Reaching more farmers

Innovative approaches to scaling up climate-smart agriculture

Working Paper No. 135

CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)

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Abstract

The purpose of this working paper is to provide insight into how we can use novel approaches to scale up research findings on climate-smart agriculture (CSA) to meaningfully address the challenges of poverty and climate change. The approaches described include those based on value chains and private sector involvement, policy engagement, and information and communication technologies and agro-advisory services. The paper draws on 11 case studies to exemplify these new approaches to scaling up. These are synthesised using a simple conceptual framework that draws on a review of the most important challenges to scaling up. This provides the material for a discussion around how particular scaling up approaches can help to address some of the challenges of scaling up. The analysis offers insights into scaling approaches, challenges and some opportunities for scaling CSA practices and technologies. We conclude that multi-stakeholder platforms and policy making networks are key to effective upscaling, especially if paired with capacity enhancement, learning, and innovative approaches to support decision making of farmers. Projects that aim to intervene upstream at higher leverage points can be highly efficient and probably offer cost-effective dissemination strategies that reach across scales and include new and more diverse partnerships. However, these novel approaches still face challenges of promoting uptake, which remain contextualized and thus require a certain level of local engagement, while continuously paying attention to farmer's needs and their own situations.

Keywords

Climate-smart agriculture, scaling, institutions, transformation

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Contents

Acronyms

AWD	Alternate Wetting and Drying
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CSA	Climate smart agriculture
CSV	Climate smart village
DFID	Department for International Development
FAO	Food and Agriculture Organisation of the United Nations
ICRAF	World Agroforestry Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
ICT	Information and communication technologies
IFPRI	International Food Policy Research Institute
IIRR	International Institute of Rural Reconstruction
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IRRI	International Rice Research Institute
R4D	Research for Development

Introduction

All over the world research on and dissemination of agricultural technologies and practices is pursued as an intervention to raise agricultural production, improve livelihoods and alleviate poverty for smallholder farmers (Kilima et al, 2010). Agricultural research in improved crop varieties, better farming methods, participatory policy analysis and new knowledge generation has contributed substantially to development impacts (World Bank, 2011). For CGIAR, for example, Raitzer and Kelley (2008) estimated that the system-wide benefits ranged from nearly $14 billion to over $120 billion in net present value, depending on the method used to select case studies. Even by the most conservative criterion, overall benefits attributable to CGIAR research to 2008 were approximately double the total costs of investment.

However, many technologies and practices are still not achieving their full potential impact because of low levels of adoption by farmers in developing countries. There are many plausible reasons for this, including our collective limited understanding of local contexts beyond the obvious constraints related to natural systems, such as how farmers make decisions, and how the institutional environment may enable or inhibit uptake of new technology. Projects, programmes and policies are often limited in scale, short-lived, and without lasting impact (Hartman and Linn, 2008). Despite successful pilot projects, uptake of new and innovative agricultural technologies and practices has often been poor and we have still not been able to resolve problems of food insecurity and rural poverty. About 805 million of the 7.3 billion people in the world, or one in nine, were suffering from chronic undernourishment in 2012-2014 (FAO, 2014), almost all of whom were living in developing countries. This is not to say that there has been no progress: on the contrary, the developing regions overall saw a 42 per cent reduction in the prevalence of undernourished people between 1990–92 and 2012–14 (FAO, 2014). But there are large regional differences: progress against poverty and hunger has been limited in South Asia, for example, and has actually gone backwards in sub-Saharan Africa since 1990-1992 (FAO, 2014). Clearly, much remains to be done.

The history of research for development (R4D) shows that only a small proportion of the results of agricultural research has been adopted by next- and end-users[1]. Climate change adds considerable urgency to the situation, and there is no good 'new' news on the climate change front: Hansen et al. (2015) demonstrate that even the 2°C target constitutes highly dangerous climate change, and our current 'business as usual' trajectory will take us way beyond even this target by the end of the current century. We are starting to run out of time, and particularly for the poor and malnourished of the developing world, the agricultural R4D community needs to find new ways of ensuring that their research outputs contribute to development outcomes much more quickly than has occurred in the past. The theme of Climate Smart Agriculture (CSA) offers one approach for transforming and reorienting agricultural systems to support food security in the face of climate change, by focusing on

[1] Next-users: actors such as national research institutions, extension organizations, NGOs and others, which access CG products directly. Next users can create an environment that enables the target impact for end-users; decision makers that we want to influence to achieve outcomes. End-users: The beneficiary population, usually quite massive, making it unfeasible for a project or program to work with them directly.

the potential synergies and trade-offs between agricultural productivity and food security, adaptive capacity, and mitigation benefits (Campbell et al., 2014). Climate change may massively disrupt food markets, posing population-wide risks to food supply, a threat that can be reduced by increasing the adaptive capacity of smallholder farmers as well as increasing resource use efficiency in agricultural systems (Lipper et al., 2014). For CSA to be effective, coordinated actions by farmers, researchers, private sector, civil society and policymakers are needed in four major areas: (1) building evidence; (2) increasing local institutional effectiveness; (3) fostering coherence between climate and agricultural policies; and (4) linking climate and agricultural financing (Lipper et al., 2014).

Inherent in the notion of CSA is the need for hundreds of millions of smallholder farmers to adopt climate smart practices and technologies, which will inevitably involve new and innovative ways of moving to scale. A gap between researchers, policymakers and practitioners continues to exist and despite huge efforts to disseminate, apply and scale up the results of research, these efforts are often insufficient or inadequate (Hartman and Linn, 2008). Research organisations are increasingly being held accountable by governments, donors, civil society and farmers themselves to show more than research results and dissemination strategies: rather, to contribute to development outcomes and lasting impacts on the lives of the rural poor. The emphasis on the effectiveness of R4D to produce adoptable technological options is increasing as well as a demand for agricultural research to achieve and demonstrate greater impacts and thus its value (Pachico and Fujisaka, 2004). The question for agricultural research is why agricultural, and in this case CSA, practices and technologies have not been more widely disseminated and adopted if they raise productivity, enhance resilience, and reduce emissions.

However this question is answered, a key component is likely to lie in adaptive management and learning-based approaches to reflect on whether we are doing things right, whether we are doing the right things, and how we know what is right. Social learning conceptualised as triple-loop learning may offer one approach to help understand whether and how meaningful and lasting engagement with stakeholders is contributing towards the scaling of research results to achieve development outcomes (Kristjanson et al., 2014).

Incremental change is no longer considered enough to bring about the societal changes needed to mitigate and adapt to climate change and enhance food security (Biermann et al., 2012). It is this need to show real impact beyond the plot or site level to impacts on more people over wider areas, and on institutions and policies that drives the interest in scaling up (Pachico and Fujisaka, 2004). The key issue is, how to scale up promising pilot initiatives so that they can have a substantive impact on poverty (Wolfensohn, 2005). It is not necessarily that researchers themselves have to bring things to scale – but it is about explicit strategies enabling next users through partnerships, engagement, capacity development and learning to apply research results in non-research processes, and helping to inform next users as to what makes enabling environments conducive to scaling up and out.

The overall purpose of this working paper is to provide insight into what researchers and their non-research partners can do to get CSA research products to key next users so that they change their practices and behaviour and put mechanisms in place that allow farmers, as the end users of research outputs, to change their farming practices. How can CSA approaches be multiplied and scaled up? What do next users need, and what do conducive enabling environments look like? What can we learn about scaling up from the portfolio of projects in the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)? These questions are inspired by the desire to deliver development outcomes through R4D.

Our purpose here is to provide insight into how we can use novel approaches to scale up research findings to meaningfully address the challenges of poverty and climate change. The approaches described include those based on value chains and private sector involvement, policy engagement, and information and communication technologies (ICT) and advisory services. The paper draws on 11 case studies that were selected from a portfolio of CCAFS CSA projects and which exemplify these new approaches to scaling up. The cases are synthesised and analysed using a simple conceptual framework that draws on a review of the most important challenges to scaling up. This provides the material for a discussion around how particular scaling up approaches can help to address some of the generic challenges of scaling up.

Scaling up

Defining scaling up

For simplicity we use the term 'scaling up' to capture a number of processes, whereas some authors uses both terms scaling up and scaling out. Other terms often used to describe the processes of scaling up and out include diffusion of technologies, dissemination of knowledge, technology transfer and mainstreaming or uptake of practices. One overarching definition is that scaling up brings more quality benefits to more people over a wider geographical area, more quickly, more equitably, and more lastingly (IIRR, 2000, in Franzel et al., 2001). Thus, scale refers to the benefits brought about through the intervention not only in terms of the number of people and the geographical area but also in terms of time and equity scales (Pachico and Fujisaka, 2004).

Scaling up rarely occurs in one dimension only: "As programs scale up quantitatively [larger number] and functionally [more complexity], they typically need to scale up politically and organizationally" (Hartmann and Linn, 2008: 8-9). Scaling up is thus largely a management issue. It is (or should be) about how to manage projects to ensure that positive impact is maximised (Pachico and Fujisaka, 2004), while acknowledging that multiple actors and scales need to be considered (Buizer et al., 2011).

The scaling up of CSA technologies and practices, in particular, brings its own issues, given considerable uncertainty, incomplete or contradictory knowledge, and massive stakes for billions of people. The complexity of the climate change challenge in general, but particularly in terms of its cross-level dynamics, requires a multi-dimensional approach to scaling up CSA responses.

Scaling up through agricultural extension services and participatory approaches

It has been a challenge to agricultural scientists and government authorities to reach large numbers of farmers with new technologies and practices. In the past, agricultural research institutions generally adopted a technology-focused or supply-led ('push') approach. Scientists developed and tested technologies that they considered relevant to farmers and then disseminated them, often through national agricultural extension services. Farmers' participation in these efforts was usually not systematic, nor were farmers genuinely involved in decision-making concerning research priorities or activities. In this approach, increasing impact is assumed to be through producing dissemination materials, and making sure such materials reach as many people as possible (Pachico and Fujisaka, 2004). The theory of change is that diffusion of and capacity building in new technologies and practices to a sample of farmers will lead to uptake by many. A significant amount of research was done on technology adoption and diffusion with the goal of improving the extension and dissemination processes (Ibid).

However, national extension systems have often had limited success due to under-funding, limited infrastructure and logistics, declining number of extension personnel, and limited capacity (Noordin et al., 2001; Snapp and Heong, 2003). At the same time, extension services often have a top-down approach to information and knowledge dissemination based on a transfer-of-technology 'push' approach - extension services offering blue print solutions, rather than context specific ones. A key problem with such approaches is that new practices and technologies often do not reach the poor

(Snapp and Heong, 2003), and may not be suitable in the first place (for example, if some level of investment is needed to adopt particular practices).

To overcome the problems related to top-down and technology-focused approaches, where recommendations are frequently not understood by farmers or are not disseminated in a way that facilitate farmers' own experimentation (Kanyama-Phiri et al., 2000), participatory, client-driven research and technology development ('pull') approaches have been introduced to support local experimentation and decision making (e.g. local agricultural research committees) (Ashby et al., 2000; Braun et al., 2000 in Snapp and Heong, 2003). Many researchers have recognised that a sound understanding of how farmers learn, innovate and make decisions is critical if widespread adoption is to occur (Scoones and Thompson, 1994; Cary et al., 2002; Pannell et al., 2006 in Millar and Connell, 2010).

Common constraints and challenges to scaling up

In the following subsections we explore some of the key challenges identified above for scaling up CSA technologies and practices: transactions costs, farmers' attitudes and objectives, and issues surrounding the enabling institutional environment.

Transactions costs: reaching large numbers

Extension approaches, especially participatory ones, often have high transactions costs and struggle to work over large areas beyond the pilot villages (Braun et al., 2000). Transactions costs are high due to the need to reach individual farmers and/or to create structures to reach groups of farmers.

While scaling up via agricultural extension services and different participatory approaches can work in certain circumstances and to some extent, we need other methods for getting research outputs taken up by next users at scale to contribute to outcomes. To overcome the challenges inherent in conventional approaches to scaling up, it is necessary to introduce CSA into existing structures – it may not be necessary to invest in scale but rather to partner with actors who already have achieved scale, and in this way add value to what others are doing. This can imply intervening upstream at higher leverage points in the system. We need to find the most effective points where science-based interventions can leverage the greatest amount of change that benefits the largest number of people.

This is not going to happen if we intervene farm by farm. Scale is best achieved through actors that set and enforce rules (i.e., powerful actors in the system) and not only by engaging with actors who are on the receiving end of these rules and have limited capacity to change the overall system dynamic (i.e., farmers). Because of this, some of the best scaling interventions that most benefit smallholder farmers take place far away from the farm. This kind of off-farm (and sometimes out-of-country) thinking is challenging for many R4D organisations. Working with farmers is still needed but achieving scale through supply-led strategies (such as seed distribution or sustainable farming systems) that are not aligned or coordinated with demand-led strategies that build on existing power dynamics and incentives have limited chance of achieving scale despite excellent results at the household level (Mark Lundy, personal communication).

There are various ways in which transaction costs can be reduced through using upstream leverage points and existing procedures: for example, through commercial organisations, input supply

businesses, and government programmes. There may also be opportunities to reduce transactions costs through designing R4D activities that revolve around processes that can be scaled, rather than the technologies themselves.

Transaction costs: meeting farmers' priorities

Supply-driven ('push') approaches will often need huge efforts to encourage farmers to adopt new technologies, compared with demand-driven approaches where technologies are innovated with farmers or adapted to their needs (Bohringer, 2001; Anderson, 2008; Schot and Geels, 2008).

Insufficient understanding of farmers' priorities is important not only for scaling up processes but also for small-scale uptake of new practices. However, pilot projects often have more time and resources to engage stakeholders to define needs and opportunities, as well as demonstrating benefits. The challenge for scaling up processes is to reduce the transactions costs involved in making technologies and practices more context specific. CSA technologies and practices may take a long time to reap the benefits: for example, improving organic matter and water holding capacity in soils, planting trees and managing landscapes. Many farmers are reluctant or unable to invest substantial time and resources in new crop varieties, inputs, technologies or practices that, to them, provide uncertain results in a long-term risky future (Hartmann and Linn, 2008; Franzel et al., 2001). Many smallholders are interested in avoiding risk, as far as is possible, and in maximum return to minimal inputs (Rohrbach and Okwach, 1999). The conventional wisdom is that farmers with sufficient land, livestock and other assets are more likely to innovate or take up new technologies, while poorer households are less able to take risks and will often wait to see the benefits of new practices before adopting.

An important question relates to whether CSA is more context-specific than other agricultural practices. One assumption could be that given the explicit focus on climate change and the goal to produce triple wins in mitigation, adaptation and food security, CSA may be more context-specific because climate change impacts and vulnerabilities vary considerably spatially. The context specificity may limit its potential for scaling up or slow down its uptake, or at least the farmer may need to make modifications for the technology to succeed (Binswanger and Aiyar, 2003). Successful scale-ups may create sophisticated, context-specific procedures constantly adapted in the light of new experiences and highly dynamic circumstances – in such cases, there may be no blueprint for CSA practices (Kaczan et al., 2013).

In some situations, options will be needed to cover up-front costs (cost of conversion, loss of productivity during transition, increased labour demand), perhaps through well-targeted input subsidies or combining CSA technologies and practices with rapidly yielding crops or livestock. For example, forages may provide an entry point or 'spark of interest' which enables farmers to see that gains can be quickly made from livestock production with little effort (Millar and Connell, 2010). Integrated approaches are needed to build adaptive capacity and mitigate environmental and socioeconomic risks, for example by diversifying incomes or providing insurance schemes that unlock a productive opportunity that was previously unattractive because of risk (Franzel et al. 2001; Greatrex et al., 2014).

Although access to markets, land, credit, and political stability and other governance issues do influence the rate of scaling up, the absence of these factors does not necessarily preclude farmers benefiting from suitable technologies and practice changes, particularly if the resulting livelihood

impacts are significant (Millar and Connell, 2010). Farmers' concerns need to take centre-stage, and if technologies are genuinely appropriate, then scaling up is more likely to occur.

Political, institutional and economic barriers

The enabling environment is critical for scaling up. Any programme working on issues of scaling should take into account existing institutions and their capacities as well as the policy and regulatory framework, and the opportunities and constraints they provide. However, programmes or projects may choose another approach that more directly targets institutional capacity building or policy change to facilitate scaling up processes. Scaling up can become very much about institutionalising or mainstreaming policy change (Jonasova and Cooke, 2012).

At the institutional level, there is a need for effective development and deployment of institutions and mechanisms that can carry forward the scaling up process. It is important to recognise that many institutions are involved and need to cooperate, and thus need to be coordinated: from line ministries to local policymakers, both traditional and governmental, in villages, districts and provinces, as well as international development and donor communities who influence investment as well as frame discourses within which decision making takes place (Linn, 2012; Franzel et al., 2001). Progress can often only be made by working at multiple levels, and dealing with cross-level relationships and impacts (Sayer and Campbell, 2004). Ideally, scaling up processes should be clear from the outset about the institutional choice to be made and the capacity building needed for the chosen scaling up pathway (Linn, 2012).

The policy and regulatory framework and its enforcement are likewise critical for effective scaling up (this may include land ownership, extension services, taxes or subsidies on agricultural inputs, credit and insurance schemes) because they provide the rules and incentives (or disincentives) for adoption of innovation. Engagement and learning are critical, to create a space with key constituencies and actors to avoid political obstacles to the scaling processes (Linn, 2012).

Methods: Selection of case studies and analytical framework

Having described the major challenges for conventional scaling up approaches, eleven case studies (CS) were selected, representing a range of recent and on-going research activities on the part of several CGIAR centres and their partners within CCAFS. Cases were selected based on their novel approach and ambition to deliver widespread impact and peer appraisal that this was being achieved or was likely. After an initial analysis of the cases these were divided into three major approaches to scaling up:

- *Case studies based on value chain and private sector approaches*

  1 Scaling CSA practices through climate smart value chains: coffee and cocoa (CIAT and IITA in Ghana, Nicaragua and Peru).

  2 Inclusive and sustainable dairy development in Kenya (ICRAF).

  3 Integrating private businesses in scaling CSA (CIMMYT in Kenya).

  4 Building agricultural resilience in Nigeria through index insurance and scaling out of CSA (CIMMYT).

- *Case studies revolving around ICT and agro-advisories*

  5 Scaling up climate smart information services to guiding climate risk management by farmers in Senegal (ICRISAT).

  6 Towards a Climate Smart Agriculture in Colombia (CIAT).

  7 Shamba Shape Up: an example of the use of edutainment for scaling out CSA practices (CIMMYT, CIP, ICRISAT, ICRAF and ILRI in Kenya).

- *Case studies revolving around policy engagement*

  8 Scenario-guided policy formulation: Cambodia's climate change priorities action plan (CCAFS).

  9 Scaling up Climate Smart Villages in South Asia (IFPRI and CIMMYT in India).

  10 Policy engagement: a strategy to make science a game changer in the Central American political arena (CCAFS in Honduras).

  11 Doing it right: Upscaling alternate wetting and drying technology in Vietnam (IRRI).

Short write-ups for all eleven case studies are included in Annex 1. To illustrate, three of the case studies are shown in highly condensed form in Boxes 2 (CS1), 3 (CS5) and 4 (CS8).

The following section reviews the different approaches in more detail, before describing the analytical framework of the paper.

New approaches to scaling up CSA

What is remarkable about the selected case studies is that none of them can be characterised as approaching scaling up through the conventional model of extension services. Almost all cases do employ elements of participatory approaches, but not combined with engaging extension services. Three approaches can be distinguished and are described below.

Approaches based on value chains and the private sector

Value chains have two characteristics that make them suitable for reaching a large number of farmers. First, they provide a mechanism for linking multiple actors around a common objective by creating space for dialog, knowledge exchange and capacity building, and strengthening negotiation capacities. Value chains can act as a delivery mechanism for government and private extension services, credit, and subsidy programmes. Second, they provide market-driven demand (currently, often towards green and more organic products) that may provide a demand-led strategy for adaptation of CSA technologies and practices. Scaling up already climate smart value chains or introducing CSA practices and technologies into existing ones may thus be an efficient way to reach large numbers of farmers with reduced transaction costs. However, approaches based on value chains may not be appropriate for the informal sector or for agricultural production for household consumption. And without taking account of these explicitly, value chain approaches may not be well suited to addressing equity and gender concerns in developing countries.

CS1-CS4 involve value chain approaches (Table 2) covering coffee, cacao, dairy, maize and rice, and partnering with large multinationals to small input suppliers, investment agencies and the insurance sector. An illustration of one of these is given in Box 1.

Box 1. Case study 1 (CS1): Scaling CSA practices through climate smart value chains: coffee and cocoa

This project is implemented by CIAT and IITA in Ghana, Nicaragua and Peru, in collaboration with the Rainforest Alliance, Root Capital and the Sustainable Food Lab. It develops appropriate CSA practices with farmers and other value chain actors, incorporating cash and food crops to increase resilience. The project leverages existing smallholder value chain interventions to translate climate science into actionable strategies for farmers and supporting actors across a number of geographies. This novel combination adds value to existing work with the goal of achieving adoption at scale for locally relevant CSA practices, while engaging multiple actors to understand site-specific projections of climate impacts and develop suitable responses.

Climate change exposure of coffee and cocoa systems is assessed at a sub-national scale, while appropriate CSA practices are codified in site-specific adaptation guidelines. These guidelines will be mainstreamed through existing certification training curricula and used to develop innovative impact investment products. Results will be promoted with voluntary certification agencies and impact investors to achieve scale. The long-term objective is to enable key public, private and civil society actors to interpret projected exposure to climate change by cropping system and region into site-specific CSA practices and to incorporate these practices into their work with hundreds of thousands of farmers through extension services or tailored financing.

The challenges to scaling up are (1) climate change information is too general from a private sector perspective, (2) benefits, timing and incentives for multiple actors need to be aligned, and (3) information and financial support need to be coordinated. To drive uptake and investment in CSA, the project develops approaches that are tailored to the needs of farmers and other value chain actors. It moves beyond mapping exposure to engage with key actors to develop a relevant set of customised CSA practices that are both effective in delivering resilience as well as feasible financially and socially. By partnering with existing voluntary certification networks that cover 30% of global cocoa producers and 15% of global coffee producers, as well as with impact investing firms that provide approximately USD 500m of investments into producer organisations annually, this project will be able to build site specific CSA practices into existing certification, training and extension networks with multiple public, NGO and private service providers.

The use of existing value chain interventions with global presence is useful for scaling up CSA. Both voluntary certification and impact investing have a long track record and a strong rate of growth in the coffee and cocoa sectors. Given their existing levels of coverage, embedding site-specific CSA practices into them is a faster and cheaper way to get these practices to scale than other potential entry points in the public or private spheres. Moreover, both the voluntary certification and impact investment communities are aware of the need to better integrate climate science into their activities and a clear demand exists. Finally, the existing level of inclusion and acceptance of voluntary certification and impact investing in coffee and cocoa value chains facilitates conversations with private sector actors who are already comfortable with these vehicles.

The challenge around making climate change and CSA practices actionable is a clear example of trade-offs across geographies. To drive investment in CSA, we need to develop approaches that are tailored to the needs of farmers and other value chain actors under specific climatic conditions. Blanket recommendations are not useful. Second, identification of costs and benefits of diverse CSA practices by value chain actor links to risk minimization strategies and timeframes of farmers and other actors. To move beyond ‘nice to have’ to ‘must do’, CSA practices have to show a clear return on investment. Finally, by building on existing structures already embedded in value chains and intervening upstream with key actors, the project will reduce the transaction costs needed to drive CSA uptake.

Approaches utilising ICTs and agro-advisory services

In order to reach more farmers and overcome the high transactions costs incurred by face-to-face interaction associated with conventional extension services, the use of ICT and associated agro-advisory services is becoming increasingly important. ICTs are effective delivery mechanics and knowledge sharing methods that can contribute to improving access to information and awareness about climate change and CSA practices and technologies. ICTs can provide a wealth of different types of information: market prices, transportation options, weather information (Box 2), commodity and stock market prices, information and analysis, meteorological data collection, advisory services to farmers for agricultural extension, early warning systems for disaster prevention and control, financial services, traceability of agricultural products, and agricultural statistical data gathering, to name several. ICTs encompass a full range of technologies, from traditional, widely used devices such as radios (Box 2), telephones or TV, to more sophisticated tools like computers, mobile phones, the Internet or social media (FAO, 2013).

