CASA
Commercial Agriculture for Smallholders and Agribusiness

Financing mechanisms to drive the uptake of climate-smart agriculture technologies

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This is a draft document that intends to inform discussions during the AGRF session 'Innovative financing mechanisms for stimulating the uptake of climate-smart agriculture technologies' on 6 September 2023.

Inputs from that session will be taken into account for the final version of this document.

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Introduction

Climate change significantly threatens global agriculture, impacting food security, livelihoods, and environmental sustainability. In response, Climate-Smart Agriculture (CSA) has emerged as a holistic approach to address the complex interplay between agriculture, climate change, and food security. CSA technologies encompass a range of approaches that aim to increase agricultural productivity, enhance resilience to climate impacts, and reduce greenhouse gas emissions.

Urgent need for climate finance in agriculture

Climate finance allocated to agri-food systems remains disproportionately low, it had only a 4.3% share of total global climate finance dedicated to all agri-food projects during 2019/20, amounting to an average annual sum of USD 28.5 billion[1]. Within the same timeframe, only one-tenth of total venture capital investments in agri-food technology was channelled into enterprises addressing climate-related solutions, equating to an average yearly infusion of USD 2.3 billion[2]. To effectively navigate the climate transition, climate finance for agri-food systems must increase by at least seven times its present level, a level essential to meet the conservative estimated requisites of this transformation, spanning hundreds of billions of dollars annually.

Sub-Saharan Africa, despite being one of the most vulnerable regions to the adverse effects of climate change on food production, receives only 16% of all tracked climate finance allocated to agri-food systems, totalling USD 4.4 billion[3]. This stark disparity underscores the urgent need for a more equitable distribution of climate finance to support climate-smart agriculture practices in Sub-Saharan Africa.

Challenges in financing CSA technology adoption

A number of overarching challenges impede the widespread adoption of CSA technologies:

High upfront costs: One of the primary hurdles to widespread CSA adoption is the substantial initial investment required. Many CSA technologies and practices demand significant capital for infrastructure, equipment, and inputs. This financial burden can be particularly daunting for resource-constrained farmers, notably smallholders who lack the financial capacity to make such investments. As a result, these upfront costs can deter farmers from considering CSA practices, even if they offer long-term benefits.

Limited access to credit: Smallholder farmers, who often stand to gain the most from CSA practices, frequently encounter obstacles when seeking affordable credit to finance these investments. Access to credit is crucial for adopting climate-smart practices, as it eases the financial strain of high upfront costs. However, limited access to affordable credit options restricts the ability of farmers to embrace CSA technologies, hindering their capacity to adapt to climate change effectively.

Uncertain returns on investment: CSA technologies are typically oriented toward long-term benefits such as improved resilience and increased yields. However, these benefits may not become immediately apparent to farmers. This uncertainty surrounding the returns on investment can make it challenging for farmers to justify the initial costs associated with adopting CSA practices. Without clear evidence of the advantages, many farmers may hesitate to transition.

[1] CPI [Daniela Chiriac, Harsha Vishnumolakala, Paul Rosane], 2023. Landscape of Climate Finance for Agri-food Systems. Climate Policy Initiative
[2] Ibid.
[3] Ibid.

Limited knowledge and awareness: The successful implementation of CSA practices relies heavily on farmers' understanding of these techniques and their potential benefits. However, many farmers lack the necessary information, training, and awareness about CSA practices. Insufficient knowledge inhibits their ability to uptake and fully capitalize on these technologies. Bridging this knowledge gap is crucial for empowering farmers to make informed decisions about CSA adoption.

Market barriers: Efficient markets and supply chains are vital for realizing the full potential of CSA practices. Inefficient market structures, logistical challenges, and inadequate infrastructure can hinder the adoption of CSA practices by limiting the potential returns for farmers. Farmers may be discouraged from investing in CSA if they face difficulties in accessing markets or experience disruptions in the supply chain that reduce the value of their produce.

Capital-intensive and behaviour-intensive CSA technologies

CSA technologies enhance agricultural resilience. Examples of CSA technologies include climate-resistant crop varieties, precision agriculture for resource optimization, timely weather data, efficient water management, and conservation agriculture practices. CSA technologies also integrate agroforestry, climate-resilient livestock practices, and real-time crop monitoring. The CSA technologies bring other benefits, including strengthening market linkages, reducing vulnerability to climate-related shocks and bolstering overall agricultural resilience.

