KP01
Knowledge Product 01

CCARDESA
Centre for Coordination of Agricultural Research and Development for Southern Africa

POLICY BRIEF:

Best Bet CSA Practices/ Technologies and How to Support Climate Smart Decision Making

CLIMATE SMART AGRICULTURE
KNOWLEDGE PRODUCTS FOR EXTENSION WORKERS
Customised Information Tool for Agricultural Professionals

Audience: Directors of Research, Directors of Extension, Heads of NARS and National Level Extension Staff

Policy Brief | Gender | Youth | Climate Smart | Technology | Practice

Jonathan Odhong, IITA, 2018

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BACKGROUND

By 2050, approximately 70% more food will have to be produced to feed growing populations, particularly in developing countries. Agriculture is already causing increased conversion of lands and placing greater pressure on biological diversity and natural resource functions than ever before. As climate change causes temperatures to rise and precipitation patterns to change, more weather extremes will potentially reduce global food production (ICRAF, 2011).

Agriculture is the economic foundation of many sub-Saharan Africa (SSA) countries, employing about 60% of the workforce and contributing an average of 30% percent of Gross Domestic Product (GDP).

GDP growth originating in agriculture is approximately four times (4x) more effective in raising income of extremely poor people than GDP growth originating outside the sector (World Bank, 2008).

Yet agricultural growth rates for SSA declined in the 2000s and food insecurity remains a concern. Considerable investments in agricultural development – research, institutional support, and infrastructural development – will be required in the SADC region if the region is to meet its food security, climate change adaptation, and mitigation commitments (African Union).

Key Messages:

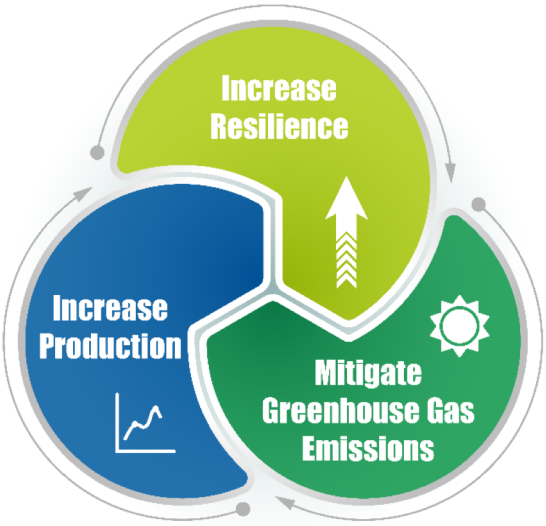
1. To achieve successful scale up productivity, adaptation and mitigation in agriculture, all three entry points for Climate Smart Agriculture should be addressed. These are as follows:
   a. Systems approach promoted
   b. Enabling environment improved
   c. Practices/technologies adopted.
2. Facilitating strong decision making at all levels will increase the chances of the successful widespread adoption of CSA practices/technologies.

WHAT IS CLIMATE SMART AGRICULTURE (CSA)?

Climate Smart Agriculture is an approach to re-orient agricultural systems to effectively and sustainably support food security. "Agriculture" is taken to include crop and livestock production, as well as fisheries and forest management. CSA incorporates actions at various scales from farm plots, farming systems and landscapes, to national and global contexts.

The approach aims, within the context of national food security and development goals, to tackle three main objectives (FAO, 2013):

1. Sustainably improve food security by increasing agricultural productivity and incomes
2. Build resilience and adaptation to climate change
3. Develop opportunities to reduce greenhouse gas emissions compared to expected trends, where possible.



How is CSA Different?

1. CSA places greater emphasis on climate risk **hazard and vulnerability assessments** and emphasises **climate information services** with **weather forecasting** (short term) and **climate scenario modelling** (long term) in the decision-making process for agricultural interventions

2. CSA promotes the **scaling up of approaches** that achieve **triple wins** (increase **production**, increase adaptation **resilience** and [if possible] **mitigate GHG emissions**), while at the same time **reducing poverty** and **enhancing ecosystem services**

3. CSA promotes a systematic approach to:
   a. Identifying **best bet** opportunities for agricultural investment
   b. Contextualising **best bet** options to make them **best fit** their specific context through learning and feedback loops
   c. Ensuring the **enabling environment** is in place so that farmers (and other stakeholders) can invest in CSA practices and technologies to catalyse adoption.
      » Includes linkages to climate finance, improved infrastructure, subsidies/incentives, regulatory environment, value chain approaches, etc.