Smallholder farmers will play a critical role in increasing food production for our future food security. Yet they are often constrained in their access to markets, knowledge, new technologies and skills, agricultural inputs, emerging value chains and other opportunities. The revolution in ICT and information management systems is radically opening up access to external knowledge among even the poorest (Pretty et al., 2011). Smallholder farmers, particularly women, have a huge advantage when the right ICT is brought into the agricultural system (Sylvester, 2013). There are potential constraints in that if women, the poor and other vulnerable groups are to benefit, these groups need to be considered and targeted specifically. There are also governance issues associated with ICT, particularly related to empowerment and elite capture.

Experiences from researchers and practitioners suggest that ICTs in combination with agro-advisory services are playing an increasing role as enablers of change. ICTs are being recognised as part of strategies to adapt to, mitigate, and monitor climate change within agricultural innovation systems. The rate of growth of mobile phone technology is particularly striking. Mobile phones are helping farmers link to one another and also to obtain early information from markets. In 2009, mobile cellular penetration in all developing countries exceeded 50 per cent, reaching 57 per 100 inhabitants, up from 23 per cent in 2005 (Pretty et al., 2011). Together with the spread of Internet access, this means agricultural and price information can be increasingly sourced from distant locations (Pretty et al., 2011).

Several of the case studies (CS5-CS7; Table 2) explore the role of mass media and ICT to create awareness of CSA technologies and to improve access to information and agro-advisory in addressing climate change issues in agriculture and whether this is sufficient to encourage adoption. Similarly, the case studies address the related question of how ICT can enable stakeholder engagement and allow groups to participate that would otherwise be excluded.

Box 2. Case study 5 (CS5): Scaling up climate smart information services to guiding climate risk management by farmers in Senegal

This project is implemented by ICRISAT in Senegal, in collaboration with the national meteorological agency (ANACIM), the association of rural radios (URACS) and a number of local stakeholders, including farmers. Within the context of more frequent and extreme weather events and climate shocks, enhanced early warning systems provide a key opportunity to curb erosion of development progress in rural sectors. Allowing farmers to base farm management decision-making on tailored and salient climate information along the cropping cycle may help them reduce climatic risk and avoid regular food insecurity. Through this project, downscaled seasonal rainfall and long-term weather forecasts are reaching around seven million people in Senegal, helping smallholder farmers to make better-informed decisions about agricultural management in a changing climate. By doing so, the services allowed farmers to improve their adaptive capacity and increase farm productivity. In addition, institutional behavioural change has been achieved by the Senegalese Ministry of Agriculture, which now considers climate information services as an input for their annual agriculture action plan.

The project has developed downscaled seasonal rainfall forecasts, and raised the capacity of partners to do longer-term analysis and provide more actionable information for farmers. The information is conveyed as agro-meteorological advisory packages that are tailored to meet the local needs expressed by farmers. The approach was piloted in Kaffrine since 2011, and has been scaled through a partnership with the association of rural radio stations. Following a training of 82 radio journalists on the jargon of climate and on understanding the seasonal forecast, climate information services across the rainy season are now transmitted in local language as special radio programs in the 14 administrative regions. The interactive nature of the radio program allows listeners to revert with their feedback including additional information, views, and requests of clarification.

The challenges to scaling up are (1) gaps in long-term series of climate data for all sub-national administrative zones, (2) insufficient coverage of the country with local multidisciplinary working groups that can translate climate information into agro-advisories and disseminate, and (3) lack of financial resources to operationalise training plans, capacity building and communication among actors. ENACTS, a model aimed at enhancing national climate services through high-resolution satellite data, is complementing available historical data and producing context-specific climate information for agricultural decision making. ‘Meteo-farmers’ provide weather information and rainfall data through mobile phones. Local multidisciplinary working groups, led by local leaders, are key to creating and disseminating timely agro-advisories and providing platforms for effective communications, and for media and private sector to participate. Finally, enabling decision-makers operating at local to sub-national levels to benefit from early warning information requires investment in training and communication, which need to be resourced financially.

A key challenge to scaling up is not only the production of accurate climate information, but also building confidence in early warning systems and thus triggering regular financial investment into early warning as an element of annual planning. Context specific partnerships through local multidisciplinary working groups, with public and private sector participants offer potential for scaling up and long-term sustainability of information provision embedded in local processes, especially in terms of financial viability.

Approaches revolving around policy engagement

It is not a new observation that policies and political engagement are important for scaling up CSA technologies and practices. In order to implement and scale up CSA it is essential to support countries in putting in place the necessary policy, institutional, technical and financial means to mainstream climate change considerations into agricultural sectors and provide a basis for operationalising sustainable agricultural and food systems under changing conditions. Innovative financing mechanisms that link and blend climate and agricultural finance from public and private sectors are a key means for implementation, as are the integration and coordination of relevant policy instruments and institutional arrangements. At the same time, there are competing interests in policymaking, necessitating the identification of windows of opportunity for meaningful engagement (recognising that engagement outside these windows may on occasion be futile). The scaling up of CSA practices will require appropriate institutional and governance mechanisms to co-generate information, ensure broad participation and harmonise policies. It may not be possible to achieve all the CSA objectives at once. Context-specific priorities need to be determined, and benefits and trade-offs evaluated (FAO 2013). If scaling up is very much about policy change (Jonasova and Cooke, 2012), the challenge is to move beyond informing policy change to informing the enactment of new policies – how policy is implemented will determine its potential for impact. Linn (2012) identifies two interlinked approaches to policy engagement: creating a political space and a policy space. Creating a political space, through advocacy and outreach, is to have the eyes and ears of major political actors and key constituencies who may facilitate or provide political obstacles to large-scale developmental processes. A policy space, on the other hand, is an opportunity to influence policy making and strategies through the provision of technical input to the formulation and implementation of policies that are robust in the light of uncertainty.

CS8-CS11 involve engagement in policy processes (Table 2). Some have focused on the processes of engagement (e.g. through a scenario approach, Box 3), others on generic climate change policies, and others on particular policies (scaling up climate smart villages; scaling up alternate wetting and drying in rice).

Box 3. Case study 8 (CS8): Scenario-guided policy formulation: Cambodia's climate change priorities action plan

This project is implemented by CCAFS; globally in collaboration with the University of Oxford, and in Cambodia also with FAO, UNEP, and over one hundred national experts and representatives of donor organisations. The project develops 'what if' narratives of the future that are then used to explore interactions between multiple drivers of change. CCAFS has developed regional scenarios on climate impacts, food security, environments and socio-economic development for six global regions: East and West Africa, South and Southeast Asia, the Andes and Central America. The innovation is the use of the regional scenarios for policy formulation in national and regional case studies. This allows for multi-dimensional contextual analyses combined with concrete and focused policy applications. In Cambodia, Southeast Asia regional scenarios were used for the formulation of the Cambodia Ministry of Agriculture, Forestry and Fisheries (MAFF)'s Climate Change Priorities Action Plan.

By using climate/socio-economic scenarios to test and develop national policies and investments, the project aims to create enabling environments for building resilience to climate change and sustainably improving agricultural productivity and incomes. In Cambodia, the main purpose of the policy is to enhance the resilience of the agricultural sector and farmers' livelihoods. When policies are tested against multiple scenarios that have stakeholder ownership and legitimacy as well as scientific credibility and appropriate scope, there is a high likelihood that each scenario offers relevant challenges and opportunities which a policy needs to deal with to be feasible in that future. Testing policies against a range of scenarios increases the likelihood that these policies will achieve their aims under uncertain climate and socio-economic conditions. Scenario-guided policy processes also allow for social inclusion and the contribution of a diversity of relevant perspectives from different governance levels, enhancing their ability to help vulnerable groups as well as their social acceptability.

In terms of scaling up, a number of points are important in this process: the creation of as single set of regional scenarios, to be adapted and used in multiple policy guidance processes, means that it is easy to scale out the process to all countries in the region; the involvement of global partners means that there is added potential for scaling up; building internal strategic planning capacity in the ministry is a form of scaling up – moving skills from the research organization to government, where it can be applied into the future; helping to find complementary funds and roles for non-state partners is a out-scaling element; support for sub-national scenario-guided development of implementation plans represents down –and out-scaling, increasing the involvement of less powerful actors and the likelihood that the plan will benefit Cambodia's population.

The main challenges are (1) leveraging the potential of scenario-guided policy formulation as an up-scaling mechanism for other research; (2) developing capacity in scenario-guided planning with governments and partner organisations is time-sensitive; (3) maintaining continuity in processes when mobility of government/partner personnel is high; and challenges revolving around time-intensive processes with frequent collaboration limits the number of processes the team can engage with; engaging sub-national stakeholders is more time/resource intensive; expert facilitation means it is difficult to do these processes virtually. Systems approaches to move beyond policy silos, capacity building and on-going mentoring, intense collaboration and relationships with several key policy makers, and flexibility to responding to emerging opportunities are key.

Scenario methods are very adoptable to the issues at hand – including different levels, or cross-level processes, different topics and short- or long-term policy processes. The combination of these methods with other research processes highlights that scenarios are themselves an up-scaling mechanism. In terms of the general challenges, scenarios can help ensure policies are more realistic and concrete and create enabling conditions that make it easier for farmers to implement CSA, but a gap between implementation planning and reaching farmers remains.

Analytical framework

Based on the constraints to scaling identified through a review of the literature and on some of the characteristics of the new approaches to scaling that are being adopted, ten variables were identified with which to characterise the case studies, so that they could be contrasted and compared:

1. Demand-led or supply-led: how was the project operating – in marketing terms, taking the product to the customer (supply-led), or motivating the customer to seek out the product (demand-led)?
2. To what extent did the project pay attention to farmer's objectives and attitudes;
3. Cost: what were the direct costs of the project to date;
4. Type and innovative nature of the delivery mechanisms that the project used, and its reach;
5. Ways in which the project addressed policy, institutional and economic barriers;
6. Ways in which the project directly addressed the context specificity of CSA in relation to targeting;
7. Partnerships and alliances that were put in place;
8. Capacity development activities that were undertaken;
9. Type of cross-level methodologies that were used; and
10. Nature and degree of learning in the project.

Two major hypotheses drove the development of this simple analytical framework. The first was that different methods of scaling up have characteristics that can help (or hinder) the effectiveness of scaling-up processes. This is illustrated in Table 1 for different approaches of scaling up and a range of different characteristics and variables. For example, agricultural extension often deals in broad recommendations, and thus does not address different farmers' objectives or contexts. While it may reach a reasonable number of farmers, it can be costly and is usually not seeking to address overcoming the barriers to adoption or the trade-offs that adoption of new technologies and practices may give rise to. ICTs, on the other hand, can be cheap and can have a huge impact, but they may have very limited effect on other key constraints. Table 1 illustrate the hypotheses regarding the effects of key variables on the methods of scaling up (for the three new approaches, as well as for methods based on more traditional extension with and without explicit farmer participation) and should be interpreted with considerable caution, as there is substantial uncertainty associated with almost all of them – but the table does illustrate the widely disparate nature of different approaches to scaling up.

Table 1: Methods of scaling up in terms of their potential effects on key variables

Method of scaling up	Potential effect on:									
	Demand-led/supply-led	Farmers' objectives addressed	Costs	Reach strategy	Barriers	Context specificity and Targeting	Partnerships and alliances	Capacity developme	Cross-level issues	Learning
Agricultural extension	Supply-led	=	-	+	=	=	=	+	=	=
Agricultural extension + farmer participation	Demand-led	++	--	-	+	+	+	++	=	+
Approaches based on value chains and the private sector	Demand-led	+	?	++	+	=	++	+	+	++
Approaches utilising ICT/ agro-advisories	Supply-led	=	+	+++	=	=	=	+	=	+
Approaches revolving around policy engagement	Supply-led/demand-led	=	+	+++	+	++	++	+	+	+

+ the method may have a positive effect on the variable (the more +'s, the more positive)
- the method may have a negative effect on the variable (the more -'s, the more negative)
= the method may have little effect on the variable
? highly uncertain or context specific

A second hypothesis of this synthesis study is that process and learning are critical to overcoming some of the constraints to scaling up. To examine learning in more depth, several qualitative indicators from an existing monitoring and evaluation framework were used for evaluating looped (or social) learning within each case study (van Epp and Garside, 2014) (see the table in Annex 1). Each case study was evaluated for its degree of learning exhibited by considering each indicator in turn and combining into one indicator.

Information on each case study was collected through a template filled in by the leaders of the case study projects. One-on-one follow up was conducted where incomplete information had been submitted or where clarification was needed. Short write-ups for all eleven case studies are included in Annex 2. The full characterisation matrix is included as Annex 3.

Case Study Analysis

Table 2 provides a comparison of the different approaches across all the case studies (referred to below by the code in column 1 of the table) of the key characteristics or constraints that each project exhibits or attempts to address.

Table 2. Case study characteristics.

Case study		Characteristic or constraint								
		Demand-led or supply-led	Farmers' objectives addressed	Reach strategy	Barriers	Context specificity & Targeting	Partners, alliances	Capacity development	Cross-level methods	Learning
Case studies based on value chain and private sector approaches										
CS1	Climate smart value chains of coffee and cocoa in Ghana, Nicaragua, Peru	Demand-led	+	+++	=	+	+++	++	+	+
CS2	Sustainable dairy development in Kenya	Demand-led	+	+	+	++	++	=	+	++
CS3	Integrating private businesses in scaling CSA in Kenya	Demand-led	++	++	=	=	++	=	+	++
CS4	Index-based weather insurance in Nigeria	Supply-led	=	+++	++	+	+++	+	++	+
Case studies utilising ICT and agro-advisories										
CS5	Climate smart information services in Senegal	Supply-led	++	+++	+	+	++	++	+	+++
CS6	Agro-climatic advisories and CSA in Colombia	Demand-led	+	+	=	+	++	+	+	++
CS7	Edutainment for scaling out CSA in Kenya	Supply-led	+	+++	=	+	=	+	=	++
Case studies utilising policy engagement										
CS8	Scenario-guided policy formulation in Cambodia	Demand-led	=	+++	+++	=	+++	++	++	++
CS9	Climate Smart Villages in India	Supply-led/demand-led	++	++	++	+++	++	++	++	++
CS10	Mitigation and adaptation planning in Honduras	Demand-led	=	++	+++	=	++	=	+	++
CS11	Alternate wetting and drying technology in rice systems in Vietnam	Supply-led	+	++	+	++	++	++	+	++

+ a positive effect on the variable (the more +'s, the more positive)

= no or little effect on the variable

Supply-led or demand-led?

In terms of whether the projects are primarily supply-led or demand-led, most of the case studies are demand-led. Of the four case studies based on value chain and private sector approaches (CS1-CS4), three are working to implement some kind of vision regarding CSA practices and technologies that has been developed with farmers, mostly to do with the provision of customised recommendations that can help to deliver resilience to smallholders in ways that are economically and socially viable. CS4, on index-based insurance in Nigeria, has more of a supply-led approach, though project participants recognise that scaling up requires meaningful engagement with communities; the project is thus partnering with other organisations that are already interacting with communities.

Of the three ICT /agro-advisory case studies, two (CS5, information services via radio in Senegal and CS7, the farm-makeover TV programme in Kenya) are essentially supply-led approaches: information is provided via broadcasting to whoever receives it. Nevertheless, both these case studies do in fact allow for some feedback from listeners and viewers, and that information is used to target subsequent shows. The case study CS6 on agro-climatic advisories in Colombia is somewhat more user-driven, in that the project is responding to the identified needs of a wide range of partners in dealing with climate variability, through national farmers' organisations.

For the four policy engagement case studies (CS8-11), the two that involve scenarios work (CS8 in Cambodia and CS10 in Honduras) can be classified as demand-led approaches, given that both projects are working with national partners on specific national plans. In both cases, however, there may be some gap between plan implementation and reaching individual farmers, or at least the influence (e.g., by helping to create enabling conditions that make it easier for farmers to adopt CSA practice) may be neither direct nor rapid. In the case of climate-smart villages (CS9), there are elements of both supply-led and demand-led approaches: while two state governments in India are implementing the CSV approach in hundreds of villages, CSA interventions are being tailored to local conditions and are often being designed and evaluated with farmers using participatory techniques. The case study on upscaling AWD technology in Vietnam (CS11) makes use of a supply-led approach, but the project has a clear strategy for farmer engagement.

Farmers' objectives addressed

The question as to whether the case studies are addressing farmers' objectives explicitly (the second characteristic in Table 2) is reasonably closely allied to the demand-led or supply-led characteristic. The case studies that are not focussed on farmers' objectives are either those that have a demand-supply-led approach (CS4) or the two scenario-based policy engagement case studies (CS8 and CS10). In the latter two cases, these projects still have a demand-led focus, but the demand does not come from farmers but from policy makers. For all other case studies, the demand-led focus is allied with a moderate (CS1, CS2, CS6, CS7, CS11) or strong (CS3, CS5, CS9) focus on farmers' objectives.

For the case studies based on value chains and the private sector, the indication in Table 2, that most have a demand-led approach along with an explicit focus on farmers' objectives, is what might be expected from a consideration of their market orientation. Perhaps more surprising is that Table 2 indicates that the ICT/agro-advisory and policy engagement case studies (excepting the two scenario-based case studies) are also able to address farmers' objectives to some degree. There appear to be two overlapping reasons for this: case studies either have a strong element of farmer-participatory

design and selection of the CSA practices and technologies to be scaled up, and/or they have a well-designed farmer engagement strategy in place (one case study with neither at present is CS4, index-based insurance in Nigeria).

Costs

The information on project cost is not presented in Table 2. (Several of the case studies do present some information on costs in the write-ups included in Annex 2.) Because of the range of case studies presented, it is difficult to present robust estimates of cost on a standardised basis. It is also challenging to estimate costs that can be meaningfully compared across a range of projects; the cost of information provision to farmers is one element, but there may be other costs associated with implementing particular decisions at the farm level that are not included, for example, as well as the (often unknown) costs incurred by next users in taking technologies and practices to scale. In addition, other partners provided inputs and funds to many of the case studies, and some were able to leverage relatively large amounts of money. It might be expected that these three approaches to scaling up would have some (possibly considerable) potential for cost effectiveness. To evaluate this, more detailed studies on the costs of the different approaches are clearly warranted.

Reach

Regarding reach, all case studies had delivery mechanisms and reach strategies to convey information to large (sometimes very large) numbers of people. Table 2 shows little consistent difference in reach between the three approaches. There is a suggestion in Table 2 that the case studies with the most reach (CS1, CS4, CS5, CS7, CS8) in general may not address farmers' objectives the most consistently, though this observation is not strong. This is no surprise, given that the trade-off between reach and context specificity constitutes one of the fundamental challenges of scaling up.

Barriers

In terms of addressing the policy, institutional and economic barriers that can inhibit farmers adopting CSA technologies and practices, the ICT / agro-advisory case studies (CS5-7) appear to have limited if any effect (Table 2). Two of the value chain / private sector case studies have some effect on specific barriers – index-based insurance in Nigeria (CS4) in relation to institutional barriers, and the dairy development study in Kenya (CS2) in relation to both policy and institutional barriers. As expected, the policy engagement case studies have real strengths here: the two scenario case studies address policy, institutional and economic barriers explicitly, and the CSVs in India case study (CS9) involves the mainstreaming of climate smart approaches into existing local development and poverty alleviation policies and plans, thus potentially overcoming many barriers to adoption. Similarly, the AWD in Vietnam case study (CS11) seeks to integrate mitigation objectives into national and sub-national agricultural modernisation and rehabilitation programmes. These results are consistent with what might be expected (Table 2).

Context specificity and targeting

Concerning the case studies and their effectiveness in addressing the context specificity of CSA, there were substantial differences between the three groups of case studies. For the value chain / private sector cases, this presents something of a challenge, with the possible exception of the dairy

development in Kenya case study (CS2), which is working through a wider range of different institutions (cooperatives, companies and regulatory agencies) that are able to articulate the needs of diverse stakeholder throughout the value chain. For the other case studies, the appropriateness of different technologies and practices in specific contexts may depend heavily on the knowledge of local input dealers and insurers. For the ICT / agro-advisory case studies, there are various strategies: working with national grower associations (CS6), with other providers and sources of climatic data (CS5), and with broad baskets of different options for different agro-ecological zones (CS7). For the policy engagement approach, the scenario-based case studies (CS8, CS10) operate at the national level and so do not address sub-national targeting or trade-off analyses, though it is possible to downscale the scenarios to provide such information. For CSVs (CS9), there are no fixed packages of intervention, but rather they differ in content depending on the region, its agro-ecological characteristics, level of development, and the capacity and interest of farmers and local government. A large part of the research work is associated with understanding which interventions work where, why and under what conditions. For CS11, AWD is a technology that can be effective using current irrigation infrastructure, and it is being targeted to areas where it will work with improved irrigation infrastructure.

Partnerships

Almost all the case studies described strong partnerships and alliances, in many cases involving non-traditional (for CGIAR) research partners such as the private sector and international NGOs. This is particularly noticeable with the value chain / private sector case studies, to a somewhat lesser extent with the policy engagement case studies, and perhaps least of all with the ICT/agro-advisory case studies. Shamba Shape-Up (CS7) is an interesting example, though, in that the making of the different episodes can involve a wide range of researchers, but these tend not to amount to lasting relationships. In general, all case studies revolve around a broad set of interactions with many different types of partners.

Capacity development

There was an interesting spread in capacity development activities among the case studies, though Table 2 does not give a very clear indication of substantive differences between types of approach, although capacity development for the policy engagement case studies does appear as a key activity. Some case studies, such as climate-smart coffee and cocoa (CS1), are developing site-specific adaptation guidelines for mainstreaming into existing certification training curricula. The case study on scenarios in Cambodia (CS8) mentioned capacity development with partners and governments as a key mechanism for upscaling, and noted the importance of time and resources for training and mentoring processes.

Cross-level methods

The case studies presented a range of approaches to the inclusion of cross-level methods. The case study on index-based insurance in Nigeria (CS4) works with different levels at the spatial and knowledge scales as it is using satellite imagery to help make on-farm decisions. Radio-based information services in Senegal (CS5) is also working at different spatial scales, from the farm to the national level. The scenario-based case studies (CS8, CS10) are based on integrating elements about household- and community-level adaptation with drivers of regional and global change. In general,

however, while some of the case studies operate across spatial scales, there is only limited cross-level activity. The integration of different types of knowledge at multiple scales, for example, clearly presents a considerable challenge.

Learning

A range of approaches to learning is also demonstrated by the case studies in Table 2; the number of +'s in the right-most column is broadly indicative of the degree of learning exhibited. Almost all case studies are engaged in at least double-loop learning (see footnote in the table in Annex 1). One case study, radio-based information services in Senegal (CS5), is bringing together a broad mix of partners for engagement and integrating different knowledge and perspectives; capacity is being built at different levels, farmers are being trained as local game changers, and the project is facilitating learning and allowing for new ideas – these are the essential elements of triple-loop learning. Shamba Shape-Up (CS7) presents a different type of learning altogether: there is engagement of viewers, better informed stakeholders, and a new type of social network via viewer identification with the farmers featured on the show, who can act as champions or mobilisers of change. Currently, there are only limited feedback loops in place, beyond farmers being able to request information sheets on the practices featured, and thus informing the content of future episodes as demand for information is analysed. The case study on index-based insurance in Nigeria (CS4) is also interesting; although partnerships exist, they revolve around national-level institutions. The challenges being addressed are largely technical (to do with data and index design), and at this stage in the process, there appears to be little learning and reflection happening with stakeholders, although this will presumably change over time.