The adoption of CSA technologies requires a combination of access to capital, changes in behaviour and practices, and a policy-enabling environment. This brief proposes two main categories for classifying CSA technologies: capital-intensive and behaviour-intensive technologies.

Differentiating between capital-intensive and behaviour-intensive technologies in agriculture involves considering the key constraints that affect their uptake, scale, and sustainability. These constraints often revolve around accessibility, affordability, and the ease of inducing behaviour change among smallholder farmers.

It is important to note that both types of technologies involve a blend of capital and behaviour components, but the key differentiation lies in emphasizing one over the other. Capital-intensive technologies primarily rely on significant financial investments, whereas behaviour-intensive technologies place greater importance on regulatory changes and changes in farmer practices and behaviours. Ultimately, addressing these constraints for both types of technologies is essential for achieving scale and sustainability. Effective business models, delivery mechanisms, and support systems must be designed to tackle these challenges, ensuring that smallholder farmers can access, afford, and successfully adopt these innovations to improve their agricultural practices and livelihoods.

Behaviour-intensive technologies	Capital-intensive technologies
• **Behaviour change**: Implementing behaviour-intensive technologies often requires smallholder farmers to adopt new practices or change traditional farming methods. Requiring them to alter their behaviours can be challenging due to deeply ingrained habits and cultural practices. • **Capacity building**: To successfully adopt behaviour-intensive technologies, smallholder farmers need access to training, extension services and education about the benefits, as well as proper implementation. Limited access to these resources can hinder adoption. • **Social and cultural factors**: Social norms, traditions, and community dynamics can influence behaviour change. Resistance to change within communities can slow down the adoption process. • **Perceived risk**: Smallholders may perceive behaviour change as risky, especially if they fear potential crop failures or income losses during the transition period. Demonstrating the reliability and benefits of the technology is crucial to overcoming this barrier.	• **High upfront costs**: Capital-intensive technologies often require significant initial investments in infrastructure, machinery, or advanced equipment. Smallholder farmers may struggle to access the necessary capital to purchase a new technology without financial support. • **Access to finance**: Obtaining loans or credit for capital-intensive technologies can be challenging for smallholder farmers, particularly due to limited collateral or financial literacy. Access to affordable financing mechanisms is crucial for scaling these technologies. • **Technical expertise**: These technologies may demand specialized skills for operation and maintenance, posing a barrier if smallholder farmers lack the necessary capacity building or technical knowledge. • **Risk aversion**: Smallholder farmers may exhibit reluctance toward significant capital investments, particularly when uncertainty surrounds their ability to assess the impact of these investments on their adaptive capacity.

Many CSA technologies are identified to be capital-intensive because they necessitate significant investments owing to factors like advanced technology, infrastructure development, and the requirement for specialized inputs. The process of developing the business case has to identify if the upfront capital costs are justified by the long-term benefits, they bring in terms of increased resilience and improved agricultural productivity. **Capital-intensive** CSA technologies may require the application of more innovative financing mechanisms to reach scale while being accessible and affordable to agribusinesses and smallholder farmers (e.g., solar-powered cooling stations).

Finance instruments for CSA technology adoption

A range of financing tools and mechanisms are being deployed by financiers and agribusinesses to stimulate the uptake of CSA technologies.

Established financing instruments

Concessional financing for risk mitigation

Financial institutions offer concessional financing to support CSA projects by providing loans at interest rates lower than the market. This type of financing has the potential to significantly decrease the cost of capital for agribusinesses. As a result, it can make the adoption of CSA technology more feasible for end-users, particularly in areas that experience financial limitations.

Patient capital

Patient capital is a strategic financial tool characterized by its extended investment horizon and willingness to accept delayed returns. This approach recognizes that CSA technologies often require time to yield their full benefits, aligning perfectly with the agricultural sector's long-term nature. Patient capital providers offer the flexibility of longer payback periods, giving smallholders the necessary time to see the full impact of their investments. Moreover, they often supplement funding with technical assistance, training, and capacity-building support, equipping smallholders with the knowledge and skills required for successful CSA implementation.