Entry points for CSA

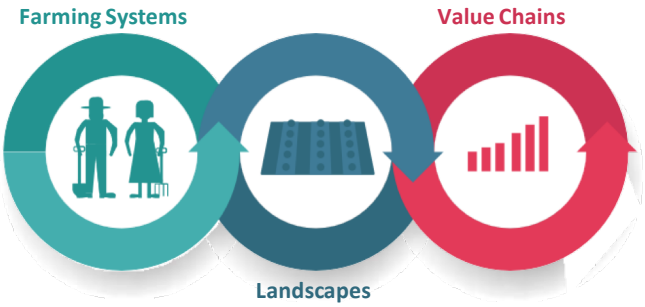
Agriculture affects and is affected by climate change in a wide range of ways. There are numerous entry points for initiating CSA programmes or enhancing existing activities. Productivity, mitigation and adaptation actions can take place at different technological, organisational, institutional, and political levels. To help navigate these myriad entry points, they have been grouped under three **thematic areas:**

- CSA systems approaches
- Enabling environments for CSA
- CSA practices and technologies.

Each of these is described further, and examples of specific Best Bet interventions are highlighted under each. The starting point for any CSA intervention should be a systematic assessment and prioritisation of potential entry points and actions. The Best Bet interventions listed in this review are subjective and have been chosen as examples based on their broad applicability across the SADC region.

THE SYSTEMS APPROACH

CSA goes beyond innovative technologies and practices like drought-resistant varieties or soil and water conservation measures. To achieve the multiple objectives of productivity, food security, enhanced farmer resilience and reduced greenhouse gas emissions, **CSA must adopt a systems perspective.** A systems approach aims to view a problem as **part of an entire system**, rather than considering problems in isolation. Agricultural systems are complex, with every part influencing every other. The systems approach aims to address each part of the system to understand where best to target a solution. In CSA, three different systems should be considered.



These systems are not mutually exclusive. The farming system operates **within** the local landscape and likely **interacts** with multiple value chains. Each system can be used as a starting point for assessing where a CSA solution might be most effective. The choice of system will depend on the focus of the intervention and the desired outcomes.

When using a systems approach, it is important to pursue **synergies** between the different elements of the system – to analyse and address **trade-offs**, and to perform **cost and benefits analyses**. Only through a process such as this can options be identified to achieve the desired outcomes. Systems approaches require the engagement of all key stakeholders. The table that follows summarises **Best Bet Climate Smart Systems Approach Options**.

Best Bet Climate Smart systems approach option	What is it?	3 Pillars of CSA		
		Increase production	Adaptation	Mitigate GHG emissions if possible
1. Landscape management	Taking account of the broader landscape and the services it provides when planning and targeting CSA interventions Looking beyond the farm-scale to the micro catchment or watershed	Maintains ecosystem services, and creates synergies between different production systems E.g., landscapes may harbour pest predators or beneficial insects, increase or stabilise pollination services, or help to improve the timing and flow of water. At the same time, mixed crop, livestock, and agroforestry/forestry systems can be complementary and mutually beneficial	A diversity of land uses and species, as well as genetic diversity across the landscape, can reduce risks (pests, diseases, and climate events) A more diversified portfolio of food and income sources can act as a buffer against climatic (and other) shocks	More diversified systems embedded in a broader-landscape approach, with an increased focus on perennial crops, grasslands, woodland, forest and wetland, is an effective way to reduce GHG emissions and promote carbon sequestration
2. Value chains	Bringing relevant stakeholders from various parts of the value chain (producers, processors, transport, regulators, etc.) together to make decisions in a coordinated way	Removing obstacles in the value chain should increase production and/ or income, through more efficient farming systems E.g., having seed/fertiliser available in 5 kg packets instead of 50 kg may result in more farmers using improved seed/fertiliser due to lower costs and easier transport	Build assets (from increased efficiencies on the farm) and institutional linkages with value chain actors	Can be designed to deliver mitigation benefits at multiple levels within the value chain E.g., reduced emissions per unit production through better access to improved seed/genetics Reduce emissions by incentivising solar technology, etc.
3. Farming system	Assessing how the different on and off farm enterprises interact with each other; the local landscape and markets, and understanding farmers' priorities within their individual socio-economic context to better design CSA solutions	Results in best fit technologies and practices that are in line with farmers' priorities, and which are therefore more likely to be adopted, to increase production/ incomes	Putting the farmers at the centre of the process – builds on local knowledge and increases the likelihood of sustainability, thus increasing household resilience over time	Aims at increasing efficiencies across the farm system, thus reducing emissions per unit production

