Food and Agriculture Organization
of the United Nations

UPSCALING CLIMATE SMART AGRICULTURE

LESSONS FOR EXTENSION AND ADVISORY SERVICES

OCCASIONAL PAPERS ON **INNOVATION IN FAMILY FARMING**

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UPSCALING CLIMATE SMART AGRICULTURE

LESSONS FOR EXTENSION AND ADVISORY SERVICES

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ABBREVIATIONS

ACRE	Agriculture and Climate Risk Enterprise
ACT	African Conservation Tillage Network
AFR	Access to Finance Rwanda
AFT	Agroforestry Technologies
AGMARK	The Agricultural Market Development Trust
AGRA	Alliance for a Green Revolution
AIS	Agricultural Innovation System
AIT	Asian Institute of Technology
AKIS	Agricultural Knowledge and Information System
ASEAN	Association of Southeast Asian Nations
ASIP	Agricultural Sector Investment Programme
BEO	Block Extension Officers
BMGF	Bill and Melinda Gates Foundation
BUCAP	Biodiversity, Use and Conservation in Asia Programme
CA	Conservation Agriculture
CAP	Conservation Agriculture Programme
CARE	Cooperative for Assistance and Relief Everywhere
CASPP	Conservation Agriculture Scaling up for Increased Productivity and Production
CASRAD	Center for Agrarian System Research and Development
CASU	Conservation Agriculture Scaling Up initiative
CEOs	Camp Extension Officers
CFPAR	Central Farmers' Participatory Action Research
CF	Conservation Farming
CFU	Conservation Farming Unit
CGIAR	Consultative Group of International Agricultural Research
CIDA	The Canadian International Development Agency
CIMMYT	The International Maize and Wheat Improvement Center
CLUSA	Cooperative League of the USA
COMACO	Community Markets for Conservation
CRI	Crop Research Institute
CRS	Catholic Relief Services
CSA	Climate Smart Agriculture
CSRD	Centre for Sustainable Rural Development (Vietnam)
DANIDA	Danish International Development Agency
DAPP	Development Aid from People to People
DARD	Department of Agriculture and Rural Development
DH	Doubled Haploid
DoA	Department of Agriculture
DOET	Department of Education and Training
DT	Drought Tolerant
DTMA	Drought Tolerant Maize in Africa
DTMASS	Drought Tolerant Maize for Africa Seed Scaling
Dunavant	Dunavant Cotton Company
EAS	Extension and Advisory Services
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FC	Field Coordinators
FCRI	Field Crops Research Institute
FCP	Farmers' Club Programme
FFS	Farmer Field Schools
FIDR	Foundation for International Development/Relief
FISRI	Farmer Input Support Response Initiative
FLAIR	Farmer-led Agricultural Innovation for Resilience
FPAR	Farmers' Participatory Action Research
FRA	Food Reserve Agency
FSP	Financial Service Provider
FVR	Farmer Voice Radio
GART	Golden Valley Agricultural Research Trust
GHG	Greenhouse gas
GIIF	Global Index Insurance Facility
GIZ	Gesellschaft für Internationale Zusammenarbeit
GMO	Genetically Modified Organism
IAE	Institute of Agricultural Environment
ICC-TNU	Thai Nguyen University

