources Research Institute (NaSARRI) and National Crop Resources Research Institute (NaCRRI)
Bio-fertilizers and bio-pesticides	2020	- Eco-friendly & sustainable	- NARO Holdings Ltd; Bumi Hijau (U) Ltd	NARO – National Agricultural Research Laboratories (NARL), Kawanda

Name of CSA technology or innovation	Year of release	CSA Attributes	Is the technology already commercialized	Contacts
Livestock				
Improved grass (Cenchrus, Brachiaria, Chloris gayana) and legume pasture species		- Drought resilient forage species with low carbon footprints; tannin & saponin based feed supplements reduce GHG emissions by ruminants; high FUE	- NARO Holdings Ltd;	Improved grass (Cenchrus, Brachiaria, Chloris gayana) and legume pasture species
Mechanisation				
Solar grain dryers	2021	- Uses solar energy; low-cost technology	- NARO Holdings Ltd	NARO-AEATREC
Use of hermetic silo structures for storage of maize	2015	- Cheap, eco-friendly and reusable over a long time.	- NARO Holdings Ltd	NARL Kawanda
Animal-drawn potato digger	2017	- Environmentally friendly	- NARO Holdings Ltd	Buginyanya ZARDI
Climate Smart Management practices				
Agro-ecology specific shade tree species for various coffee agro-ecologies of Uganda	2016	- Comprises of only shade trees that are not alternative hosts/sources of BCTB, provide effective and efficient shade and mulch that increases coffee yield by 20-50%	- NARO Holdings Ltd	NARO-NaCORI

Name of CSA technology or innovation	Year of release	CSA Attributes	Is the technology already commercialized	Contacts
Plantation Carbon Sequestration InfoPak (PCS InfoPak)	2017	- The first documentation of the quantity of carbon sequestered in 3, 5 & 8-year-old clonal eucalyptus and 3, 7 & 11-year-old pine plantations in Uganda	- NARO Holdings Ltd	NARO-NaFORRI
Hydrogel AppRate	2017	- Techniques for application of hydrogel to enhance water retention for tree seedling survival under water-stressed environments. 10 g of hydrogel per plant applied during planting at the onset of rains increases tree survival to 90% compared to 50% under no hydrogel	- NARO Holdings Ltd	NARO-NaFORRI
NARO-CAST Carboniser Stove	2017	- Reduces carbon monoxide emissions and produces high-quality charcoal. The stove uses 66% less wood fuel than the 3-stone stove which is used by 80% of Uganda's households. It	- NARO Holdings Ltd	NARO-NaFORRI

Name of CSA technology or innovation	Year of release	CSA Attributes	Is the technology already commercialized	Contacts
		cooks twice as fast as the 3-stone stove		

4.9 CLIMATE-SMART TECHNOLOGIES/INNOVATIONS AVAILABLE, COMMERCIALIZED OR READY FOR COMMERCIALIZATION FOR THE PRIVATE SECTOR IN RWANDA

The Private Sector Federation – Rwanda (PSF) is a professional organization, dedicated to promoting and representing the interests of the Rwandan business community. It was established in December 1999, replacing the former Rwanda Chamber of Commerce and Industry. It is an umbrella organization that groups professionals 5 clusters: Agriculture and Livestock, Industry, Trade, Services and a special cluster for Women, Youth and People with Disabilities (PWDs)

Roles

- Advocacy
- Capacity building
- Transfer of technologies
- Linking members with the market through trade fairs, e
- Network members with a global market.
- Climate-smart technologies/innovations available
- Introduction of Postharvest technologies through the PPP model (40% Grant /under IFAD fund and 60% private contribution investment) to reduce production losses and improve quality.
- Driers (fixed and mobile driers) for grains especially maize
- Construction of Hangars across the country to support farmers in post-harvest activities
- These CSA started to be established under the IFAD project in 2017, priority crops: Maize

Impact

- Post-harvest losses reduction and increase in profits
- Reach the goal of Zero aflatoxins and more safety
- Increase the quality and value of the product

Mobile drier

This is the use of Greenhouses to mitigate climate change. It is a technology transfer done by both private entities and public institutions. Private entities sell the equipment and install it. The technology transfer innovation to farmers is done mostly by the public sector through the Rwanda-Israel Center of Excellency (RAB). The priority commodities in this program are tomato, capsicum and sweet melon.

Rwanda –Israel Horticulture Center of Excellency

The Rwanda –Israel HCoE was established in 2016. HCoE is co-financed by the State of Israel and the Government of Rwanda to create a self-sustaining centre. The project was designed such that other development partners can be invited to contribute to creating synergies and experience sharing as well as the transfer of CSA innovations. Since September 2017, about 10 different types of vegetables made of 30 different varieties of vegetables were tested in 3 cycles for adaptability to Rwandan conditions. Sweet melon and capsicum are the main vegetables being grown in greenhouses using an irrigation system. For coffee washing stations, solar power is used to pump water.

Challenges for engagement of the Private sector

- Limited skills and knowledge and information on CSA Technologies
- High cost of technologies (eg: Green Houses, driers are costly)
- Availability of equipment

Proposed interventions

- Support the Private Sector Federation of Rwanda to build the capacity of privates in CSA technologies for further investment.
- Initiate PPP Model and support this initiative through a grant where at least support can be 40% and contribution of private (60%).
- A good example of IFAD Support for the initiative of investing in driers and storage facilities.
- Support PSF-RWANDA to link innovators of CSA Technologies with our private companies to avail CSA facilities.
- Support PSF-Rwanda to commercialize the solar power water treatment technology for PSF members involved in the Coffee business.

4.10 LIST OF THE BEST-BET TECHNOLOGIES/INNOVATIONS AVAILABLE IN SOUTH SUDAN AND ARE COMMERCIALIZED, THE CASE OF GUMBO GLOW COMPANY, SEED PRODUCER

Introduction

Gumbo Glow Company started in 2016, as an out-grower company to produce seeds. The company was registered in 2018 and is located in the Eastern Bank of Juba in the Central Equatoria State. It mainly produces certified or quality declared Seeds sauced from Research and Uganda.

Table 13: CSA Technologies in South Sudan

TIMP	Year of release	CSA attributes	Private sector player involved in commercialization of TIMP	Name of scientist or contact person currently promoting this technology	Contact
NARD1 (Maize OPV)	2012	- Medium maturity, high grain yield (t/ha) and - tolerance to foliar diseases and pests	*Companies involved in all* Masco Seed Co. +211921701611; mascoseedscoltd@gmail.com) Pro Seeds Ltd +211926512468; proseedsltd@gmail.com) Seed Grow Seed Co +211920197495; Seed.grow@yahoo.com) Gumbo Glow Seed Co Ltd 211928351106; gumbogloseeds@gmail.com) Green Horizon Seed	Luka Awata	+211923648250; lukatwok11@gmail.com
Sesso2	2012	- Medium maturity, high grain yield (t/ha) and		Victor Bennet	+211924295401 Bennetv1962@gmail.com

TIMP	Year of release	CSA attributes	Private sector player involved in commercialization of TIMP	Name of scientist or contact person currently promoting this technology	Contact
		- tolerance to foliar diseases and pests			
SESO3 (Sorghum)	2012	- Medium maturity, high grain yield (t/ha) and - tolerance to foliar diseases and pests		Victor Bennet	+211924295401 Bennetv1962@gmail.com
WAD AHMED (Sorghum)	2012	- Medium maturity, high grain yield (t/ha) and - tolerance to foliar diseases and pests		Victor Bennet	+211924295401 Bennetv1962@gmail.com
AGRAC116 (Cowpea)	2016	- Early maturity, high yield (t/ha) and - tolerance to foliar diseases and pests		Tony Ngalamu	
AGRAC216 (Cowpea)	2016	- Early maturity, high yield (t/ha) and - tolerance to foliar diseases and pests		Tony Ngalamu	
AGRAC316	2016	- Early maturity, high		Tony Ngalamu	

TIMP	Year of release	CSA attributes	Private sector player involved in commercialization of TIMP	Name of scientist or contact person currently promoting this technology	Contact
(Cowpea)		yield (t/ha) and - tolerance to foliar diseases and pests			
YEIPA1 (Groundnut)	2018	- Medium maturity, high yield (t/ha) and - tolerance to foliar diseases and pests		Innocent Kitara	211920555956; ikitara72@gmail.com
YEIPA2 (Groundnut)	2018	- Medium maturity, high yield (t/ha) and - tolerance to foliar diseases and pests		Innocent Kitara	211920555956; ikitara72@gmail.com
YEIPA3 (Groundut)	2018	- Medium maturity, high yield (t/ha) and - tolerance to foliar diseases and pests		Innocent Kitara	211920555956; ikitara72@gmail.com
MAAG191 (Common beans)	2019	- Early maturity, high yield (t/ha) and - tolerance to foliar diseases and pests		Susan Ayot	211920157783; susantokwiny@gmail.com

TIMP	Year of release	CSA attributes	Private sector player involved in commercialization of TIMP	Name of scientist or contact person currently promoting this technology	Contact
MAAG192 (Common beans)	2019	- Early maturity, high yield (t/ha) and - tolerance to foliar diseases and pests		Susan Ayot	
MAAG193 (Common beans)	2019	- Early maturity, high yield (t/ha) and - tolerance to foliar diseases and pests		Susan Ayot	
PAYE1	2019	- Medium maturity, high starch content (t/ha) - and tolerance to foliar disease		George Tadu	+211921288331;
PAYE2	2015	- Medium maturity, high starch content (t/ha) - and tolerance to foliar disease		George Tadu	georgetadu57@gmail.com

4.11 CLIMATE SMART TECHNOLOGIES THAT HAVE BEEN COMMERCIALISED BY THE PRIVATE SECTOR: EXPERIENCE FROM NIREX CAMEROON

Introduction

Nirex is engaged in the production of catfish and tilapia mono-sex male fingerlings; table fish (Tilapia and catfish); import and distribute fish feed; training fish farmers in collaboration with IRAD and the Ministry of livestock using the farmer-to-farmer approach; works with World fish through the TAAT project to disseminate proven technologies in the fish sector, works with the Ministry of livestock on aquaculture entrepreneurship supported by IFAD; and with World fish, IRAD and the Ministry of livestock to co-creation of a Private Public Partnership for the fish breeding centre in Cameroon.

Climate-smart technologies commercialized

Nirex is mainly involved in animal feed production (excluding pasture improvement), and domestication of technologies in cane rats and snails. Most of the technologies commercialized in Cameroon are imported.

Table 14: Some climate-smart technologies in the aquaculture sector in Cameroon

Commodity	TIMP	Source	Year adapted
Tilapia:	YY-male technology,	Imported from Til-aqua	2018
	GIFT	Imported from Asia	2019
	Tilapia cage culture	Currently being introduced	2018
Fish feed	Locally produced pelleting machines		2020
	Aquaponics	150 and 250 sq m sets produced and commercialized	2018
Catfish infrastructure	Tarpaulin fish tanks	Importation from Nigeria and China	2016
	Smoking/drying kilns	Locally fabricated by some start-ups	2017

4.12 CLIMATE SMART TECHNOLOGIES THAT HAVE BEEN COMMERCIALISED BY THE PRIVATE SECTOR: EXPERIENCE FROM ERITREA

Introduction

To use and adapt CSA-related agricultural technologies released by the MoA in scaling up. And the private sector acts as a demonstration hub for practical training to nearby local farmers. Most private enterprises intensively work under the consultation of agricultural experts.