THE ENABLING ENVIRONMENT

Enabling environments for CSA are the **conditions that facilitate and support the widespread adoption of climate-smart technologies and practices.** They include policies, institutional arrangements, stakeholder involvement, gender and youth considerations, infrastructure, financing, insurance schemes, as well as access to weather information and advisory services, that together create an enabling environment for scaling of climate-smart agriculture at local, national and international levels

The enabling environment should provide the **laws, regulations,** and **incentives,** that assures the **reorientation** and **transformation** towards climate-smart agriculture proceeds effectively and sustainably. It helps build institutional capacity at all levels and reduces the risks that currently deter farmers from investing in innovative technologies and practices. Experience has shown that investing in the enabling environment is essential for implementing CSA on larger scales. The table that follows provides a summary of **Best Bet Climate Smart Enabling Environment Options**.

Best Bet Climate Smart enabling environment options	What is it?	3 Pillars of CSA		
		Increase production	Increase resilience	Mitigate GHG emissions if possible
4. Gender, Youth & Social Inclusion	Understanding gender relations, local norms and power dynamics, to ensure locally appropriate CSA solutions are developed	Women play a vital role in food production, distribution and its utilization. If women had access to resources, on-farm yield could increase by 20%–30% – reducing the number of hungry people in the world by 12%–17% (FAO, 2011)	If implemented without consideration of gender and social inequities, CSA practices risk losing opportunities to improve livelihoods and may in fact increase these inequities and reduce resilience	Understanding gender and social inclusion issues will lead to CSA solutions that are adapted to real needs and more efficient production systems
5. Digital Agriculture	The use of information and communications technology to get usable information to farmers at the right time so that they can use it to inform decision making. E.g., weather forecasts, diagnostic tools, market information, agronomic information, etc.	Information is key for the transition towards CSA systems. E.g., access to timely weather information and pest/disease alerts can help farmers increase productivity	Timely access to critical information can enable farmers to adapt to expected climate-related risks. E.g., decide not to use fertiliser due to bad rains; change planting date; control pests/diseases; apply micro-nutrient; change crops to meet market demand, etc.	More efficient use of inputs results in reduced GHG emissions per unit produced
6. Index-based Insurance	Offer pay-outs based on aggregate indicators (e.g., rainfall and temperature measurements or vegetative cover) rather than outcomes for individuals. These cost-effective schemes are potentially viable for protecting smallholder farmers against climate variability where the challenges related to individual-specific insurance are a significant constraint	Index insurance, often coupled with access to credit and inputs, allows farmers to take additional risks and to invest in improved practices that increase productivity and food security – even in a situation of adverse weather conditions	In many parts of the SADC region, rainfall is very variable – both in seasonal volume and distribution patterns. Under such conditions, farmers inevitably experience the risk of livestock loss, or crop yield reduction or crop failure. Index insurance is explicitly designed to manage such risks, and as a result makes a substantive contribution to farmers' resilience	Depends on the degree to which insured farmers can invest in improved production practices, which either enhance carbon sequestration or reduce greenhouse gas (GHG) emissions

CSA PRACTICES/ TECHNOLOGIES

There is a wide range of CSA practices and technologies to choose from, which can be broken down into seven categories:

1. Soil management
2. Crop management
3. Water management
4. Livestock
5. Forestry
6. Fisheries and aquaculture
7. Energy management.