ICRAF	International Centre for Research in Agroforestry
IFAD	International Fund for Agricultural Development
IFT	Improved Fallow technologies
IITA	The International Institute of Tropical Agriculture
ILeP	Innovation Learning Platform
IMAG	Institute of Agricultural and Environmental Engineering
IMAS	Improved Maize for African Soils
IMIS	International Maize Information System
IMPP	Improving Market Participation of the Poor
IPM	Integrated Pest Management
IRRI	International Rice Research Institute
ISFM	Integrated Soil Fertility Management
KALRO	Kenya Agricultural & Livestock Research Organization
KARI	Kenyan Agricultural Research Institute
KATC	Kasisi Agricultural Training Center
KEPHIS	The Kenya Plant Health Inspectorate Services
KII	Key Informant Interview
LC&MF	Land Management and Conservation Farming Project
LF	Lead Farmers
LMB	Lower Mekong River Basin
MACO	Ministry of Agriculture and Cooperatives
MAFF	Ministry of Agriculture, Food and Fisheries
MAL	Ministry of Agriculture and Livestock
MEL	Monitoring, Evaluation and Learning
MFI	Microfinance Institution
MINAGRI	Ministry of Agriculture and Animal Resources
MARD	Ministry of Agriculture and Rural Development (Vietnam)
NAP	National Agricultural Policy
NARS	National Agricultural Research System
NCATF	National Conservation Agriculture Task Force
NGO	Non-Governmental Organization
NORAD	Governments of Norway
NPT	National Performance Trials
NRM	Natural Resource Management
OFF	Own Farm Facilitators
OPV	Open-Pollinated Variety
Oxfam	Oxford Committee for Famine Relief
PAM	Programme Against Malnutrition
PARA	Poverty Alleviation in Rural Areas
PC	People's Committee
PLARD	Programme for Luapula Agriculture and Rural Development
PPD	Plant Protection Department
PPP	Public-Private Partnership
PROFIT	Production, Finance and Improved Technology
RBGP	Rural Business Group Programme
RIU	Research Into Use
RSCU	Regional Soil Conservation Unit
SACCO	Savings and Credit Cooperatives
SCAFE	Swedish-funded Soil Conservation and Fertility Enhancement
SEMI	Seed Enterprise Management Institute
SFSA	Syngenta Foundation for Sustainable Agriculture
SIDA	Swedish International Development Cooperation
SG	Sasakawa Global
SOA	Sustainable Organic Agriculture
SRD	Centre for Sustainable Rural Development
SRI	System of Rice Intensification
SSA	Sub-Saharan Africa
STMA	Stress Tolerant Maize for Africa
TSB	Technical Services Branch
UoN	University of Nairobi
USAID	United States Agency for International Development
VECO	Vredeseilanden in Vietnam
WVAIP	World Vision Agroforestry Project
ZARI	The Zambian Agricultural Research Institute
ZNFU	Zambia National Farmers' Union

CHAPTER 1
INTRODUCTION

Extension and advisory services (EAS) can play a very important role in scaling up Climate Smart Agriculture (CSA). EAS contribute to the realization of all three objectives of CSA (food security, adaptation and mitigation), but are currently focused on the first of these, namely food security through enhanced productivity. EAS now need to be more actively deployed both to help rural communities adapt to climate change and to contribute to climate change mitigation (Sulaiman *et al.*, 2017).

Upscaling CSA will certainly entail changing the behavior, strategies and agricultural practices of millions of agricultural producers, who need to become better informed about the impacts of climate change so that they may adopt better climate-smart strategies. EAS have traditionally served as a bridge between research and farming, and supported farmers through the delivery of knowledge about new technologies. Yet the successful upscaling of CSA requires strategies that go well beyond changing farm-level agronomic practices. Indeed, it requires the identification and promotion of appropriate practices, technologies and/or models (new, improved, adapted) within favourable enabling environments, and needs to comprise constructive institutional arrangements, policies and financial investments at both a local and an international level (Neufeldt *et al.*, 2015). EAS therefore need to be backed by comprehensive expertise and skills to foster interaction and encourage the flow of knowledge among a broader range of stakeholders than at present. The stakeholders in question include both those engaged in policy formation and those engaged in the actual practice of farming.

This paper explores how EAS should be organized to support the upscaling of CSA, and approaches the task by drawing lessons for EAS from four successful cases where this has been done. The paper builds upon and uses the Innovation Management Framework (Sulaiman *et al.*, 2010), which identifies three elements that are critical for innovation: functions, actions and tools. Innovation in this context refers to the process by which new knowledge is generated, adapted, disseminated and adopted by a large number of stakeholders.

We selected the following four cases in which CSA practices and technologies were adopted on a large scale. Each case, in its own way, illustrates the complexities of scaling up:

1. Conservation Agriculture (CA) in Zambia;
2. System of Rice Intensification (SRI) in Vietnam;
3. Drought Tolerant Maize in Africa (DTMA);
4. Index-based weather insurance: The case of Agriculture and Climate Risk Enterprise (ACRE), east Africa.