Case study: AgDevCo[4]

AgDevCo, a specialized impact investor and project developer, is dedicated to nurturing early-stage small and medium-sized agribusinesses in Sub-Saharan Africa. With a mission to bolster food security, generate employment opportunities, and enhance climate resilience for smallholder farmers, AgDevCo deploys long-term capital, typically ranging from USD 2–10 m along with crucial technical assistance. To support these interventions, AgDevCo collaborates with key funding partners, including **British International Investment** (formerly CDC Group), Norfund, U.S. International Development Finance Corporation (DFC) and the Foreign, Commonwealth & Development Office, harnessing concessional investment capital and securing grants for essential technical support. The involvement of development finance institutions (DFIs) is instrumental in de-risking this approach, often through first-loss subordinated investments. AgDevCo operates across multiple Sub-Saharan African nations, contributing to the development of sustainable agri-food sectors.

Patient capital's sustainability focus positions it as a catalyst for environmentally conscious CSA technology adoption, helping smallholders enhance soil health, reduce environmental impact, and build agricultural resilience over the long haul.

Grant and blended finance

Grants are pivotal in financing CSA technologies, especially for early-stage technologies and approaches targeting smallholder farmers and community-driven projects that do not meet traditional risk and return profiles for more commercially costed capital. Grants provide essential funding that can be used to initiate CSA initiatives, support research and development, and facilitate knowledge dissemination and capacity building. They are particularly valuable in addressing the financial barriers associated with behaviour-intensive

[4] AgDevCo

CSA practices, which often require investments in training, extension services, and community engagement and for which financial returns may only accrue into the longer term or to parties other than the investor.

Case study: The AgriFI Kenya Challenge Fund[5]

The AgriFI Kenya Challenge Fund, backed by the European Union and co-funded by SlovakAid, channels USD 20m to support smallholder agriculture's integration into productive markets. Focused on environmentally sustainable and climate-smart farming practices within inclusive value chains, AgriFI seeks to enhance the capabilities of smallholder farmers and pastoralists. The European Investment Bank (EIB) collaborates under the AgriFI Kenya program, providing long-term local currency financing through Equity Bank for eligible food and agriculture projects, with additional matching funding available. Managed by Self Help Africa and Imani Development Limited, the Challenge Fund has already committed USD 12m across diverse value chains, benefiting farmers nationwide and creating thousands of jobs.

Blended finance represents a collaborative approach to financing CSA initiatives by combining public and private resources. This innovative mechanism leverages the strengths of both sectors to maximize the impact of climate-smart agriculture. Blended finance structures can involve various combinations of grants, concessional loans, equity investments, and commercial financing.

Case study: The AGRI3 Fund[6]

UNEP, Rabobank, IDH (the Sustainable Trade Initiative) and the Dutch Development Bank (FMO) partnered to establish the AGRI3 Fund, a ground-breaking initiative that combines public and private capital to support projects characterized by higher-risk profiles. This innovative public-private partnership is dedicated to mobilizing a substantial USD 1 billion in funding for initiatives focused on forest protection and sustainable agriculture while addressing the challenges faced by farmers due to limitations in accessing conventional bank loans.

The AGRI3 Fund plays a pivotal role in de-risking bank loans for various stakeholders operating within the agricultural value chain, with the aim of facilitating the transition to more sustainable agricultural practices. Managed by IDH, a technical assistance facility complements these efforts by supporting pipeline development, monitoring and evaluation, and capacity-building initiatives designed to facilitate the shift towards sustainable and climate-smart agriculture. By offering credit enhancement tools and technical assistance, the AGRI3 Fund seeks to catalyze transactions that combat deforestation, promote reforestation, drive efficient and sustainable agricultural production, and elevate rural livelihoods, all contributing to a more sustainable agricultural landscape.

Blended finance strategies are instrumental in harmonizing the interests and goals of various stakeholders involved in investing in CSA. Public sector contributions work to mitigate investment risks, thereby increasing the attractiveness of CSA projects to private investors. In parallel, private sector engagement ensures the expansion and long-term viability of CSA technology initiatives, yielding economic benefits while bolstering climate resilience outcomes.