Practices are broadly understood as ways of doing things; for example, precision farming, tillage and fertilisation – these are all CSA practices.

Technologies are new materials introduced into new or old practices and might include new drought-tolerant varieties, a hardy breed of cattle, or a new slow-release fertiliser.

Many practices and technologies involve interventions at the **farm systems level**, but the landscape management and value chain approaches should also be considered. In most cases, there will be an inevitable and desirable convergence between systems, enabling environment and practices, and technologies. The table that follows highlights just a selection of practices/technologies that are considered best bet due to their wide applicability across the region – **Best Bet Climate Smart Practice/Technology Options.** Many more (c. 70) are included in a CCARDESA Knowledge Product Series – see the CCARDESA website for more details.

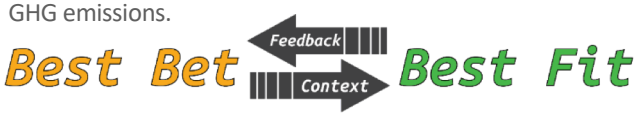
Best Bet Climate Smart practice/ technology options	What is it?	3 Pillars of CSA		
		Increase production	Increase resilience	Mitigate GHG emissions if possible
7. Agroforestry	Incorporating trees (and shrubs) into the farming system – a dynamic and ecological method of land management involving the simultaneous cultivation of farm crops and trees	The production of ecosystem services, including provisioning services (food, fibre, fodder, fuel, etc.) can be improved. Integrating trees in farming systems can also improve air, water, soil quality and water retention, leading to higher and more stable crop yields	Healthy and diverse ecosystems are more resilient to natural hazards. Trees can be used as shelterbelts and windbreaks, and play a key role in protecting against landslides, floods, and avalanches. Trees also stabilise riverbanks and mitigate soil erosion. Agroforestry practices increase the absorptive capacity of soil and reduce evapotranspiration. The canopy cover from trees can also reduce soil temperature and reduce the runoff velocity and soil erosion caused by heavy rainfall	Actions that increase tree cover (afforestation, reforestation, and agroforestry) and reduce deforestation and degradation, can increase carbon sequestration through increased biomass both above and below ground

Best Bet Climate Smart practice/ technology options	What is it?	3 Pillars of CSA		
		Increase production	Increase resilience	Mitigate GHG emissions if possible
8. Stress tolerant varieties	Choosing the right crop to suit climatic conditions and choosing the variety/ies that reduce risks of heat, drought, salinity, pest and/or diseases affecting yield	Selecting the right crop/variety for the conditions will maximise yield potential. Improved varieties generally have higher yield potential under optimal conditions. Local varieties may be more suited to constrained production systems	Tolerance for identified climate risks reduces the risk of crop failure and increases resilience and diversification, considering crop sustainability through more predictable yields	Can result in better water-use efficiency, reducing irrigation inputs. More efficient production reduces the amount of GHG produced per unit of production from the crop
9. Solar irrigation	Using solar technology to irrigate crops from either surface or sub-surface water sources	Plants get enough water Potential for two or more cropping seasons per year	Predictable yields Higher production equals increased food security/income and resilience	Significant reductions in CO_2 emissions, compared to grid and diesel-fueled systems
10. Manure management	Methods for collecting, storing, and treating animal manure in an environmentally-sustainable manner – to ensure minimal nutrient losses and GHG emissions, and to improve applicability and/or increase value	Manure applied to soils improves, or restores soil fertility, and increases the potential crop up-take, leading to higher crop yields. May also reduce the need for supplementary synthetic fertiliser Potential to reduce energy costs through biogas production	Addition of organic matter improves soil physical conditions – particularly aggregation and pore space, which in turn leads to increased water infiltration and water-holding capacity, improved soil tilth, and decreased soil erosion Organic matter additions also reduce the impacts of wind and rain erosion on soil, and thus strengthen the resilience to climate change	Integrated Manure Management has the potential to mitigate two powerful greenhouse gases: methane (CH_4), and nitrous oxide (N_2O)

The research programme on Climate Change, Agriculture and Food Security (CCAFS) and the Food and Agriculture Organization (FAO) have a comprehensive compendium of CSA practices and technologies that can be searched online. This compendium also highlights where there are gaps in research to support CSA.