Dairy production and processing activities for CSA related Technologies in private sectors

Forage based production

Evaluated based on;

- Drought tolerance and ease of establishment
- Disease and pest tolerant
- Palatability
- Biomass and ground cover scores
- Phenology and seed setting ability

Improved Forage Seeds Released by NARI So far that have been commercialized include Temperate forages, Tropical legumes, Tropical grasses, Fodder trees, and Sweet potatoes. This is being practised and adapted by all private farm enterprises. Technologies used and adapted on concentrate feeds are based on feed formulation techniques adapted from NARI. The local feed ingredient materials include Maize, Sorghum, and Wheat bran.

Dairy cows technologies released by NARI used and adapted:

a. Adaptation of AI

- Feed additives like vitamins and minerals
- Introducing technologies on protecting diseases like foot root disease, mastitis, and others through lime baths, and sanitary measures to avoid using antibiotics)

b. Fattening technologies released:

- Feed-based instead of growth promoters

c. Technologies in farm productivity improvement

- Back use of Farm Yard Manure, manure as organic fertilizers on irrigated farms
- Production of compost in large-scale operations on the technologies released by NARI should be also certified for application
- These have been Commercialized (Certified compost).

d. Milk processing technologies (adapted):

- Starter cultures (probiotics) are imported, but the MoA is trying to practice and produce starter cultures and rennet locally (in the process)

e. MIHAP (Minimum integrated household agricultural packages)

Technology was released to farmers as a package in two regions and became successful and easily adopted by the farmers through the technical assistance of private enterprises. Now it is on the way to extending to other regions. To be the beneficiary, one must have at least 500m2 farmland, and water for irrigation. The government provides cow, hen, improved forage seeds, crop seeds, fruit seedlings etc (all in one package system).

The private farm enterprises associations in Cameroon

a) EWAA – Eritrean women agribusiness association
b) Established in 2003
c) Provide trainings to women farmers
d) Plant-improved variety (recommended)
e) Harvest and Commercialize the mushrooms
f) Successful activity in the country.

Private Sector Strategies

The private sector collaborates with international organizations like ASARECA on:

- Scaling up the CSA technologies adapted
- Improved variety use based on production with the environmental situation
- Dairy production and processing
- Best farm packages
- Organic farming technologies
- Develop a private-sector platform

Challenges for the private sector:

- Financial support

4.13 STRATEGIES FOR COMMERCIALIZING & BARRIERS AND SOLUTIONS FOR TRANSFER OF AGRICULTURAL TECHNOLOGIES: EXPERIENCE OF AGRICULTURAL MECHANIZATION

A glimpse at Our Learnings

Africa needs 70% more food in the next 10 Years. However, the provider of this food is a smallholder farmer, who represents 80% of food production using only a hoe in hand. It should be noted that 60% of idle productive land is in Africa. In addition, agricultural mechanization power is lacking, producing only 0.2kW/ha vs 2.5kW/ha in India (12x more). In Africa, 2 tractors are available per 1000ha and this compares badly with 16/1000ha which is the world average.

Agrimech Hub

The Agrimech Hub provides products and services which include;

• Full range mechanization tools & services
• Training
• Soil Health Farm input supplies
• First & Last mile distribution
• Aggregation, Storage & Marketing
• Agricultural data capture and sales
• Model farms and EcoTourism

What, Why and How

What 10 Women will do all day for USD 35 can be done by simple machine in 7 Minutes, for USD 0.35 (1.5% of the Time and 100 times Cheaper, and young men are more than happy to take on the job). Donor projects are supplying the wrong machinery, underpowered for CA work. Service providers are unable to make money at rates that are cast against private sector providers. In as

much as Africa is ready for standard-size machinery, business models are the answer to smallholder mechanization. Therefore, there is a need to empower the Private Sector, Seek Their Opinion and Position before Procurement. Also, there is a need to seek farmers' opinions and train them for professional and profitable mechanization businesses.

The rollout of technology-managed agricultural mechanization services hubs for Kenya
The hub model:
This is a one-stop shop for farmers (Center of excellence/Agribusiness centre). It is built on a Farm Model and equipped with a full assortment of implements that work the entire value chain. It promotes professional agricultural practices and enhances information exchange and acts as an agribusiness referral centre. It is a congregation point for Farmers and their Development Supporters where supply meets demand side on equal footing, a training base for Mechanization Operators, Farming Excellence and Climate Smart Agriculture. It is also a place where the youth Aggregate and incubates their businesses.

Climate-Smart Potato Farming Strategies, their operationalization, challenges/barriers, interventions and cross-border rollout of Private Sector-led CSA Mechanization
There is a need for

- Policy level support defines the roles of various parties (CSA-Multi- Stakeholder Platform (MSP)), and the participation of the private sector and defines the source of resources for the same.
- National Mechanization Strategy and Policy re: Import (duty exemption) and testing, research etc., of machinery that protects local industry and performance of Mechanization Service Providers.
- Sector institutions, management, regulation and capacity building for all value-chain players and especially MSPs to not only survive but thrive.
- Mechanization of Finance Schemes and especially centralized Credit Guarantee Schemes to business-link importers, dealers, MSPs and Farmers.

How to operationalize Strategies for Engagement of the Private Sector in the Commercialization of CSA Mechanization

This can be done through a;

- Representation by practitioners at all levels, led by a legislated National CSA Mechanization Committee of Stakeholders should be established.
- Central Support to CA Mechanization organizations such as Importers and Dealers Association, Association of Mechanization Service Providers, etc.
- Formation of Climate-Smart Villages led by Climate Smart Village Committees (CSVCs).
- Support to SHFs from strong Farmer SACCOs with digital support to inputs and services (including CSA Mechanization) e.g. Digifarm, Hello Tractor and others Farmers League etc.
- CSA Mechanization.

Barriers to Commercialize CSA Mechanization by Private Sector
Mechanization is expensive and typically complicated because;

i. Agribusiness funding is held as highly risky by all standards of finance sources (banks, asset leasers etc). Sales are down to 600 tractors a year in Kenya.

ii. Traditional plough-based farming is deeply engraved in farmers' practice therefore huge and multi-sectorial efforts and resources are needed to change paradigms.
iii. Lack of political will in Ag Sectors that are thoroughly under-resourced.
iv. Farmer literacy levels and trade mechanisms are driven by selfish cash-thirsty off-takers and their brokers.
v. "Mercenary" CSA Mechanization Service Supporters (hidden in farmer sustenance and environment protection projects with big names).
vi. Entry of Government/Donor projects that have no link to the ground, which have the wrong machinery and also dictate unfavourable work charges that compromise private sector business performance and profit margins.

Interventions to Commercialize CSA Mechanization by Private Sector

There should be a:

- Private-Sector led National Committee with an Umbrella mechanization programme, protected in legislation.
- Nationwide (whole value-chain based) Model Farms demonstrating the gains of CSA Mechanization, GAP and excellence in farming.
- CSA Mechanization Centres of Excellence like Agrimech/HT are established with the support of USADF (Case of Potato Commercialization and Nyandarua County).
- Government-led and private-sector-attractive PPP programmes and projects, including partners such as ACT, Agrimech, PAFID, F2MA (FSC Scheme), HT etc.
- Incentives for Private-Sector Investors to place their hard-earned money in CSA Mechanization.

Strategies to transfer private sector CSA Mechanization across national Border

- REC supported cross-border mechanization schemes, common learning and cross-border capacity exchange, led by private-sector performers and mobilizers (e.g. sitting at EAC among other cross-border trade professionals.
- Research and understand Cross-border mechanization service schemes from ground-up (e.g. FAO study by Sokoine University Project)
- Establishment and recognition of Centres of Excellence to avoid duplication across borders.
- National, into regional (ASARECA-led?) CSA Mechanization Practitioners Committees.
- Partnership support to private-sector PPP schemes like that of Josera, out to improve the Tanzania Dairy Sector by introducing mechanization (eg Silage packing.

Barriers to transferring private sector CSA Mechanization across national Borders

- Limited mechanization efforts and investments overall, in the countries concerned
- Why cross the border before satisfying your locality or nation?
- Cross-border variation of policy and regulatory guidelines, insurance, hence general cross-border insecurity.
- Challenges of machinery purchase and service infrastructure, human resources and amenities for professional and credible mechanization, maintenance and repair services.

- Ecological and value-chain variations as well as applicable work-service rates across borders.
- Cross-border tech changes or ineffectiveness of work protection gadgets and rules such as machinery and work tracking gear (and costs of the same), insurance etc.
- Highly limited and varying levels of (cross-border) attention to Climate Smartness, let alone CSA Mechanization.
- Cross-border business competition, regulations for mechanization service providers and possible duty-payment requirements for cross-border equipment sales.

Proposed interventions to transfer private sector CSA Mechanization across national borders

- There should be donor-driven or private-supplier talk shops, Mechanization Zoning of the continent and establishment of "Centres of Excellence" for Mechanization.
- Interventions that have established model mechanized farms (Zambia, Malawi, Ethiopia) - with no real intention of regional growth.
- FAO and AUC should be private-sector driven, Government intervention programme needs to be guided by the Forum for Sustainable Agricultural Mechanization for Africa (F-SAMA) – CSA needs Mechanization and Mechanization needs National Committees of Stakeholders.
- Silent but ongoing credible efforts of the private sector (e.g. by JFF and Agrimech) should be recognized and embraced.

Business Case

It currently costs a farmer in Kenya approximately USD.550 per acre per season to generate 5 tons/acre. If the farmer invests USD. 950 s/he can get 12 tonnes per acre. Agrimech Hub wants farmers to stay away and pay USD 480 per acre, to deliver an increase to 16 tonnes per acre. This way the farmer will pay Agrimech Hub services, HT (Booking agent and Platform) and comfortably service the tractor & loan, payable in 2 years in a Pay as You Go MSP scheme

4.14 BEST BET CSA TECHNOLOGIES BY THE PRIVATE SECTOR FOR COMMERCIALISATION PRESENTATION DES ACTIVITIES DES ETS EMAR

PRESENTATION DE L'ENTREPRISE

Dénomination: Ets EDMAR créé depuis 2015

Monsieur Ir NTALE MIRINDI EDO, Directeur Gérant
Spécialiste en Agroéconomie , membre de la Fédération des Entreprises du Congo /Chambre de Commerce du Sud-Kivu

Son siège social: 14, avenue Hyppodrome; commune d'Ibanda Bukavu/Ibanda.

Domaine d 'intervention: AGRIBUSINESS

Dont: Production;Transformation et Commercialisation

des produits agricoles spécifiquement les bio-fortifiés

Les cultures sont Haricot bio-fortifié et maïs bio-fortifiés

Domaine d 'intervention: AGRIBUSINESS
Autres domaines

- Vente des équipements agricoles (houes, pulvérisateurs, machettes,…
- Ventes des équipements agroalimentaires (égraineuse, décortiqueuses, des unités des transformations , moulins….
- élevage (des poules pondeuses, aliments pour bétails).
- Notre unité de transformation pour la production de farine , une capacité de 5 tonnes de farine par jours.

Partenaires
Harvest plus CIAT
SENASEM
INERA
IITA
People In Need
ONG ADVS
OXFAM.