The results in Table 2 are summarised by the scaling-up approach in Table 3, by taking the number of pluses for each case study, dividing by the number of case studies of that type, and then rounding to the nearest integer. Table 3 summarises what the case studies are telling us, while Table 1 summaries what we initially hypothesised about these approaches. The agreement between the two tables is good, and three points might be made. First, the case studies underline the fact that different approaches to scaling up do indeed have different characteristics, and there may well be trade-offs to consider when choosing an approach. Second, the ability of the case studies to address farmers' objectives is somewhat better in the case studies than might have been anticipated. This is possibly because several case studies had well-established processes for engaging meaningfully with farmers. Third, approaches based on ICT and agro-advisory services tended to perform rather better than might have been anticipated in relation to context specificity and partnerships. For at least two of the three case studies of this type, this reflects the fact that the work was grounded in strong national platforms with the engagement and involvement of a wide variety of different stakeholders.

Table 3. Summary of eleven case studies by type of approach to scaling up.

Approach based on	Characteristic or constraint									
	Demand / supply led	Farmers' objectives addressed	Costs	Reach strategy	Barriers	Targeting, trade-offs	Partners, alliances	Capacity development	Cross-scale methods	Learning
Value chains / private sector	Demand -led	+	?	++	+	+	++	+	+	+
ICT / agro-advisory services	Supply-led	+	?	++	=	+	+	+	+	++
Policy engagement	Supply-led /demand-led	+	?	++	++	+	++	+	+	++

+ the approach has a positive effect on the variable (the more +'s, the more positive)
= the method has little effect on the variable
? insufficient information

Conclusion/recommendations

The eleven case studies describe a wide range of activities at different stages of completion and located at different places on their respective impact pathways. Even so, these three approaches overall do appear promising in terms of their ability to scale up climate-smart technologies and practices. Several points can be made in conclusion.

First, the case studies highlight the need for strong grounding in existing local (e.g. CS9, CSVs) or national multi-stakeholder platforms (e.g., CS5, radio information in Senegal) to help address the issue of context specificity and to facilitate strong partner and stakeholder engagement.

Second, the case studies with the most reach may not address farmers' objectives most clearly: there may be an unavoidable trade-off between reach and context specificity in scaling up. The impacts of the trade-off can be ameliorated via effective engagement and capacity development strategies. On the other hand, decades of research for development activities have shown that context matters and that farmers are more likely to take up new technologies if they are involved with the process. Scaling up often needs to have some element of local engagement ('scaling down', in effect), and while this may be a trade-off we have to live with, the approaches used in the case studies here can help to address this.

Third, all the case studies revolve around a broad set of interactions with many different types of partner. These interactions are often involving different types of partner that go well beyond the traditional partnerships of CGIAR. Several of the case studies also highlight the need for leaders or champions who can help to foster change. The expanded range of partnership brings some challenges, however, particularly in the area of integrating the different types of knowledge that different partners may have. None of the three approaches to scaling up that are being implemented in the case studies appear to have addressed this issue as yet.

Fourth, most of the case studies were engaging in at least double-looped learning. The case studies do not provide evidence to suggest that the more looped the learning, the more effective the scaling up, but this is a reasonable working hypothesis that can be tested through time.

Fifth, several of the case studies illustrate the importance of formulating and addressing critical assumptions, which may make or break the scaling-up process. These 'killer' assumptions may be to do with continuing high-level political support after national government change (CS4, insurance in Nigeria and CS8 and CSA10 on Scenario Guided Policy Formulation) or the availability of continuing funding for irrigation infrastructure development and maintenance in the case of CS11, AWD in Vietnam, for example.

What can be concluded about the new approaches being tried in the case studies with respect to the challenges discussed in section 2.3 above? Regarding transactions costs, the case studies unfortunately provided little robust information. Estimating the costs of the different approaches poses considerable challenges, but cost comparisons would be of considerable interest with regard to the economic efficiency of scaling up. While it may be envisaged that approaches to scaling up based on value chains, ICT / agro-advisory services and policy engagement would be cost effective, more rigorous information is needed, and this warrants further work. With respect to the tension between scaling up and the importance of local context, these three approaches appear to have some ability to

resolve this, particularly when grounded in existing multi-stakeholder learning platforms. With regard to the political, institutional and economic barriers that can inhibit an enabling environment for widespread adoption of CSA technologies and practices, scaling up approaches based on policy engagement and (to a lesser extent) value chains and the private sector hold considerable promise for addressing such barriers. Case studies based on ICT / agro-advisory approaches may need to consider adoption barriers more explicitly, perhaps through hybrid scaling up approaches that can combine elements from policy engagement and/or value chain approaches. Regarding cross-level approaches, the case studies discussed here had different abilities to address these, seemingly not primarily related to the type of approach being used. The most effective at this (CS9, CSVs in India) works at different spatial levels and across spatial and institutional scales via a wide range of partnerships and alliances and considerable investment in engagement processes, including at the political level.

In summary, CCAFS, through 11 case studies, has been exploring novel scaling approaches for CSA. The case studies revolved around value chains and the private sector, information and communication technology, and policy engagement. The analysis offers interesting insights into scaling approaches, the main challenges and some opportunities for scaling CSA practices and technologies. We conclude that multi-stakeholder platforms and policy making networks are key to effective upscaling, especially if paired with capacity enhancement, learning and innovative approaches to support decision making of farmers (either directly or indirectly). Projects that aim to intervene upstream at higher leverage points can be highly efficient and probably offer cost-effective dissemination strategies that reach across scales and include new and more diverse partnerships and alliances. However, these novel approaches still face challenges of promoting uptake and adaptation, which remain contextualized and thus require a certain level of local engagement, while continuously paying attention to farmer's needs and their own situations.

Appendix 1: Learning Indicators

Table A1. Subset of indicators for assessing the degree of learning exhibited in the case studies (from van Epp and Garside, 2014).

Type of Indicator	Indicator	Learning loop[1]
Process	Groups/individuals are engaged through appropriately tailored means	Double
Process	Systems are in place to foster and implement new ideas	Triple
Process	Capacity development activities target all participants in appropriate ways (e.g. governments, farmers, scientists)	Double / Triple
Process	Key individuals/institutions who will support/champion change are identified	Double
Learning Outcome	Knowledge of the problem enhanced by interactions	Double
Learning Outcome	Different knowledge types successfully integrated	Triple
Learning Outcome	Increased understanding between different participant groups of different needs and perspectives	Double / Triple
Value / Practice Outcome	New social networks established	Double
Value / Practice Outcome	More informed stakeholders	Double
Value / Practice Outcome	Reduced number and severity of barriers and/or increased number and potential impact of opportunities	Double / Triple

1 Learning loops (see, for example, LeBorgne et al., 2014):
Loop 1, are we doing things right: is there basic evaluation of the effectiveness of the work?
Loop 2, are we doing the right things: is there a loop back from project results to the assumptions of the work?
Loop 3, how do we know what's right: is there a loop back from the results to the context of the scaling up work?

Appendix 2: Case Study Summaries

CS1. Scaling CSA Practices through Climate Smart Value Chains: coffee and cocoa

M. Lundy[2]

Description

Climate change and climate variability are expected to have a significant impact on smallholder farming globally. As a response, new measures that can address those impacts are being defined under what we call 'Climate Smart Agriculture' (CSA). This new buzz term already includes many of the tried and true measures that form the backbone of sustainable agriculture – building soil fertility, protecting watersheds, increasing access to knowledge, inputs and markets for more profitable and food secure livelihoods. In addition, and apart from aiming to reduce GHG emissions from farming, the concept of CSA also introduces a new angle in that it helps farmers, government, companies and NGOs better understand and manage the risks posed by climate change and thus become more resilient. In order to make such efforts meaningful for a large number of stakeholders, scaling climate smart agriculture necessitates engaging multiple actors to understand site-specific projections of climate impacts and develop suitable responses accordingly.

To confront this challenge, our project leverages existing smallholder value chain interventions to translate climate science into actionable strategies for farmers and supporting actors, including agricultural businesses, voluntary certification schemes, and investors, across a number of geographies using smallholder coffee and cocoa systems in Africa and Latin America as model cases. This novel combination adds value to existing work with the goal of achieving adoption at scale for locally relevant CSA practices

We assess the climate change exposure of coffee and cocoa systems at a sub-national scale, develop appropriate CSA practices with farmers and value chain actors that incorporate cash crops and food crops to increase the resilience of these systems, and codify these practices in site specific adaptation guidelines. These guidelines will be mainstreamed through existing certification training curricula and used to develop innovative impact investment products. Results will be promoted with multiple voluntary certification agencies and impact investors to achieve scale. Outcomes will influence government, private sector and civil society actors towards a common adaptation agenda applicable to other smallholder crops. The project brings together preeminent actors in agricultural climate science (the International Center for Tropical Agriculture, CIAT, and the International Institute of Tropical Agriculture, IITA), voluntary certification (Rainforest Alliance), impact investing (Root Capital) and sustainable agriculture systems (the Sustainable Food Lab) to achieve the expected outcomes.

The long-term objective of this work is to enable key public, private and civil society actors to interpret projected exposure to climate change by cropping system and region into site-specific CSA

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practices and to incorporate these practices into their work with hundreds of thousands of farmers through extension services or tailored financing, as needed. Success is defined as adoption of recommended CSA practices by 15% of global cocoa producers and 7% of global coffee producers, as well as the provision of USD 350m of tailored financial products to producer organizations, traders, exporters, and other key value chain actors by 2019.

Challenges to scaling out and up and strategies to address them Climate change information too general from a private sector perspective

Most of the climate project tools currently generated such as exposure gradient maps are effective at calling attention to the issue but too general to be useful to design specific CSA interventions. To overcome this limitation we are attempting to go beyond exposure maps to identify, codify and analyse the cost benefit of specific CSA practices relevant to diverse levels of climate risk. This process requires the engagement of key value chain actors from the farm to global buyers to identify, prioritize and analyse recommended practice as well as design mechanisms that will inform value chain actors about what needs to be done and unlock funding. Through the provision of both information and financial services the project seeks to move climate change from scary maps to actionable interventions.

Benefits, timing and incentives for multiple actors need to be aligned

The rational for investing in CSA is often not clear and different value chain actors have different agendas and timeframes. Most value chain actors recognize the need to develop tools to improve the uptake of CSA practices to ensure a resilient and sustained supply of agricultural goods and services going forward but often the incentives and time frames do not line up. For example, farmers and the rural poor may have short-term needs that reduce their capacity to invest in CSA practices that pay off in the mid-term. Likewise, private actors may be unwilling to invest without some security that they will be able to recoup their investments through increased or stable supply of agricultural goods. Finally, many CSA practices also generate positive environmental externalities such as improve water management that extend beyond the farm and the value chain. How should public goods generated by CSA practices be accounted for and funded when benefits cannot be captured by any one actor?

The project seeks to address these issues through the application of robust processes of cost-benefit analysis of prioritized CSA practices along the exposure gradient with value chain actors. This approach will allow us to understand the costs over time of a given practice, who bears the cost, what benefits are expected, over what time frame and to whom will the benefits accrue. By clarifying the costs and benefits of CSA practices with direct participants, the project will be able to facilitate discussions about how to better align costs, benefits and incentives to achieve CSA uptake in ways that are clear to all. Out hope is to be able to assign different cost elements to those most likely to benefit to ensure greater clarity around why a given actor might want to invest in CSA.

Information and financial support need to be coordinated

To achieve uptake of CSA practices in a commercial context, both information about what to do and financial support to implement must go hand in hand. One of the major challenges to date with the uptake of CSA has been both a lack of site-specific knowledge about what practices are more recommendable where and under what time frame as well as viable financial instruments to support

implementation. Farmers might well know what they need to do to adapt to climate change but rarely have access to the necessary financing to carry through with these plans. On the other hand, financial investments rarely account for climate change except as a risk factor. This project seeks to develop approaches that effectively provide both knowledge and funding to farmers and producer organizations in a coordinated fashion.

Key enabling factors for these three challenges are existing voluntary certification networks that cover 30% of global cocoa producers and 15% of global coffee producers as well as impact investing firms that provide approximately USD 500m of investments into producer organizations on an annual basis. By partnering with Rainforest Alliance the project will be able to build site specific CSA practices into existing certification, training and extension networks with multiple public, NGO and private service providers. These networks will assist in helping farmers know what needs to be done depending on their level of exposure to climate change. Impact investing, on the other hand, focuses on providing capital to the 'missing middle' of the rural economy: producer organizations and private companies that are too large for microfinance but too small for formal commercial lending. The inclusion of site specific CSA practices into loan instruments, particularly longer term instruments, will provide capital to assist farmers in implementing these practices.

Key game changers here include scalability and influence. Both voluntary certification and impact investing are proven value chain interventions that can reach large numbers of small producers in a cost effective and sustainable way. By learning how to embed site-specific CSA practices into these vehicles, there is a strong potential for replication both across Rainforest Alliance and Root Capital activities as well as through existing peer learning spaces such as ISEAL and COSAF. A second game changer is influence. Both voluntary certification and impact investment punch above their weight with key actors in the private sector. By showing how to successfully move from climate exposure maps to training materials, recommendations and financial vehicles, the project has a strong possibility of shifting private sector thinking around climate smart agriculture.

Discussion

The use of existing value chain interventions with a strong track record and global presence is useful for scaling up CSA for the following reasons. First, both voluntary certification and impact investing are approaches that have a long track record and a strong rate of growth in the coffee and cocoa sector. Given their existing levels of coverage, embedding site-specific CSA practices into them is a faster and cheaper way to get these practices to scale than other potential entry points in either the public or private policy spheres. Second, both the voluntary certification and impact investment communities are aware of the need to better integrate climate science into their existing activities. A clear demand exists as both communities seek to contribute to sustainable rural livelihoods over the long-term. In this sense the project is pushing on a half-open door. Finally, the existing level of inclusion and acceptance of voluntary certification and impact investing in coffee and cocoa value chains facilitates conversations with private sector actors who are already comfortable with these vehicles. Promoting a novel, stand-alone approach to CSA would require significantly more efforts to generate private sector buy-in that is the case with impact investing and voluntary certification.

Despite these benefits, this approach has clear limits. First, to be effective this intervention requires the existence of either voluntary certification or impact investing in a given value chain. While coverage of both vehicles is growing, they still tend to cluster around higher value export value chains rather than domestic food security crops. We hope to address this by including food crops in the

existing coffee and cocoa systems in the analysis but this is a current limitation to the approach. Second, producers who are able to access voluntary certification or impact investments are by definition organized in some form. Producer organization remains the exception rather than the rule in much of the developing world so this approach faces limits in that regard as well. Finally, many of the most at risk farmers and rural inhabitants live in areas where there is a clear need to transition from a traditional cash crop into a different set of crops and livelihood strategies. While impact investment does have potential to assist in these transition zones, there is also a key need for public investment that will most likely not be channelled through this type of vehicle. The project is engaging with this topic through the use of multi-stakeholder platforms by level of exposure to climate change but more work is needed here.

General challenges

The scaling challenges identified above relate to the general framework of the paper in the following ways. First, the challenges around making climate change and CSA practices relevant and actionable is a clear example of trade-offs across geographies and poor targeting. To drive uptake and investment in CSA, we need to develop approaches that are tailored to the needs of farmers and other value chain actors in a specific set of climatic conditions. Blanket recommendations are not useful. This requires moving beyond simply mapping exposure to engage with key actors to develop a relevant set of customized CSA practices that are both effective in delivering resilience as well as feasible financially and socially. Second, the clear identification of the costs and benefits of diverse CSA practices by value chain actor links to risk minimization strategies and timeframes both of farmers and other actors. Few commercial actors, including farmers, are willing to make investments where they are not clear on the size and timing of the return of those investments. Currently CSA practices remain too general with limited site-specific cost-benefit analysis to really be attractive investments. To move beyond ‘nice to have’ to ‘must do’ CSA practices have to show a clear return on investment broken out by different potential investors. This will assist in making a stronger case for investment at farm level, producer organization and broader public good benefits from CSA. Currently this is lacking. Finally, by piggy backing on existing structures already embedded in value chains, the project will reduce the transaction costs needed to drive CSA uptake. Strategically this decision should allow the project to intervene upstream with key actors in the voluntary certification and impact investing communities to develop pre-competitive interventions that mainstream the approaches developed by this project across large numbers of farmers already covered by these interventions.

Project links:

http://dapa.ciat.cgiar.org/building-climate-resilient-cocoa-value-chains-in-ghana/

http://dapa.ciat.cgiar.org/ghana-workshop-on-climate-smart-cocoa-a-success/

http://dapa.ciat.cgiar.org/cocoa-production-in-ghana-needs-to-confront-heat-and-drought/

CS2. Inclusive and sustainable dairy development in Kenya

A. Wilkes[3], S. van Dijk[4], T. Tennigkeit[5]

Description

Milk in Kenya is produced by 1.8 million farm households, of which 70% are smallholder farmers, mostly women and youth (Makoni et al., 2014). Population growth, urbanization and increasing prosperity will increase the demand for dairy products (Robinson and Pozzi, 2011). Significant growth potential for the dairy sector in Kenya exists, but low-productivity, weak extension systems and a fragmented value chain hinder stable and high quality milk supply to consumers, constraining farmer incomes and resulting in high emissions per litre of milk and other environmental impacts.

Outcomes aimed for including CSA objectives

As productivity (milk yield per cow) is strongly related to GHG emission intensity, this project focuses on the mitigation benefits of productivity increases as an entry point to leverage climate finance to promote sustainable development of the sector. This project will develop a Nationally Appropriate Mitigation Action (NAMA) for Kenya's dairy sector. The NAMA will aim to improve dairy feeding regimes and husbandry practices and achieve a sustainable increase in milk production by smallholders, and thus improve the livelihoods of 600,000 smallholder farmers, enhance resilience to climate change while reducing the emission intensity of dairy production.

Theory of change narrative

The project aims to develop a NAMA to promote sustainable development of Kenya's dairy sector. The NAMA will propose interventions at three levels:

- On-farm productivity increases: interventions to address barriers at farm level for adoption of productivity-increasing technologies and management practices will be identified;
- Supporting institutions: effective approaches to provision of support for adoption of on-farm practices (e.g. private sector supported extension services, cooperative marketing and input supply arrangements) will be identified;
- Policies and finance: Policies and financial mechanisms to enable up-scaled provision of support for on-farm adoption of productivity increasing practices will be developed.

Implementation strategy

Kenya's dairy sector is both diverse and in a process of dynamic change. The sector has a large informal value chain (80% of milk is sold raw), as well as a rapidly growing commercial value chain. Competition from the informal sector is a constraint on development of the commercial sector.

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Although government policy envisages growth of the commercial sector, the informal sector is expected to continue to play a major role for some time to come.

There have been numerous initiatives to increase dairy productivity in recent decades, including initiatives led by farmers' organizations, the government, the private sector and development partners. This provides a wealth of knowledge and experience within the sector of what works, what doesn't work, what support is needed and what remaining gaps require further innovation and research to address.

The main strategies for development of a dairy NAMA are (i) to identify best practices from existing experience at farm, supporting institution and policy levels; (ii) to support innovation in areas where existing experience is lacking; (iii) to involve diverse stakeholders in identifying best practices and designing the NAMA interventions. The NAMA project will engage a range of stakeholders from both public and private sectors in this process.

For reaching scale, the focus will be on engaging a number of strategic partners and initiatives driven by institutions that aggregate across large numbers of farmers. These include (1) government agencies (e.g. the Livestock Department at MoALF) for political support of large-scale smallholder dairy commercialization projects; (2) semi- and non-governmental organizations working in the sector (e.g. Kenya Dairy Board, industry associations, farmer associations); (3) private sector (e.g. lead companies with large supplier base, cooperatives); (4) development partner initiatives (e.g. smallholder dairy projects) and (5) research institutes (e.g. national universities, ILRI).

Extent of scaling aimed for

The resulting NAMA will aim to reach at least 600,000 farmers across 28 key dairy production counties in Kenya. Costs of scaling up are still unknown at this stage.

Challenges to scaling up and strategies to address them

To scale the adoption of best dairy management practices among large numbers of smallholders

Strategy to overcome this challenge: Identify existing value chain actors and supporting institutions working with large numbers of farmers.

Key inhibitors for scaling up: Low level of farmer organization, weak management of cooperatives, unsustainable (short-term) financing of development initiatives.

Key enabling factors: Supportive government agencies; organization of farmers and input suppliers in cooperatives, industry and trade associations; a growing commercial dairy sector with growing and stable supplier base.

Key game changers: MoALF, private companies and cooperatives including feed and other input provider, milk hubs and milk processor.

Identifying effective enabling conditions, delivery approaches and policy mechanisms to support large-scale adoption of productivity increasing management practices by smallholders

Strategy to overcome this challenge: Engaging diverse stakeholders including private sector with sustainable business models in collating and assessing good practices at farm and supporting institution level.

Key inhibitors for scaling up: Limited amount of robust evidence on what works, what doesn't (especially for long-term impact) and on barriers for adoption/key success factors.

Key enabling factors: A wealth of experience generated in recent years among diverse stakeholders with an interest in identifying good practices.

Key game changers: A multi-stakeholder platform for sharing and collective deliberation to be established by the project.

Formal and informal milk supply chains, and input supply chains have no institutionalized incentives for higher productivity, better quality milk and stable milk supply

Strategy to overcome this challenge: Formal and informal milk supply chains and input supply chains face different challenges and have different potential options. The project will work with diverse initiatives across different supply chains (e.g. quality-based payments in the commercial sector, hygiene and quality training in the informal sector, development of feed quality standards in feed input supply chains), to support stakeholders to generate lessons for policy and practice.

Key inhibitors for scaling up: Some initiatives require piloting over a longer period before they can be assessed on their long-term impact.

Key enabling factors: Government, industry and private sector active in innovating new standards, mechanisms and policies to address issues in the sector.

Key game changers: Private sector, regulatory bodies.

Discussion

Kenya's dairy sector is large, with diverse actors facing numerous challenges, and with different experiences of what works and what doesn't. Some initiatives are ready to scale up, others require further investigation, innovation and assessments. In this context, the project will work with diverse stakeholders to identify policies and practices that work at the farm, supporting institution and policy levels. A multi-stakeholder platform initiated by the project will provide a forum for sharing knowledge and perspectives, and deliberating on good practices and effective mechanisms for up-scaling their adoption. The project will also enhance knowledge generation by supporting learning from existing initiatives. In a dynamic sector, where the existing evidence base is often limited, best-judgment and collective deliberation by stakeholders will enable the project to make use of the best available knowledge to identify good practices. The project will make particular efforts to involve organizations working with large numbers of farmers, so that practices and supportive policies are identified that can be applied on a large scale. The end goal is that the NAMA can include a set of policy and financial instruments that can support approaches to increasing productivity across the dairy sector.

General challenges

High transaction costs involved in reaching individual farmers or creating structures to reach groups of farmers with new CSA technologies or practices

Different institutions have different strengths and potentials in aggregation: Cooperatives can bring together farmers within a geographical area; lead enterprises work with many cooperatives and large numbers of farmers; regulatory agencies work across the sector and throughout the value chain. The project will work with these existing aggregators to identify how to strengthen their competitiveness and ability to support larger numbers of farmers to adopt productivity increasing management practices.

Farmers risk minimization strategies and urgent needs versus high transaction costs and long term impact of implementing CSA practices

On-farm practices and approaches by supporting institutions (e.g. extension services, credit providers) will be assessed to identify effective practices at each level. These practices will include those that address farmers' ability to manage risk (e.g. credit provision, insurance) and farmers' urgent needs vs. long-term viewpoint (e.g. extension support on farming as a business, cash-flow calculations)

Political, institutional and economic barriers (getting institutional arrangements, policies, economic incentives right)

Among the aggregating organizations, they face different challenges and opportunities for addressing political, institutional and economic barriers. The project will work with stakeholders on a number of strategic issues affecting incentives in the value chain (e.g. quality based payment systems, hygiene licensing for informal traders), supporting stakeholders to draw lessons from practice for policy.

Trade-off across scales and poor targeting: what works at one scale will not necessarily work at another and what is good for some interest groups is not automatically good for others

Smallholder farmers supply both the formal and informal sector; some farmers supply both, or shift between them depending on procurement prices and the litres of milk to be sold. Lead enterprises can aggregate within their supply chains, often working with multiple cooperatives and numerous farmers, but targeting support to commercial value chains risks undermining the competitiveness of informal value chains, which at present supply the majority of milk to Kenyan consumers. There may, therefore, be both winners and losers from the policies supported by the NAMA, and the NAMA development process needs to consider these trade-offs.