CLIMATE SMART DECISION MAKING

CSA is not just a simple set of practices and technologies that can be easily replicated in every context. Farming systems are **complex systems that must be understood** in connection with climate, weather, soil, the farmers' own socio-economic context, gender dynamics, markets, and regulatory environments. This understanding is needed to move from the often-unsuccessful promotion of **best bet** practices/technologies to **best fit** practices/technologies, that meet female and male farmer's individual priorities while simultaneously increasing production, building resilience to climate change and where possible, reducing GHG emissions.



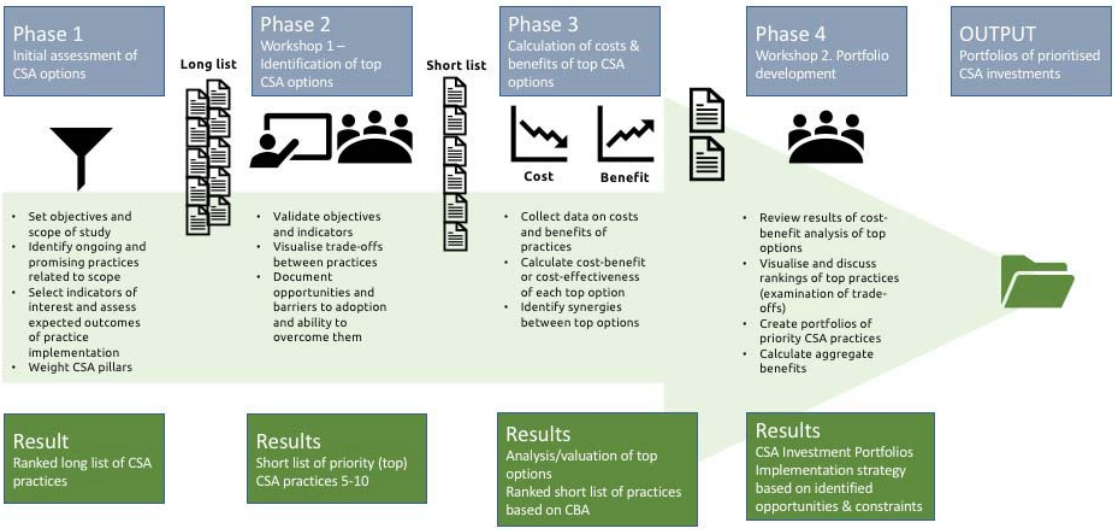
Climate Smart decision making needs to happen at **every level**, from the individual farmer making decisions on which climate smart practice/technology best fits their situation, to national (and regional) stakeholders making strategic decisions on how best to access and utilise limited resources to enable/incentivise CSA to be implemented **at scale**.

In 2020 a new **e-learning course on foresight on climate resilience** has been launched by the SADC Futures project to promote climate-resilient agricultural development. Better foresight means plans, policies and programs can be adapted to respond to the foreseeable effects of climate change. The **CCAFS–CIAT CSA Prioritisation Framework** is another tool available to support decision making at national level (see **CCARDESA KP23**). This tool is designed to help decision makers **identify best bet CSA investment portfolios.**

Once the **best bet CSA options** are identified, the next step is to analyse where resources should be focused to promote large-scale uptake of the practices/technologies involved. This step is critical, as interventions at the individual farm level may not be the most effective use of resources. Understanding the barriers to widespread uptake is a critical component in this process. These may include access to information in a usable form (knowledge); capacity gaps in extension provision; institutional capacity to coordinate resources/delivery of services; access to input/product markets; infrastructure (roads, telecoms, etc.), and the regulatory environment (incentives/subsidies and/or policy issues).

Political will is an often-overlooked constraint to the implementation of national CSA programmes. Understanding the political economy and identifying CSA champions, in the form of both individuals and institutions, is a critical success factor.

Figure 1: Climate-smart agriculture investment prioritisation framework.