The central question we are trying to answer here is which EAS functions and actions need to be addressed for the upscaling of CSA, and what type of tools will ensure its wider adoption and optimize its impact.

The paper begins with a discussion of the general concept of upscaling new knowledge. It then (Chapter 2) carries out a literature review of CSA upscaling and considers the various findings and observations made. Chapter 3 analyses the four cases mentioned above, while Chapter 4 looks at the key elements of upscaling. Finally, Chapter 5 discusses the implications of upscaling for EAS.

CHAPTER 2
UPSCALING NEW KNOWLEDGE

UPSCALING CSA FOR INNOVATION AND IMPACT

Knowledge and ideas are key drivers of economic growth. Globally, there is an increasing interest in strengthening innovation, which is the process by which new knowledge is generated, disseminated, adapted and, finally, deployed on a large scale so that its socio-economic benefits can be maximized. Innovation augments the productivity and competitiveness of all enterprises, and thus raises the income of all stakeholders. Several organizations are generating new agricultural knowledge, but a wide gap persists between the knowledge generated and the knowledge used. Extension and Advisory Services (EAS) were established primarily to address this gap.

Although the EAS approach has contributed much to agricultural development by disseminating technologies, it has been less successful at upscaling new knowledge (Box 1). New knowledge is often adopted by a limited number of farmers only, and even successful pilots tend not to have a far-reaching impact. Moreover, "projects, programmes and policies are often limited in scale, short-lived and without lasting impact" (Hartman and Linn, 2008).

Box 1
UPSCALING

The World Bank (2003) defines the purpose of upscaling (or scaling-up) as "to efficiently increase the socioeconomic impact from a small to a large scale of coverage." Upscaling is the "replication, spread, or adaptation of techniques, ideas, approaches, and concepts (the means)," and aims at achieving an "increased scale of impact (the ends)." It can occur horizontally, by replicating promising or proven practices, technologies or models in new geographic areas or target groups (e.g. Linn, 2012); vertically, by catalyzing institutional and policy change (e.g. World Bank, 2003); and diagonally, by adding project components, altering the project configuration or changing strategy in response to an emergent reality. Upscaling can be effected either directly (a given organization is directly responsible for change), or indirectly (the organization influences change).

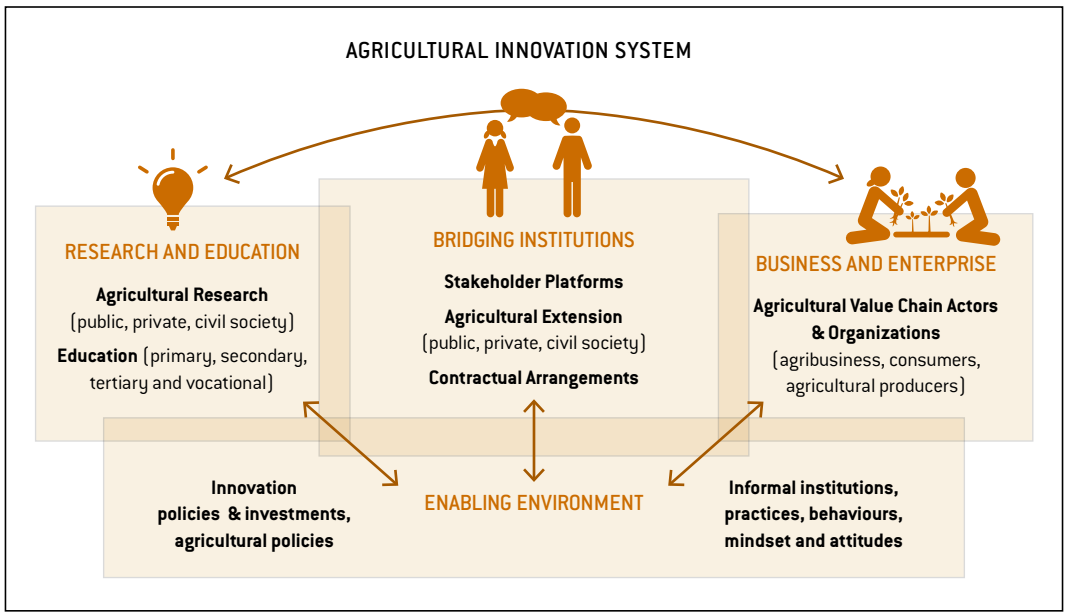
The myth of the smooth progression of research to adoption and diffusion among farmers continues to influence the theory and practice of EAS. Even though the theory of technology transfer and the linear model of innovation have been widely discredited (Biggs, 1990), efforts to dislodge them have been unsuccessful (Ruttan, 1996). The result is that the work of technology development (research) and technology transfer to farmers (extension) is done by two completely separate organizations that have tightly defined and mutually exclusive roles. These organizations also operate separately from other public agencies with analogous rural development functions.