Production des bio-fortifiés

1. Les Haricots bio-fortifiés: Production de semences:
- Volubiles
- nains

2. Les maïs bio-fortifiés:
- Production de semences: SAMVITA, PVASYN
- Production des grains: SAMVITA, PVASYN

Production des bio-fortifiés: champs de culture de haricots et des maïs

Production des bio-fortifiés: récolte des maïs
Production des bio-fortifiés: semences de haricots

Transformation des bio-fortifiés
Transformation des Haricots bio-fortifiés
Objectif :

- Donner de la valeur ajouté à la culture de maïs
- Produire de la farine riche en éléments minéraux afin de contribuer à la lutte contre la malnutrition des enfants de 0 à 59 mois;
- Farine utilisée sous forme de la bouillie**.**

1. **Transformation des maïs bio-fortifiés**
   objectif :

Valoriser la culture de maïs bio-fortifies
Produire de la farine de qualité enrichie en provitamine A;
Vendre à un prix abordable par rapport aux farines importées;

Farine utilisée sous forme de la bouillie et ou sous forme de la pâte de foufou

commercialisation des bio-fortifiés
Exposition de nos produits (semences de haricots et farines de maïs) au foire organisés par CIAT:
Visite de partenaire à notre point de vente.

Prix de Vente de :
Farine de maïs bio-fortifiés: 1$/Kg
Farine de haricot bio-fortifiés: 0,8$/Kg

Prix de Vente de :

Semence de maïs bio-fortifiés: 2,5$/Kg
Semence de haricot bio-fortifiés: 2,2$/Kg

4.15 PRESENTATIONS ON STRATEGIES FOR COMMERCIALIZING & BARRIERS AND SOLUTIONS FOR TRANSFER OF AGRICULTURAL TECHNOLOGIES, CAS DU CONGO

Quelques éléments du contexte de l'agriculture en Rep du Congo

1. L'économie congolaise présente une très forte dépendance au secteur des hydrocarbures - les recettes pétrolières représentant plus de la moitié du PIB et des recettes publiques - et à l'exploitation forestière, ce qui a longtemps retardé le développement du secteur agricole.
3. désengagement progressif de l'Etat du secteur productif
4. absence quasiment totale des équipements et infrastructures nécessaires à la transformation et à la conservation des produits
5. une faiblesse au niveau de la recherche- développement et de la vulgarisation
6. L'agriculture, essentiellement vivrière, fait vivre 40% de la population mais contribue à moins de 7 % du PIB national
7. Une superficie cultivables d'environ 10 millions d'ha (moins de 10% exploités)
8. Une forte dépendance des systèmes culturaux aux précipitations en dépit d'une disponibilité en eau équivalent à 59000m3 / habitant .
9. Recours important à l'importation des produits alimentaires : 600 à 700 milliards de FCFA
10. Une population jeune (65% ont moins de 25 ans) et fortement urbanisée
11. Un regain d'interet pour le secteur agricole Plusieurs facteurs entrent en jeu dans cette trajectoire :, manque de financement structurel,, isolement de certaines zones de production, main d'œuvre vieillissante ,

Vulnérabilité face au changement climatique

1. ccc• Diminution des précipitations moyennes (mensuelles, saisonnières, annuelles) et augmentation fortement significative des épisodes secs (diminution du nombre maximum de jours consécutifs sans pluies dans l'année, une diminution du nombre maximum de jours avec pluies par an)

2. Les températures en hausse affectent négativement les rendements qui sont déjà faibles : le cas du mais avec une hausse du prix du kg qui est estimé entre 0,50 -075 $ (comme c'est déjà le cas pendant les années chaudes et sèches) et augmenter le risque de maladies et d'infections fongiques.
3. Des précipitations intenses et l'augmentation de l'humidité favorisent le lessivage des nutriments, la croissance fongique et l'érosion
4. Victime du changement climatique au Congo, l'agriculture en est également responsable en partie directement : le secteur contribue à hauteur de 16%.

L'intervention du secteur privé

1. ccTrois points importants à prendre en compte dans le cas du Congo
2. le secteur privé est multiple (comme ailleurs en Afrique de l'Est et du Centre) les petits agriculteurs/exploitations familiales les moyens producteurs quelques grandes exploitations les multinationales qui se tournent vers la production locale (le cas de SARIS et des Brasseries pour le mais), les institutions financières commerciales (les EMF) les banques de développement et les partenaire les multilatéraux à travers quelques projets (UE , Banque mondiale , la BAD , l'AFD)
3. Les investissements consenti par les privés nationaux ces 5 dernières années avoisinent entre 50 et 60 milliards de FCFA
4. Ces investissements se font sans un appui réel des institutions habileté (recherche , vulgarisation …) .Des réseaux de partage d'informations entre exploitants se sont constitués par défaut.

Priority commodity	Name of CSA Technologie or innovation	Year of release	Attribute that make it technologie climate smart	Is this technologie already commercialized	If ready for commercialisation , give the name of the scientist and institution
Crop sector					
	Technologie endogène				
	Moudikoula : construction des canaux d'irrigation pour la production de haricot	2015	Il a permis de passer de 2 cycles de production à 3 cycles dans l'année		C'est une technologie endogène connue en milieu paysan dans le sud et que le PAM a capitaliser et diffuser dans le cadre du PAPPH Fiancée par l'UE
	Utilisation du Mucuna utilis pour l'amélioration de la fertilité du sol	Entre 2015 et 2017	La fertilisation biologique du sol, ses effets nématicides qui permettent de réduire l'utilisation des fongiques chimiques		Cette technique a été exploité par les petits producteurs de haricots avec l'appui du PAM dans le projet PAPPH financé par la FAO
	Production et vente de compost ceinture	A été initié vers les années 2010 et Repris en 2020	Limitation du recours aux engrais chimiques		TPE appuyé par la Banque mondiale et une institution de microfinance locale

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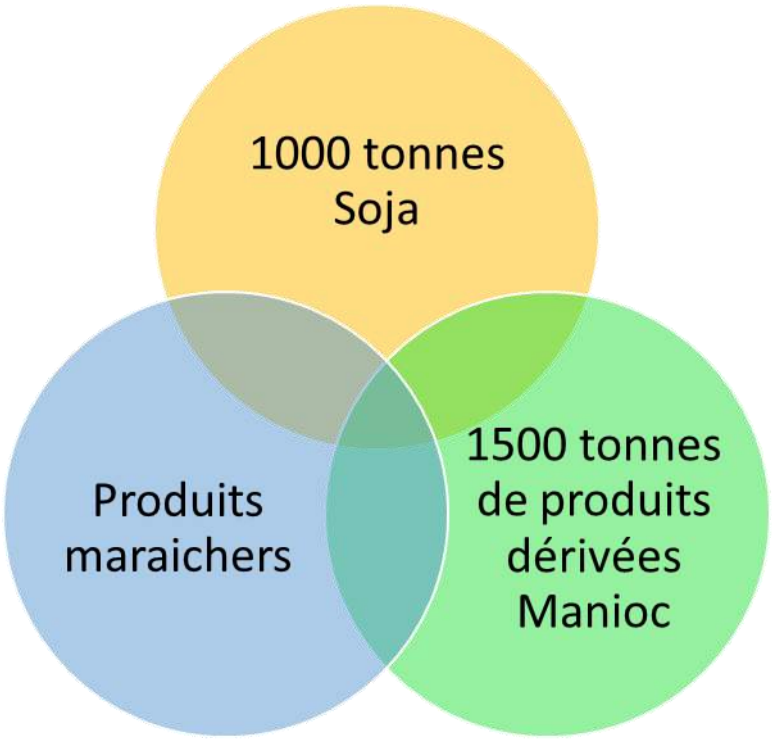
Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies

Ces stratégies doivent prendre en compte les éléments ci après (non exhaustif) :
La notion de profitabilité / de rentabilité qui conditionne l'intervention des capitaux privés le caractère très risqué du secteur agricole qui limite les possibilités de financement par le secteur financier (notamment les banques commerciales) des activités agricoles.
Devant ces contraintes nous avons initié deux actions majeures basées sur le contrat farming
la signature d'un protocole d'accord avec l'Institut de Recherche Agricole (par défaut)
la signature d'une convention avec un établissement de micro-crédit (pour le financement direct et la levée des fonds à travers le capital investissement)
Deux (2) objectifs sont visés à travers garantir la régularité , les quantités et la qualité des approvisionnements Inciter les producteurs a consommer les services de conseil , les intrants et techniques de qualité

Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies
1. partenariat avec l'IRA
Demande exprimée et soutenus par des pré accords commerciaux.



Accord avec l'IRA

le développement des pépinières des spéculations à cycle court ;

La production des semences améliorées des spéculations retenues dans le cadre des contrats commerciaux signés par Omega conseil.

Quelques axes stratégiques pour favoriser la commercialisation , le transfert des technologies et innovations

- Favoriser la mobilité des experts au sein des pays du réseau pour la diffusion des informations disponibles
- Instituer une certification qui faciliterait la circulation de ces technologies et innovations
- L'existence des avancées significatives en matières de TIMPS et la nécessité d'un répertoire des technologies déjà disponibles et utilisables
- Faciliter le transfert vers les zones mois avancés des technologies utilisables par les petits/moyens agriculteurs agriculteurs en s'appuyant sur les organisations et associations paysannes et les entreprises des pays concernés
- Pour l'implication du secteur financier
- Analyser à travers une études exhaustive de marché sur les besoins en matière de technologie et d'innovation au niveau des pays couverts par l'ASARECA
- Définir des agrobusiness modèl qui intègre ces technologies et ces innovations
- Sensibiliser les banques, les institutions de garanties et les compagnies d'assurances sur les possibilités de mitigations des risques par l'utilisation des Technologies et Innovations d'adaptation aux changements climatiques
- Favoriser l'exploitation conjointe Entreprise – Institut de recherche pour les technologies dont le marché /les niches de marché sont prouvés.

4.15 END OF DAY 2 DISCUSSIONS AND REFLECTIONS

Day 2 Discussion on first round of presentations.

On what can be done to support commercialisation in the livestock and fish innovations

-The new species of fish discovered in Zambia and Congo exhibits fast growth, producing and reproducing within 4 months. This fish could be handy where climate issues are affecting the performance of tilapia. Fingerlings are being multiplied

On what can be done to support commercialisation in the livestock and fish innovations

On breeder seed

-There is need for private sector support to invest in scaling out breeder seed.
-Commercialising varieties requires research to find a solution towards, tolerant varieties

On the criteria for choosing the best bet technologies?
Three main criteria
-The farmers, researchers and private sector decide on best best
-The private sector responds to the market, the farmers do the same, so therefore, research acts accordingly.
-Genetic gain of the variety on existing
-Nutrition value such as in QPM with protein, vitamin and minerals

-Consumer preference.

On policy issues to attract the private sector to rice which is being imported while farmers in country are unable to sell

-Lack of information may prevent the private sector from making the right decision

-The issue of cost may affect the aptitude of the private sector action in adoption.

-Rice issues are complicated. Farmers are looking for aroma.

-Rice varieties need a lot of promotion around them.

-Possibility to put tax measures on imported rice

On shelf life QPM maize

-All types of crops need good storage to extend their shelf life.

-There has been a programme on value addition of maize to further to increase the shelf life via products.

On resistance to pests and diseases

Kenya has a number of varieties that are resistant to many pets and diseases, however, some of them have been developed as GMOs. Policy movement along this will help.