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FAO. 2011. Mapping supply and demand for animal-source foods to 2030, by T.P. Robinson & F. Pozzi. Animal Production and Health Working Paper. No. 2. Rome.

Project Links

https://ccafs.cgiar.org/nationally-appropriate-mitigation-actions-kenya%E2%80%99s-dairy-sector#.VdrHtZeGfgA

CS3. Integrating private businesses in scaling Climate Smart Agriculture

M. Misiko[6], C. Stirling[7], D. Kahan[8]

Introduction

Scaling is becoming increasingly privatized as technologies become more proprietary and as farmers become more market-oriented (e.g. Kahan 2009). The agricultural landscape is changing rapidly, comprising more complex and formalized input supply and output marketing systems. The role of private businesses is expanding, from mere dealership in inputs to increasingly procuring and selling farm produce together with advice and information. The cost of staying in business is therefore increasingly complex, that also includes technical advisory to client farmers, and feedback provision to their suppliers. To fulfil this more complex role, input dealers require technical and business development competencies and skills to ensure that their business provide quality and timely provision of inputs and materials together with agronomic and marketing advice and information on recommendations for their application and use. Agrodealers require support in business management, marketing and contracts together with knowledge on safety issues amongst others (Kahan 2009). In short, private sector agrodealers cannot stand on their own. The public sector extension services, along with NGOs, CBOs, farmers and research play unique roles supporting them.

Public extension systems are critical, yet often strapped for operational budgets and prone to bureaucratic decision making processes. Very few have unallocated program funds available for use by field-level staff, to respond to new farmer demands and increasing farming populations (Swanson 2008). The challenge is how different information and technical advice sources/ channels can be efficiently and sustainably integrated into regulated programs designed to serve these demands and needs. This requires strong public-private-NGO collaboration that builds on the comparative advantage of the various actors involved in research and extension.

Targeting immediate reach among millions for sustainability and resilience

By reaching a farming population of up to 3 million with ready to use information, the CIMMYT-AGMARK partnership targets to increase efficiency of use of agricultural inputs through access to CSA information.

Sustainably increasing agricultural productivity and incomes

Access to CSA advice is a key requirement for efficient use of inputs. Availing CSA information could for instance reduce losses resulting from poor use of fertilizer under erratic rainfall conditions and the inclusion of storage information will help stem about 30% (Abassa et al., 2014) climate-related post-harvest grain losses.

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Theory of change

Mutual interests among smallholders and agrodealers are sustained when the former receive timely and affordable quality inputs with both parties benefiting from increased profits. Farmers are looking for advantageous prices when selling their produce, and highly in need of customized information. Such information includes the use of new technologies, field agronomy, as well as knowledge on input use, business management and marketing. Agribusinesses often require information, advice and engagement skills on/ for key informants, useful resource people, potential customers, suppliers and collaborators.

In Kenya, a good example of collaboration is where the private sector relies on the Ministry of Agriculture to shape the required enabling environment for farm supply business. Public extension plays a critical role of creating awareness of new products – hybrids, fertilizers, herbicides – as well as improved agronomic technologies and practices. Public sector extension organizes field days, farm visits, trainings, radio programs and other nation-wide events that attract private dealers to demonstrate, promote or sell their products.

The AGMARK-CIMMYT process ensures that information from input suppliers is demand driven, while the interactions between farmers and extension workers is often supply-led. In the former case, farmers articulate their demands and the private sector responds to manifested opportunities. Since this information is provided by companies that are buying produce from farmers, their confidence level – and hence information uptake – is higher than with other delivery channels. Companies see information delivery as a business necessity in order to build a reliable supply base. Increasingly the private sector is providing a wide variety of information services to their farmer clientele (Hansra and Vijayaragavan 2003). In fact, market information of a specialized nature is appreciated by market-oriented farmers and is more likely to be purchased as a private good (Kahan, 2009).

Emerging lessons show business-led information supply is based on unregulated programs, and is flexibly guided by seasonal feedback from farmers. There are no guidelines, recommendations or standards used among business to acquire or pass on information. Farmers receive information from input traders and agro-processors, who in turn respond to consumer demands. Regular input clients shape business-farmer feedback discourse. CIMMYT's niche; is to gather evidence/ lessons to guide extension and agrodealers about recommended practices e.g. use of herbicides and new germplasm, and engage them to understand and shape feedback to ensure more effective input delivery. Private businesses are directly accountable to their clients, and their delivery systems are therefore well suited to ensure that advice is demand driven. The main constraint is they are only active where there is a favourable market for their services and they are absent in many of the more remote rural areas where market infrastructure in unavailable.

Objective

This paper reports and analyses a strategy to scale-out CSA information through farm supply dealers in Kenya. The objective is to analyse lessons on private sector integration in scaling of CSA content, based on the experience of AGMARK-led work through a network of agro-dealers in Kenya.

Implementation strategy

The overall vision of the Agmark program is to develop a network of small-scale, entrepreneurial agro-dealers who would transform the currently fragmented input distribution system in Kenya into an efficient, commercially viable input infrastructure, which would in turn enable farmers to have greater access to productivity enhancing inputs and technologies. This vision is inspired by the fact that lack of access to basic farm supplies has made it quite challenging for poor rural farmers to increase their yield or income, reinforcing widespread poverty.

The AGMARK led scaling work is based on existing evidence that shows agrodealers are key sources of information and advice among smallholders (also see Lwoga et al., 2011; Mwalukasa 2013; Adomi et al., 2003). It is also based on the premise that data exists and is readily available to guide scaling. Two bundles of CSA have been developed based on CIMMYT's research on: i) storage of grain and ii) based on CA principles. In June 2015 three trainings were conducted among AGMARK appointed mobilisers, to explain the project, CSA concepts and the information bundles. These mobilisers are distributing the CSA materials through 1,500 agrodealers. Each agro-dealer has physical access to a mobiliser at least once, and later through telephone for any clarifications or further information requested by clientele farmers. These mobilisers keep records of sampled farmers (gender, contacts) to verify the process. Each mobiliser will integrate these with other planned scaling activities; exhibitions, field days, etc. organized by the Ministry of Agriculture (MoA), the Kenya Agricultural and Livestock Research Organisation (KALRO), and the National Cereals and Produce Board. Each of these AGMARK partners has a set of unique latent and manifest incentives. For instance, MoA's goal of contributing to "Vision 2030" national policy framework is not necessarily its staffs' every day driving motivation.

The key reason agro-dealers are not charging a fee to disseminate CSA materials is the potential of this process to increase their appeal among farmers. They're being sensitized on CSA, a theme with current interest among their clientele farmers. In fact, advice constitutes a key smallholder incentive for repeated visits to agribusiness outlets.

Findings from this process are expected to be communicated widely, and especially to influence bilateral projects. For instance, the SIMLESA Program (simlesa.cimmyt.org) has a wider scope, which encompasses setting up and strengthening Agricultural Innovation Platforms. There is therefore possibility for this work to incorporate farmer extension groups with new resources. Going forward, simple briefs to explain the process will be critical to influence policy. *Each dollar spent*, for instance, will create awareness on CSA portfolios among at least *10 farmers*. With a more integrated process (involving regular extension, research, business, ICT), this process can be made more interactive to aid learning; a common difficulty in most scaling programs. The overarching principle to be embraced for scaling therefore must be "reaching more people, faster with lasting impact. This is what is guiding the extent of scaling in this work.

Extent of scaling

This scaling initiative is involving 1500 agribusinesses in 9 Kenyan counties. These counties have highly negative interactions among dense populations, poverty and climate change risks. These counties have over 15 million residents whose more than 75% of livelihoods have over 95% direct dependency on rain-fed agriculture. Over 75% of the residents are smallholders, 60% of whom according to AGMARK's experience get farming information from agro-businesses (also see Tumsifu

and Silayo 2013). Past initiatives at AGMARK show each agro-dealer serves on average 50 households daily during peak months. This project can reach 3million farmers by September. *However*, there are two risks against efficient progress. One, there were delays in organizing the agreement between CIMMYT and AGMARK due to funding cuts. Second, costs of printing and organizing materials are prohibitive, especially after the cuts.

Costs of scaling out in this program

To reach one member of the target households, we need 3 million (double sided, office/standard black-and-white) A4 size leaflets. This requires US$214,000; each leaflet costs KSh7 (US$0.07 cents). To print 3 million sets of recommended colour materials with illustrations on five higher quality A4 pages, we require over US$1m. This is not relatively expensive given the huge potential for success. Such success is also easier to evaluate given we're soliciting agrodealer client contacts. In spite of this high potential, there are further emerging challenges that have to be overcome.

Overcoming common challenges in business-based scaling

Emerging challenges include the difficulty to gain an insight in the nature and content of feedback, interaction, or the lack of it among agribusiness and smallholders. More challenging is how to influence these interactions and enrich the feedback process. Usual (agrodealer-farmer) interactions are "unregulated" or spontaneous. CSA is a highly knowledge intensive bundle of technologies. Agrodealers therefore need more time to interact with research. Maintaining constant partnerships with research is often perceived as a burden for small business enterprises and gender targets are often of little interest to them. The agrodealer is interested in buyers, whether male or female. The challenge is for research to demonstrate in a clear-cut way that targeting women with valuable CSA knowledge is good for business in the long run. Research also needs to ensure that promising germplasm are available for agro-dealers in a timely and effective manner. Agrodealers for instance do need to have DTM varieties from CIMMYT along with the CSA bundles of technologies.

Solutions to these challenges include applying anthropological tools to gain insights or even tap into the dynamic agrodealer-farmer interactions. Agrodealers need to become aware of the benefits that can be gained from targeting women in promoting CSA, and how this can eventually improve their business. This introduces a secondary challenge; research will need to unearth evidence in economic terms, about lost profits when gender is not central in agribusiness strategies.

To address cost constraints, there needs to be "project pooling", for instance to share costs of developing materials. In the long term, an integrated scaling framework must be developed, to have business-based scaling embedded in extension programs. These programs need guides, with enough clarity on CSA practice.

Why business-led approaches?

Business incentives based on business modelling approaches are critical to ensure procurement of inputs, the adoption and spread of technologies. The approach aims at spreading the costs of scaling whilst sustaining knowledge sharing. Smallholders are incentivized to travel to the agro dealers in order to get valuable information embedded as part of the commercial transaction. Travel and information collection cost money. Often, public extension workers have limited financial means to

travel to meet individual farmers. Relying on a business-led approach is sustainable, especially when smallholders act collectively to pay. Going forward, farmer organizations or innovation platforms and aggregated demand for products could incentivize the agro-dealer to visit farmers in the rural area. If an agrodealer has the potential to make money it would be within his or her interest to generate more demand and this can be done by providing additional advisory services. In this alternative scenario of farmer organization the costs to the dealer are likely to be reduced.

Most agrodealer outlets in target sites are in close proximity to the smallholder, which means partnerships with public extension can be a win-win situation. With clear CSA messages, extension services in collaboration with agrodealers have the potential to multiply outreach considerably. In the case of collective action, farmer cooperatives/ CBOs need to be effectively managed to operate along business and commercial lines to enjoy economies of scale and reduce transaction costs.

CSA options are mostly long-term investments: A menu of CSA practices has been developed by CIMMYT for sharing. However, communicating the CSA technologies is not a simple process carried out in a way. CSA requires for adoption immediate returns possibly based on business-led scaling approaches, which should enable farmers and agrodealers to sustain their investments to realize the longer-term CSA benefits.

Institutional challenges: There is lack of clear mandate on whose responsibility it is to organize farmers. This is not the role or mandate of public extension and NGOs have insufficient capacity to do this to scale. Kenyan policy is vague as to how different institutions ought to be organized to come together to reduce land fragmentation amongst farmers in the agriculture sector. AGMARK has been engaging with the Kenya Government for policy dialogue. Emerging evidence in this project is critical for strengthening the role of business in scaling.

Trade-off across scales: The symbiotic relationship between the agrodealer, and the smallholder is hard to replicate with large suppliers; employing several attendants, selling to distant buyers or selling wholesale with no intensive relationship with the end-user. The agrodealer enables a transition, from this business-only relationship to customized interactive process for clients and suppliers.

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CS4. Building agricultural resilience in Nigeria through index insurance and scaling out of climate smart agriculture

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Description

Well-designed and agricultural insurance can contribute directly to climate resilience. It can also mitigate risk that often acts as a barrier to farmer adoption of climate-smart technologies. The Nigerian government recognizes climate-related risk as a major challenge to the success of its policy – the Agricultural Transformation Agenda (ATA) – to transform its agricultural sector, which accounts for more than 40% of its GDP and 70% of its workforce. In 2012, torrential rains in Southwestern Nigeria caused rice farmers to lose crops to floods. In 2013, maize farmers in the north were hit by drought that halved their expected yields. These climate-related shocks can undermine development gains by destroying rural infrastructure and eroding farmers' productive assets. Even in climatically-favourable years, climate risk is one of the main reasons why farmers do not invest in their farms, have limited access to credit, and remain trapped in low income and low productivity farming.

Outcomes aimed for

In 2012, the Nigerian Federal Ministry of Agriculture and Rural Development (FMARD) developed a National Agricultural Resilience Framework (NARF) to ensure that Nigeria's agricultural sector is able to cope with the shocks and stresses of a changing climate (Adegoke et al., 2014). NARF calls for resilience, low carbon development, low environmental impact, blue and green growth – all three pillars of CSA – to be mainstreamed into Nigeria's agricultural transformation process. At Climate Week in New York (September 2014) FMARD announced ambitious plans for covering all of its 14.5 million smallholder farmers with an inclusive and diverse agricultural insurance system. The insurance would build on the existing Growth Enhancement Scheme (GES) platform for distributing subsidized inputs (fertilizers, seed) to farmers. FMARD's future plans focus on index-based insurance, in which pay-outs are based on an objectively measured index that is correlated with a target loss rather than the farmers' actual loss. Index-based insurance can overcome some of the obstacles to insuring smallholder farmers at a significant scale: high transaction costs of verifying loss claims, and related problems of adverse selection and moral hazard.

Theory of change narrative

The driving force behind the effort is the Federal Government, which invited CCAFS to develop a roadmap for achieving its ambitious insurance goals; and to work with a core set of partners on an

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initial pilot implementation phase. The theory of change in Nigeria is based on the nature of this partnership, and depends on several assumptions:

- CCAFS role in drafting a roadmap for scaling up insurance will provide a sound strategy that addresses the key requirements for index-based agricultural insurance to be effective and economically viable at scale.
- Linking scaling of insurance with scaling-out of climate-adapted maize and rice germplasm will strengthen uptake of both.
- The credibility of CCAFS as an independent global research organization will foster adoption, by the new administration, of an insurance goal and strategy initiated under a previous Minister prior to the national election early in 2015.
- CCAFS and partners can mobilize financial resources and partnerships for successful implementation of a first-year pilot that will provide sufficient evidence and guidance for the next phase of expansion.
- CCAFS-supported analysis and pilot implementation will find solutions for technical requirements, identify viable business models, and provide sufficient insights and evidence to support continued development of agricultural insurance towards FMARD's goal.

Implementation strategy

At the request of FMARD, CCAFS is leading the development of a roadmap for scaling up insurance, and providing technical support to strengthen the initial implementation of index-based insurance. The relationship between FMARD and CCAFS began with CCAFS' contribution to NARF. Subsequent informal interactions during and after Climate Week in New York in September 2014 led to knowledge-sharing workshops in London (January 2015) and subsequently in Zurich (May 2015). CCAFS organized the workshops (see below). CCAFS is taking the lead in developing a roadmap for expanding index insurance in Nigeria. The roadmap will be used a brief for the new Minister of Agriculture and also will form a chapter in a revised NARF.

CCAFS has also been instrumental in connecting the index insurance plans to climate-smart technologies such as improved stress-tolerant seed. CCAFS has brought in three key agricultural research organizations. Building on their on-going Drought-Tolerant Maize for Africa project (DTMA), CIMMYT and IITA will provide technical guidance to FMARD and the seed sector on supplying the most appropriate drought-tolerant maize varieties, as well as providing technical support for analysing and mapping risks to maize production. Meanwhile AfricaRice will contribute through its RiceAdvice site-specific management advisory tool, the new rice varieties NERICA and ARICA, and technical support for analysing drought risks in rice-growing environments.

Extent of scaling aimed for

FMARD has ambitious plans to cover all of its 14.5 million smallholder farmers with an inclusive, innovative and diverse agricultural insurance system. FMARD together with CCAFS and other partners worked together from January to July 2015 on initial plans to scale out index insurance bundled with climate-adapted maize and rice germplasm. A proposed 18-month pilot is seen as the beginning of a phased expansion of index insurance. A costed concept note has been developed for an 18-month pilot, followed by further scaling out.

Pilot phase:

- 2015-2016 dry season: two Local Government Administrations offering an area-yield index and weather index-based insurance to 10,000 farmers each with a focus on maize and/or rice
- 2016 main season: five states, target 350,000 farmers overall; with a possible broader focus of crops
- The targets FMARD and CCAFS envision for scaling up insurance in subsequent years are:
- 2017: 800,000 farmers across 10 states, introduction of additional priority crops
- 2018: 3 million farmers, including nationwide coverage of maize and rice;
- 2019: full nationwide coverage of 14.5 million farmers participating in the Growth Enhancement Scheme (GES) (see below).

Costs of scaling up/out

The cost of the 18-month pilot is USD 1.8 million. This covers only the pilot phase (18 months' duration). The proposed budget for the pilot phase is based on experiences in implementing index insurance pilots in East Africa. The full cost of extending index insurance to the 14.5 million farmers linked to GES is uncertain but FMARD and CCAFS are developing business models for expanding the coverage of index insurance.

Challenges to scaling out and up and strategies to address them

Challenge 1 – establishing a robust partnership of public- and private-sector actors

Bundling index insurance with climate smart agricultural technologies requires bringing together public and private actors who have not readily worked together. FMARD's commitment to providing agricultural insurance to 15 million of its smallholder farmers (announced by the former Minister of Agriculture and Rural Development, Dr. Akinwumi Adesina, at Climate Week in New York, September 2014) has been the driving force to establishing a public-private sector partnership for scaling out. This prompted a series of consultations among key partners including the Nigerian Government, CCAFS, the donor community and international re-insurers.

Upon the request of the Nigerian Government, CCAFS organized two workshops; one in London (January 2015) and another in Zurich (May 2015). The workshops included the heads of the Nigerian and Indian Agricultural Insurance Corporations, CCAFS, SwissRe, German Development Corporation (GIZ), Nigerian Meteorological Agency (NIMET), Nigerian Agricultural Insurance Corporation (NAIC) and Pula Advisors (a consultancy company). Subsequently, FMARD and CCAFS have overseen:

- The writing of a two-page policy brief on the index insurance initiative for the incoming minister and an index insurance roadmap that will be included in the next version of the NARF;
- The development a concept note for implementing an index insurance pilot starting in the dry season late 2015 (if feasible), covering maize and rice value chains in two states. The pilot will take advantage of the infrastructure provided through the GES.

Challenge 2 – Access to high quality credible and unbiased weather data

The relationship between crop yields and weather observations weakens, and therefore basis risk increases, with increasing distance. Early pilots only offered index insurance to farmers within a given distance from a long-term weather station. There is, hence, a need to strengthen weather-observing infrastructure to enable scaling up weather index insurance. CCAFS is drawing on satellite-based

estimates of rainfall and other weather data that offers a potential alternative to sparse ground-based observations.

Satellite rainfall estimates, which now go back over 30 years, offer complete coverage in time and space. An effort by the IRI in partnership with CCAFS, WMO, USAID, UNDP, University of Reading and others, known as ENACTS (Enhancing National Climate Services), works with African national meteorological services (NMS) to produce reliable climate data and information products. Combining data from the national observation network, with satellite (or reanalysis in the case of temperature) data, produces spatially and temporally complete historic time series at a high spatial and temporal resolution.

Challenge 3 – Selecting the most appropriate index insurance approach

There are many different approaches to designing and implementing index insurance not least whether it is a weather-based index or one based on area yield. Nigeria can learn from past and existing index insurance schemes worldwide that CCAFS has analysed and documented (Greatrex et al. 2015). FMARD and CCAFS are drawing on the expertise of PulaAdvisors, a consultancy company whose staff were intricately involved in the design and implementation of one of the most successful index insurance initiatives to date: the Climate Risk Enterprise (ACRE) (formerly known as Kilimo Salama that has reached 200,000 farmers in Kenya and Rwanda. The pilot scheme proposes to test both weather-based and area yield index insurance and will also draw on CCAFS' experience of working with farmers so that they understand how index insurance works especially basis risk. Furthermore, during the pilot stage, viable business models for scaling out index insurance will be explored taking into account the possible end to premium subsidies.

Discussion

One of the keys to success in Nigeria has been both FMARD and CCAFS recognizing the unique opportunity that exists for scaling out climate smart agriculture. This facilitated the establishment of a robust partnership of public- and private sector actors (**Challenge 1**). Agricultural insurance was introduced to Nigeria in 1987 through the Nigerian Agricultural Insurance Scheme (NAIS). The Nigerian Agricultural Insurance Corporation (NAIC) was established in 1993 as a public-sector corporation to administer NAIS. Plans to expand agricultural insurance in Nigeria are linked to several new initiatives under the Agricultural Transformation Agenda (ATA) and the agricultural insurance initiative is one of the pillars of the NARF (Adegoke et al., 2014).

CCAFS has considerable experience of the opportunities and challenges of implementing index insurance. It has been able to draw on this experience to map out how to overcome, amongst others, the data challenges (**Challenge 2**) and the most appropriate business model to pursue (**Challenge 3**) along with which crops to bundle with the crop insurance. With more than 5.56 million ha of land planted to maize in 2013 (or about 16% of all of Africa's maize area combined), The national program in Nigeria, in close collaboration with DTMA, has released a total of 22 drought tolerant maize varieties between 2007 and 2013. CCAFS is particularly interested in the role insurance plays play in improving accessibility of climate-smart production technologies, especially drought-tolerant maize varieties.

The example of index insurance in Nigeria was made possible by the fortuitous coming together of the policy priorities of the Nigerian Government and the objectives of CCAFS. The Nigerian example epitomizes the link between research and policy promoted by the DFID-supported *Research and Policy in Development (RAPID) Programme* at the Overseas Development Institute (Court et al., 2005).

General challenges

Transaction costs – Institutions already exist in Nigeria to reduce transaction costs, not least the GES. The GES was launched in 2012 to revamp the Federal and state fertilizer and seed subsidy, transferring what was largely a paper process to a mobile enabled platform. The result is a mobile platform (the e-wallet) that in 2014 allowed 14.5 million farmers to access seeds and fertilizers in a transparent and efficient way. The demographic reach of the GES is unique, as it has managed to target young farmers. The GES also squarely targets those at the bottom of the pyramid, with 50% of GES applicants having only completed primary or no formal education at all.

The Nigerian Government plans to develop and deploy index insurance, via the e-wallet, to all farmers that are entitled to subsidized input under the GES scheme. This system will facilitate insurance providers' access to all farmers on the GES platform, and encourage competition for clients. It will also allow insurance companies to target specific points along the value chain, specific crops, and offer cover for specific risks. In addition, suitable climate-adapted maize and rice varieties have been developed for different agro-ecological zones in Nigeria and there is a dynamic private seed sector that is in a position to produce sufficient quantities of these varieties.

Farmers' risk management strategies - Index insurance differs from traditional indemnity insurance (such as the current GES scheme) where pay-outs are based on measured loss for a specific client. High transaction costs of verifying loss claims, and related problems of adverse selection and moral hazard, have made traditional loss-based insurance difficult to implement at scale. Instead, in index insurance, farmers purchase coverage based on an index that is correlated with crop losses. Indices include the amount of rain during a certain window of time (weather based indices) or average yield losses over a larger region (area yield indices). Pay-outs are then triggered when this index falls above or below a pre-specified threshold. Index-based insurance can overcome some of the obstacles to insuring smallholder farmers at a significant scale. Index insurance is a tool that enables smallholder farmers to better manage climate risk and to invest in farm inputs knowing that the insurance will pay out in the event of a climate shock. Furthermore, the use of the e-wallet means that pay-outs can be made more rapidly. If farmers have insurance cover, credit providers are more disposed to lend to farmers, and farmers are more inclined to take out credit and invest it in farm productivity.