The thinking on agricultural technology development and promotion has advanced in the last 20 years. For instance, it is now recognized that technological innovation comes from multiple sources, including farmers (Röling, 1990), and that the manner in which the agendas of different stakeholders are represented affects the "appropriateness" of new technologies. Both farmer participation in technology development and a participatory approach to extension work have emerged as a response to this new thinking. Often, however, the wider institutional and political context in which "participation" takes place is overlooked.

In the early 1990s, the literature on extension activities began to embrace holistic ideas such as the Agricultural Knowledge and Information System (AKIS). AKIS acknowledges the relevance of a wider set of information sources, and recognizes the value of systems that assist in the generation and dissemination of knowledge, especially in the context of sustainable agriculture. More recently, the idea has emerged that extension services should be part of a wider system. For example, the innovation system framework offers a more inclusive way of thinking about the actors and the institutional context in which the generation, dissemination and use of new knowledge takes place. This system of actors and process not only includes research and extension, but also technology users, private companies, non-governmental organizations and supporting structures, such as markets and credit providers. The innovation system framework emphasizes the importance of knowledge flows and interaction among the various actors in the Agricultural Innovation System (AIS) (Figure 1) and of the "learning processes", by which new arrangements are developed for specific local contexts.

But how can innovation be generated and managed? The old way of thinking about agricultural innovation held that researchers produced ideas, extension workers passed them on to farmers, and farmers put them into practice. Under this earlier framing, then, Innovation Management was a question of simply making sure that farmers were apprised

Figure 1: Agricultural Innovation System



Source: Tropical Agriculture Platform (2016)

of new ideas. The new understanding of agricultural innovation, however, is that its success depends on connecting different elements and coordinating actions to maintain coherence (Hall, 2005). The collective name for the broader range of tasks that the newer understanding of agricultural innovation implies varies from author to author. Some call it "boundary work" (Kristjanson *et al*., 2009); others refer to it as "intermediation" (Howells, 2006; Klerkx and Leeuwis, 2008) and, more recently, the term "innovation brokerage" has been used (Klerkx and Leeuwis, 2009).

Sulaiman *et al.* (2010) explain that innovation involves a wide range of functions, activities and tools, and is delivered by several agencies operating through platforms, alliances or partnerships, whose work can be collectively referred to as "Innovation Management". While facilitating access to technology is important for putting new knowledge into wider use, access really has value only when it is combined with other elements of the Innovation Management process, such as the building of networks, the organization of producers, the communication of research needs, conflict mediation, the facilitation of access to credit, inputs and output services, the convening of innovation platforms, advocacy for policy change, and negotiations and agreements leading to other changes in practice and action (Table 1).

Table 1: Innovation Management Tasks observed in the RIU Asia projects

FUNCTIONS	ACTIONS	TOOLS
Networking and partnership building	Convening	Grain cash seed bank Community-based user groups
Setting up/strengthening user groups	Brokering	Producer companies NGO-led private companies
Training	Facilitating	Market-chain analysis Market-planning committees
Advocacy for institutional and policy change	Coaching	Community germplasm orchards Village crop fairs Food processing parks Use of lead entrepreneurs
Enhanced access to technology, expertise, markets, credit and inputs	Advocating Information dissemination	Participatory action-plan development Community resource centers Policy working groups
Reflective learning	Negotiating Mediating	Thematic committees Cluster-level sharing workshops