On how much it cost Kenyan counties to set up climate information services.

- The documentation to cost is still ongoing customising transmission of messages, satellite availability, the cost will be determined by the density of transmission, which requires the private sector.
- Demand led market determines the involving the private sector. Involving the private sector earlier is better.
- Do you have a framework for monitoring technologies?
- Surveys are done every 3-4 four years for maize to get feedback on performance of varieties.

On the potential of changing the demand for orphan crops

- There is an inclination for maize in Kenya, but the seed companies are now moving towards other seed like sorghum.
- Globally maize is a hybrid crop.
- In south Asia, there are many small companies that are in the OPV business, which they sell as a technology package.
- How do you consider the linkage of seed companies where some are public and private?

On the place of vegetative propagated crops like cassava, potato?

- Seed companies are keen on profit oriented seed. However, the seed companies are beginning to broaden on the scope.
- The varieties are buttressed on farmer's preference.
- Another idea is to find a niche for the new product, with adequate marketing sowing benefit.
- Socio-economics play a key role in breeding, sometimes farmers prefer the old varieties to the new ones.

On NARO bean varieties

- The new been varieties from NARO are highly cost effective in terms of fertilizer
- The bio-pesticides at NARO are also cost effective
- The new NARO beans are high yielding and very cost effective
- There are many transboundary technologies that ASARECA can pick from for cross country transfer

On Cameroons perception of the west coming on to the east.

- East Africa is very much advanced in TIMPs and their use and could be of help to central Africa. Currently Cameroon is importing technologies from Asia. Central African countries need to leverage of expertise and experience to develop faster in agriculture

On opportunities of exchange can we have for RoC, DRC, Cameroon

- Cameroon and DR Congo have the opportunity of cross border exchange of TIMPs. Central African countries are still struggling to come together as umbrella organisation

5. DAY3: STRATEGIES FOR COMMERCIALISING AND BARRIERS TO TRANSFER OF CSA TECHNOLOGIES IN ECA

5.1 STRATEGIES FOR COMMERCIALIZING, BARRIERS AND SOLUTIONS FOR TRANSFER OF AGRICULTURAL TECHNOLOGIES: EXPERIENCE OF A CGIAR CENTRE (IRRI)

RICE IN AFRICA: Opportunities

Rice has become a very important food and cash crop in Africa. Approximately 230 million ha in SSA are suitable for rice production but only 12 M ha are estimated to be in use. The yield of smallholder farms averages only about 1.4 t/ha and the imports exceed 6 billion USD per year. This widening gap can be narrowed through learning, innovation and partnership

Issues holding progress in rice production

- The low productivity in both irrigated and rainfed areas
- Lack of incentives due to low farmgate prices
- Old varieties: A handful of them still predominate: Basmati 370 (1958) and IR64 (1985) in Africa
- Traditional production systems, slow adoption of mechanization
- Poor use of and access to inputs – fertilizers and other agrochemicals are too expensive
- Poor and broken value chains
- The dominance of informal seed systems leads to low productivity and poor quality – less competition.
- Public research and development programs are under-funded
- Lack of capacity for EGS production
- Poor seed/product quality monitoring and inspection
- Varietal release guidelines are old and slow
- Good policy instruments, but weak implementation
- Good products but low adoption.

Linkages for broader impacts: Role of ASARECA

a. Policy dialogues to build trust and strengthen collaboration. This approach has worked in Asia
b. Catalyze implementation of reformed policies via learning through the establishment and promotion of South-South Collaboration, Bilateral and regional tours and events
c. Bilateral and multi-national engagements and dialogues between countries across SSA and Globally across continents
d. Coordinating with regional and continental networks for seed and knowledge exchange to establish;

    -cross border trade across EAC, ECOWAS, ECCAS, COMESA, SADC, IGAD, CORAF
    -Research/development: CGIAR, AGRA, JICA/CARD, CCARDESA, AFTSA, APBA AUC–CAAPD, African Seed Biotechnology Partnership Platform (ASBPP

Enabling policies to facilitate cross-border exchange

There is a need for

- Reforms to streamline varietal release policies for faster release of new varieties to replace old varieties and landraces
- Proper certification systems by engaging seed producers
- Policies that support private sector engagement
- Fast-tracking access to modern varieties of all food crops, data and knowledge through the exchange of visits and experiences and joint training and forums for scientific exchange.

Aim for regional and global engagements and cooperation

- To harmonize seed systems and policies
- Joint varietal evaluation and release
- Recognition of evaluation data for similar agro-ecologies to reduce the time for release;
    - Therefore shortening evaluation time for varieties developed via MABC
    - Fast tracks acceptance of PVS data for varietal release
    - Enhance re-release seed multiplication & promotion
- Encourages private sector involvement

Newly released varieties in one country are to be released in other countries specifically in areas of similar ecology after one year of testing in other areas.

Benefits for partner countries - SWB

- Immediate access to varieties of different food crops
- Accelerates replacement of older varieties – cereals, root crops, vegetables, oil and fibre crops, sugarcane
- Strengthen SSC
- Strong private sector engagement
- Improved seed systems
- Knowledge sharing and capacity strengthening
- Improved cross-border trade
- Contribute substantially to food and nutrition security of the continent

Engaging with Private Sector: Why and how?

Engaging with the private sector is necessary for impact acceleration and for harnessing their strength & leveraging resources for product development. This also indicates full compliance with CGIAR IA principles, CGIAR IP and Commercialization policies which stipulate that all materials are free of charge for the public sector and NARES partners.

Improving Rice based agrifood and nutrition systems

This can be done through

- Germplasm exchange
- Digital Tools

- Management, post-harvest, mechanization
- Capacity Building
- Advanced technologies for breeding
- Value added germplasm
- High-value Traits/ products.
- Commercializing high-yielding varieties with good quality and market value.
- Commercializing climate resilient varieties Drought tolerant varieties e.g. Sahbhagi dhan; moti
- Breeding Salt tolerant varieties
- Promoting flood-tolerant varieties e.g. Ciherang-sib 1; Swarna, with Field, submerged for 22 days

Bangladesh.

Hybrid Rice Technology for Africa

Several countries have good agroecological conditions favouring the exploitation of heterosis in rice. Hybrid varieties have higher yields of up to 25% than most inbred varieties. Adoption of hybrids over inbreds can free more land for other cash crops while sustaining current rice production. Additionally, there is a need to support the engagement of the private sector. IRRI is coordinating the Hybrid Rice Development Consortium (HRDC).

Hybrid Rice Development Consortium (HRDC)

HRDC Develops elite parental lines suitable to target markets. It also conducts member-driven research for the development of technologies with a collective evaluation of hybrids across geographies. It has approximately 95 members now and the list is growing. It provides licensing of finished hybrids/ co-hybrid development.

Climate-smart management technologies

Direct Seeded Rice (DSR)

DSR enables water savings from 60% - 90% and time-saving by approximately one month. It saves rice production costs by approximately 80% compared to puddled transplanting. Mechanization support large-scale production and save labour and costs, encourages crop intensification/ diversification and reduces GHG emission

Direct Seeded Rice Consortium which is an Open Innovation Platform promotes the:

- Mechanized operations and services
- Water management
- Weed control technologies
- Crop protection
- Precision Technologies
- Capacity strengthening.

Mechanized production and post-harvest handling of rice

a) Flatbed dryer (FBD)
b) Husk furnace
c) Solar bubble dryer (SBD)
d) Laser Levelling

Efficiency via precision farming

▪ ICT-based decision support tools include

− Rice Crop Manager
− EasyHarvest
− SeedCast
− AutoMon (AWD)
− Rice Doctor (pest and diseases)

▪ GIS and remote sensing include

− Crop mapping, targeting and monitoring
− Drones
− Satellite imagery

▪ Foresight: −
High-level policy recommendations for food security monitoring.

Reaching out to farmers: sustainable food systems

These are partnerships to leverage knowledge and resources. It is a systematic approach for healthy value chains to improve and sustain farmgate prices and farmers' income. It promotes ownership by aligning with local priorities, strategies and funding schemes. Creates awareness and demand using participatory approaches from setting priorities to deploying innovations, validation and scaling. The promotion of local entrepreneurship enables diversification of resources, engages women and youth, strengthens public-private sector partnerships for access to quality inputs and services and lastly promotes proper policies to accelerate progress and impact.

5.2 STRATEGIES FOR COMMERCIALIZING, BARRIERS, AND SOLUTIONS FOR TRANSFER OF AGRICULTURE TECHNOLOGIES – EXPERIENCE BY EAST AFRICA FARMERS FEDERATION

The primary objective of the EAFF 2021-2028 Strategic Plan is to transform smallholder agriculture into a rewarding investment opportunity. This transformation will be realized through investment in the following 5 mutually reinforcing thematic thrusts:

i. Taking aggregation in use to scale;
ii. Leveraging digital technology;
iii. Taking provision of economic services to scale;
iv. Advocating for supportive policies; and
v. Improving the capacity of members to discharge their representation mandate.

Agriculture transformation

Agricultural transformation can broadly be defined as the process by which an agri-food system transforms over time from being subsistence-oriented and farm-centred into one that is more commercialized, productive and off-farm centred. Many organizations are involved in Agriculture Transformation – research (ASARECA); dev partners (AGRA, EU, IFAD), Policy makers (AUC, national governments), NGOs (Farm Africa, harvest plus..), Farmers (EAFF etc.) and private sector (AfDB).

Agriculture transformation

The questions are, why haven't we achieved a green revolution? why do we still have high import bills? why are we not adapting to climate change quickly? why are farmers not rich & agriculture drives our economies? where are all these investments being done? why aren't our models working? And how much time do we need to achieve transformation?

Challenges & Barriers to agricultural transformation

1. Disaggregation of actors

- Farmers are still fragmented, and VCs are very fragmented
- No partnership ecosystems; no value/ investments in relations
- High transaction costs; low matching of technologies with needs
- Board room models that fail in the field

2. Costs and pricing associated with technologies

- Unsupportive policies to promote transfer/uptake/ investments
- Unpredictable policies based on annual budget policy; TAXES
- Compliance with National standards and associated costs
  High costs associated with technology after-sales support (including language barriers).

3. Climate change effects

- New pests and diseases/ persistence of pests & disease
- No clear farmer/ consumer safety nets; poorly structured subsidy programs
- Lack of diversity in climate risk management products
- Insufficient information on/ access to available technologies

4. Market Access

- Low-value value chains markets are poorly developed meaning
- Import policies not protective of local production/ low VVs
- Market incentives not promotive of technology uptake
- Financial markets view the sector as too risky e.g. after covid.

5. Competing interests

- Lack of coordination by the Transformation partners
- Competing priorities at the farmer level
- Competing government policies in agriculture/livestock/irrigation

6. Capacity of technology provider

- Understanding the Agriculture landscape/ sector e.g. digital providers
- Understanding the business proposition/cost benefit.