Political, institutional and economic barriers – these barriers had been largely overcome by the explicit commitment of the Nigerian Federal Government to scaling out index insurance in Nigeria. FMARD is leading the implementation of the aforementioned pilot schemes and has proposed a steering committee of the following key actors:

- CCAFS and its partners (including CIMMYT, IITA, AfricaRice, IRI), supporting understanding and analysis of agro-climatic risks, identification of appropriate seeds and input packages, understanding of interactions of insurance and adoption of improved technologies, and contributing to evaluation;

- Cellulant, providing the IT support services and platform for integration through the GES e-wallet;
- GIZ, providing technical advice and services with regard to regulation, and coordination of the insurance sector;
- NIA (and its member companies) and NAIC, providing primary insurance services;
- Pula Advisors, providing technical advice and services with regard to insurance pricing, pilot design and execution; and
- Swiss Re, providing advice and services with regards to data, pricing, structuring and reinsurance.

The challenge for CCAFS is to work with Nigerian officials to ensure that the new government continues to prioritize index insurance.

Trade-off across scales and poor targeting – Based on the pilot schemes, decisions can be made as to what type of index insurance is suitable for different areas i.e. weather-based or area-yield. Furthermore, IITA/CIMMYT and Africa Rice have bred climate-adapted maize and rice germplasm respectively for different agro-ecological zones in Nigeria. This facilitates judicious targeting of different varieties to appropriate zones. Nigeria's plans to rapidly scale up agricultural insurance will require efficient, scalable mechanisms to engage farming communities, and build their capacity to understand and hence effectively demand appropriate insurance products. Partnering with organizations that already interact with farming communities, and that have already built trust, proved to be effective in most of the case studies reviewed in Greatrex et al. (2015). The interaction with farmers need not all be face-to-face and can be via radio. Furthermore, offering the products to aggregators like millers, processors, input providers, seed companies, might offer an alternative to scaling up agricultural insurance, since they are better educated and at a better position to stand against contractual non-performance by insurers.

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CS5. Scaling up climate smart information services to guiding climate risk management by farmers in Senegal

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Description

Senegal, with 90% rain-fed agriculture, is subject to rainfall variability, especially in the northern region where crops are particularly prone to the effects of erratic rainfall and long drought (Khouma et al., 2013). These are becoming more frequent with climate change, therefore may lead to frequent crops failures during the only short rainy season per year. Indeed, extreme climate events can undermine agriculture and rural development. Even in years when extreme events do not occur, the uncertainty that results from climate-related risk is an impediment to sustainable intensification of agriculture and adoption of climate-smart agricultural (CSA) production practices. In an era of more frequent and more extreme weather events and climate shocks, enhanced early warning systems provide a key opportunity to curb erosion of development progress in rural sectors. Allowing farmers to base farm management decision-making through tailored and salient climate information along the cropping cycle may help them reduce climatic risk and avoid regular food insecurity. With CCAFS support, vital downscaled seasonal rainfall and long term weather forecasts are reaching around three million people across Senegal, helping smallholder farmers to make better-informed decisions about agricultural management in a changing climate. By doing so, the provided climate information services (CIS) allowed farmers to improve their adaptive capacity and increase farm productivity. In addition, an institutional behavioural change has been operated by the Senegalese Ministry of agriculture who now consider CIS as an agricultural input for their yearly agriculture action plan development and implementation.

CCAFS scientists worked with the national meteorological agency, Agence Nationale de l'Aviation Civile et de la Météorologie (ANACIM), to develop downscaled seasonal rainfall forecasts, and to raise capacity of partners to do longer-term analysis and provide more actionable information for farmers. The forecast information includes the total rainfall, the onset and end of the rainy season, plus a 10-day forecast across the rainy season. The information is conveyed to farmers as agro-meteorological advisories package that are tailored to meet the local needs expressed by farmers themselves through discussion groups. While this approach has been piloted in the Kaffrine region since 2011, the geographical scope has now been widened through a partnership with the Union des Radios Associatives et Communautaires du Sénégal (URACS), an association of 82 community-based radio stations promoting economic development through communication and local information exchange (http://uracsenegal.org/). The union spans across all of Senegalese 14 administrative regions and operates in all local languages, giving it significant adoption potential by local farmers to

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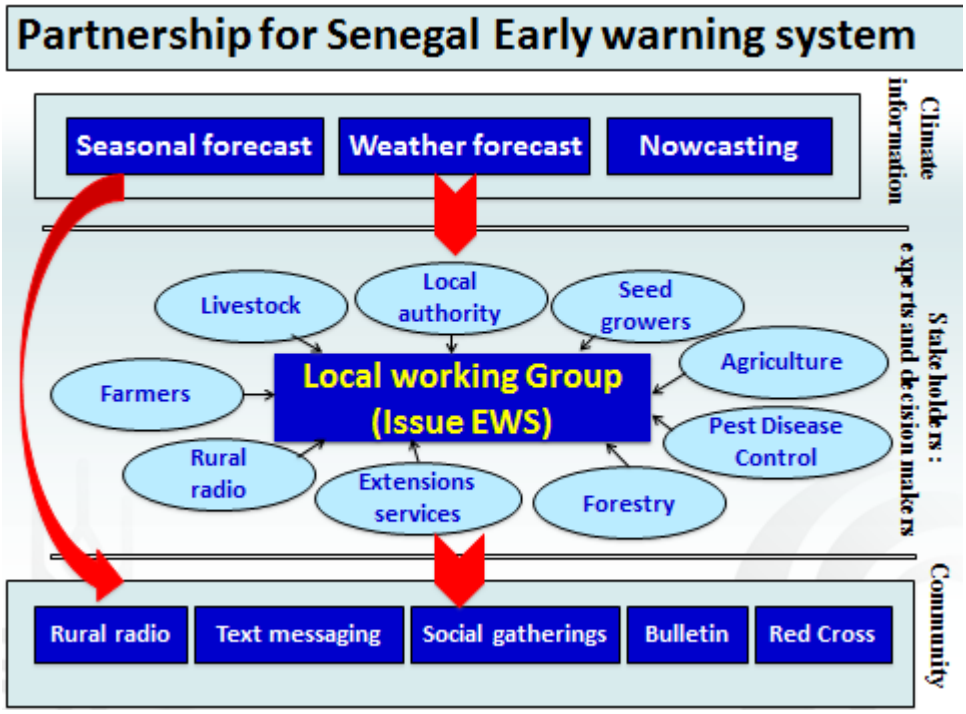
transform their lives through reliable information. Following a training of the 82 radio journalists on the jargon of climate and on the understanding of the seasonal forecast, climate information services across the rainy season are now transmitted as special radio programs in the 14 administrative regions of Senegal. The interactive nature of the radio program allows listeners to revert with their feedback including additional information, views, and requests of clarification. This scaling up of CIS has been possible thanks to the partnership between CCAFS, ANACIM and URACS with each stakeholder playing a specific enabling and complementary role.

Figure 1: Chart of information flow chart between stakeholders from generation up to dissemination.



Challenges to scaling out and up and strategies to address them

The following three challenges are considered as of major consideration for a successful scaling up of CIS and thus need to be addressed:

Gaps in long-term series of climate data for all sub-national level administrative zones to allow ANACIM design the downscaled seasonal rainfall forecast information.

This coupled with the limited skill and performance of climate models simulation from one place to another: the number and quality of weather stations in many African countries has been declining and has contributed to challenges in accessing relevant climate data. The available stations are often unevenly distributed with most of the stations located along major roads or big agglomeration or cities. This imposes severe limitations to the availability of climate information and services to rural communities where these services are often needed the most. Where observations are taken, they

suffer from gaps and poor quality and are often unavailable beyond the respective national meteorological services (Ali et al., 2014).

In order to facing the issue of lack of data, CCAFS is supporting the development through ENACTS model (Enhancing National Climate Services), of satellite high-resolution gridded data in West Africa. Implementing the ENACTS model or any similar approach could help complement the existing historical climate database of ANACIM. The ENACTS model for instance opens a lot of possibilities for developing historical and seasonal forecast products that are relevant to agricultural decision-making, with complete spatial coverage. As an example, in West Africa, AGRHYMET in collaboration with IRI developed a Climate Forecast Map Room that translates the PRESAO seasonal forecasts to different values that can easily be understood by users. It presents the forecasts in the context of historical rainfall data and ENSO events. This information can be analyzed and extracted at national or sub-national levels. Extracting and presenting information at any administrative level enables focusing on specific areas of interest.

A key inhibiting factor is the lack of sufficient expertise within ANACIM to take up this database development and its use to generating CIS products. It is therefore of foremost importance that human expertise of ANACIM be substantially increased and trained to make effective use of generated climate dataset. With the pilot of Kaffrine on the communication of CIS to farmers, a new generation of "meteo-farmers" is now born as these sorts of lead farmers are recognized by their communities as providers of weather information through mobile phones. The "meteo-farmers" are also able to communicate the rainfall data from their region to ANACIM, therefore contributing to improve the historical rainfall database. This growing awareness of rural communities about the usefulness of CIS and the aggressive request for the seasonal forecast information before the onset of the rainy season, it is likely that community-based organizations can now bring the need for accurate climate data and thus, of automated met equipment for instance, to the political level; therefore could change the game that will lead to improved climate databases that allow generating more reliable downscaled seasonal forecast information for their respective regions.

Insufficient coverage of the country with local multidisciplinary working groups (GTPs), which constitute the institutional bodies translating the climate information into agro-advisories for farmers and disseminating the information through various channels.

Well-structured and operational farmers organizations that are able to take over the role played by the GTPs could be an alternative solution. For instance, the fact that URAPD (L'Union Régionale des Associations Paysannes de Diourbel) was the far dominating farmers' entity in Bambey with leaders well-identified and well-connected down to families was conducive to the successful scaling up implementation in this region. This explains the need for diversified types of relays for CIS dissemination, including private sector, which, with capacity strengthening, could be motivated to engage in the translation of the climate information into agro-advisories that are tailored to their specific needs. Given the central role played by the local GTPs and their pluri-disciplinary nature, their leaders, notably the prefect or the mayor, are key to emulating and fostering timely effective holding of the regular decadal meetings for the development and dissemination of the agro-advisories. The leaders should make sure that all development sectors are represented in the local GTP (Weather, Food Security, Hydrology, Agriculture, Disaster risk, CSOs, media, farmer organizations, etc.). The active involvement of the local media (press, radio) and the private sector are particularly instrumental to the widespread right away dissemination of the context-specific agro-advisories for each zone.

Linked to that is the need for operational research and extension services across the country that are working with farmers to developing and/or identifying CSA technologies and practices that are applicable to the decision made from the received CIS.

This also poses the need for an efficient communication between ANACIM and the local GTPs and rural radios to ensure timely updates on CIS and their understanding by the information relay entities (e.g. nowcasting). Users of EWS will lose faith in the information provided if uncertainty is not effectively communicated. For information at a long lead-time, e.g., near the start of the growing season, uncertainty of early warning information should be factored into communication, in probabilistic terms. Also, developing additional information products such as the start of the growing season, rainfall intensity and frequency, drought index, maps of drought risks, maps of flood risks, plant water requirements, pasture conditions, climate and health Map Rooms, etc. are very crucial to engaging the diversity of users.

Lack of financial resources to operationalize training plans, capacity building of GTPs and URACS journalists, communication among actors, etc.

Providing information at longer lead times would expand the range of decisions that early warning systems could inform. However, enabling decision-makers operating at local to sub-national levels, to benefit from early warning information requires investment in training and communication, in addition to implications to system design. ANACIM organizes training sessions for all local relay bodies to understand the climate jargon and the rainfall seasonal forecast information. This requires financial resources that more often the government is not able to plan or allocate for. The need of funding becomes even more urgent given the short time between the seasonal forecast design (in May) and the commencement of the rainy season (June), rendering these training sessions more intensive in order to be able to cover the whole country. Now that the CIS is considered by the government as an agricultural input that must be factored into the yearly agricultural action plan, one may expect that consequent public funds be formally planned to cover some of the costs for capacity building. This could be also made possible through the national science-policy dialogue platform on climate change, agriculture and food security facilitated by the Ministry of Agriculture and Rural Equipment. The platform allows regular dialogues and knowledge exchange among key national players on climate change, therefore constitutes a powerful sensitization instrument to accelerate informed decision making, including national budget planning for rural development. One additional effective way to scale up is certainly through the major agricultural development programs where a better enabling environment for the scaling up is available. This has been for instance the case with the PAFA program, a value chain project funded through IFAD and covering 4 administrative regions.

Discussion

The most important challenge along the scaling up process is the production of enough accurate climate information. Confidence in early warning systems (EWS) is influenced by the quality of data. Quality is often compromised because EWS is based on multiple streams of information. Investments in quality and streamlining help increase confidence. In the case of meteorological data, the ENACTS product helps create high spatial and temporal resolution rainfall and temperature data through blending of observations and satellite data. This complements and fills the gaps in the ground historical climate database as with ENACTS: (1) climate data are available for each 10km by 10km

grid in West Africa, (2) Data are available online and any user can therefore access them at any time, (3) Usage of data and products from ENACTS is easy provided weather services and users are trained.

The local GTPs are in principle setup in each district through ANACIM. However, the latter doesn't have the required funds to cover their operational costs (meetings, transport, etc.) rendering it difficult to cover the whole country with such an important entity in the scaling up process. Using context-specific partnerships to play the role of GTPs appears relevant as this was demonstrated in the case of Bambey district by the existence of a powerful farmers' organization. In these kinds of public-private partnerships, the added value is that the private sector, because of its interest in the produced CIS, will also support the scaling up process. And as members of the local GTPs where they contribute to the development of the agro-advisories, the vast network of rural radios can easily understand the messages to be largely disseminated through their radio broadcast programs.

Our proposed approach of public-private partnership to develop more local GTPs across the country will allow rationalization of the financial resources needed to capacitate all actors involved in the scaling up process including ANACIM, the local GTPs, and the 82 rural radios of URACS. In Louga for instance where a bank (Crédit Mutuel du Sénégal) which was part of the scaling up process led by ANACIM, strongly expressed the willingness to base its loans on the forecast. The bank was therefore ready to support (financially) the development of the CIS and during 2014, the bank already sponsored the development of the CIS bulletin by the national GTP. This, in addition to the government support through major rural development projects and through dedicated allocation of public funds to strengthen the capacity of key actors (ANACIM, Extension services, URACS, etc.), will sustainably operationalize the scaling up process.

CS6. Towards a Climate Smart Agriculture (CSA) in Colombia

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Description

When growers are asked why they chose to plant a particular variety or technology in a given season, the majority answer either that it worked well for them the season before, or that a neighbour planted it and it did well for them. In the context of a stable and predictable climate, this is a very robust means of making decisions, with low probability of failure. Unfortunately, climate is not stable or highly predictable, and farmers are faced with a reality that the next cropping season is more likely to be different than the past one. In addition, rural populations are being left behind in the information revolution. New approaches are required to both support farmers' decision making processes and adapt to climate change and ensure that crops maintain high and stable yields despite an increasingly variable climate from year-to-year. Since 2012, a range of national growers associations, and the International Center for Tropical Agriculture (CIAT) signed an agreement with the Ministry of Agriculture and Rural Development (MADR) of Colombia to strengthen the capacity of Colombia's agricultural sector to adapt to climate variability. The project includes varietal evaluation within context of both climate variability and change, seasonal agro-climatic forecasting, and climate site-specific management systems as a tool to determine the most limiting factors associated with variation in productivity, and therefore to increase productivity. Scientists are responsible for calibrating a range of varieties, generate seasonal agro-climatic forecast, and analyse historical records. Federations are empowered with the tools used by scientists, and at the end of the project they are capable of: (a) selecting, multiplying and spreading the most adapted varieties according to the regions, (b) generating and interpreting seasonal forecasts not only to know the best management options (what, and where to grow) according to biophysical conditions but also the potential yield of the most adapted varieties under specific conditions, and (c) analysing their own information to determine the most limiting factors in the production of their crops in specific regions. Colombian government counts then on a strategy of adaptation to climate change based on the strengthening of thousands of farmers through countrywide associations of growers. Farmers organizations include: the Colombian National Federation of Rice Growers (FEDEARROZ) with 24 000 farmers, the National Federation of Cereal and Grain Legume Growers (FENALCE) with 7 000, Colombian Association for Fruits and Vegetables (ASOHOFRUCOL) with 20 000 Foundation for Territorial Sustainable Agriculture FUNDESOT with 200. From those, about 6000 farmers are currently implementing Climate Smart Practices (CSP), mostly based on best varieties and planting dates at site-specific level. The approach

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implemented in Colombia has the potential in the mid-term of having about 700 000 farmers implementing CSP thanks to the successful program in Colombia which in its second phase involves other national growers associations and therefore thousands of new growers.

Currently the project reaches about 500 000 growers through a platform for information management and knowledge called Agronet http://www.agronet.gov.co/. The strategy to reach farmers across Colombia also includes the release of agro-climatic newsletters by MADR. The newsletter has been created under the premise of providing greater information producers recommendations to mitigate effects of climate events and report data on the evolution of the same. Both, Agronet and the newsletter are unique efforts in Colombia, that as far as the author of this case study knows, join not only MADR, CCAFS and a wide range of national growers associations, but also the National Institute of Hydrology, Meteorology, and Environmental Studies (IDEAM) which is the national meteorology office, and National Agricultural Research Systems (NARS) such as the Colombian Corporation for Agricultural Research (CORPOICA). The newsletter is released in a monthly basis. Approximately the costs of scaling up such initiative is about 5 000 000 USD/year/5 federations.

Challenges to scaling out and up and strategies to address them

To gain credibility with national farmers' organizations: Lack of understanding of the tools proposed.

Strategy to overcome: Adaptation strategies should be presented as a combination of methods to address climate change challenges rather that a "shopping list" of tools/methods. In terms of the analysis of historical information, both benefits and capabilities of using the tools proposed to analyse data, need to be demonstrated in order to gain credibility with data owners and encourage them to share more information.

Key inhibiting factors for scaling up: (a) lack of scientific background within the associations, and (b) technicians are used to traditional methods.

Key enabling factors for scaling up: (a) to use more user friendly tools, (b) regarding the analysis of historical information, once national associations understand research organizations methods, they agree to provide researchers with more data.

Key game changers: (a) Vision from managers of growers associations, they should be open to adopt new approaches to cope with climate variability, (b) young people within the associations are much more open to implement and be empowered with the approaches, those technicians should be identified rapidly to ensure the empowerment of the institution given the sort-term funding, and (c) farmers understand the effects of climate variability and in general the usefulness of the project.

National farmers' organizations neither cover all farmers in all producing regions nor know in detail growers' situations in all of the regions

Strategy to overcome (a) Alliances with other either public or private institutions to reach more farmers, (b) to work more closely with technicians in the regions.

Key inhibiting factors for scaling up: (a) Lack of knowledge of growers' organization headquarters of the actual situation in the regions (sometimes we went to the field to suggest for example best sowing

date and growers have already planted). (b) The graphs and data as strategy of presenting results to farmers, (c) lack of knowledge on participatory research methods.

Key enabling factors for scaling up: (a) the use of spaces to talk to farmers that have been generated by growers associations over the last years. Researchers and associations technicians take advantage of those spaces to share results and get feedback.

Key game changers: (a) Associations` technicians in the regions should be contacted first, (b) technicians do require to be trained on participative research methods to make more efficient the task of sharing results, they should also find more creative ways to inform the farmer about CSA practices, (c) farmers need to see that a given technology/recommendation is working in order to implement it in his/her own field. As far the author of this case study knows, that is the way how massive adoption technologies take place in LAM, therefore donors need to understand that impacts are achieved in the mid-term for short-period crops, and long term for perennial.

The language of the agro-climatic newsletters is still very technical

Strategy to overcome: Bridge the gap between meteorologists, agronomists, modellers and practitioners.

Key inhibiting factors for scaling up: (a) the people doing the newsletter are far from the people who make communication in its institutions. (b) Terminology is often confused (e.g. meteorological and agronomical terms, empirical and process based modelling, probability, forecast, etc.).

Key enabling factors for scaling up: To (a) involve other actors for the dissemination of the newsletter, (b) get feedback of the agro-climatic newsletter by the farmers.

Key game changers: The people responsible for doing the newsletter need to be more creative finding better ways to communicate.

Limited access to Internet in some rural communities does not allow to have access to Agronet

Strategy to overcome: To maximize the dissemination through other channels.

Key inhibiting factors for scaling up: Farmers remain uninformed on relevant, timely and synthetic agricultural information.

Key enabling factors for scaling up: Support this process with existing tools like celu-Agronet for a better reach.

Key game changers: Extension officers, community knowledge workers, and technicians with access to the information provided by Agronet, finding ways to communicate it to farmers.

Lack of a platform to monitor with accuracy the number of farmers reported by each institution adopting CSP

Strategy to overcome: To achieve a more precise monitoring system.

Key inhibiting factors for scaling up: The exact number of farmers implementing CSP, it is not clear, sometimes the data is estimated from farmers` average production areas.

Key enabling factors for scaling up: To develop a crowdsourcing learning platform among different institutions, share learned lessons, successful experiences and knowledge.

Key game changers: Growers associations should be aware of the importance of having a better idea of growers implementing CSP.

Discussion

The partnership is the fundamental factor of success for this idea. The holistic approach consists of lining up a range of partners to generate, transfer and generate impact for farmers with appropriate information and technologies to make agriculture climate smart. This requires a partnership consisting of: (a) farmer organizations, trade federations or grower associations (depending on the country, these can be not-for-profit, mixed purpose or private sector), (b) meteorological service providers including the national meteorology offices, (c) research organizations to generate knowledge of how climate and agriculture interrelate, in site-specific and crop-specific contexts, and (e) ministry of agriculture, local government organizations.

To work closely with national growers associations seems to be a feasible strategy to reach not only thousands of farmers, but also to bridge the gap between scientists and practitioners. Most of the research in agriculture has been top-down based, and have not had necessarily responded to farmer's needs. The approach used in this case study is a more "user-driven design" and responded to what a wide range of partners have identified as required to cope with climate variability. Nevertheless, despite of having growers association on board, not necessarily all the population of growers is covered, and in that direction extra-efforts are required to involve public/private institutions.

In general, modern information technology, such as ICT, seem to be a promising tool to reach thousands of farmers. Informatics platforms such as agronet allows not only to reach thousands of farmers but also demonstrate that institutional efforts can be coordinated to facilitate the provision of information to farmers. However, the limited access to internet in some regions makes difficult to reach more farmers, in this regard other channels of communication need to keep testing. Although it is noteworthy that within the Colombian context, most of farmers nowadays have mobile phones, situation that 10 years ago would have been thought as a very unlikely scenario, and that is why efforts based on Internet need to be continued. Another research direction that should be considered regarding agronet is how to use it as a platform to monitor the impacts of the agricultural information provided to farmers.

The agro-climatic newsletter, is another inter-institutional product that has proven potential to reach thousands of farmers, nonetheless the technical language used need to be addressed by experts.

Also, novel analytical tools allows to process historical agricultural information that was difficult to analyse in the past due to: (a) assumptions required by conventional statistical approaches, (b) incapability to both manage and process non-, noisy, incomplete, and heterogeneous data, (c) availability of data, and (d) costs of both software and hardware. These analytical approaches, mostly based on machine learning seem to be promising tools to get better insights o the most limiting climatic factors in the production. With regard to data sharing, as it is still in its infancy in many places and primary data holders often have legitimate concerns about how the information is used, analysis should be made with a small sample to show capabilities and gain credibility.

Other issues to be considered in terms of the particular context of this case study include: The general approach will succeed as long as in the country exists well organized crop sectors and therefore growers understand the benefits of being part of an association. As far as funding is concerned, as it has been a project funded by the Colombian government for periods no longer than 2 years, it leads to two major problems: (i) the difficulty to accomplish 100 % of outcomes and impacts expected, and (ii) the pressure on scientists to obtain results rapidly, that often compromise the academic results and high science quality. In the particular context of the case study discussed here a compromise between rapid results and high quality science should be found. Another issue that needs to be taking into consideration is that each farmer association and each region is different to others, thus strategies should be thought as context-specific.