[5] The AgriFi Kenya Challenge Fund
[6] AGRI3 Fund

responsAbility and CGIAR partnership

The responsAbility and CGIAR collaboration, supported by German Agency for International Cooperation (GIZ) and Kreditanstalt für Wiederaufbau Bankengruppe (KfW Development Bank) showcases the tangible benefits of blended finance in advancing CSA. This initiative pioneers science-based impact investing, directing long-term expansion debt to forward-looking enterprises within the food value chain across Asia Pacific, Latin America, and Africa. The primary aims are to combat climate change, curtail food loss, and reinforce the resilience of smallholder farmers. The initiative's potential to transform 300,000 hectares into climate-smart practices while reducing 8 million tonnes of greenhouse gas emissions (equivalent to 1.7m car emissions annually) underscores the significant impact of blended finance in propelling transformative changes within global food systems.

Subsidies and tax incentives

Government interventions, in the form of subsidies and tax incentives, are pivotal drivers of CSA adoption, benefiting farmers and agribusinesses. Subsidies, typically provided as direct financial support, alleviate the substantial upfront costs associated with CSA technologies, enhancing accessibility for smallholder farmers and agribusinesses. These subsidies often cover expenses related to CSA components like drought-resistant crop varieties, precision agricultural equipment, and resource-efficient irrigation systems. Complementing subsidies and tax incentives bolster the economic viability of CSA technologies by reducing tax liabilities for adopting farmers and agribusinesses.

Case Study: SunCulture's CSA subsidy success in Togo[7]

In collaboration with EDF and BBOXX-EDF Togo, SunCulture empowered Togo's smallholder farmers through a pilot program in 2019. In 2020, responding to COVID-19 supply chain challenges, the Togo government, EDF, SunCulture, and BBOXX-EDF signed an MOU.

This expanded the CIZO program to include solar irrigation systems, offering a 50% subsidy for 5,000 units. SunCulture and BBOXX-EDF Togo partnered to facilitate this initiative, enabling customers to pay the subsidy after their own contribution. In two years, SunCulture installed nearly 4,000 solar irrigation systems. This success demonstrates the potential of subsidies to drive CSA adoption, boosting food security and economic activity in Togo.

First loss mechanisms and debt guarantees

First loss mechanisms allocate funds to absorb initial project losses, boosting investor confidence. First loss mechanisms involve a designated portion of the investment capital stack being earmarked to absorb initial losses in the event of project underperformance or adverse climate-related events. Funding for this element is usually provided by a donor or government party willing to accept the highest risk of loss. This provides a safety net for other investors, providing more commercially costed capital with lower risk tolerance, making CSA investments more attractive by more accurately aligning the financial risk for different investors.

[7] SunCulture's CSA Subsidy in Togo

Case study: Acumen Resilient Agriculture Fund (ARAF)[8]

In 2020, the ARAF Fund initiated a transformative venture with $58m in funding. ARAF specializes in early-stage start-ups investments that empower smallholder farmers to adapt to climate change. Their focus lies on platform businesses facilitating access to inputs, finance, technical support, and markets for farmers. With ticket sizes ranging from USD 300,000 to USD 4m, it has funded ten companies across Kenya, Uganda, Rwanda, Nigeria, and Ghana. Its financial structure includes a USD 25m First Loss Pool, USD 33m Senior Equity, and USD 5m for scaling interventions. ARAF exemplifies innovative financing's role in advancing climate-smart agriculture for smallholders.

Debt guarantees, conversely, are contractual arrangements that provide assurances to financial institutions that they will recover their loans in the event of default. This encourages banks and lending institutions to offer loans to farmers and agricultural enterprises involved in CSA projects. By lowering the risk for lenders, debt guarantees can increase access to capital for CSA initiatives. This mechanism enhances access to capital for CSA initiatives, allowing more stakeholders to engage in climate-smart agriculture without the burden of high borrowing costs.

First loss and debt guarantees are financing mechanisms designed to de-risk CSA investments, particularly capital-intensive technologies. These mechanisms provide a layer of protection to investors and financial institutions, reducing their exposure to potential losses. This risk mitigation encourages private sector investments in CSA, as it reassures investors that their capital is safeguarded.