Source: Sulaiman *et al.*, 2010

In this study, we used the Innovation Management Framework shown above to explore the experiences of upscaling CSA practices and to learn how EAS can be leveraged for upscaling purposes. The analytical approach underpinning our work highlights several important points that need to be borne in mind:

a. The adoption of CSA practices usually requires "new forms of interaction, organization and agreement between multiple actors" (Leeuwis, 2004). Moreover, the implementation of appropriate CSA actions on a large scale essentially depends on the successful coordination of different public- and private-sector actors (World Bank, CIAT, CATIE, 2014). Lipper *et al.* (2014) note that four major benefits flow from coordination among diverse actors, which (1) contributes to the gathering of evidence, (2) enhances the effectiveness of local institutions, (3) ensures coherence between climate and agricultural policies, and (4) links climate considerations with agricultural financing.

b. Successfully scaling up CSA signifies identifying and promoting appropriate practices, technologies and/or models within favourable enabling environments that comprise supportive institutional arrangements, policies and financial investments from the local to the international level (Neufeldt *et al.*, 2015, Sulaiman, 2017).

c. The key challenges for scaling up CSA technologies and practices include: transaction costs, farmers' attitudes and objectives, and issues surrounding the institutional enabling environment (Westermann *et al.*, 2015).

The Innovation Management Framework acknowledges many of these challenges. It recognizes the importance of collaboration among multiple actors as well as the need for a broad range of functions and for the deployment of appropriate tools to upscale new knowledge.

EVIDENCE FROM THE FIELD: SCALING CSA PRACTICES

Four cases were selected with reference to the nature of the practice or technology and the impact of its upscaling. As this research is mostly based on a secondary review, the cases were selected also with reference to the quantity of useful information that they could yield for analytical purposes. The cases are outlined in Table 2 below.

Table 2: Details of cases

	NATURE OF UPSCALED KNOWLEDGE	TECHNOLOGY/ PRACTICE	COUNTRY/ REGION	SINCE	INITIATOR	REACH (NUMBER OF ADOPTERS)
1	Natural Resource Management (NRM)	Conservation Agriculture (CA)	Zambia/Africa	1996	Farmer organization	350 200 (2015)
2	Crop Management	Systems of Rice Intensification (SRI)	Vietnam/Asia	2003	Government *	180 000 (2015)
3	Varietal improvement	Drought Tolerant Maize in Africa (DTMA)	Sub-Saharan Africa	2006	CGIAR (CIMMYT/IITA)	6 000 000 (2016)
4	Weather insurance	Index-based weather insurance (ACRE)	East Africa (Kenya, Rwanda, Tanzania)	2009	Private sector	400 000 (2013)

* SRI emerged primarily from Civil Society initiatives worldwide, but was introduced in Vietnam by government agencies in collaboration with FAO.

To draw lessons for EAS, the cases were analysed with reference to the following two aspects:

a. The impact and role of actors who contributed to the innovation (knowledge generation, adaptation, dissemination and use);

b. The functions and tools used by the different actors to upscale new knowledge.

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CHAPTER 3

SCALING CSA PRACTICES: ANALYSIS OF THE CASES

Four cases of the successful promotion of CSA practices are presented in this chapter.

CASE 3.1 CONSERVATION AGRICULTURE IN ZAMBIA

PRACTICE

Conservation agriculture (CA) refers to a combination of crop production practices that include minimum tillage, mulching, the use of composite and green manure, planting in pits and intercropping, crop rotation, and integrated crop management (Tripp, 2006). CA as practised in Zambia consists of the application of five key principles: (i) reduced tillage on more than 15 percent of the field area without soil inversion; (ii) the precise digging of permanent planting basins or the preparation of soil with a "Magoye Ripper" (where draft animals are available); (iii) the leaving of crop residues in the field (no burning); (iv) the rotation of cereals with legumes; and (v) dry-season land preparation (CFU, 2007).