General challenges

Two thousand farmers are currently implementing CSP in Colombia, and 500 000 have been reached through Agronet and agro-climatic newsletter, both strategies from de MADR in Colombia working together with a range of other institutions and meant to provide farmers with relevant information including strategies of adaptation to climate change. Partnership between government, grower's organizations, and research institutions has been a key factor to succeed with the project. Tics have a huge potential not only as tools to reach unprecedented number of farmers, but also as a mechanisms to collect information and monitor the impacts of the project. Agro-climatic newsletter seems to be a promising channel to provide producers with information on how to mitigate effects of climate variability and report data on the evolution of climate. Several challenges have been identified: (a) to gain credibility with national farmers' organizations, (b) national farmers' organizations do not necessarily know the different situations that take place in all the producing regions and with the total of farmers, (c) the language used in agro-climatic newsletters and the limited access to internet seem to be the relevant to reach more farmers. The agreement with the MADR has demonstrated that strategies and results are context-specific and each region and association needs to be treated differently. The bet in this case study lies in working closely with government and farmer associations to facilitate the influence on policies. However, the fact of producing results relevant to such stakeholders does not ensure that they will be taken as input for national policies, there is a still a long way to go to fulfil such task. A strategy is required to better communicate the benefits of the research to decision makers and have better access to policy makers.

Reference

Online document with main results in terms of CSA actions: http://www.aclimatecolombia.org/wp-content/uploads/2014/12/Revista-Convenio-Nov.15.pdf

Blog of Agreement between CIAT- CCAFS and MADR where processes and results are documented: http://www.aclimatecolombia.org/Interactive agroclimatic newsletter: http://www.aclimatecolombia.org/boletin-agroclimatico/

Project links

http://www.aclimatecolombia.org/

CS7. Shamba Shape Up - an example of the use of edutainment for scaling out climate smart agricultural practices

P. Dorward[19], G. Clarkson[20]

Description

Aimed at the region's rapidly growing rural audience, Shamba Shape-Up (SSU) is an edutainment TV series, which aims to give smallholder farmers tools and information to improve productivity and income on their farms. The core of the series tackles issues surrounding livestock, poultry, crops, soil fertility and the home using experts from each sector. It covers a wide range of existing innovations and technologies. The show includes a range of ecological zones and has mainly focused on Kenya with some activity in Tanzania and Uganda. SSU illustrates the techniques for each location and crop/livestock type so that the audience can easily understand and adopt the practice. CCAFS in the past has supported SSU in explicitly focusing on information and tools related to climate-smart agricultural practices and technologies.

Outcomes aimed for

SSU has a broader remit than CSA and includes a wide range of practices. Within these it has focused on several CSA practices including agroforestry, better livestock management, water harvesting, soil conservation, terracing, efficient use of fertilizers and manure, introduction of crop- and livestock breeding for more productive varieties, and pest- and disease management.

Theory of change narrative

SSU uses a form of reality TV (the makeover) with smallholder farmers in Kenya, coined as edutainment. It is a departure from conventional approaches using TV. Instead SSU incorporates key ideas from mass media theory, good practice in extension and advisory services and innovation systems frameworks. Rather than broadcasting of information seeking simply to educate or share knowledge (sometimes accompanied by interactive 'phone in' format that is now common in farm radio), it focuses on individual farmers and brings specialists (e.g. research experts) to a farm household. The audience then watches the 'reality' of the interaction as the expert engages with the farmer and seeks to help address the issues raised. The program is designed and presented in a way to lead viewers to identify and empathize strongly with the 'host' farmers and want to see how they will find a positive outcome. The emotions of the viewer are engaged and as with all good edutainment it affects not just individual viewers but stimulates interest and discussion between them.

Beyond the TV show itself, viewers can engage with SSU in other ways – e.g. via sms or Facebook, where viewers can ask for and will receive additional information about the technologies and practices presented in a specific episode. This information is in the form of leaflets.

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Implementation strategy

Scale is achieved through the TV program being broadcast weekly in two different languages, English and Kiswahili (on the Citizen Channel in Kenya). The series has interactive support services to increase the uptake of information - viewers can SMS to be sent a free information leaflet or link up with experts, and follow updates and video clips online and on mobiles. Mediae has recently pilot launched a call centre and subscription SMS service to cater for the more mobile savvy viewers.

Extent of scaling aimed for

SSU has an estimated audience of 5 million in its first season, rising to over 10 million people (18+) by the end of the fifth series in East Africa (approximately 5 million in Kenya watch SSU at least once a month). As per SSU's estimate, if even just 10% of viewers of series one adopt new practices as a result of watching the show, that's 1 million farmers who's livelihoods have become more informed and productive. In Kenya, SSU is watched by an estimated 12.6% of households (including those without TV). Series 4 received nearly 32,000 sms from March to November.

Report for AECF led by the University of Reading estimated that over 428,000 households (14.7%) in rural and peri-urban areas of Kenya targeted by SSU had benefited (those households specifically reporting that they had made changes to their maize or dairy practices as a result of SSU OR who reported that they had benefited from SSU through increased profit or improved household food situation). Households reported making changes in their farming as a result of SSU are estimated at over 218,000 for maize and over 65,000 for dairy – from these two enterprises the statistically estimated net economic impact in 25 Kenyan counties was over 24 million USD, mostly from dairy.

Costs of scaling up/out

TV series production: each segment/story costs app. 10,000 USD; each episode consists of around 5 segments/stories, making the total cost: 50,000 USD/episode. Series 4, for example had 26 Episodes in total: 50,000 x 26 = 1,300,000 USD.

Challenges to scaling out and up and strategies to address them

There are a wide range of agricultural innovations from different sources (including government research) that are commonly known but which have had limited uptake by smallholder farmers. Government extension faces resource constraints, which limits operation, coverage, and the proportion of farmers reached directly is small. Resource constraints also affect staff training and capacity. NGOs have limited reach and will often work through already stretched government services.

Strategy to overcome these challenges: Use of television and ICT to reach large numbers of farmers and related stakeholders. SSU raises awareness of and provides 'training' in selected key innovations / practices that have been proven to work. The novel use of edutainment engages viewers with the host farmers i.e. they can strongly identify with hosts and their situations and want to see what happens when innovations are tried (reality TV format). Innovations are demonstrated in ways that show that they are achievable and beneficial. SSU deliberately seeks to stimulate conversation and discussion about farming and the innovations covered amongst and between farmers and other stakeholders (e.g. extension providers, input suppliers).

Key inhibiting factors for scaling up: Access to TV and to electricity. Cost of airing the program at peak viewing times (evenings are when farming families will be at home and are the most expensive slots). Language, if expanding to other countries.

Key enabling factors for scaling up: The ability to reach hundreds of thousands of farmers with every program. Research on viewer numbers show where most interest lies, information can thus be targeted. Edutainment format is engaging people, they can associate with the farmers and see direct value. They can get in touch with SSU for more information.

Key game changers: Goes direct to farmers (who have access to TV) without the 'constraints' of the intermediaries and of local hierarchies. Experts talking about specific technologies in the show are usually from the region and can relate content in easily understandable ways to the viewers.

Limited willingness and ability by farmers and others to invest in smallholder agriculture. Farming is not widely seen as career or as a lucrative business. People who have resources are not inclined to invest in agriculture and a large proportion of small scale farmers lack access to funds

Strategy to overcome these challenges: Edutainment engages with viewers and enables them to see the potential of agriculture and view it in a positive light. Some innovations / practices are relatively low cost and relatively easy to implement.

Key inhibiting factors for scaling up: Access to TV and to electricity. Cost of airing the program at peak viewing times (evenings are when farming families will be at home and are the most expensive slots). Access to resources and funding remain a constraint in rural areas and particularly for the poorest; thus actual changes in farmers practices will depend on other factors beyond SSU – possibly the poorest are not reached through this program, more targeted towards small-scale farmers who have resources to play with and can make a certain level of investments in their shamba.

Key enabling factors for scaling up: Shamba Shape Up has been widely watched in urban areas where it has engaged the interest of a range of people including those with relatives farming in rural areas, people who still own and farm land remotely (i.e. work in towns and send back instructions and funds to farm workers), individuals looking for business opportunities. These urban viewers regularly share ideas from the program and send funds for implementation to farms in rural areas. Mobile phones facilitate this.

Key game changers: People feel motivated and interested in agriculture and the innovations - sufficiently to act to invest and to take up the innovations. Agriculture becomes more appealing and a subject of conversation in homes, work places and social settings.

Discussion

SSU was not developed for CSA specifically but there are very useful lessons that can be drawn regarding scaling up and out in general. Technologies and practices covered in SSU can be presented in a way to highlight their climate smart aspects and encourage people to think about climate change and the implications for their farming. SSU would thus be an excellent vehicle to promote CSA further, IF the short-term economic value can be demonstrated since that is what people are interested in. The practices are geared towards specific agro-ecological zones and contexts.

What is more difficult to integrate are aspects of CSA that do not specifically link to household farms – e.g., collective action, institutional barriers, etc.

References

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Project Links

www.shambashapeup.com
www.mediae.org

CS8. Scenario-guided policy formulation: Cambodia's Climate Change Priorities Action Plan

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Description

There is an urgent need for policies and investment strategies for agriculture and socio-economic development in the world's vulnerable regions to engage more effectively with climate change as it interacts with socio-economic drivers to impact poverty, food insecurity and environmental degradation (Vermeulen). Integrated plans are needed that are robust and flexible enough to be feasible under a wide range of challenging future conditions.

Future scenarios –'what if' narratives about the future, told through words, numbers, visuals and other means- can be used to explore the interactions between multiple drivers of change (Kok, 2007). But scenarios offer only contexts – to be effective, they should be used to test and develop plans and strategies. CCAFS has developed regional scenarios on climate impacts, food security, environments and socio-economic development for six global regions: East and West Africa, South and Southeast Asia, the Andes and Central America. The main focus, and innovation, of the CCAFS scenarios project is the use of the regional scenarios for policy formulation in a wide range of national and regional case studies. This allows for a combination of regional scenarios which offer multi-dimensional contextual analyses on the one hand, and multiple, concrete and focused policy applications on the other (Vervoort et al. 2014). To understand the potential and challenges for up-scaling involved in this approach, we present one such case study – the development of scenarios for Southeast Asia and the subsequent use of these scenarios for the formulation of the Cambodia Ministry of Agriculture, Forestry and Fisheries (MAFF)'s Climate Change Priorities Action Plan (CCPAP, US$147 million).

Outcomes

By using climate/socio-economic scenarios to test and develop national and regional policies and investments, the project aims to create enabling policy environments for building resilience to climate change and sustainably improving agricultural productivity and incomes. Whether the focus is more on development, resilience or mitigation depends on the nature of the policy for which the scenarios are used – in the Cambodia case, the main purpose of the policy is to enhance the resilience of the agricultural sector and farmers' livelihoods. Because of a focus on national policy, this type of process has the potential to benefit the entire population in the countries where it is used – over 15 million people in Cambodia, of which over 12 million live in rural areas (WorldBank 2015).

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Theory of change

The theory of change informing the CCAFS scenario-guided policy formulation work is as follows:

When policies and plans are tested and developed against multiple scenarios that have stakeholder ownership and legitimacy as well as scientific credibility and an appropriate scope, there is a high likelihood that each scenario offers relevant challenges and opportunities which a plan or policy needs to deal with to be feasible in that future. Testing and developing policies against a range of scenarios increases the likelihood that these policies will achieve their aims under uncertain climate and socio-economic conditions. This is especially true when the scenarios are used to ask challenging questions about policy implementation; and when the scenario-guided policy development process is guided from initiation to policy finalization, and beyond, for instance into the formulation of sub-national implementation plans. Scenario-guided policy processes also allow for social inclusion and the contribution of a diversity of relevant perspectives from different governance levels, enhancing their ability to help vulnerable groups as well as their social acceptability.

Implementation strategy, scaling extent and costs

Socio-economic and climate scenarios were created for a Southeast Asia region encompassing Cambodia, Viet Nam and Lao PDR, together with a range of regional stakeholders, based on an analysis of interacting drivers. The process was co-led by two global partners: the UN Food and Agriculture Organization and the UN Environment Program's World Conservation Monitoring Centre. This regional scenario development process formed a starting point for conversations with policy makers about policy processes that would benefit from scenario-guided analysis and development. These scenarios were quantified using two agricultural economic models, IMPACT (Rosegrant and team, 2012 and GLOBIOM (Valin et al. 2013) and linked to the IPCC's new scenario sets (O'Neill et al. 2014).

Cambodia's MAFF was involved in this scenario process and invited the CCAFS scenario project to 1) help them use the scenarios to develop their CCPAP and 2) integrate scenario-guided planning into MAFF processes. The CCAFS regional scenarios coordinator was invited to join the CCPAP development team, which included UNDP (one of the key donors for the plan)'s national climate point. She organized several internal trainings where the scenarios were used to identify priorities for the CCPAP, and the familiarity of the policy writing team with scenario methods was enhanced. As a result, the draft of the CCPAP included recommendations from the scenarios, key concepts such as Climate Smart Agriculture (CSA) and food systems, but also a section on 'integrative activities' that includes scenario-guided planning and land use mapping methods. This draft as well as CCAFS scenarios and modelling outputs and methods, plus CCAFS CSA tools and research were subsequently presented and approved at a dialogue session with 100 national experts and representatives of donor organizations, shortly after which the final version of the CCPAP was signed. Next, CCAFS was involved in discussions around implementing the training in scenario planning and other integrative activities, as well as general issues of implementation. CCAFS has supported the MAFF in further fundraising related to the CCPAP. Furthermore, in a meeting co-led by CCAFS and UNEP WCMC, the CCPAP was reviewed by potential non-state partners to suggest how they could support the implementation of the plan.

In terms of scaling out and up, a number of points are important in this process:

- The creation of as single set of regional scenarios, to be adapted and used in multiple policy guidance processes, means that it is easy to scale out the process to all countries in the region. And although the CCPAP case was the first be engaged with in Southeast Asia, other cases followed, like CSA investment planning with FAO in Viet Nam, a review of Viet Nam's agricultural development police, and an evaluation of the socio-economic development plan in LAO PDR.
- The involvement of global partners FAO and UNEP WCMC means that there is added potential for scaling up. In fact, the UNEP WCMC project coordinator went on to integrate scenario planning as a tool into UNEP's central strategic plan. An important part of the up-scaling strategy of the scenarios project is to support the mainstreaming of scenario methods in global partners.
- The process can also build on success related to one policy or plan to engage with other policies in the same country – another form of scaling out.
- Building internal strategic planning capacity in the MAFF, both in the CCPAP's development and as an integral part in the plan's agenda, is a form of scaling up – moving skills from the research organization to government, where it can be applied into the future.
- Helping to find complementary funds and roles for non-state partners is a further out-scaling element.
- Support for sub-national scenario-guided development of implementation plans represents down –and out-scaling – taking the plan from central government to the targeted regions, increasing the involvement of less powerful actors and the likelihood that the plan will benefit Cambodia's population.
- Importantly, the scenario-guided policy process is itself a mechanism for scaling up other CCAFS research, as evidenced by the opportunities to include CSA approaches in policy.
- The costs of the basic process for the research organization were around 100K USD for personnel and some co-funding of the primary workshop. Partners provided significant additional process funding; and the up-scaling and sub-national down/out-scaling of scenario methods is budgeted at 8 million USD in the CCPAP. This means that the majority of funds needed for the process is leveraged with partners.

Challenges to scaling out and up and strategies to address them

The three main challenges for scaling up and out scenario-guided policy formulation have been identified as follows:

Challenge 1: Leveraging the potential of scenario-guided policy formulation as an up-scaling mechanism for other research.

While scenario-guided policy formulation has proven effective as a standalone method for policy guidance, there is potential for increasing its use in the linking of research, and research planning, conducted at lower levels into policy. The CCPAP already demonstrates this – CCAFS research was presented and linked to the CCPAP in its development. But further integration could be possible. An example is a process conducted by the scenarios project in Burkina Faso where the CGIAR research agenda for the country is developed together, theme by theme, with the National Plan for the development of the Rural Sector, and reviewed together using tailored scenarios. The main inhibiting factor is that the timing of research results and planning/agenda setting does not always coincide with policy cycles. Game-changers are individuals in governments as well as in research organizations who are willing to combine planning efforts.

Challenge 2: Developing capacity in scenario-guided planning with governments and partner organizations is time-intensive

The basic concept of using multiple scenarios for planning is simple, and the approach, though often representing an unfamiliar way of thinking, can be highly accessible to participants when facilitated well. However, training individuals in partner organizations and in governments to run high-quality scenario processes is more difficult and requires a number of skills, including critical systems thinking (Midgley, 2000), multi-dimensional knowledge of the subject matter, specific facilitation skills and the ability to convene the appropriate groups of stakeholders and take them through an intense scenario development and use process.

In addition, scenario planning, with its focus on engaging with uncertainty and complexity, goes against forecasting-style approaches that seek to limit or partly ignore/discount uncertainty (Ramírez and Selin 2014). Because it offers a systems approach, it also attempts to move beyond policy and research silos. These approaches are often still dominant among governments and some partners and substantial shifts in thinking are required.

This means that training individuals in partner organizations and governments is time-intensive; a well-rounded set of scenario skills usually comes only by having gone through and co-facilitated a number of such processes.

To tackle this challenge, training programs in the scenarios project aim to recreate true process conditions as faithfully as possible. This includes learning methods by immediately having to facilitate them and role-playing difficult characters that have to be managed. Another approach is that in each scenario process, those who are seeking training in scenario facilitation are immediately involved in facilitation with strong guidance from more experienced process leaders. On-going mentoring schemes with staff in governments and partner organizations can also be part of the up-scaling approach. Game-changers are individuals in governments or partner organizations who have or discover a particular aptitude to scenarios and systems thinking and are able to communicate the principles and practice well to others.

Challenge 3: Maintaining continuity in processes when mobility of government/partner personnel is high.

Scenario-guided policy formulation is a highly experiential process built on intense collaboration and relationships with policy makers, and this is especially the case when a strong focus is placed on enhancing strategic planning capacity. Because scenario-guided planning is a new way of approaching policies for most members of government, by far the best way to understand it is by going through such a process. However, individuals in governments are highly mobile, and often move away to other sectors or other government departments.

To deal with this challenge, the research team has to stay in close contact with multiple members of a ministry or department, be aware of personnel changes, and quickly introduce new individuals into the approach and the results generated with their predecessors. This is particularly important when personnel changes happen in the middle of a policy formulation cycle. A complementary strategy is to capture the process in as much detail and as experientially engaging as possible, notably through video and visualizations. Nonetheless, the fact that these new individuals cannot fully revisit the preceding process will be a limiting factor. Game changers can be those in the research organization tasked with maintaining partner relationships who quickly identify personnel changes; and potentially

relationships with those involved in attracting new individuals to a given position, to try to ensure that systems thinking and scenario skills are considered in the hiring process.

Additional challenges are:

- Scenario-guided policy formulation processes are time-intensive, requiring frequent collaboration with policy makers over the entire policy development, and beyond, by scenario experts with strong regional networks – this limits the number of such processes that can be engaged with unless more personnel is involved.
- Policy formulation processes that are strongly built on bottom-up inputs from large groups of community and sub-national representatives are time -and resource-intensive compared to processes that mainly engage national stakeholders or a small set of stakeholders from different levels.
- Large-scale on-line engagement with scenarios is challenging, because these processes depend on expert facilitation and the benefits of live interaction with others. Scenario-based games offer a potential solution.

Discussion

The use of scenarios for planning is particularly useful from a scale-sensitive perspective, because scenario methods are scale-independent and can be developed from community to global levels. Scenarios can also connect subject matter and strategies across different levels, integrating scenario elements about household-level adaptation with drivers of global change (Zurek and Henrichs 2007). Scenario methods are also applicable to a wide range of different topic areas, and provide an opportunity for integrative analysis of challenges and strategies. In terms of CSA, they highlight interactions between climate change and other drivers. They allow decision-makers to engage with climate and other uncertainties while empowering them through an explicit focus on what can be done under these different futures.

Scenario-guided policy formulation is mainly useful for policy processes that aim at the middle to longer term, typically from around 4-5 years and beyond – though scenarios are used to set a longer-term context for shorter-term policies.

Concerning the three highlighted challenges:

- The combination of scenario methods with other types of research content and processes highlights the fact that scenarios are themselves an up-scaling mechanism. Scenario processes are also strengthened by a combination with other types of research results and methods.
- Capacity development with partners and governments is a key mechanism for (further) up-scaling – this requires a significant allocation of resources to training and mentoring processes because of the steep learning curve for scenario process organizers and facilitators.
- The involved nature of scenario processes makes translation of their benefits to those not involved in the processes a challenge – new forms of on-line engagement and participatory game design can be valuable to overcome barrier.

General challenges

High transaction costs involved in reaching individual farmers or creating structures to reach groups of farmers with new CSA technologies or practices

The challenge here is primarily related to the long process from policy formulation to effective implementation, and therefore mostly related to challenges 2 and 3 (building capacity and maintaining continuity). Scenario processes can be helpful both by ensuring policies are more realistic and

concrete; and by guiding national and sub-national implementation plans. Nevertheless, the gap between implementation planning and reaching individual farmers remains.

Farmers risk minimization strategies and urgent needs versus high transaction costs and long term impact of implementing CSA practices

The benefit of engaging directly with policy formulation is that enabling conditions can be created that make it easier for farmers to engage in implementing CSA practices. This relates to scaling challenge 1 – research and tools for CSA practices can support scenario-guided policy.

Political, institutional and economic barriers (getting institutional arrangements, policies, economic incentives right)

This is the key challenge that scenario-guided policy formulation seeks to address, and it relates most to challenges 2 and 3 (building capacity and maintaining continuity) in the case. Scenarios can be used to engage with specific policies, but strong internal strategic planning capacity in governments and other organizations is needed to help create change in a wide range of policy and institutional arrangements.

Trade-off across scales and poor targeting: What works at one scale will not necessarily work at another and what is good for some interest group is not automatically good for others

Scenario processes are flexible across scales and can support multi-level thinking and dialogue. However, such multi-level processes require capacity development, time investment and continuity and therefore this challenge is related to challenges 2 and 3.

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Project Links

Blog story on Cambodia: http://ccafs.cgiar.org/blog/future-scenario-development-now-part-cambodias-action-plan-agriculture#.VNUQjZ3F-So

Blog story on Honduras: https://ccafs.cgiar.org/blog/helping-honduras-build-more-robust-climate-adaptation-strategy-agriculture-sector#.Vbc3Z_mqqko

2013 review of scenario process: https://cgspace.cgiar.org/bitstream/handle/10568/34994/Evaluation%20Report%20Final%2018%20Feb%2014-1.pdf

CS9. Climate-smart villages in South Asia

P.K. Aggarwal[24], A. Khatri-Chhetri[25]; M.L. Jat[26], P.K. Joshi[27], P.B. Shirsath[28]

Description

A range of technological, institutional and policy options have been proposed by researchers and others to help agriculture become climate-smart. These include changes in agronomic practices, weather insurance, weather forecasts, agricultural diversification, stress-tolerant crop varieties, community management of soil and water resources, and policies related to water, energy and carbon management. Many of these interventions have been successful individually in raising production and income and in building resilience of farming communities in several regions. These interventions have, however, varying costs and economic impacts, and their implementation requires appropriate investment decisions in both on-farm capital and for wider agricultural outreach programmes. The evidence base for many of these interventions at a large scale need to further explored. There is a need to maximize synergies among these interventions as well as minimize trade-offs.

CGIAR-CCAFS, in collaboration with national programmes, is partnering with rural communities to develop Climate-Smart Villages (CSVs) as models of local actions that ensure sustainable increase in food security. Researchers, local partners, farmers' groups and policy makers collaborate to select the most appropriate technologies and institutional interventions based on global knowledge and local conditions to enhance productivity, increase income, achieve climate resilience and enable climate mitigation (Aggarwal et al. 2013). The key focus of the Climate-Smart Village model is to enhance climate literacy of farmers and local stakeholders and develop climate resilient agricultural system through linking existing government's village development schemes and investments. Climate information is an important part of the model (Figure 1). The model also put emphasis on the involvement of existing community groups consisting of farmers, village officials, civil society organizations, local government officials, community based organizations (e.g. water user groups, forest user groups, and micro-finance institutions), private sector and researchers from the national agricultural research systems (NARS) in design, implementation and monitoring of CSVs.