Source: Adapted from Corner-Dolloff C. 2014. [Presentation at COP20, Lima Peru. http://es.slideshare.net/ciatdapa/climatesmart-agriculture-investment-prioritization-framework]

At the farm level, extension services need to be supported to help farmers make climate smart decisions. CCARDESA has developed a set of decision support tools to help extension staff make climate smart decisions with their clients on a range of practices and technologies across four priority value chains – **maize, sorghum, rice and livestock**. These KPs refer to other decision-support tools that are available to assist farmers in making climate smart decisions. The aim of all these tools is to move from **best bet** to **best fit** CSA solutions. This reflects the understanding in CSA that there is no 'one-size-fits-all' approach. CSA option selection is achieved through:

- A deep **understanding of the farm system**
  - Landscape, weather, gender, farm enterprises, off-farm income, local culture, markets/value chains, etc.
- Select **priority CSA options**
- **Assess feasibility**
  - Economic analysis cost benefit
  - Include gender assessment
  - Farmer priorities
- **Continuous assessment** (feedback loops) and improvement
  - Accurate data collection
  - Gross margins (or other economic analysis tool)
  - Reflection, discussion, and continuous improvement.

SCALING UP FINANCING FOR CSA

The success of adaptive action in agriculture relies not only on technological innovations but also on the supporting institutional, policy and investment environments, which can help innovations achieve heightened scale rapidly. New, fit-for-purpose business and financial models are an area for innovation to support scaling up of proven technological innovations (CCAFS, 2017). Key areas of focus include:

- **Mobilising private adaptation finance:**
  - Motivate the private sector to invest in CSA to create more resilient value chains and/or take advantage of new opportunities (e.g., solar energy)
- **Impact Investment:**
  - This is a rapidly growing sector. Impact investors fund projects with social and environmental benefits
- **Blended finance:**
  - The strategic use of development finance and philanthropic funds to mobilise private sector capital that can accelerate investments in CSA.

The CSA finance landscape is diverse, with a range of options available that must all be evaluated to ensure that they are appropriate for the national or local context:

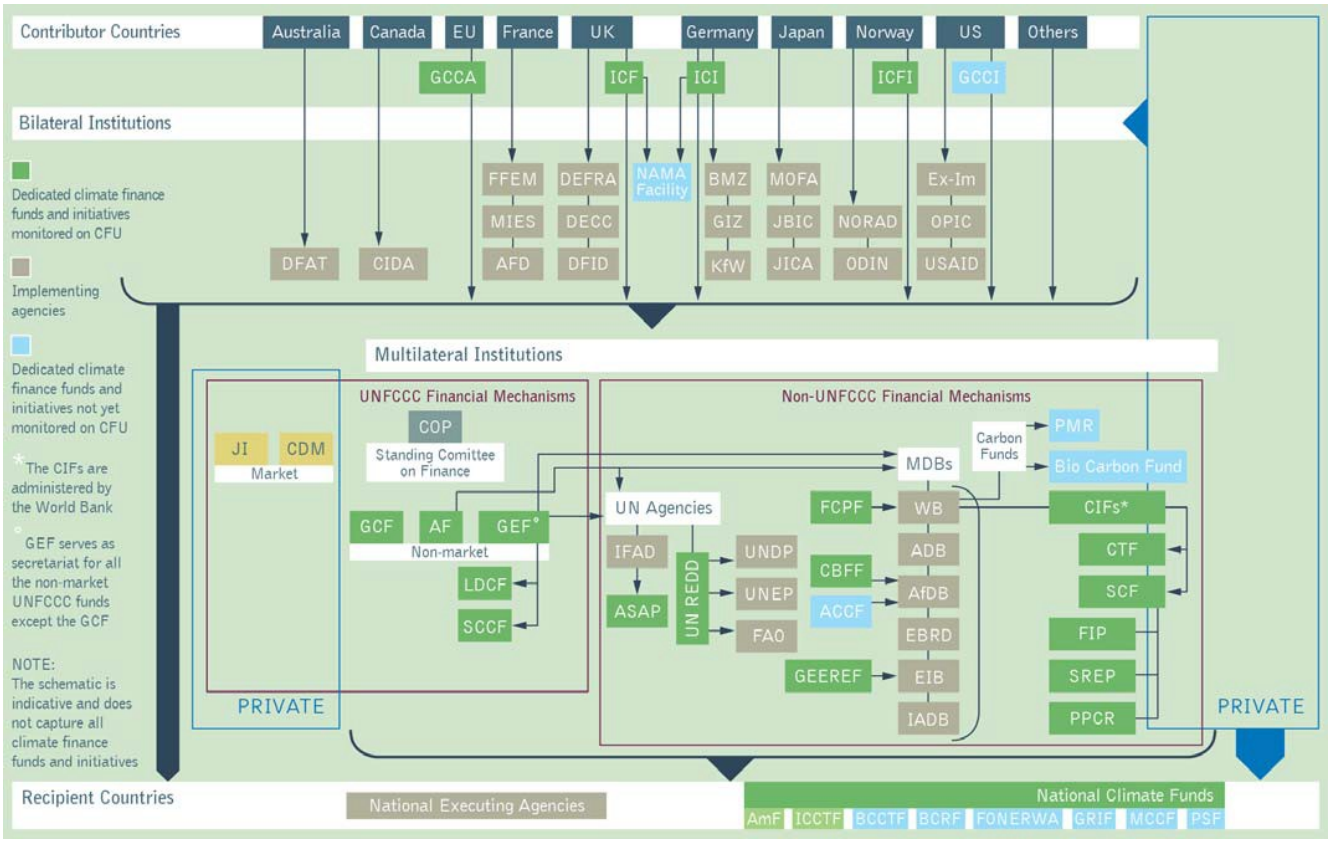
- Private investments provide the main source of climate finance
- Public resources remain the key drivers of the climate financing system
- Domestic investments, from both public and private sources, provide the mainstream of agricultural finance
- International sources are scare and difficult to access.