Equity investment

Equity investment serves as a critical support system for Climate-Smart Agriculture (CSA) technologies by providing the essential capital needed for their development and growth. Financial institutions, including investment banks, private equity, and venture capital firms, leverage their expertise and resources to identify promising CSA innovations and offer the necessary equity capital.

Case study: Healthy Food Systems Impact Fund II[9]

Pymwymic, a group of European investors, launched the Healthy Food Systems Impact Fund II in 2021. The fund is a pioneering venture capital program that focuses on technology-driven agricultural innovation. It supports companies that work on crop intelligence software and soil biology analytics, aiming to invest USD 55m in up to 14 forward-thinking businesses over the next decade. By providing equity financing, the fund serves as a catalyst for the growth and scaling of these technologies, facilitating their potential to bring about substantial positive change in the global agricultural landscape. The Healthy Food Systems Impact Fund II is a testament to the power of technology in reshaping agriculture, promoting climate-smart practices, and contributing to a more sustainable and resilient future for food systems.

[8] ARAF Fund
[9] Healthy Food Systems Impact Fund II

This infusion of funds facilitates increased accessibility and affordability of CSA technologies, making them more accessible to farmers. In emerging economies, where financial resources for sustainability initiatives can be scarce, equity investment becomes particularly crucial. Tools such as private equity funds and venture capital funds play a pivotal role in scaling organizations that are at the forefront of developing CSA innovations.

Mezzanine finance

Mezzanine finance represents a hybrid financing approach that holds significant promise for promoting the uptake of climate-smart agriculture (CSA) technologies among smallholder farmers. This unique financing mechanism combines elements of both debt and equity, making it an attractive option for smallholders seeking to invest in CSA technologies. Mezzanine finance offers flexible repayment terms, accommodating the often variable nature of agricultural cycles and mitigating the risk associated with temporary setbacks. Furthermore, it provides risk-sharing features, enabling smallholders to access funding without extensive collateral or strong credit histories. With its equity-like upside potential, mezzanine finance aligns the interests of financiers with the success and profitability of smallholders adopting CSA technologies.

New financing instruments

Results-based financing

Results-based financing mechanisms, underpinned by the principle of outcome-based financing, incentivize the uptake of CSA technologies. By tying financial rewards to measurable climate-resilient outcomes, such as increased crop resilience, reduced emissions, or enhanced soil health, results-based financing ensures that investments yield quantifiable benefits in terms of climate resilience and sustainability. This direct linkage between financial incentives and desired outcomes effectively aligns financial interests with environmental stewardship, promoting the widescale adoption of climate-smart agricultural practices.

By establishing clear expectations and outcomes, results-based financing helps to implement rigorous monitoring and evaluation processes, ensuring that funding is directed towards CSA technology efforts that consistently deliver tangible benefits for climate resilience and sustainability. Additionally, RBF enables adaptive management, allowing interventions on CSA technology to modify their strategies as they progress, ultimately maximizing their impact.

One of the significant challenges in promoting CSA technologies is the cost and complexity associated with measuring their impact. results-based financing mechanisms offer a practical solution to this predicament by focusing on predefined targets and outcomes – allowing for a more streamlined and cost-effective measurement process. It enables policymakers and stakeholders to prioritize specific indicators directly linked to climate resilience and sustainability, thereby reducing measurement costs and enhancing efficiency.

Carbon credits

Carbon credits represent a unique financing mechanism for CSA initiatives, particularly those focused on emissions reduction and carbon sequestration. Carbon credits are tradable certificates that represent a reduction in greenhouse gas emissions or the removal of carbon dioxide from the atmosphere. These credits can be generated by investing in CSA technologies that demonstrate emissions reductions or enhanced carbon sequestration.

Carbon credits **assign a tangible value** to the carbon aspects of CSA technologies. They provide financial incentives for CSA interventions that can demonstrate their contributions to mitigating climate change by sequestering carbon, reducing emissions, or enhancing the

sustainability of land use. Farmers and project developers can sell carbon credits on carbon markets, generating revenue from their climate-smart practices.

Case study: SunCulture and G2 Venture Partners' Agriculture Carbon Credit[10]

SunCulture and G2 Venture Partners have formed a strategic partnership to advance climate-smart agriculture. SunCulture, a leader in solar irrigation systems, actively reduces emissions by approximately 3 tonnes per pump per year. G2 Venture Partners, committed to sustainability, has chosen to support SunCulture's solar irrigation projects by purchasing carbon credits.