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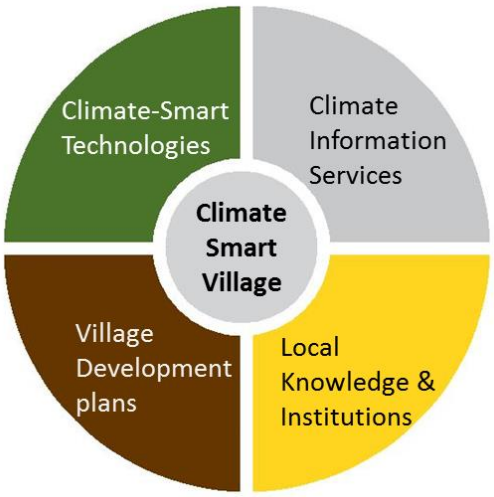
Figure 1. Components of Climate-Smart Village



There is no fixed package of interventions or a one-size-fits-all approach - they differ in content based on the region, its agro-ecological characteristics, level of development, capacity and interest of the farmers and the local governments. CCAFS does a lot of research in terms of understanding through farmer typologies which intervention works where and why. CSVs are currently being piloted in several countries in South Asia, East and West Africa, South-east Asia and Latin America. In South Asia, CSVs are being piloted in Bangladesh, India and Nepal.

Achievements

Evidences of CSVs: Data and interviews with farmers in Haryana, Punjab and Bihar indicate considerable potential of climate-smart agricultural interventions in crop yield, farm income, input use efficiency and emissions and synergies and trade-offs among them (Aryal et al. 2015, Jat et al. 2014, Sapkota et al. 2014, Khatri-Chhetri et al, 2015 (accepted), Sapkota et al 2015 (accepted)). These are based on several participatory on-farm trials conducted in farmers' fields over a period of last few years. Further evidences of CSVs from Bangladesh, other parts of India and Nepal are also being gathered and documented.

Development of partnership: A major outcome of this CSV approach has been that CSVs approach is helping to bring together different CGIAR centers, NARS and private sector came together for participatory evaluation of diverse CSA technologies in farmer's fields. CSV in South Asia are also becoming learning platforms for many for climate-smart interventions in agriculture. Many farmers, government sector officials, NGO/INGOs and private sector organizations are frequently visiting CSV pilot areas.

Investment and scaling out/up: International organizations, national and state governments have shown keen interest to invest and scale out CSV approach in various locations. In India, CSV are currently being piloted in 75 villages in Haryana, Punjab, and in Bihar. These include interventions related to tillage, planting methods, diversification, water and nitrogen management individually or in various combinations based on farmer's choice. Based on the evidence created, it is planned to implement the CSV approach in Maharashtra tribal regions (1000 villages) and Haryana (500 villages) with seed money grant from the state Government. The encouraging results are now being replicated at large scale in Nepal (15000 farmers across a few districts) through a funding support from IFC. CDKN has also funded to pilot and prepare CSA scaling out plan with CSV approach in collaboration with government of Nepal. LI-BIRD Nepal is piloting solar power based CSVs in 5 drought and flood prone areas through women cooperative groups. The Council of Renewable Natural Resources Research, Ministry of Agriculture and Forestry is piloting CSVs in Bhutan too.

Challenges to scaling out and up and strategies to address them

Although resilience to climatic risks, adaptive capacity and mitigation are of interest to most stakeholders, smallholder farmers having agriculture as the key livelihood option remain more focused on current farm income.

STRATEGY: Generation of science based region specific evidence that CSA\CSVs while increasing income for farmers can also provide co-benefits in resilience, adaptation and even mitigation.

KEY INHIBITING FACTOR: Limited evidence base for individual CSA interventions and bundled ones in CSVs for sub-national and national level.

KEY ENABLING FCTORS: Viable business models around CSA/CSV approach to address the goals of stakeholders.

GAME CHANGERS: Persons with a larger integrated vision of agriculture; value added to CSA components beyond production.

There are issues related to awareness, accessibility, affordability, agro-ecological targeting, and opportunity costs for investments for several CSA interventions such as water harvesting, solar pumps, ICT, and nutrient sensors for smallholder farmers.

STRATEGY: On-farm demonstrations of CSA; Capacity strengthening of farmers, industry, and government officials through site visits and participatory videos, farmer typologies and agro-ecological assessment for targeting.

KEY INHIBITING FACTOR: underdeveloped market for CSA and high risk of investment; limited capital for agriculture in developing countries; poor infrastructure of weather monitoring.

KEY ENABLING FCTORS: promotion of supply driven market (e.g. solar power) and farm typology based technologies and targeted evaluation of portfolio of CSA practices and technologies.

KEY GAME CHANGERS: policy makers, technicians and private sector.

Integration of CSA into current policies and schemes relating to agricultural development and climate change

STRATEGY: Increasing the capacity of policy advisors to mainstream CSA/CSV approach into existing local development and poverty alleviation policies/schemes.

KEY INHIBITING FACTOR: lack of science-policy dialogue, demand (policy) – supply (evidence based plans/programme) mismatch, limited institutional arrangements to organize farmers both in India and Nepal.

KEY ENABLING FCTORS: keenness of governments to insulate agriculture from climatic risks; engagement and networking with a multitude of stakeholders in the policy design and implementation process, supply of science-based complete package of CSV programme.

KEY GAME CHANGERS: Evolution of PPP models; committed bureaucracy, policy makers and scientists.

Inclusion of marginalized and socially disadvantage groups

STRATEGY: Mainstreaming marginalized and socially disadvantaged groups in CSV development processes.

KEY INHIBITING FACTOR: Prevailing cultural norms and practices, lack of clear impact pathway.

KEY ENABLING FCTORS: training and capacity building.

KEY GAME CHANGERS: local women leaders, community based organizations.

Discussion

To scale-out and up we are following two pronged approach- building evidence for CSA in a participatory manner and developing policies and institutions around these evidences. Since large scale implementation of CSA necessitates involvement of government agencies, we have made a deliberate attempt to understand the decision making process of the policy makers. Policy makers in any country deal with policy and developmental issues typically around administrative units such as states, district and villages and not ecological units such as landscapes. They are thus easily able to relate the efforts to the Climate-smart villages in terms of geographical location, numbers and their priority regions. CCAFS efforts of creating evidence base for CSVs through integrated evaluation of CSA interventions in pilot regions thus become easily saleable horizontally and vertically by the government agencies as well as other development partners. For this reason, in our pilots local, sub-national and national government agencies and other stakeholders are engaged in the process of setting up CSVs right from the beginning.

CSVs generates strong evidence base through its collaborative and participatory research. CSV interventions are tailored to local conditions and are often designed with farmers using participatory techniques. Capacity building and detailed portfolio assessment is an integral part of the process. The targeting portfolio of CSAPs with a community based approach (CSV) will help in assessing (i) if x, y element is missing from the portfolio of technologies, what effect it will have on household food security vis-a-vis (ii) what will be return over investment if interventions are targeted in isolation or as a portfolio at field/household/community/cluster/district/sub-national/national level and hence help planners to prioritize investments with multiplier effects.

For scaling out with policy makers, we have adopted five pronged strategy: (1) sensitizing senior bureaucracy and political leadership about CSVs, (2) converging various existing government programs those contribute in overcoming risk of climate change, increasing farm incomes, and reducing GHG emission, and packaging to brand CSVs for upscaling, (3) developing new programs on CSVs at sub-national levels (e.g., using National Mission on Sustainable Agriculture in India) for allocating financial resources for upscaling, (4) developing course modules on Climate Smart Agriculture for master trainers, and (5) exploring financing opportunities (other than government) for upscaling CSVs such as through Farmer Producer Organizations, contract farming and cooperatives.

General challenges

High transaction cost: size of landholding is too low in India and Nepal; 85% in India and >90% in Nepal are smallholders (<2 ha land). Their transaction cost in accessing technologies, services, finance and insurance is very high due to small and fragmented land holdings. Transaction costs of financing and insurance institutions are also too high to deal with tiny holdings, credit, and insurance.

Farmers risk minimization strategies: focusing more on water harvesting and stress tolerant crop varieties. Also promoting community based insurance to minimize risk of farmers due to crop loss, reduce transaction cost of the insurance company, and improve transparency in claim settlement.

Political, institutional and economic barriers: Lack of awareness about CSVs, unorganized farming, and financial constraints are obstructing promotion of CSV concept. Our approach is to undertake policy advocacy, organize farmers through existing innovative institutional arrangements, and explore donors (national, international and private sector).

Trade-offs: there is trade-offs in adopting various climate smart practices. We prioritize those based on farmers' preferences and their willingness to pay. We are also prioritizing investment on different climate smart options across different landscape for better targeting and higher impacts.

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CS10. Policy Engagement: a strategy to make science a game changer in the Central American political arena

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Description

Assuming that better informed policies in Central American countries that include a CSA approach will contribute to the improvement of smallholder farmers' livelihoods, CCAFS began to interact with relevant regional and national institutions adopting a policy engagement strategy. This strategy was focused on enabling the environment in order to incentivize policy formulators and decision makers to use scientific outputs as inputs when defining governmental actions to alleviate smallholder farmers' needs in the face of climate change and variability.

Cases in Honduras and Guatemala will evidence how CCAFS policy engagement strategy has already contributed to make changes within Central American policy formulators who are focused mainly on food security and adaptation, although understanding the consequences of various agricultural activities in terms of greenhouse gas emissions has also been relevant. The strategy started by connecting key institutions in order to identify potential synergies. During this process, the engagement with partners became stronger and credibility of CCAFS potential and strategic capacity was acknowledged each time more among key stakeholders in the region.

The policy engagement strategy had two key components: co-creation and leverage. The State of the Art on Climate Change, Agriculture and Food Security documents made possible to have a strong link with the Ministries because of the involvement and co-creation between them and CCAFS. This scheme was also applied to specific collaborations that were requested by the same Ministries. In these collaborations, the leadership of the processes was taken by them and CCAFS role was to be their technical support. In order to achieve appropriation and ownership, CCAFS made special emphasis on identifying leverage points that were useful for specific tasks of Ministries technical teams, as well as to include topics that were prioritized in the national agenda.

In Honduras the engagement began with the elaboration of the State of the Art document which made possible for the Secretariat of Agriculture and Livestock (SAG) to identify national priorities regarding climate change, agriculture and food security, focusing on climate risks management. The identification of priorities was key to articulate not only national institutions but also the international cooperation. Given that Honduran government evidenced CCAFS as a key collaborator, they were interested in taking advantage of its capacity and proposed a collaboration in order to strengthen the National Climate Change Adaptation Strategy for the Agricultural Sector. The collaboration with Honduran government went beyond the formulation of the Strategy and continued by helping the government to seek coherence among local policies and the National Strategy through the downscaling of CCAFS Socioeconomic Scenarios.

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The State of the Art document was also made jointly in Guatemala with the Ministry of Agriculture and Livestock (MAGA) and, as in the case of Honduras, it made possible to strengthen trust among CCAFS and the Guatemalan government. Since drought events are a priority for MAGA, CCAFS worked jointly with Bioversity and other key partners to support the government to adopt a participatory simulation as an approach for climate disaster preparedness. This approach allowed the government to design a response plan with efficiency and few resources. The adoption of this approach was the result of a significant policy engagement process with high-level staff showing them scientific evidence of damages in relation to climate-induced food security crises and benefits of developing an approach of participatory simulations.

The number of potential farmers that could be reached by this policy engagement strategy is around 4.89 million (3.95 million assuming that the National Climate Change Adaptation Strategy for the Agricultural Sector in Honduras will affect the total rural population of this country and 0.9 million farmers assuming that the response plan implemented in Guatemala will have a positive impact on all farmers affected by severe draughts in this country).

The total resources invested in this policy engagement process were close to US$0.68 million.

Challenges to scaling out and up and strategies to address them

Continuous changes of government staff in Honduras.

The co-elaboration between CCAFS and SAG of the State of the Art document was key to overcome this challenge. The document was elaborated jointly with José Luis Moncada, who was the Climate Change Unit Coordinator in SAG in 2013 and early 2014. Given that SAG recognized this document as theirs and it was used to identify priority topics within SAG's national agenda, the incoming staff led by Ivette Velazquez since mid-2014, took over the portfolio of activities and decided to continue working with CCAFS as one of its' key partners.

Even though the new staff had different points of view compared to the previous one, CCAFS' constant engagement with SAG supported by the Central American Agricultural Council (CAC) Executive Secretary made possible the adjustment of the agenda in order to guarantee the continuation of ongoing actions but also the incorporation of activities that responded to SAG's new working plan.

Overcoming this challenge was also enabled by the fact that Honduras was classified as the most vulnerable country to climate risks events for the past 20 years according to the Germanwatch 2014 report (Kreft & Eckstein, 2013). Also, the Climate Change Committee in Honduras, which is an inter-institutional platform where climate change related topics are discussed and articulated across the government, was key in overcoming this challenge. The Committee was aware of SAG's on-going agenda and informed the new staff of its previous advances. Since the National Adaptation Strategy was elaborated before the change in staff, it was easy for the Committee to keep track and move forward the process with the new staff in order to include the local perspective into the strategy using CCAFS socioeconomic scenarios. However, difference of perceptions and ways to work were inhibiting factors that made difficult overcoming the challenge as the staff was changing.

In 2015 Ricardo Peña, Planning Director of SAG, assumed the leadership of the Climate Change Unit and based on the previous collaborative work decided to work closely with CCAFS and prepared a delegation to visit Colombia. SAG had the chance to talk with CCAFS partners and scientists and

could understand the variables that enabled the success of Colombia on tackling various topics such agro-climatic forecasts, long and short term adaptation, CSA technologies, among others, and how it could be applied in the Honduran context. As a result of this visit, SAG elaborated an agreement in order to provide an official framework to start working in major activities supported technically by CCAFS scientists.

Moving from a workshop to actual policy influence in Honduras.

Through constant interaction between CCAFS and SAG several CCAFS tools were shared. The socioeconomic scenarios methodology generated special interest since SAG was in the process of formulating its National Climate Change Adaptation Strategy for the Agricultural Sector. Therefore, given the trust and knowledge of CCAFS capacities, SAG asked CCAFS to support them by using the socioeconomic scenarios to evaluate their climate change strategy and include the local perspective to make it stronger.

The big question was how to move from a workshop where socioeconomic scenarios were created to really influencing policy in Honduras. The strategy was to take advantage of the positive environment in the political arena with respect to climate change and agriculture in the country, to use the successful experience of the previous work on the State of the Art document and to adapt the scenarios methodology to respond to SAG needs in terms of adjusting their National Strategy to a local scale keeping the participatory emphasis which was one of the key aspects that captured SAG's attention in the first place. SAG understood this new methodology as a way to receive feedback from the local perspective but also as a way to get the local representatives involved in the formulation of the National Strategy and make them feel part of the process. The latter helped SAG to apply its Strategy at a local scale avoiding what is very common in this type of processes: having a document elaborated at the national level with deep obstacles to be implemented.

The key inhibiting factor throughout this process was the rigidity of some government staff with respect to the way of doing things. The usual mechanism to formulate policies at the national level is within the national institutions without taking into account regions or local levels. It was challenging to make SAG take an alternative path (different to the business as usual model) regarding policy formulation. However, once the workshop was done, the participants understood the importance of involving local actors in the process and continuing asking CCAFS for more support in this matter.

This challenge was possible to overcome also due to the quality of the leaders that were involved in SAG within these topics: starting with José Luis Moncada and then Ivette Velazquez who led the process of positioning the topic and CCAFS strategic partnership into the agenda and then Ricardo Peña who, given his position as Planning Director of SAG, led the elaboration of an Agreement to formalize the alliance between CCAFS and SAG.

Making Guatemalan politicians believe in science.

Drought is one of the extreme climate events that is affecting each time more Central America, particularly the Dry Corridor. However this has not been relevant enough to capture the attention of politicians in order to address those needs using as an input scientific outputs. This was the challenge for CCAFS and its partners including Bioversity and ACF (Action against Hunger).

Given that MAGA had already developed protocols to address drought events, the strategy to address this challenge was to engage with policy makers in two directions. First, by framing the scientific evidence attractive enough to capture MAGA's attention. The idea was to develop strong enough

arguments in order to convince MAGA that they needed to use the protocols already established and that through a simulation, they could understand the impact of adopting a preventive behavior for the upcoming drought events. The arguments included presenting the reduction of resources invested because of the early response, and the information to design an efficient recovery portfolio of measures after the event. The second part of the strategy was to approach the key staff in the Ministry in order to get the attention of high level key persons, such as the Vice-Minister and by these means, make the simulation an official strategy to respond to drought events in the country. Therefore, there was an important work in terms of generating the information for the key people including topics such as: what is the total population affected in the country by draughts; how MAGA, by allocating few resources, could alleviate the negative impacts for a significant number of people; and which crops could be more affected by the drought. At the end, MAGA devoted some resources to do the simulation and the Minister declared that drought simulations should be done regularly in the Dry Corridor of Guatemala.

The need of engaging into lobby in order to get the Vice Minister's attention and getting involved in the country's bureaucracy was a factor that made the achievement of the outcome a challenge, however the skills of the researcher leading the project, Vesalio Mora from Bioversity made that factor an advantage. The dramatic situation generated by the extremely dry period occurred in 2014 in the Dry Corridor made easier to capture the Ministry staff attention because this was a priority for the country.

Discussion

Continuous changes of government staff in Honduras. It is very important to keep in mind that the strategy used to overcome this challenge does not necessarily work exactly the same way in all cases. In general, it needs a lot of dedication and time in order to generate trust among the parties. The latter is relevant given that the emphasis is on making the Ministry a leader of the process and results. It is also important to consider the internal structure of the Ministry, how it works and what is its' perspective to approach the topics of interest. This approach works better where there are supranational institutions that enable the environment and support the creation of discussion spaces to deal with specific priorities for agriculture and climate change issues. This is the case of CAC, which was the door to enter into the Ministries of the region and was a fundamental body to help strengthened the relationship between CCAFS and the Ministries each time that there was a change in staff. Finally, it is important to take into account two things: first, it is key to make sure that Ministries truly understand the value added that CCAFS collaboration generates for the institution and the professional evolution of the staff and second, it is essential to consider that, for example in Latin American countries, working teams within the Ministries are very small, and this means a big burden on the time that staff can devote to working together with research programs such as CCAFS.

***Moving from a workshop to actual policy influence in Honduras*.** This approach works when the government body in charge of formulating a policy is willing to listen to other bodies at different scales in order to strengthen its policies; when the government is ready to get involved in participatory methods and to make a change in the way the policy formulation is usually done. Therefore, a proactive change behaviour within Ministry staff is needed in order to rethink processes already done and improved them with inputs from other institutions at different scales.

***Making Guatemalan politicians believe in science*.** It is key to be aware of opportunities in each of the countries by keeping permanent communication with national contacts within the Ministries and relevant institutions. In the case of Guatemala, MAGA needed immediate information to face an upcoming drought event and since CCAFS knew that, it was able to provide an alternative tool to respond to this type of emergencies. It is key to take advantage of opportunities like this, a context where the Ministry has a problem to resolve and CCAFS can provide a solution or can be part of it.

General challenges

All three challenges discussed can be categorized within *Political, institutional and economic barriers* generic challenge, due to the fact that there are often political barriers that determine the way to work with government institutions, such as Ministries of Agriculture. For example, institutions are highly affected by the constant staff changes in Honduras in order to achieve goals and implement even short-term actions. Also, changing the business as usual way to formulate policies requires an important effort in terms of overcoming political barriers persuading key government staff through scientific evidence. Finally, high levels of bureaucracy often challenge scientists in order to make their science useful in the political arena. This is the case of Guatemala, where getting closer to the Vice-Minister implicated several attempts but convincing him of the importance of implementing periodic simulations for drought events was also difficult. Strong bonds with supranational and national institutions interested in climate change and agriculture discussions are key to overcome these challenges but also building up the trust in terms of positioning CCAFS as capable to provide useful inputs for their decision making process.

Addressing *Trade-off across scales and poor targeting* has been a challenge, not only because of the different scales of implementation but also because of the disconnected communication within national and local government institutions. However adapting CCAFS methodologies, such as the socioeconomic scenarios, and bringing to the discussions stakeholders from different scales, has been a useful strategy to address the challenge. The methodologies are used to informed national decision making processes but they are validated at a local level to ensure that they are context grounded and possible to implement. CCAFS role has focused on facilitating processes by gathering key people from different disciplines, institutions and sectors that can contribute and need to be involved in the discussions on climate change and agriculture.

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Project Links

Estatus de la gestión de riesgos climáticos en el sector agroalimentario y su importancia para la seguridad alimentaria y nutricional en Honduras (Status of climate risk management in agricultural sector and its importance for food security in Honduras) published by CCAFS, DFID, Observatorio Regional de Innovaciones Tecnológicas, ASOCAM and Agrefeeds

Presenta estrategia hondureña en cambio climático a líderes campesinos de CA (Honduran climate change adaptation strategy is presented to farmer leaders of Central America). Article published by SAG communications office

Estado del Arte en Cambio Climático, Agricultura y Seguridad Alimentaria en Guatemala (State of Art on Climate Change, Agriculture and Food Security in Guatemala) published by DIFID, ASOCAM, AGRIFEEDS, San Carlos de Guatemala University, IISD and CCAFS

Nuevo proyecto aborda las preocupaciones sobre sequía en Guatemala (New Project addresses issues in Guatemala related to droughts) published by CCAFS.

CS11. Doing it Right - Up-scaling Alternate Wetting and Drying (AWD) Technology in Vietnam

L. Sebastian[31] and N.D. Minh[32]

The AWD in rice was developed as a water saving technology in the late 1990s and has since been promoted in many areas in Southeast Asia. Lately, AWD has also been found to be effective in reducing up to 40% of methane emissions compared to continuously flooded irrigated rice systems (Wassmann et al. 2010). This technology is very important because methane emission from irrigated rice in Vietnam is estimated to be about 41 million tons CO_2^e per year (46.5% of agriculture emission) (MONRE, 2014). Considering AWD's benefits from methane emission reduction, it is now promoted by development projects and included in the National Green Growth Strategy, National Action Plan and National Target Programme on Climate Change Response. Despite this, however, the widespread adoption of AWD as mitigation measure is still limited (Table 1).

Table 1. Estimated area coverage of AWD used as a water saving strategy in Vietnam as of 2009

Regions	Partial AWD area (ha)[1]	Full AWD area (ha)[2]
Northern Highlands	9,125.2	2,125.2
Red River Delta	155,688.6	36,568.6
North Central Coast	20,159.1	3,509.1
South Central Coast	9,329.1	1,309.1
Central Highland	0.7	0.7
Mekong River Delta	50,962.7	8,615.4
Total	**245,265.5**	**52,128.1**
	7.8% Irrigated areas	1.7% Irrigated areas

1. Partial AWD: On-farm systems, partly control, apply some crop seasons;

2. Full AWD: Complete system, full control of water delivery & drainage and apply AWD for every specific crop season. Source: Directorate of Water Resources – MARD, Jan 2015).