Solutions and conclusions – enablers

1. Disaggregation of actors: Build an ecosystem of mutually reinforcing partnerships along the value
chain; we need to aggregate farmers and not work in silos

2. Costs and pricing associated with technologies*:* Advocacy for supportive policies is always a work in progress; again via partnerships we have a stronger voice. Policies need to support medium and long-term investments in tech transfer

3. Market access: Need to better structure low-value value chains through VC partnerships to drive the right incentives, decision making and impactful policies. We need to have national/ regional events promoting investments in agriculture.
4. Climate change effects: Access to climate finance to support adaptation; Need to enhance information access on available technologies; Continous lobbying for significant resilience support/ fund to support technology uptake; Partnerships along the value chain
5. Competing interests: Coordination by the Transformation/government/farmers partners needed to reduce
duplication and enhance value for money investments
6. Capacity of technology provider: Need for relationships between tech providers and users

5.3 STRATEGIES FOR COMMERCIALIZING, BARRIERS AND SOLUTIONS FOR TRANSFER OF AGRICULTURAL TECHNOLOGIES: EXPERIENCES FROM KALRO

Commercialization Strategies for KALRO

KALRO has a Seed Unit (KSU) that is in charge of contract farming, technology shops and Commercial villages eg. Cassava in Western Kenya (Busia County), Kales in Central Kenya (Kiambu County) and Indigenous chicken in Eastern Kenya (Embu County). The Unit is also a Business Dept./Office, runs digital platforms showcasing KALRO products, agricultural shows, trade fairs & field days, Mass media (print & electronic) and Innovation platforms.

Challenges

- Exorbitant fees & too much Govt bureaucracy
- Inadequate staff
- Insufficient infrastructure (irrigation facilities, greenhouses, warehouses & transport)
- Counterfeiting

Opportunities

- Sticker labels
- Capacity Building
- Lobby Govt. agencies to waive some fees & expedite the approval process
- Strengthen partnerships with seed companies, NGOs & multinationals
- Product diversification
- Sufficient arable land
- Huge market (local, regional & international).

5.4 DISCUSSION OF DAY-3 QUESTIONS AND REFLECTIONS

The following are the key outcomes from the discussions;

i. Observance of biosafety laws is a key pillar of research
ii. IRRI is still part of the CGIAR and will align interventions with the priorities of governments.
iii. The various CGIAR centres will continue doing their mandates, which has changed a consolidation of management structure into one.
iv. The idea is to engage the private sector by setting priorities, research and testing and scaling.
v. Work on the entire value chain to ensure
vi. Yield and aroma have been combined in breeding.
vii. The regional market for Tanzanian rice has expanded
viii. At the policy level, we need to have policies that are pro-farmers including access to inputs. The policy around the processes towards the evaluation of breeding materials, submission for release and commercialisation needs to be reviewed because they are too long.
ix. In India, private companies are considered in the subsidy process.
x. There is a need for transparent sharing of data on what is being produced in countries is critical.
xi. The farmer association takes up the cost of marketing and negotiates lower credit rates, the farmers are trained on how to make money.
xii. Sharing of information across borders enables farmers in the region to share lessons and experiences on how to leverage best in the market.
xiii. Aggregating farmers are meant to make a case for the pro-poor technologies and show them as a market.
xiv. Building partnerships through MoUs with roles and responsibilities, demonstrating to members what they gain from the partnership.
xv. The issue of convening meetings for partnerships is critical. Partners need to agree on who convenes them.

5.6 PANEL ONE DISCUSSION: THE TECHNOLOGIES THAT ATTRACTED ATTENTION FOR COMMERCIALISATION

AKFEMA, Kenya: Feed makers are advocating for the use/adoption of biotechnology for manufacturing animal feeds in GM soya, GM cotton, sunflower, yellow maize, and wheat. This will also benefit the food oil sector as well as offer an opportunity for its production of materials.

NIREF, Cameroon: Uses Fish breeds from Uganda. It is an effort by private sector actors to aggregate themselves by building a network of actors that are willing to buy products sourced across the region. However, none of the insurance companies nor banks is willing to insure agriculture value chains. It is critical therefore to breakthrough into financing commercialisation

DAL Foods (Sudan): technology for Fish feeds and production of high-nutrient maize for human consumption. DAL Foods also provides microfinance services to farmers

Seed Trade Association of Kenya (STAK): Provides pesticides for FAW, Rice research with IRRI, the Asian experience, Bean varieties from Uganda, Alfa Alfa seed from Ethiopia, Soy been varieties from Uganda and Automation of SPS.

Notes: ASARECA should do a feasibility study on technologies that can be directly transferred and adopted by the private sector

5.7 PANEL TWO DISCUSSION: STRATEGIES FOR COMMERCIALISATION OF CSA

Important factors of social perspective for commercialisation

- Farmers should be linked to a ready market, so that when they are ready to adopt**.**
- Facilitate multiplication of foundation seed.
- Promote and work with Quality Declared Seeds
- Engage SMEs in the multiplication of quality declared seeds.
- Break through the issue of financing SMEs who are the middle man to technology actualisation.
- ASARECA should seek financing from global multi-lateral funding targeting SMEs including Canada, targeted to climate-smart adaptation.
- Work with the SMEs to train farmers in CSA best bet TIMPS and mechanisation SMEs on mechanisation.
- Demonstrating the value of CSA TIMPs
- Establish joint ventures between the public and private sectors to multiply basic seeds.
- Investing in the promotion and marketing of new technologies, such as bio-fortified food, which are suspected to be GMOs.
- Establish mechanisms for establishing a demand for the breeder, foundation, certified, and QDSand engages NGOs.
- Involve all stakeholders in participatory breeding including millers, traders, farmers, and users to take care of milling needs, taste, and availability of seed.
- Ensure quality of seed for technologies being promoted to embed trust in consumers.
- Enabling a policy environment that supports private sector engagement in commercialisation
- Use of marker-assisted breeding technologies for desired traits.

Hub and Spoke Model of Extending Mechanization Services

"*Despite positive efforts and improvements in technology, most initiatives lack scale, and numerous infrastructural and capacity-related challenges exist, - hampering ability to realize full potential – the national capacity building is critical for broad scale adoption".*
Dawit Solomon, Regional Program Leader of AICCRA Eastern and Southern Africa

Strategies for Commercialization & Scaling of CSA TIMPs – CGIAR Perspectives

- Link farmers to a ready market
- Facilitate multiplication of foundation seed
- Promote Quality Declared Seed
- Engage SMEs in the multiplication of quality seed

- Support the private sector e.g. SMEs to access finance including access to climate finance and joint proposal development and project implementation.
- Enhance the capacity of farmers in CSA practices
- Demonstrate the economic, agronomic & nutritive value of CSA TIMPs
- Establish demonstration farms with the private sector & farming communities
- Joint ventures between public and private sectors to multiply basic seed.
- Raise awareness of biofortified technologies
- Establish mechanisms for determining prior demand of seed (breeder, foundation, certified, QDS) and engage NGOs
- Participatory breeding involving users of the TIMPs and consideration of their needs and preferences
- Quality assurance for seed through trainings of seed producers
- Enabling a policy environment that supports private sector engagement in the commercialization of CSA TIMPs
- Use of marker technologies in breeding for desired attributes

5.8 PANEL THREE DISCUSSION: BARRIERS TO TRANSFER OF TECHNOLOGIES

Table 15: Technology transfer barriers

Barriers	**Solutions**
Poor facilitation of the extension systems	Governments need to invest in extension.
Location-specific adaptation of TIMPs.	-Joint evaluation sites for best TIMPs -Establish multi-stakeholder platforms. -Conduct a regional inventory of technologies available in the NARIs
Counterfeit inputs	-Need to develop the capacity to import genuine products.
Failure to produce foundation seed	The private sector is willing to invest in the production of foundation seed
IP for crops is clear but not for animals	Awareness of the role of IPs in the transfer of the various TIMPs.
Lack of information	-Use the ASARECA platforms to make available TIMPs available at the national level, including EAFF
Poor infrastructure	
Low uptake of new TIMPs	-Conduct field days -Focus on the needs of end users. -Awareness of the creation of the new TIMPs, especially on utilisation and processing. -Technology transformation via value addition and inroads to the potential market. -Ensure the technologies where possible are simple to utilise and affordable. -Repackage technologies that have failed to be appreciated by the market.
National borders	-Improve relations and communication during transfer among countries

The misconception of the role of IP in technology transfer	-Need to leverage on IPs. It is critical to understand the language of the private sector such as exclusivity and semi-exclusivity rights through the IP system.
Porous borders lead to sneaking out of TIMPS	
Lack of sufficient seed delivered on time and when needed.	-Involvement of stakeholders including farmer's organisation in seed multiplication. -Contract farming. -Use of ICT and platforms to make seeds available. -Use proper official mechanisms to exchange varieties. -Develop an efficient demand pre-booking system. -Engagement of the private sector in a partnership with the NARI to produce seed as in the case of Rwanda
SPS limitations are real across borders	-Lobby governments to facilitate the exchange of TIMPS. -Create awareness among policymakers to relax SPS restrictions. -Sign contracts with NARIs
	-Ensure private companies pay royalties to NARIs

5.9 PANEL FOUR DISCUSSION: BARRIERS AND SOLUTIONS TO COMMERCIALIZATION OF TECHNOLOGIES

Table 16: Commercialization barriers and solutions

Barriers	**Solutions**
Extension staff themselves are not up to date with the latest TIMPs and need regular capacity strengthening	Capacity strengthening, re-training, tooling and retooling, and updating of the extension staff
Scattered information	Digitization of information to make extension information available through online platforms.
Antiquated extension systems	Revision of the extension systems to ensure all extension players are working in a coordinated manner, as in the case of Kenya and Uganda through a single spine system.
Pluralistic extension system	-Private sector investments in training extension workers to offer advice to farmers Have the policy to regulate and coordinate all extension services -Provide space for cross learning

Lack of information about the TIMPs. How much do researchers involve the extension agents when developing new TIMPs	An inventory of Technologies for all member countries and place them into one digital hub for all TIMPs available.

6. DAY 4: MAPPING DIGITAL CLIMATE ADVISORY NEEDS AND MAINSTREAMING EXTENSION IN NATIONAL EXTENSION SYSTEMS

6.1 PRESENTATION ON ENHANCING INTEGRATION OF NATIONAL EXTENSION SYSTEM FOR WIDESPREAD DISSEMINATION: AFRICAN FORUM FOR AGRICULTURAL ADVISORY SERVICES (AFAAS).

Overview of AFAAS

The African Forum for Agricultural Advisory Services (AFAAS) is the continental umbrella organization and platform that aims at strengthening national Agricultural Extension and Advisory Services (AEAS) in Africa to contribute to sustained productivity, profitability and growth of African agriculture for poverty reduction. AFAAS was established in 2004, with Secretariat in Kampala, Uganda. AFAAS is aligned with the Comprehensive Africa Agriculture Development Programme (CAADP) and the Malabo declaration of June 2014.

Its specific focus is on knowledge sharing, knowledge support and innovation. AFAAS has 40 African States as members. Countries establish a multi-stakeholder platform called Country Forum (CF) through which its activities are to be implemented. AFAAS has also Regional Fora (SARFAAS and RESCAR-AOC) that link the continental level with the country level. Its mission is to promote lesson learning and professionalism and add value to national agricultural extension and advisory service systems.

AFAAS provides Agricultural Extension and Advisory Services (AEAS) in such a way that includes:

- Dissemination of information and technologies,
- Training and advice of groups or individual farmers,
- Testing and dissemination of new technologies on-farm level
- Facilitation of learning and knowledge sharing
- Lobbying and advocacy
- Contents: Technical to economic; production to marketing, CSA, nutrition security, agri-business, commercialization
- Target: Farm level to collective level (value chain actors)
- Methods: Participatory approaches and focus on learning processes to strengthen farmers' capacities to make their own decisions.