Global climate finance architecture is complex. Finance is channelled through multilateral funds – such as the **Global Environment Facility** and the **Climate Investment Funds (CIF)** – as well as, increasingly, through bilateral channels. In addition, a growing number of recipient countries have set up national climate change funds that receive funding from multiple developed countries to coordinate and align donor interests with national priorities.

There is generally much more transparency about the status of the implementation of multilateral climate finance initiatives than of bilateral climate finance initiatives. The proliferation of climate finance mechanisms increases the challenges of coordinating and accessing finance.

The diagram below illustrates the architecture of global climate finance (Climate Funds Update, 2015).

Figure 2: The global climate finance architecture.



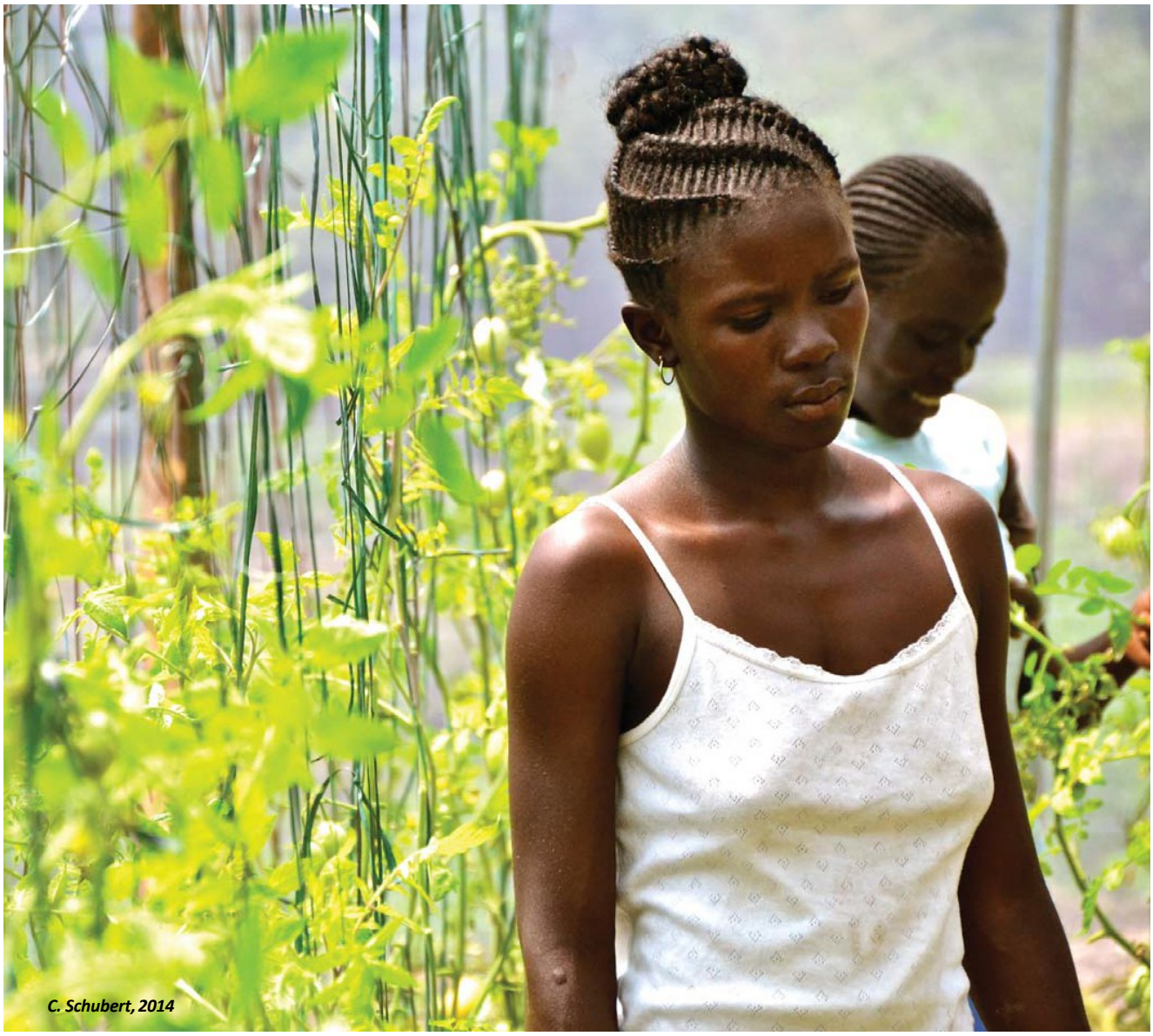
Source: The Climate FundUpdate

CONCLUSIONS

To achieve the successful scaling up of productivity, adaptation and mitigation in agriculture, all three entry points for Climate Smart Agriculture should be addressed:

- Systems approach promoted
- Enabling environment improved
- Practices/technologies adopted.

Facilitating strong decision making at all levels will increase the chances of the successful widespread adoption of CSA practices/technologies. There are various tools and resources available for use at various levels to assist in climate smart decision making.



C. Schubert, 2014

WHERE CAN I FIND MORE INFORMATION?