CONTEXT

In Zambia, CA methods were promoted and adopted for two main reasons. First, as very few small- and medium-scale farmers use irrigation systems, most are highly dependent on rains in a country that has experienced periods of drought. To remain productive in the face of climate challenges, Zambian farmers need to adopt viable and more sustainable methods. Second, following the removal of subsidies[1] for agricultural inputs, which rendered intensive farming unaffordable for most small- and medium-scale farmers, CA technology turned out to be a cost-effective way of maintaining the same level of productivity (Chompolola and Kaonga, 2016).

[1] Structural adjustment policies in the 1990s were associated with a temporary reduction of subsidies for fertilizers by the Zambian government (Whitefield *et al.*, 2015). Three decades of heavy subsidies for maize, fertilizer, tractors and plows came to an abrupt end following the bankruptcy of Zambia's key agricultural parastatals and the collapse of world copper prices, which had financed the Zambian government for decades (IESR, 1999; Zulu *et al.*, 2000).

Based on an empirical analysis, Abdulai and Abdulai (2016) concluded that farmers who use CA are technically and environmentally more efficient than those who use conventional means.

ADOPTION

As of 2015, approximately 350 000 small-scale farmer households in Zambia (41 percent of the national total) were practicing forms of CA on an area of almost 175 000 ha, which corresponds to 0.5 ha/farmer (see Table 3). Between 2000 and 2015, the number of participating farmers and the amount of land under CA management grew almost 12-fold. Table 4 gives a breakdown of the various forms of CA that have been adopted.

Table 3: Extent of adoption of CA in Zambia in last 10 years

ATTRIBUTE	UNITS	SMALL-SCALE (< 2 HA)				LARGE-SCALE (> 2 HA)				TOTAL (2015)
		2000	2005	2010	2015	2000	2005	2010	2015	
Estimated number of smallholders practising CA	Number	30 000	78 000	250 000	350 000		15	150	200	350 200
Estimated amount of land under CA	Hectares	500	19 500	125 000	175 000		150	1 500	2 000	177 000
Estimated percent of farmers adopting CA	Percent			16	20-25				17	41

Source: Findings from key informant interviews (KIIs) (Mawanza, 2016)

Table 4: Breakdown of CA attributes

ATTRIBUTE	PERIOD		
	2000	2010	2015
Estimated percent of farmers practising reduced tillage	10	13	25-35
Estimated percent of farmers using herbicides for weed control		5	12.5-30
Estimated percent of farmers practising residue retention/ mulching		10	20-30.5
Estimated percent of farmers using cover crops		5	10
Estimated percent of farmers practising crop rotation		20	25-30

Source: Findings from KIIs (Mawanza, 2016)

ACTORS AND THEIR ROLES

Since 1996, the Conservation Farming Unit (CFU) of the Zambia National Farmers Union (ZNFU) has been involved in the promotion of CA. Apart from CFU, several other actors also supported the

generation, adaptation, promotion and use of CA in Zambia (Table 5). They include the Institute of Agricultural and Environmental Engineering (IMAG), the Golden Valley Agricultural Research Trust (GART), the Dunavant Cotton Company, the Cooperative League of the USA (CLUSA), and the Land Management and Conservation Farming Project (LMCF), together with their partners at the extension service of the Ministry of Agriculture and Cooperatives (MACO), and NGOs such as the Catholic Archdiocese of Monze, Development Aid from People to People (DAPP), CARE and Africare.