The current move of Agricultural Extension and Advisory Services (AEAS) is towards pluralistic, demand-led and market-oriented extension systems and focuses on multi-stakeholders national ownership. This means AEAS is no more the sole responsibility of public extension systems. An increase in the landscape of actors involved in pluralistic AEAS delivery, integration and effective application of ICT tools in agricultural extension become essential to facilitate linkages, interactions
and coordination among actors. AEAS are all the different activities that provide the information and services needed and demanded by farmers and other actors in rural settings to assist them

in developing their own technical, organizational and management skills and practices to improve their livelihoods and well-being.

Challenges of the current extension system

- Public extension systems face difficulty in reaching all farmers and communities (Low farmers to extension workers ratio)
- Farmers are sparsely populated across large areas and oftentimes isolated
- Farmers increasingly request specified and varied information, as farming is becoming more and more market-orientated.
- Lack of access to up-to-date information
- Existing services are not tailored towards farmers' needs and circumstances
- The nonrecurring character of information and knowledge provision to farmers.

Importance of e-extension

- ICT has the potential to respond to several challenges that confront public extension systems;
- ICTs enable individuals to create, collect, process and manage information in different ways (Audio, visual or Audio-visual);
- Awareness creation and promotion
- Provide specific information needed for change
- Facilitate access to credit and inputs (e-voucher/wallet).
- Link and facilitate farmers to markets
- Collect and respond to farmer feedback
- Assist with business planning
- Training and mass advisory
- Monitoring and Evaluation
- Linkage and partnerships.

Commonly applied technologies in extension services

- Radio and Television - The Farm Radio International
- Videos - Access Agriculture offers an internet-based platform for agricultural research and development (R&D). They have branded this service AgTube. Digital Green (COCO; using Smart PICO Projector)
- Mobile phones (Mob Apps) + IVR (voice, text or photos) M- Omlimisa; Farmer Hotline 8028; M-Pesa; Hello Tractor; Digifarm
- Social Media (Facebook, WhatsApp; Telegram; Twitter; etc)

There is a need to formulate/package the right messages for and with farmers, addressing illiteracy/local language and empowering farmers can lead to increased adoption of new technologies and improved practices.

Challenges: use of ICT/e-extension

- Erratic power supplies;
- Fluctuating networks and internet;
- High costs of ICT infrastructure;
- Low incomes of rural farmers;
- Lack of policies to enhance ICT development in rural areas;
- Lack of necessary skills to use the technologies.
- Low investment for R&D

- Lack of favourable business environment, especially for start-ups.

Opportunities: use of ICT/e-extension

- Huge support from Government- Enabling environment;
- Rapid internet expansion and ICT infrastructure
- Youthful population and increased mobile penetration
- Private sector engagement and investment
- Strong partnership (PPP).

The strategy: Digitalization for AEAS (D4AEAS)

Digitalization of AEAS is the wise use of digital technologies to achieve AEAS goals and generate sustainable impact, considering the specificity of each context. Digitalization of agriculture is a game changer in improving the reach, effectiveness and efficiency of agricultural and extension and advisory services. It is fundamental to leverage the benefits of digital technologies in transforming societies, improving livelihoods and accelerating the ability of the Sustainable Development Goals to eradicate poverty.

The expected outcomes for digitalization include bringing AEAS providers and farmers to a digitally empowered state is at the heart of the D4AEAS strategy; Enhance informed decision-making for AES providers, as this makes them well informed, smarter, more effective and more efficient in service provision and lastly, training of farmers and value chain actors to make them informed, smarter, more productive and more efficient in their activities (production, processing or marketing).

Strategies for integration of D4AEAS in the countries

• Establish National D4AEAS Forum/Platform
• Enabling environment from the government: policies, strategies, regulatory framework (mainstreaming and institutionalization);
• Constitute D4AEAS TWG (Multidisciplinary team)
• Clear ToRs (governance, roles and responsibilities).
Establish National D4AEAS Forum/Platform…
• Needs assessment (Service providers and end users)
• Mapping of digital services and solution providers (don't reinvent the wheel) – GGP; Market place,
• AFAAS' national Hackathon (innovation digital solutions) e.g.
  – AEAS worker's database,
  – CSA knowledge repository and
  – meteorological information/advice
  - Clear framework and roadmap
  – Partnership arrangement
  – Capacity development (individual, organization and systems level) - Capacity to innovate
  – Investment and funding/financing mechanisms
  – Strategies for packaging, dissemination, scaling up) –
  – One-stop shop of Integrated digital platform (access to data and information) – Digital Hub
  – Experience capitalization and cross-learning.

6.2 PRESENTATIONS ON THE ROLE OF MEDIA IN PROMOTING AND INCREASING ADOPTION OF CSA APPROACHES KENYA NEWS AGENCY.

Promotion of CSA Technologies

If a technology doesn't reach farmers, then it's not useful. Stories have to be characterised by a human face showing that somebody is doing something for a reason. Currently, there are ongoing CSA stories on mainstream televisions like Kenya Broadcasting Corporation (KBC), Royal Media Services (RMS) Airing in English, Swahili, Kikuyu, Nation Media Group (NMG) in English and Swahili and Kenya Television Network (KTN) also airing in English and Swahili over several weeks.

The weekly slots are usually on Monday to Sunday on TV and in print. Normally recycling stories is not permissible because fresh stories are in high demand. Stories on CSA technologies are highly welcome. There are also talk shows that are aired and feature experts in the studio to discuss CSA issues moderated by a host. This allows call-in sessions and interaction through social media.

There are paid for productions and the rate depends and differs for each media house. The paid productions can be documentaries, special reports and adverts. All the stations that air their stories also publish them online, especially on Youtube and The Star Online. The print versions also exist like The Star(The Big Read) and Seeds of Gold (The Saturday Nation). The only handicaps towards these endeavours are limited facilitation in transport and accommodation and unfortunately, journalism workshops on agriculture are rare.

New Story Ideas

• CSA technologies can be captivating
• For TV remember, 'If you don't see pictures in your mind, then the required threshold hasn't been met.'
• KALRO has been pivotal in fronting technologies to media houses
• Behind a technology, there's a scientist to be interviewed
• 100s of stories have been covered

6.3 PRESENTATIONS ON THE ROLE OF MEDIA IN PROMOTING AND INCREASING ADOPTION OF CSA APPROACHES: FANA BROADCAST SERVICE, ETHIOPIA

There are weekly Radio and TV programs incorporate with the Ministry of Agriculture Ethiopia.

Why Media for CSA?

The mass media plays a significant role in the agricultural awareness of farmers which ultimately increases production. Media is the most effective medium of communicating scientific knowledge about agriculture development to farmers. Scholars agreed that farmers preferred mass media for agricultural development, they received updated information regarding agriculture innovations of technologies.

The role of media for CSA

- Facilitate the three pillars of CSA (Productivity, Adaptation and Mitigation)
- Increase overall awareness of CSA

- Can be a bridge (innovation and end users)
- Guide farmers and educate them about CSA
- Communicate agricultural extension information to users
- Promote agricultural technology
- Address early warning (climate change, pests, diseases etc.).

Some works related to CSA in FBC

i***. A monthly live show radio program*** was conducted in 2020 to provide seasonal and intra-seasonal climate forecasts and advisories to smallholder farmers amid the Covid-19 pandemic in Ethiopia. The work involved

- General overview of crops status: general information on the seasonal climate and weather performance throughout the growing period, and crop and other environmental conditions.
- Agro-climate advisories: general weather/climate conditions and their implications for crop growth, disease, and pest incidences. These advisories were developed and provided by a group of experts from EIAR, the National Meteorology Agency (NMA), the Ministry of Agriculture (MoA), CIMMYT, and CCAFS.
- COVID-19 update: include information on the status of Covid-19 spread in the country, its impacts on health, the agriculture sector, markets, and that farmers need to make (physical distancing, hand washing and use of locally available face masks)

ii. ***TV Panel discussion*** with a focus on digital agro-climate advisory platforms in Ethiopia. News coverage is normally done by all media outlets (Radio, TV and Social media). Agricultural news and program is a prior agenda in FBC.

.**Challenges**

- awareness of CSA
- Availability of experts for interviews
- Resources

6.4 PRESENTATIONS OF DIGITAL CLIMATE ADVISORY NEEDS IN KENYA

Table 17: Digital climate advisory Kenya

EXPERTS	FARMERS	SERVICE PROVIDERS
1. Acquisition of climate, crops, livestock and NRM data availability – spatial and temporal – expensive, lacking and inadequate	Limited skills to interpret climate information – user needs and capacity building	Limited skills in interpreting climate information – training

EXPERTS	FARMERS	SERVICE PROVIDERS
2. Skills in climate, agronomic and livestock modelling, including crop-water monitoring	Limited tools for receiving CI – think through modalities of dissemination	Limited awareness of veritable CI services – awareness creation
3. Skills in climate downscaling – local level	Cost of receiving information - policy and regulatory	Cost of receiving information - policy and regulatory
4. Capacity and skills to develop advisories based on downscaled information	Network coverage – mapping on infrastructure, best-bet dissemination platforms	Network coverage - mapping on infrastructure, best-bet dissemination platforms
5. Need for regular data updating - limited resources for data updating	Limitations of power reach – map out power reach, invest in green energy	Skills in the use of mobile apps info access
6. Lack of consistent standards and data validation – the need for a one-stop shop	Limited awareness of veritable CI services – awareness creation	
7. Costs related to the generation of advisories – policy and regulatory	Translation of interpreted information into visual, braille and or local language	
8. Development of content for extension training – content development	Skills in the use of mobile apps - info access	

6.5 PRESENTATIONS OF DIGITAL CLIMATE ADVISORY NEEDS IN ETHIOPIA

Table 18: Digital climate advisory Ethiopia

No	Digital climate advisory need	Beneficiaries			Remark
		Research, extension & other services providers	Farmers	Policymakers	
1	Mapping of available digital technologies & services				
2	Collection and packaging (content development) & dissemination EAS				
3	Selection of appropriate digital media tools & channels				All
4	M&E impact assessment including lesson documentation				
5	Communication & regulation, policies, strategies & guidelines				
6	Communication and facilitation skills in multi-stakeholder platforms				
7	ICT tools & equipment				

8	Technical skill training				Media, PR & ICT personnel
9	Sensitization of value chain actors on digital EAS				
10	Establish & mgt of national digital hub/platform				Research & Ext
11	Training on digital app use				

6.6 PRESENTATIONS OF DIGITAL CLIMATE ADVISORY NEEDS IN UGANDA

Uganda climate advisory needs

- Web-based climate change monitoring portal giving real-time spatial and temporal data, preferably at the farm level
- Real-time satellite data on the crop, climate, and soil moisture conditions
- Soil nutrient analysis tools (soil maps) e.g. soil scanners (AgroCares, Kenya) & testing kits
- Technical (climate scientists), institutional and infrastructural capacity building
- Awareness and capacity building on the use of available climate advisory tools
- Build capacity for precision farming (use GIS-based soil and water hydrological management tools (e.g Ethiopia & Kenya) such as Decision Support Tool for Agriculture (DSAT), climate-soil moisture & crop modelling
- Payment of subscription fees (mobile phones) for e-CSA platforms

6.7 PRESENTATIONS OF DIGITAL CLIMATE ADVISORY NEEDS IN TANZANIA

The Government of Tanzania has launched several policies recognizing the importance of ICT tools for information dissemination and supporting the introduction of mobile phones for agriculture. In line with the government's efforts, ICT specialists designed new information services which are necessary to accompany the ongoing research efforts. The digital information designed and used currently in Tanzania includes “Ushauri”, M- Kilimo, A-Kilimo, Social media (WhatsApp, Twitter, Instagram, blogs, Facebook) and simple messages through the phone.