This collaboration not only offsets G2 Venture Partners' carbon footprint but also encourages climate-resilient farming practices. It further lowers the cost of solar pumps, making them more accessible to smallholder farmers and promoting sustainable agriculture. This case study demonstrates the practical impact of carbon credits in supporting sustainable farming, reducing emissions, and fostering a greener future.

While carbon credits offer potential benefits for CSA financing, they also come with complexity. Generating and trading carbon credits involves rigorous measurement, reporting, and verification processes, often requiring technical expertise and upfront investments. However, for projects that can navigate these complexities, carbon credits can be a valuable source of revenue that supports the long-term sustainability of CSA initiatives.

Nature-for-debt swap

The Nature-for-Debt Swap offers an inventive approach to boost climate-smart agriculture (CSA) technology adoption among smallholder farmers, particularly in debt-burdened regions like Africa. This strategy combines debt relief with CSA promotion and nature conservation commitments to advance sustainable agriculture.

Under this swap, nations struggling with high debt levels can renegotiate repayment terms, freeing resources for targeted investments in CSA technologies. A portion of the debt relief is then allocated to support CSA adoption by smallholders, promoting climate-resilient farming practices and crop varieties.

This mechanism comprises three key elements: debt restructuring, nature conservation commitments, and CSA technology investment. Smallholders benefit by gaining access to CSA innovations, enhancing climate resilience and food security. Governments benefit from debt relief to fund sustainable agriculture while contributing to environmental goals. The Nature-for-Debt Swap fosters international collaboration, ensuring accountability through rigorous monitoring. In summary, it provides a comprehensive solution to address debt sustainability, environmental conservation, and CSA technology adoption, fortifying smallholder resilience in agriculture.

Financial inclusion for smallholders

While the focus is primarily on financing tools for agribusinesses and tech investors, there is also a **consideration for financial inclusion for smallholders** through:

Microfinance

Smallholder farmers face multiple challenges in adopting CSA technology, but microfinance institutions have stepped in to offer tailored financial services that meet their unique needs. Through micro-loans with flexible repayment options and small denominations, small farmers can access the necessary resources to invest in CSA technologies. This approach is particularly effective given the limited resources available to smallholders. By empowering

[10] SunCulture and G2 Venture Partners' Agriculture Carbon Credit

farmers to implement climate-smart techniques and technologies, microfinance institutions play a vital role in promoting financial inclusivity, enhancing farmers' resilience to climate change impacts and boosting agricultural productivity.

Climate insurance

Insurances could be leveraged to reduce risks in CSA technology adoption. It compensates farmers for climate-related losses, fostering confidence amid rising climate uncertainties. Simultaneously, insurers can help address transition challenges in adopting CSA technologies. They offer incentives like reduced premiums, specialized insurance, and risk management services tailored to the needs of CSA technology adopters. However, it's essential to note that innovative insurance for CSA technologies is emerging due to regulatory factors. Early adopters, including governments and sustainability-focused insurers, are leading the way in shaping the future of sustainable agriculture.

Case study: Index insurance - R4 Rural Resilience Initiative[11]

Launched in 2011 by the World Food Program (WFP) and Oxfam America (OA), the R4 Rural Resilience Initiative (R4) strives to bolster food and income security while adapting to rising climate risks. R4 combines four pivotal pillars: risk reduction via natural resource management and agricultural best practices, risk transfer through microinsurance, prudent risk-taking involving livelihood diversification, investments, microcredit, and risk reserves, including savings and deposits. By 2020, R4 had empowered approximately 180,000 farmers across ten countries with access to index insurance products and complementary risk management services. This initiative collaborates with government safety net programs and NGO-led development initiatives, creating a scalable model for pro-poor market growth while promoting increased insurance penetration and financial inclusion. Successful expansion opportunities in regions like West Africa, including Nigeria, demonstrate R4's potential to enhance climate resilience and food security through innovative index insurance approaches.