The following resources, which were used as reference for the development of this Knowledge Product, provide valuable additional reading on this subject. Please also refer to the CCARDESA website (www.ccardesa.org), the full series of Knowledge Products, and associated Technical Briefs. Translations of this Knowledge Product to French and Portuguese was achieved using machine translation tools, and the results were checked by an accredited translator.

- **CCARDESA Knowledge Hub** – See Best Bet Options Papers on CSA in Maize (KP02), Sorghum (KP03), Rice (KP04) and Livestock (KP05) as well as Decision Support Tools on specific practices technologies on each of these four value chains (KPs 6-21)

- **CCAFS – CSA Guide:** "This site is your gateway to implementing climate-smart agriculture. It will help you get started and guide you right through to implementation on the ground, connecting you with all the resources you need to dig deeper". **https://csa. guide/**

- **SADC Futures Training Series and Toolkit on Climate Foresight Capacities.** "The e-learning course is designed to be engaging, fun and convenient for your busy schedule."

- **Department of Communities and Local Government** London 2009 – Multi Criteria Analysis: A Manual
  - Just one tool that might be useful in making decisions, especially at the strategic level when multiple criteria need to be considered, as is often the case in CSA.

- **Green Climate Fund** – Green Climate Fund 101: **www. greenclimate.fund/gcf101** a comprehensive guide to how to access and engage with GCF.

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