Digital climate advisory needs

- Introduction of simple and smart applications
- Capacity building on the use of applications and interpretation of results
- Financial support for;
    - Designing web-based materials for addressing farmers’ priorities in the local language.

- Establishing a database of all proven CSA technologies and their sharing infrastructures.
- Designing simple and strategic content delivered to farmers through cell phones by improving the information and knowledge-sharing infrastructures between key stakeholders.
- Establishing innovation platforms for documenting and sharing scientific and traditional knowledge through social media such as blogs, audio files or community video, among others
- Improving and strengthening internet access in research centers, building and improving Local Area Networks for strengthened linkages between researchers and stakeholders.

Table 19: Digital climate advisory in Tanzania

Digital needs	**Application**	**Beneficiaries**
Crop modeling and simulation.	Environmental interactions to determine crop growth and development	Researchers, Extension officers, seed companies, farmers
Collection of agricultural risk management tools.	Climate, Fallow, Crop, soil nutrient (NP), Moisture availability	Researchers, Extension officers, seed companies, farmers, and traders.
Agronomic and satellite-based models and single crop calendar.	Aims to connect farmers, sellers and buyers, develop financial products and reduce disaster-related crop loss	Smallholder farmers, traders, processors, and researchers.
Realtime forecast Focus on insect pests surveillance.	General advice, specific advice for crops grown in Tanzania.	Farmers, extension agents, seed companies, researchers, and policymakers.
Forecast and crop condition Information on crop growth limiting factors (climate, soil fertility, water supply) and remedy on reducing the limiting factors by adjusting farm management Alert message when crop growth is non-optimal based on real-time satellite imagery.	General advice, specific advice for crops grown in Tanzania.	Farmers, extension agents, researchers, and policymakers.
Instant weather updates through mobile phone	Information for making a farming decision	Farmers, Researchers, Extension Officers, and Seed companies.

6.8 PRESENTATIONS OF DIGITAL CLIMATE ADVISORY NEEDS IN RWANDA

Table 20: Digital climate advisory in Rwanda

Digital needs	Beneficiaries	Priority
There is a need for a digital platform for all available CSA technology and the capacity for maintaining the system	-Public and private involved in Climate Smart Agriculture technologies transfer	-CSA can be based on crops or animals and land husbandry too -And others can be across the value chains Priority crops: Priority crops : - Maize -Horticulture -Irish potato -coffee and Tea Livestock Dairy farming -Poultry sector -Piggery sector
Capacity to develop simple digital advisory service tools to have access to climate data for farmers	Farmers and Extensionist	All climate data needed in Agric and Livestock and land husbandry
Binding CSA services	Privates companies	Agric and Livestock and land husbandry
Technical skills in climate data downscaling	Farmers and extensionist	Agric and Livestock and land husbandry
Awareness creation on climate info	Farmers	Agric and Livestock and land husbandry
Capacity building on the use of digital platform and interpretation	Farmers and extensionist	Agric and Livestock and land husbandry

6.9 PRESENTATIONS OF DIGITAL CLIMATE ADVISORY NEEDS IN BURUNDI

Table 21: Digital climate advisory Burundi

Digital climate advisory needs	Actors
1. Availability of CSA (adapted crops, resilient crops, resistant crops or animals,	Researchers, Extension services, regulatory services Private sector (seed companies, Farmers,
2. Awareness of Climate changes	Policymakers, Researchers, Extension services Private sector (seed multipliers), Farmers,
3. Techniques of soil exploitation adapted to climate changes	Extension services Farmers

Digital climate advisory needs	Actors
4. Post-harvesting management according to the crops	Extension services Private sector, farmers,
5. Diseases management (crops and animals)	Research, Extension services Private sector (seed multipliers, Farmers
6. Prevision of metrologies before agricultural seasons	Researchers, extension services, Private sector (seed multipliers, Farmers
7. Water management	Farmers
8. Management of soil fertilities	Extension services, farmers
9. Data and knowledge sharing	Researchers, services extension
10. Training on communication in agricultural	Researchers, Journalist, Famers,

6.10 PRESENTATIONS OF DIGITAL CLIMATE ADVISORY NEEDS IN SOUTH SUDAN

Digital Advisory Needs for South Sudan include

- Introduction of E-Extension System
- Training for NARI staff, private sectors and champion farmers on the e-extension system and new TIMPS
- Support the trained extension workers with mobile phone Apps and bundles.
- Support the extension workers with motorbikes for easy facilitation of COCO
- Non-radio channel for dissemination of CSA information to farmers (movable mobility)
- Meteorological gadgets
- Support for private media companies to disseminate information through multimedia mode.

6.11 PRESENTATIONS OF DIGITAL CLIMATE ADVISORY NEEDS IN CAMEROON

In Cameroon, there is an ongoing capacity building for researchers and extension workers on the collection and interpretation of meteorological data for;

- Training for farmers on the use of mobile/digital applications and information
- Create small meteorological stations in different agro-ecological zones
- Renovating the existing meteorological stations
- Use of drones for irrigation, fertilization and pest control
- Mobile/digital applications for each CSA and related products

Agrometeorological and biophysical data management utilizes GPS coordinates, rainfall/temperature distribution & seasonability, soils patterns: acidity, pH, N-P-K, Pests/Diseases incidence, severity and prevalence

- Collection, analysis, management, and sharing of climates information
- CSA weather forecasts and technical advisory to farmers, producers, traders,…
- Area under production, yield, the volume of seed /grains produced, sold, locally consumed
- Sources of agricultural inputs (Seed, fertilizers, pesticides,..) and products (prices)
- Location and contacts of producers, agro-dealers, aggregators, processors

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- Agricultural statistics and information

Capacity Building on Multimedia

- Digital marketing campaign
- Social media (Facebook, Twitter, Instagram, etc) management
- YouTube
- e-Commerce
- e-Extension
- Plant-wise softwares
- Cabi plant clinic
- Drones
- Mobile Applications

7. ESTABLISHMENT OF A CSA TECHNOLOGY & INNOVATION COMMERCIALIZATION PLATFORM IN THE ECA REGION

7.1 KEY CONSIDERATIONS ON THE DESIGN OF E-EXTENSION IN UGANDA

In Uganda, there is an e-extension strategy, the media such as new vision have Harvest Money, Gold. There is a collaboration of media and research called farm clinics, which provide real-time solutions to farmers, there is also farm radio international which has promoted agro-forestry restoration, paid-for radio programmes have been made affordable, edutainment, specialisation in agricultural reporting, media campaigns, growing use of ICT.

7.2 KEY CONSIDERATIONS ON THE DESIGN OF E-EXTENSION IN KENYA

In Kenya, before devolution, the extension was well organised but went down. The ICT digitized the information and made it available. The scientists worked with ICT to break down the information and are currently in the process of working with the farmers to ensure the information is demand-driven. KALRO uses mass media to make information and TIMPs available to farmers. The KALRO agro-advisory call centre, which is online or a live feedback platform enables the scientist to rethink interventions and is also active on YouTube. KALRO is in collaboration with CABI via plant clinics to provide solutions to the farmer. However, this is challenged by poor synergy especially in providing content for the apps. While developing apps, it is important to engage scientists, get to know the diverse needs of the farmers and factor in agro-advisories which are hard to pick from some remote locations. KALRO has 1.2million farmers' platforms grouped in terms of agroecologies but unfortunately, there is a lack of daily Agro-met data. It has been buying data from a private provider (AWARE). KALRO also has apps that provide SMS platforms. Additionally, it also has a policy that captures e-extension and climate change.

7.3 KEY CONSIDERATIONS ON DESIGN OF E-EXTENSION BY EAST AFRICAN FARMERS FEDERATION

East Africa Farmers Federation uses an aggregation model of aggregated farmers for the e-granary. It is hard to make money out of extensions. The best is to deliver extension services through a bulked arrangement. They collect data by denying partners and building a partnership eco-system with farmers' details based on gender, location and quantities. Most of the framers don't have smartphones, they use a USSD platform. A web portal called chap chap was built to provide information with messages that are both audio and video, and the system can tell who listened to its contents. Extension was combined with other models like the use of chats, pamphlets and holding field days with partners. Radios are used to get content from all partners including the ministry of agriculture, KALRO and CABI.

The Challenges include the cost of deployment of ICT, cost to the user, deploying technical staff, content management; network connectivity; competition and collaboration with telecoms service

providers such as digi-farm. To expand the ICT models African Union is building a digital strategy for Agriculture.

Research is called upon to identify what they consider high-impact stories and make them available to the media.

Media is powerful. Scientists and the private sector should consider programmes where they take advantage of media as a totality but not rely on editorials. This enables them to facilitate farmers' participation in what they are implementing. Ensure that media communication is entrenched in the research project proposal including financing. Media is effective in creating awareness.

There is a need to conduct a readiness assessment including apologizing to farmers and other users. This should inform how the service is rolled out. The youths or jobless graduates can be used in rolling out extension services or participating in agriculture.

8. WAYFORWARD AND WORKSHOP CLOSURE

The workshop had a three-day rich discussion on the commercialization of TIMPs, laid out strategies for commercializing technologies and identified barriers and solutions for the transfer of agricultural technologies as well as e- extension. Media was identified as a key player in e-extension but needs to closely work with researchers to deliver high-impact stories as accurately as possible. There is a need for a strong network, to build partnerships and collaboration, especially in areas where we can mutually reinforce each other- leverage on synergies. The digital age or e-extension represents a powerful tool for the engagement of farmers. ***"The combination of digital technology and human creativity in deploying it will revolutionize life for Africa's farmers by overcoming isolation, speeding up change, and taking success to scale"***, Kofi Anan.

Way forward

- ASARECA will share with participants all the workshop presentations.
- The ASARECA Secretariat will engage with AICCRA project leadership to forge collaboration, especially in the area of capacity building to address some of the capacity challenges expressed by national stakeholders (private sector and research).
- ASARECA will operationalize the Private Sector Platform and establish associated communication channels: WhatsApp, Email etc.
- The Secretariat will also organize a meeting for the newly created Private Sector Platform to further discuss modalities of operation, the scope of work, as well as governance issues
- ASARECA will commission a study to inventorize and document best bet tools available in the countries that are ready for commercialization.
- The Secretariat will initially moderate the discussions of the PS platform using various discussion channels.
- The ASARECA Secretariat will initiate processes towards the development of a harmonized regional IPR policy to facilitate/support cross border movement of technologies.

- ASARECA will undertake a needs assessment to identify various needs and gaps for the e-extension at the country level.
- ASARECA has noted that there are a lot of cross-border trade activities among the member states which need to be coordinated. ASARECA will engage with the PS actors on the platform to initiate discussions on how these activities can be better coordinated.
- ASARECA will also plan for policy dialogues (under CAADP-XP4) to: (i) build trust; (ii) advocate for the exchange of TIMPs as well as knowledge and information; and (iii) dialogue on possible policy reforms to incentivize farmers (linkage to competitive markets and subsidies).
- ASARECA will engage with EAFF on the issue of promoting investments in agriculture. ASARECA Convene/engage with stakeholders to develop regional proposals based on emerging private sector priority issues:
- ASARECA will develop training materials based on consolidated country digital climate advisory needs.
- ASARECA will organize trainings for the public and private sector, farmer representatives, media and other non-state actors on digital climate service delivery tools and models; and their integration into national agricultural extension systems.