Digital finance

Digital Finance solutions, such as mobile banking and digital payment platforms, transform financial transactions for smallholders. These technologies simplify processes related to credit access, payments, and financial transactions. Digital finance champions financial inclusion by enhancing the efficiency and accessibility of financial services, particularly in remote or underserved areas. By empowering farmers to access financial services through their mobile phones, digital finance equips them to invest effectively in CSA practices, equipping them to confront climate-related challenges with confidence.

[11] The R4 Rural Resilience Initiative

Evaluating climate benefits for CSA technologies

Assessing the climate benefits of CSA technologies is crucial for attracting investment and demonstrating their effectiveness in mitigation and adaptation. To illustrate:

Methodological diversity

Challenge: One of the foremost challenges in quantifying climate benefits in CSA technologies is the diversity of methodologies used to measure carbon sequestration, emissions reduction, and other climate benefits associated with CSA technologies. This diversity makes it difficult to standardize results across technologies and regions, leading to variations in reported climate benefits, hindering accurate comparisons and the establishment of credible baselines.

Role of financing tools: To tackle this challenge, financing tools can be instrumental in supporting research and standardization projects aimed at developing consistent measurement approaches for CSA technologies. Climate finance mechanisms can allocate funds to initiatives that work on harmonizing methodologies, creating standardized guidelines, and conducting research to ensure reliable quantification of climate benefits associated with CSA technologies.

Time lag

Challenge: CSA technologies often require a considerable period before the full extent of their climate impact is realized. Convincing investors to commit to long-term financing when immediate returns are not guaranteed poses a significant challenge. The time lag between investment in CSA technologies and the realization of climate benefits can be a deterrent for potential funders.

Role of financing tools: Innovative financing tools can be crucial in addressing the time lag challenge. For example, climate bonds with staggered returns can attract investors seeking both short-term and long-term gains. These bonds can provide periodic returns while also contributing to the long-term sustainability of CSA technologies, making them more appealing to a wider range of investors.

Complexity of ecosystem services

Challenge: CSA technologies contribute to various ecosystem services, including improved soil health, enhanced biodiversity, and sustainable water management. Quantifying these benefits in a way that accurately reflects their value remains a complex endeavour. Traditional financial metrics often fall short of capturing the full scope of these ecosystem services, making it challenging to monetize and communicate their significance to investors.

Role of financing tools: Financing tools can facilitate the valuation of ecosystem services associated with CSA technologies by allocating funds to projects focused explicitly on ecosystem services. These projects can develop innovative valuation methodologies and metrics that encompass the wide array of benefits generated by CSA technologies. Additionally, climate finance mechanisms can offer financial incentives to technologies that prioritize and quantify ecosystem services, encouraging greater recognition and investment in these critical components of CSA.

Data limitations and monitoring challenges

Challenge: Reliable and comprehensive data on climate-related parameters, such as carbon sequestration rates or emissions reductions, can be scarce, particularly in developing regions. Additionally, monitoring and verifying these parameters require technical expertise and resources that may not be readily available.

Role of financing tools: Climate finance can address data paucity and monitoring challenges for CSA technologies by allocating funds to build data infrastructure, develop remote sensing technologies, and establish monitoring and verification systems. Climate finance mechanisms can enhance the availability and accuracy of climate-related data associated with CSA technologies. This, in turn, can facilitate more robust quantification of climate benefits in CSA technologies, making them more attractive to investors.

Measurement and verification costs

Challenge: The costs associated with measuring and verifying climate benefits can be prohibitive for many CSA technologies, especially smaller-scale initiatives. High measurement and verification costs can erode the financial viability of CSA technologies, limiting their ability to attract financing.

Role of financing tools: Financing instruments specifically designated for measurement and verification activities can alleviate this challenge. Climate finance mechanisms can offer grants or concessional loans to cover these costs, making it more feasible for CSA technologies to engage in rigorous measurement and verification processes. This not only enhances the credibility of quantified climate benefits but also makes CSA technologies more appealing to investors by reducing their financial burden.

Incorporating financing tools into these solutions can enhance the effectiveness of climate benefit quantification in CSA technologies, facilitating their adoption and promoting sustainable agricultural practices. By strategically allocating funds and incentives, climate finance mechanisms can address these challenges and encourage greater investment in CSA technologies, ultimately contributing to climate resilience and agricultural sustainability.