To address the scaling-up challenge, two projects (one CCAFS Flagship and another CCAC funded) led by IRRI focusing on Vietnam are currently being implemented. The expected outcome of the two

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projects is the strengthened capacity of various stakeholders (farmers groups, irrigators / water management & exploitation of hydraulic organizations, local agriculture office, and water resources department and government ministries) to plan, innovate, incentivize, invest, and regulate implementation of AWD as part of an integrated Climate Smart Agriculture (CSA) strategy. The theory of change is that augmenting knowledge and testing practice in the areas of 1) emissions reductions for diverse settings, (2) best practices and policy priorities, (3) incentives for farmers, and (4) enabling conditions for farmer innovation, done together with agricultural development stakeholders will catalyse investments and actions by stakeholders at the country and multilateral levels. The projects' theory of change is composed of three pillars: (1) stakeholder engagement, (2) knowledge sharing and innovation, and (3) catalysing policy and investment for implementation. The project's strategies includes the following 1) Engage farmers in participatory mitigation selection (PMS), allowing them to decide freely on low-emission crop management options that are suitable to their locale- assessing the co-benefits of mitigation techniques alone and when combined with other techniques. 2) Identify where AWD as a mitigation measure is effective under current irrigation infrastructure and where it will work with improved irrigation infrastructure; 3) Improve information support up-scaling and link policy partners with policy makers. Link CCAFS FP4 project with CCAC project to ensure that well-established network with policy maker is taken advantaged. 4) Strengthen capacity (through trainings, workshops, field visits) of local extension services to enable local policy makers to implement successful mitigation strategies. 5) Integrate mitigation objectives into agriculture modernization plans and rehabilitation programs of the government and development organizations, e.g. for irrigation infrastructure. 6) Undertake an analysis of national climate change actions plans, and the development of a "rice component" that will be integrated into the NAMAs (Nationally Appropriate Mitigation Actions). The target area for the application of AWD as a mitigation measure by 2019 is 500,000 hectares in Vietnam and the development of a low emission plan integrating AWD that will have significant mitigation potential by 2025. The two projects will invest about USD2.5 million in the next 4 years.

Challenges for up-scaling

The key challenges in up-scaling AWD are following: 1) Identifying areas where AWD as a mitigation option will work and can be up-scaled; 2) Making farmers recognize the benefits of AWD viz-a-viz perceived added cost and risk; and 3) Developing effective collaboration among various stakeholders involved in irrigation and on-farm water management. Here we consider the three challenges in detail.

Identifying areas where AWD as a mitigation option will work and can be up-scaled. Currently, there are constraints in irrigation systems' infrastructure that limits the widespread application of AWD in Vietnam. The lack of distribution and drainage canals, and pumping station in many places allows for application of AWD in one season only (e.g. during winter spring rice season). This can be overcome by the development of more distribution (tertiary) and drainage canals from the main/secondary canals, and pumping station to reach inner and elevated fields. This is not easy, however, because of lack of funds. Government investments are focused on constructing main and secondary canals only with the irrigation company taking care of the distribution canal development. Furthermore, there are areas where AWD will not result in substantial methane emission reduction or where draining is not recommended (e.g. actual acid sulfate soils). Under this condition, developing

a suitability map that considers the available irrigation infrastructure and biophysical characteristics (i.e. soil, rainfall, evapotranspiration, seepage, and percolation) of the irrigated areas in Vietnam will be important. Furthermore, there is also a need for more confidence in estimated GHG reductions for both methane and nitrous oxide across a range of rice systems, agro-ecosystem zones, and farmer conditions.

Making farmers recognize the benefits of AWD viz-a-viz perceived added cost and risk (declines in yields from pest infestations, drought). Many farmers still practice the traditional water management of keeping the paddy field flooded most of the time. The usual land preparation also does not make the field well levelled (uneven drying). To address this, farmers should be engaged in participatory mitigation selection (PMS) for their locality. This will allow testing of AWD and related practices (AWD+) in more sites under varied conditions, and the effects (co-benefits) of added efficiency in water, fertilizer use, and harvest index can be quantified to identify incentives for farmers (as a no regret option) in addition to yields and GHG emission. Farmers' participation in the "small farmer-large field or large-scale rice field program" will also encourage the farmers to appreciate the benefit of AWD. In this program, farmers, extension workers, input providers, irrigation management & hydraulic exploitation company and rice traders work together in applying "1 must do, 6 reductions" which include AWD. More investment will be needed under this program to increase farmers' knowledge about technical options and support farmer innovation in AWD+.

***Developing effective collaboration among various stakeholders in implementing AWD (Irrigation management & exploitation of hydraulic-works company/irrigator, pump owners, input suppliers, and local farmer groups*).** These groups often have conflict of interest providing no incentive for applying AWD. Hence, improvement of enabling conditions such as secure water sources and water pricing will be essential in engaging these sectors in up-scaling AWD. At the district level, developing policies/regulations for water access and use of irrigation water that encourages and rewards water saving will be desirable. Water user groups (WUG) at the commune or village will have to be organized or strengthened also to better manage irrigation water distribution. The government programs such as "small farmer-large field program" also encourage multi-stakeholder collaboration and promote practices that include AWD.

Addressing the above key challenge is very important for the following reasons:

Identifying areas where AWD as a mitigation option will work and can be up-scaled. Identifying the suitable areas is essential for proper implementation of AWD and in attaining successful scaling-up considering that not all areas are suitable for AWD application as a mitigation option. This will give local extension staff working with farmers more confidence and credibility in recommending AWD to farmers. Successful AWD implementation in suitable areas will help pass on knowledge about AWD in the target areas as well as to motivate other farmers ("farmer-to-farmer diffusion") to try the new technology in their field. Proper identification of suitable areas will improve understanding of where AWD can be introduced or improved to support investment and planning for up-scaling AWD.

Making farmers recognize the benefits of AWD viz-a-viz perceived added cost and risk. Farmers usually adopt technology options or practices that they see will benefit their farming. AWD has multiple benefits (water saving, time & cost reduction for water pumping and irrigation, no yield difference from practice of continuous flooding, fewer insect pests and diseases, large methane reduction), however, farmers have been constrained from adopting it because their

perceptions/experiences that AWD: 1) increase their labour & cost (for herbicide/weeding and rodent management); and 3) increase their risk (more rat, lower yield). Involving farmers in selecting their mitigation options (PMS) and packaging AWD with other complementing technology options and practices (AWD+) coupled with enhanced extension programs (1 must do, 6 reductions) will help them overcome their the perceived added cost and risk.

Developing effective (synchronization and cohesive) collaboration among various stakeholders involved in irrigation and on-farm water management. Wide scale implementation of AWD requires good synchronization and coordination of efforts among various stakeholders involved in irrigation and on-farm water management (farmers, pump service providers, local and national government agencies). Good collaboration will reduce conflicting interests, maximize benefits from AWD, and provide incentives to adopting AWD. This will also allow adoption of regulations and policies that will support implementation of AWD in large scale (i.e. irrigation schedules designed for wide scale AWD implementation in command areas of irrigation systems) and adaption of dissemination approaches to local irrigation system conditions.

The three challenges above relates to the following generic categories of challenge in varying degree as shown in the table below: 1) High transaction costs involved in reaching individual farmers or creating structures to reach groups of farmers with new CSA technologies or practices; 2) Farmers risk minimization strategies and urgent needs versus high transaction costs and long term impact of implementing CSA practices; 3) Political, institutional and economic barriers; and 4) Trade-off across scales and poor targeting.

Key Challenges to AWD Up-scaling	Generic Categories of Up-scaling Challenges			
	1	2	3	4
1) Identifying areas where AWD as a mitigation option will work and can be up-scaled.	x	x	x	X
2) Making farmers recognize the benefits of AWD viz-a-viz perceived added cost and risk.	x	X	x	x
3) Developing effective collaboration among various stakeholders involved in irrigation and on-farm water management.	x	x	X	x
X- main , x- contributing				

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Project Links

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ANNEX 3: Compete Case Study Matrix

	Case study	Demand or supply-led approaches - farmers' objectives	Costs	Delivery mechanism / reach strategy	Barriers addressed	Targeting, trade-offs	Partners and alliances	Capacity development	Cross- scale methods	Learning
VALUE CHAIN AND PRIVATE SECTOR APPROACHES										
CS1	Coffee and Cocoa	Appropriate CSA practices are developed with farmers and other value chain actors. A demand-led approach where a vision for enhance climate resilience and improved livelihoods are defined and relevant technologies and practices implemented	No estimates	Climate change exposure of coffee and cocoa systems assessed at sub-national scale, appropriate CSA practices developed to increase system resilience, practices codified in site specific adaptation guidelines. Aiming for adoption of CSA by 15% of global cocoa producers and 7% of global coffee producers 2019.	The project relies on existing certification and investment networks with proven record of practices and procedures that address barriers.	Develops approaches tailored to the needs of farmers and other value chain actors in a specific set of climatic conditions. Engages with key actors to develop sets of customized CSA practices that can deliver resilience and financial / social feasibility.	Project brings together actors in agricultural climate science (CIAT, IITA), voluntary certification (Rainforest Alliance), impact investing (Root Capital) and sustainable agriculture systems (Sustainable Food Lab).	CSA practice guidelines mainstreamed through existing certification training curricula and used to develop innovative impact investment products.	Works across spatial scales from farm to global level.	Diverse group of stakeholders; game changers/platforms not evident, how will learning / reflection happen (limited to loop 2 on improving within given context); how does capacity strengthening happen.

	Case study	Demand or supply-led approaches - farmers' objectives	Costs	Delivery mechanism / reach strategy	Barriers addressed	Targeting, trade-offs	Partners and alliances	Capacity development	Cross- scale methods	Learning
CS2	Inclusive and sustainable dairy development in Kenya	Analysis and identification of practices and barriers at farm level for adoption of productivity-increasing technologies and management practices. A pull approach. At the stage of involving diverse stakeholders in identifying best practices and designing the NAMA interventions.	No estimates	Engagement of strategic partners that aggregate large numbers of farmers, including government agencies for political support, NGOs, private sector, development partner initiatives and research institutes, to reach 600,000 smallholder farmers.	Object is to develop a NAMA, working with initiatives across different supply chains (quality-based payments in the commercial sector, hygiene and quality training in the informal sector, development of feed quality standards in feed input supply chains), to generate lessons for policy and practice.	Working through different institutions (cooperative, lead companies and regulatory agencies) that articulate diverse stakeholder needs through the value chain, from farmers to regulators.	Engaging several strategic partners and initiatives driven by institutions that aggregate across large numbers of farmers. A multi-stakeholder platform for sharing and collective deliberation being established.	No training explicit reported.	Works across spatial scales from farm to national level, and across spatial and jurisdiction scales.	Contains elements of loop 2 in engagement processes with stakeholders to identify best practices and design NAMA interventions; game changers engaged through a multi-stakeholder platform, co-learning may happen, new ideas may be able to be implemented once NAMA framework is in place.
CS3	Integrating private businesses for demand-led CSA scaling in Kenya	Farmers need immediate returns if they are to adopt CSA. The AGMARK-CIMMYT project ensures that information from input suppliers is demand driven.	The approach aims at spreading the costs of scaling whilst sustaining knowledge	Develop a network of small-scale entrepreneurial agro-dealers to transform the fragmented input distribution system into an efficient, commercially viable	Organization and land fragmentation. Engaging with the Kenya Government for policy dialogue.	The adequacy of technologies in specific contexts depends on the knowledge of local agro-dealers, who are key sources of information and	Mobilizers are distributing material through 1500 agro dealers, integrating these with other scaling activities such as exhibitions and field days,	Three training workshops with appointed mobilizers to explain CSA concepts and information bundles (e.g. on grain storage	Mobilizers as trainers to train others, with potential to scale up to large numbers of agro-dealers and thence to	Several elements of loop 2 learning: engagement, champions or mobilisers, cap dev of these champions, new social networks.

	Case study	Demand or supply-led approaches - farmers' objectives	Costs	Delivery mechanism / reach strategy	Barriers addressed	Targeting, trade-offs	Partners and alliances	Capacity development	Cross- scale methods	Learning
		Farmers articulate their demands and the private sector responds to the opportunities.	sharing. US$0.4 for generating informatio n for each farmer.	operation, enabling farmers to have better access to inputs and technologies. Aiming for 3 million households.		advice among small-holders.	organised by the Min of Agriculture, Kenya Agricultural & Livestock Research Organisation, National Cereals and Produce Board.	and Conservation Agriculture principles)	much larger numbers of farmers.	How might iterative learning occur?
CS4	Building agricultural resilience in Nigeria through index insurance and scaling out of CSA	Scaling up agricultural insurance needs engagement with communities and capacity building. Partnering with organizations that already interact with farming communities. A supply-led approach, but with a clear theory of change.	US$ 1.8 million for 360.000 farmers in the pilot phase (US$5 per farmer)	Builds on an existing mobile platform for distribution of seeds and fertilizers. Index insurance bundled with climate-adapted and improved stress tolerant maize and rice germplasm.	Commitment by the federal government. Aligned with national agricultural resilience framework. Active engagement with policy and institutional stakeholders via workshops and policy briefs.	A key challenge. Uses new technologies such as satellite-based estimates of rainfall and other weather data. Climate-adapted maize and rice varieties have been developed for different agro-ecological zones in Nigeria.	Partnership with and fostering alliances between government institutions (FMARD NiMET), research centres (CIMMYT, IITA, AfricaRIce), private sector partners (SwissRe and Pula Advisors) and donors.	Mostly with institutional stakeholders (workshops). More with farmers envisaged.	Works with different levels at the spatial and knowledge scales as it uses satellite imagery to make on-farm decisions.	Partnerships revolve around national level institutions. Supply led as challenges revolve around data and insurance approaches. Farmers could be involved in designing systems and in developing crop/technology selection.
ICT AND AGRO-ADVISORY										

	Case study	Demand or supply-led approaches - farmers' objectives	Costs	Delivery mechanism / reach strategy	Barriers addressed	Targeting, trade-offs	Partners and alliances	Capacity development	Cross- scale methods	Learning
CS5	Scaling up climate smart advisory through rural radios in Senegal	Agro-meteorological advisory packages are tailored to meet local needs as expressed by farmers themselves through discussion groups.	No estimate.	Downscaled seasonal rainfall forecasts are conveyed to multi-disciplinary working groups who translate the information into agro-advisories transmitted to farmers through a network of 82 rural radios in local languages.	Senegalese Min of Ag now considers climate information services as an agricultural input for their yearly agriculture action plan development and implementation.	Project supports development of satellite-based high-resolution gridded data. Implementing this model could help complement existing historical climate databases. Could lead to information products relevant to agricultural decision-making with complete national coverage.	Partnership with several relevant organizations such as the national meteorological agency, the Association of Rural Radios, and many local experts and stakeholder including farmers	Capacity built among partners to do longer-term analysis and provide more actionable information for farmers.	Works across levels at the spatial scale (from farm to national level) and across spatial and jurisdiction scales.	Mix of partnership forms good basis for engagement: different knowledge and perspectives integrated, capa city built at different levels, trained farmers as local game changers, context specific partnerships, and mechanisms in place to allow for new ideas.

	Case study	Demand or supply-led approaches - farmers' objectives	Costs	Delivery mechanism / reach strategy	Barriers addressed	Targeting, trade-offs	Partners and alliances	Capacity development	Cross- scale methods	Learning
CS6	Agroclimatic advisory and CSA in Colombia	Approach is demand driven, responding to what a wide range of partners have identified as being required to cope with climate variability. But national farmers' organizations do not cover all farmers, and growers' situations may not be well understood in some regions.	US$5 million per year over 5 federations, amounting to about US$7.1 per farmer per year.	Farmers' associations trained to select well-adapted varieties for their regions, interpret seasonal forecasts, and determine limiting production factors. Project utilises an information platform and agro-climatic newsletters. Reaching half a million farmers, with only limited adoption of CS practices as yet. Potential to reach 700,000 farmers.	Although the project works closely with government and farmer associations, it does not ensure that the results will be taken as inputs into national policy formulation.	The project works with national growers' associations, which have first-hand knowledge of the specific needs of the crops they work with. But their coverage of smallholders is limited.	Partnership between MADR, CCAFS and a wide range of national growers associations, as well as IDEAM, the national meteorology office, and national agricultural research organisations such as CORPOICA.	Farmers association are trained to use research outputs in various ways, including variety selection, and seasonal forecast use in their own contexts.	Moves across scales via an online platform and newsletters. Key importance of the national growers associations to reach larger numbers of farmers. Importance of simple tools that farmers can use themselves.	Wide mix of partners, though how much multi-stakeholder learning is facilitated; systems are in place to address context through new alliances, utilising existing spaces of interacting with farmers. More explicit learning platform to understand adoption and uptake is planned.
CS7	Shamba Shape Up: Edutainment for scaling out CSA in Kenya	SSU presents a range of technologies and practices developed for a range of ecological zones and types of crop / livestock systems that farmers can choose from. A	Each segment / story costs US$ 10,000, and each episode consists of around 5 segments / stories,	SSU uses a form of reality TV (edu-tainment) where an individual farmer or farming family is trained in selected technologies and practices suitable to their needs. Viewers can identify	No strategy for working with the enabling environment.	The project presents a range of technologies and practices developed for different agro-ecological zones and for different crops and	Several centres of CGIAR have supported SSU with information and tools related to CSA, but these partnerships are rather ephemeral.	Training of individual host families, which can be replicated by the viewer. Comparable to demonstration plots, except that viewing can	No deliberate attempt to work across levels (e.g. from plot to landscape) or scales	Demonstrates a type of engagement, more informed stake-holders, and a new type of social network via viewer identification

	Case study	Demand or supply-led approaches - farmers' objectives	Costs	Delivery mechanism / reach strategy	Barriers addressed	Targeting, trade-offs	Partners and alliances	Capacity development	Cross- scale methods	Learning
		supply-led approach promoting many technologies, including CSA.	total cost is US$ 50,000 per episode (Series 4 had 26 Episodes, so in total US$ 1.3 million).	with the farming family and assess whether the technologies are beneficial for themselves.		livestock.		be repeated ad lib and there is huge potential to reach very large numbers of farmers.		with the farmers featured on the show, who can act as champions. By demanding information, farmers can inform content of future episodes.
POLICY ENGAGEMENT										
CS8	Scenario-guided policy formulation in Cambodia	Demand-led approach, though with a gap between implementation and reaching individual farmers. Scenario processes can help to ensure that policies are realistic and concrete, and can guide implementation plans to create enabling conditions that make it easier for farmers to adopt CSA practices.	Around US$100k for workshops. Partners provided significant additional funding.	Regional climate / socio-economic scenarios developed with regional stakeholders and used to converse with national policy makers about climate sensitive national development plans and processes. Can be adapted for multiple policy guidance processes, facilitates scaling out the process to other countries in	Key challenges addressed are the political, institutional and economic barriers. Can use scenarios to engage with specific policies, but strong internal strategic planning capacity in governments and other organizations is needed to help create change in a wide range of	The regional scenarios are adapted to national scales. Further down-scaling and out-scaling to support implementation plans is feasible	The process was co-led by FAO and UNEP's World Conservation Monitoring Centre, culminating in dialogues with 100 national experts and representatives of donor organizations. The project is supporting the mainstreaming of scenario methods in global partner organisations.	Capacity development is a key mechanism for upscaling, requiring significant time and resources for the training and mentoring processes.	Scenarios can connect subject matter and strategies across different levels (spatial levels), integrating scenario elements about household-level adaptation with drivers	Great engagement with next users, new social networks established, more informed next users, and different types of knowledge integrated. More capacity development is still to be done, particularly with an eye to the legacy of this work.

	Case study	Demand or supply-led approaches - farmers' objectives	Costs	Delivery mechanism / reach strategy	Barriers addressed	Targeting, trade-offs	Partners and alliances	Capacity development	Cross- scale methods	Learning
				the region.	policy and institutional arrangements.				of global change. They are flexible across scales and can support multi-level thinking and dialogue.	
CS9	Climate smart villages in South Asia	A supply-led/demand-led approach. CSV interventions are tailored to local conditions and often designed with farmers, to generate evidence about the benefits of CSA. The project also works on mainstreaming marginalized and socially disadvantaged groups in CSV development processes, training local women leaders and working with	No estimates	Integration of CSA into current policies and schemes relating to agricultural development and climate change. In India, CSVs are being piloted in 75 villages in Haryana, Punjab, Bihar. CSV approach will be implemented in Maharashtra tribal regions (1000 villages) and Haryana (500 villages) with seed money from the	Increase the capacity of policy advisors to mainstream the CSV approach into existing local development and poverty alleviation policies and programs. Involves policy advocacy and organizing farmers through existing innovative institutional arrangements.	There are no fixed packages of intervention. They differ in content based on the region, agro-ecology, level of development, capacity and interest of the farmers and the local governments. Much work done to understand through farmer typologies which intervention works	Brings together different CGIAR centers, NARS and private sector for participatory evaluation of diverse CSA technologies in farmers' fields. CSVs are also becoming popular learning platforms for CSA interventions for farmers, government officials, NGO/INGOs and private sector	Capacity strengthening of farmers, industry, and government officials through site visits and participatory videos, farmer typologies and agro-ecological assessment for targeting. Increasing the capacity of policy advisors to mainstream CSA approaches into existing	Works at different spatial levels (plot, village, state) and across spatial and institutional scales.	End- and next users are engaged in tailoring interventions, including training of women. Extensive capacity development, farmers and others as champions, context specific needs considered and networks established.

	Case study	Demand or supply-led approaches - farmers' objectives	Costs	Delivery mechanism / reach strategy	Barriers addressed	Targeting, trade-offs	Partners and alliances	Capacity development	Cross- scale methods	Learning
		community based organizations.		state governments.		where and why.	organizations.	local development and poverty alleviation programs.		Mechanisms for fostering new ideas and integrating different types of knowledge.
CS10	Mitigation and adaptation planning in Honduras using scenarios	Scenarios and national decision-making processes are validated at regional and local level.	Potential reach 4.89 million farmers in both Honduras and Guatemala . Cost approximately US$ 0.68 million, or US$0.14 per farmer	Better informed policies in Central America that include CSA will contribute to the improvement of smallholder farmers' livelihoods. The policy engagement strategy involves co-creation of climate impact evidence and climate and socio-economic scenarios, and leverage through key staff to get the attention of high level government personnel.	The approach addresses policy, institutional and economic barriers, for example via providing government staff with robust scientific evidence or working with supranational and national institutions to access national decision makers. Also by connecting national and local government institutions to create coherent	By connecting national and local government institutions and creating coherence among local policies and national strategies through down-scaling the scenarios.	The project works via supranational and national institutions interested in climate change and agriculture, with a view to accessing national decision makers who are the key partner.	Not mentioned as an explicit strategy.	Works across spatial scales (from regional to national to local level).	Good engagement with next users, new networks are being formed, and better informed next users are resulting.

	Case study	Demand or supply-led approaches - farmers' objectives	Costs	Delivery mechanism / reach strategy	Barriers addressed	Targeting, trade-offs	Partners and alliances	Capacity development	Cross- scale methods	Learning
					local policies and national strategies					
CS11	Upscaling Alternate Wetting and Drying (AWD) technology in Vietnam	Engages farmers in participatory mitigation selection (PMS), allowing them to decide freely on low-emission crop management options that are suitable to their locale, and assessing the co-benefits of mitigation techniques alone and when combined with other practices. A supply-led approach but with a clear strategy for farmer engagement.	US$2.5 million over 4 years for 500, 000 ha, or US$ 5 per ha.	Via stakeholder engagement (farmers, development organizations, extension workers, policy makers); knowledge sharing and innovation (produce new knowledge irrigation infrastructure and build capacity of extension workers and local policy makers); catalysing policy and investment for implementation	Integrate mitigation objectives into agricultural modernization plans and rehabilitation programs of the government and development organizations, e.g. for irrigation infrastructure. Analysis of national climate change actions plans, and the development of a "rice component"	Identify where AWD as a mitigation measure is effective under current irrigation infrastructure and where it will work with improved irrigation infrastructure;	Improve information support upscaling and link policy partners with policy makers. Putting in place links across projects to ensure that well-established networks with policy makers are taken advantage of.	Capacity strengthening via trainings, workshops, field visits, of local extension services to enable local policy makers to implement successful mitigation strategies.	A key element is targeting (at a landscape or district level) to identify where AWD may be appropriate and viable - the project then works in these identified areas to focus on farm	Good engagement with next users and end users by co-learning and capacity at different levels, different perspectives are brought in as evidence of double loop.

	Case study	Demand or supply-led approaches - farmers' objectives	Costs	Delivery mechanism / reach strategy	Barriers addressed	Targeting, trade-offs	Partners and alliances	Capacity development	Cross- scale methods	Learning
				(link policy partners and policy makers, rice component in NAMAs).	that will be integrated into the NAMAs.				households.	

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