ANNEX 1: DIALOGUE PROGRAM OUTLINE

DAY 1: TUESDAY 15/03/2022: BEST BET CLIMATE-SMART TECHNOLOGIES AVAILABLE AT NATIONAL AGRICULTURAL RESEARCH INSTITUTES (NARIs) THAT ARE READY FOR COMMERCIALIZATION		
Time (EAT)	**Session**	**Responsible**
08:00 – 08:30	Arrival & registration	Racheal Namuzibwa
08:30 – 09:30	Self-introductions & presentation of the program	Joshua Okonya
09:30 – 09:50	Presentation on CAADP-XP4 Project and its focus on climate-smart agriculture	Moses Odeke ASARECA
09:50 – 10:10	Presentation on AICCRA Project and its focus on climate-smart agriculture	Dr. Solomon Dawit International Livestock Research Institute (ILRI), Ethiopia
10:10 – 10:40	Discussion	Julian Barungi
10:40 – 11:10	**Tea/Coffee Break**	**Hotel**
11:10 – 11:55	Presentations on best-bet climate-smart technologies ready for commercialization ◎ Burundi ◎ Uganda ◎ Kenya	Country Representative ◎ Dr. Musonerimana Samson ◎ Eliza K. Nahayo ◎ Dr. Michael Okoti
11:55 – 12:15	Discussion	Julian Barungi
12:15 -12:30	Statement from ASARECA Executive Director	Dr. Enock Warinda
12:30 -12:40	Remarks from the representative of the private sector on the ASARECA Board of Directors	Regina Kayitesi

12:40 – 13:00	Welcome remarks & Official Opening by DG KALRO	Dr. Eliud K. Kireger
13:00 – 14:00	**Lunch Break/Group photo/ Media Interviews**	**Hotel**
14:00 – 14:45	Presentations on best-bet climate-smart technologies ready for commercialization ◎ Ethiopia ◎ South Sudan ◎ Rwanda	Country Representative ◎ Dr. Addisu Bezabeh ◎ Bryan Elwich John ◎ Dr. Athanase Nduwumuryemi
14:45 – 15:05	Discussion	Moses Odeke
15:05 – 16:05	Presentations on best-bet climate-smart technologies ready for commercialization ◎ Sudan ◎ Tanzania ◎ Eritrea ◎ Cameroon	Country Representative ◎ Dr. Amir Abdullahi Y. Malik ◎ Margaret Mchomvu ◎ Dermas Sultan Dainom ◎ Dr. Mbesso Abeline
16:05 – 16:25	Discussion	Moses Odeke
16:25 – 16:55	**Coffee Break**	**Hotel**
16:55 – 17:25	Presentation on the role of the private sector in easing sanitary and phytosanitary (SPS) related trade barriers regionally and internationally	Regina Kayitesi Land O'lakes, Rwanda
17:25 – 17:45	Discussion	Joshua Okonya
	Presentations on best-bet climate-smart technologies ready for commercialization ◎ Republic of Congo ◎ Democratic Republic of Congo	Country Representative ◎ NGUINDA AKANI Christian ◎ Dr. Kanyenga L. Antoine
17:20	**End of Day 1 & Logistics**	**Racheal Namuzibwa**

DAY 2: WEDNESDAY 16/03/2022: CLIMATE SMART TECHNOLOGIES COMMERCIALIZED BY THE PRIVATE SECTOR		
08:00 – 08:30	Arrival & registration	Racheal Namuzibwa
08:30 – 09:00	Presentation on Best bet climate-relevant agricultural technologies, innovations, and management practices	Dr. John Recha International Livestock Research Institute (ILRI), Kenya
09:00 – 09:15	Presentation on the engagement of the private sector to commercialize Quality Protein Maize (QPM) in DR Congo	Prof. Mbuya Amand Kankolongo INERA, D.R. Congo
09:15 – 09:30	Presentation on the engagement of the private sector to commercialize Quality Protein Maize (QPM) in Tanzania	Rose Ubwe Tanzania Agricultural Research Institute (TARI), Tanzania
09:30 – 09:45	Presentation on the engagement of the private sector to commercialize Quality Protein Maize (QPM) in Kenya	Charles Bett Kenya Agricultural and Livestock Research Organization (KALRO), Kenya
09:45 – 10:00	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of a Livestock breeder	Leonard Mukhebi Muganda Kenya Livestock Breeders' Association (KLBA)
10:00 – 10:30	Discussions	Dr. Evans Ilatsia
10:30 – 11:00	**Tea/Coffee Break**	**Hotel**
11:00 – 11:45	Presentations on climate-smart technologies that have been commercialized by the private sector ◎ Ethiopia ◎ Kenya ◎ Sudan	Private Sector Representative ◎ Fikadu Temesgen ◎ Duncan Ochieng Ondu ◎ Elmuiz Mohamed O. Ibrahim
11:45 – 12:05	◎ Discussion	Dr. Evans Ilatsia

12:05 – 12:50	Presentations on climate-smart technologies that have been commercialized by the private sector ◎ Uganda ◎ South Sudan ◎ Tanzania	Private Sector Representative ◎ Chris Muwanika ◎ Michael Pitia ◎ Esther Moshi
12:50 – 13:10	◎ Discussion	Dr. Evans Ilatsia
13:10 – 14:10	**Lunch**	**Hotel**
14:10 – 14:55	Presentations on climate-smart technologies that have been commercialized by the private sector ◎ Rwanda ◎ Eritrea ◎ Democratic Republic of Congo	Private Sector Representative ◎ MBONIGABA Eric ◎ Abrehet Tekleggiorgis ◎ Edo Ntale Mirindi
14:55 – 15:15	◎ Discussion	Dr. Michael Okoti
15:15 – 15:50	Presentations on climate-smart technologies that have been commercialized by the private sector ◎ Cameroon ◎ Central African Republic ◎ Republic of Congo	Private Sector Representative ◎ Djam Wilfred Chiatoh ◎ ELENGA Josiane Pétronile ◎ Dr. NDAMBA Jeannin
15:50 – 16:20	Discussion	◎ Dr. Michael Okoti
16:20 – 16:50	**Tea/Coffee Break**	◎ **Hotel**
16:50 – 17:20	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of Agric Mechanization	◎ Dr Pascal G Kaumbutho Agrimech Africa Ltd
17:20 – 17:40	Discussion	Dr. Michael Okoti
17:40	**End of Day 2**	**Hotel**

DAY 3: 17/03/2022: STRATEGIES FOR COMMERCIALIZING & BARRIERS TO TRANSFER OF CSA TECHNOLOGIES IN ECA REGION		
08:00 – 08:30	Arrival & registration	Racheal Namuzibwa
08:30 – 09:00	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of a CGIAR centre	Dr. Abdelbagi Ismail International Rice Research Institute (IRRI)
09:00 – 09:30	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of Regional farmers organization	Steven Muchiri Eastern African Farmers 'Federation (EAFF)
09:30 – 10:00	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of seed traders associations	Duncan Ochieng Onduu Seed Trade Association of Kenya (STAK)
10:30 – 11:00	Discussion	Dr. Musonerimana Samson
11:00 – 11:30	**Tea/Coffee Break**	**Hotel**
11:30 – 11:50	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies.	TBD
11:50 – 12:10	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of a Dairy processor	Abrehet Tekleggiorgis ZAC Dairy and Milk Processing, Eritrea
12:10 – 12:30	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural	Anthony Weru Association of Kenya Feed Manufacturers (AKEFEMA)

	technologies: Experience of Animal Feed Manufacturers	
12:30 – 13:00	Discussion	Dr. Musonerimana Samson
13:00 – 14:00	**Lunch**	**Hotel**
14:00 – 14:20	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of Aquaculture company (fish breeder & producer)	Djam Wilfred Chiatoh NIREX Cameroon Farms Ltd, Cameroon
14:20 – 14:40	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of crop processor (post-harvest handling)	Elmuiz Mohamed Osman Ibrahim DAL Foods, Sudan
14:40 – 15:10	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of Private Sector Federation	MBONIGABA Eric Rwanda
15:10 – 15:30	Discussion	Dr. Mbesso Abeline
15:30 – 15:50	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of seed companies	Michael Pitia Gumbo Glow Seed Production Company
15:50 – 16:10	Presentations on strategies for commercializing & barriers and solutions for the transfer of agricultural technologies: Experience of NARI's	Dr. Kwena Kizito KALRO, Kenya
16:30 – 16:50	Discussion	Dr. Mbesso Abeline
16:50 – 17:20	**Tea/Coffee Break and End of Day 3**	**Hotel**

DAY 4: 18/03/2022: MAPPING DIGITAL CLIMATE ADVISORY NEEDS & MAINSTREAMING e-EXTENSION INTO NATIONAL EXTENSION SYSTEMS		
08:00 – 08:30	Arrival & registration	Racheal Namuzibwa
08:30 – 08:45	Presentations on the role of Media in promoting and increasing the adoption of CSA approaches in Kenya	William Inganga Kenya News Agency
08:45 – 09:00	Presentations on the role of Media in promoting and increasing the adoption of CSA approaches in Ethiopia	Yimer Dawod Nana Television, Ethiopia
09:00 – 09:30	Presentation on enhancing integration of national (e-) extension system for widespread dissemination	Dr. Samson Eshetu African Forum for Agricultural Advisory Services (AFAAS)
09:30 – 10:00	Panel Discussion	EAFF NARO KALRO
10:00 – 10:30	Discussion	Dr. John Recha
10:30 – 11:00	**Tea/Coffee Break**	**Hotel**
11:00 – 11:30	Group work on the identification of digital climate advisory needs in ECA	Julian Barungi ASARECA
11:30 – 12:05	Presentations of digital climate advisory needs in each country ◎ Kenya ◎ Ethiopia ◎ Uganda ◎ Tanzania ◎ Rwanda ◎ Burundi	Country Representative
12:05 – 12:30	Discussions	Nelson Mandela

		Agricultural Advisory Service Unit State Department for Crops Development Ministry of Agriculture Livestock Fisheries and Cooperatives, Kenya
12:30 –13:05	Presentations of digital climate advisory needs in each country ◎ South Sudan ◎ Sudan ◎ Central Africa Republic; Cameroon ◎ Ethiopia ◎ Eritrea ◎ Republic of Congo	Country Representative
13:05 – 13:30	Discussion	Germame Garuma Directorate of Extension Services, Ministry of Agriculture, Ethiopia
13:30 – 14:30	**Lunch**	**Hotel**
14:30 – 15:00	Establishment of a CSA technology & innovation commercialization platform in the ECA region	Ben Ilakut ASARECA
15:00 – 15:30	Discussion	Mr. Moses Odeke
15:30 – 16:00	The way forward & Closing Remarks	Dr. Enock Warinda ASARECA
16:00 – 17:00	**Tea/Coffee Break**	**Hotel**
	End of Dialogue	

ANNEX 2: DIALOGUE PARTICIPANT LIST

	Name of participant	sex	Organization	Email
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