Recommendations

To drive the adoption of CSA technologies in Sub-Saharan Africa through innovative financing tools, we present a comprehensive set of recommendations for different audiences:

Stakeholder group	Recommendations
Policymakers and regulators	• Create an enabling policy framework by developing clear and supportive regulations for promoting CSA technology interventions. • Streamline approval processes and consider subsidy and tax incentives for CSA investments. • Encourage public-private partnerships (PPPs) for joint investments in CSA technologies. • Invest in farmer and agribusiness education to build capacity on CSA technologies. • Support knowledge-sharing through workshops and digital platforms. • Establish a robust monitoring system to assess the impact of financing mechanisms employed for the uptake of CSA technologies.

Stakeholder group	Recommendations
Development finance institutions	• Establish dedicated CSA financing facilities with funds and grant programs. • Offer affordable financing options to agribusinesses, including low-interest loans and grants. • Invest in capacity building through training programs. • Collaborate with local partners to create knowledge-sharing platforms. • Leverage international climate funds.
Private financial institutions (FIs)	• Develop CSA insurance products tailored to risks, encouraging smallholders and agribusinesses to invest in CSA. • Innovate with digital finance solutions to provide easier access to credit for CSA investments.
Agribusinesses	• Develop CSA practices for technological solutions that promote climate mitigation and resilience. • Engage in integrating smallholder farmers to foster a market for CSA technologies.
Multinational corporations	• Promote climate finance reporting for transparency and attraction of investments. • Actively engage in public-private partnerships (PPPs) to drive innovative CSA technologies. • Support sustainable supply chains by integrating CSA principles.

Conclusion

Promoting Climate-Smart Agriculture (CSA) in Sub-Saharan Africa necessitates a multifaceted and coordinated approach anchored in critically examining the concepts of affordability and accessibility, particularly when dealing with capital-intensive technologies. To embark on this transformative journey effectively, a consortium of key stakeholders, including policymakers, regulators, development finance institutions, private financial entities, agribusinesses, and multinational corporations, must combine their efforts.

One of the central issues that must be addressed is the question of affordability. For CSA to genuinely impact agriculture across the region, it is imperative to understand how smallholder farmers and agribusinesses at different scales can afford the technologies and practices associated with CSA. This demands meticulous assessment and tailored financial solutions that cater to the diverse economic realities within Sub-Saharan Africa. Policymakers must design strategies and mechanisms that ensure that CSA innovations are not only accessible but also financially viable for those at the heart of agricultural production. This includes leveraging financing instruments such as grants, subsidies, and innovative loan products to make CSA technologies more affordable and accessible.

Simultaneously, the aspect of accessibility comes to the forefront. CSA technologies should not remain confined to a select few; they should be within reach for farmers at all levels. The challenge here is twofold: physical access to CSA solutions and ensuring that farmers are adequately trained and equipped to utilize these technologies effectively. This demands robust infrastructure development, which can bridge the gap between technology hubs and remote farming communities. Additionally, it necessitates robust extension services and training programs to empower farmers with the knowledge and skills to make the most of CSA practices.

By collaboratively grappling with these pressing questions and harnessing financing instruments strategically, stakeholders stand to make a significant impact on sustainable agricultural development, bolstering resilience against the escalating challenges posed by climate change and fortifying food security throughout the region. This collaborative effort holds vast potential to unlock the benefits of CSA for all stakeholders, ranging from smallholder farmers who form the backbone of Sub-Saharan Africa's agriculture to agribusiness giants.

Most crucially, this approach ensures that the financial dimensions of CSA are not an insurmountable obstacle but a pathway to sustainable, prosperous, and climate-resilient agriculture. As the region embarks on this transformation, the nexus between accessibility, affordability, financing instruments, and the broader CSA agenda remains paramount in shaping a more sustainable and prosperous agricultural future for Sub-Saharan Africa.

CASA

Commercial Agriculture for Smallholders and Agribusiness

CASA aims to drive global investment for inclusive climate-resilient agri-food systems that increase smallholder incomes.

The programme makes the case for increased agribusiness investment by demonstrating the commercial and development potential of sourcing models involving empowered smallholder producers and by tackling the information and evidence gaps holding back investment.

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