Table 5: Key actors instrumental in the promotion of CA in Zambia

ACTOR	ROLES/FUNCTIONS	ACTIVITIES
Swedish-funded Soil Conservation and Fertility Enhancement (SCAFE) project	Promoting erosion-control measures and soil-fertility enhancement techniques through agronomic, agroforestry and physical measures.	In what was perhaps the first project to promote conservation tillage in Zambia, in 1985 SCAFE and the Ministry of Agriculture and Cooperatives (MACO, then named MAFF) began promoting a wide range of erosion-control measures (bunding, contour tillage, cultivation of vetiver grasses etc.) and soil-fertility enhancement techniques (crop residue management, green manures, cover crops, mulching, improved fallows and conservation tillage).
Conservation Farming Unit (CFU) of the Zambian National Farmers Union (ZNFU)	› Adaptive Research and technology development. › Training of farmers › and other stakeholders. › To spearhead experimentation and extension, in close collaboration with Dunavant Cotton and a network of religious and secular NGOs.	ZNFU set up the CFU in 1995 to adapt the hand-hoe basin system to Zambian conditions and to promote its use among smallholders. The CFU organized demonstrations and field days, as well as specialist training for MACO, Dunavant, CLUSA and other promotional agencies; it produced radio broadcasts and a series of field manuals in different local languages to facilitate CF extension by its staff and others; it conducted training and farm trials for government extension staff; and it worked with Dunavant Cotton famer distributors, as well as with a shifting coalition of NGOs. It also teaches precise input application as an important part of their package of technologies and is currently devoting more resources to supporting the CA initiatives of other agencies.
Dunavant Cotton Company	› Input distribution. › Distributor training. › Financial support to CFU.	The company runs a series of training programmes every cropping season for their 1 400 group distributors, who are lead farmers or farmer-entrepreneurs, and through whom Dunavant distributes inputs, credit and information on key management practices to its 80 000 or so cotton farmers. Through CFU participation at distributor training sessions, Dunavant's smallholder training personnel disseminate CF principles to the farmers. Dunavant remains keenly interested in the CF management system because several of its features coincide with best-practice management for cotton production.

ACTOR	ROLES/FUNCTIONS	ACTIVITIES
CLUSA (Cooperative League of the USA)	› Technical advice and input supply. › Promotion of conservation farming programme. › Own training extension system › Credit management services. › Facilitating the promotion of agribusiness farmer groups.	CLUSA has recommended the adoption of CF in the field demonstrations and the training session it runs for the 6 000 to 8 000 farmers in the Rural Business Group Programme in the Southern and Central Provinces. CLUSA developed a training-of-trainers manual, which covers CF extension methods, is addressed to CLUSA extension staff (group facilitators), and contains advice to farmers on the formation and management of groups, and on business and conservation farming techniques.
National Conservation Agriculture Task Force (NCATF)	Advocates and influences agriculture policies and other policies relating to conservation agriculture; facilitates capacity-building among stakeholders; and develops strategies for the roll-out and adoption of conservation agriculture.	NCATF facilitates the networking of conservation agriculture implementers. It advocates and influences agriculture policy and other policies relating to conservation agriculture. It facilitates the development and dissemination of conservation agriculture through stakeholder consultation. It facilitates capacity-building among stakeholders, and participates in regional and global CA projects.
National Conservation Farming Steering Committee	Set up in 2001 by the Ministry of Agriculture's Technical Services Branch.	The Committee helps coordinate information flows and facilitate collaboration.
MAL (Ministry of Agriculture and Livestock)	One of the most important ministries of the Government of Zambia, it is responsible for designing, implementing and managing all government activities in the agricultural and livestock sectors.	MAL plays an active role in formulating guidelines on how stakeholders will operationalize the National Agricultural Policy (NAP) of 2004-2015.
MACO (Ministry of Agriculture and Cooperatives)	Planning, coordination, implementation, monitoring and evaluation of agricultural extension programmes.	Formerly known as MAFF, MACO was involved in the early stages of CA roll-out in Zambia. In 1985, it actively supported the implementation of the SCAFE project to promote a wide range of erosion-control methods. The LMCF, modified from the SCAFE project, operates administratively under the MACO with the support of SIDA. It has promoted a wide range of measures on conservation farming and was involved in the extension of a full menu of tillage options to farmers. In 1998, MACO formally embraced CA as an official policy of the Zambian Government (GART, 2002; MAFF, 2001). Support for CFU's adaptive research programme has come from Lonrho Cotton and from ASIP via grants from MAFF. Also, the CASPP project was jointly implemented by MACO, FAO and other stakeholders to lay the ground for building the capacity of the MACO Department of Agriculture and Own Farmer Facilitators (lead farmers) in anticipation of a longer-term investment in CA expansion countrywide. MACO also hosts the Secretariat of the National Conservation Agriculture Task Force.

ACTOR	ROLES/FUNCTIONS	ACTIVITIES
Farmer Promoters	a. Lead/Contact farmers under WVAIP.	Trained by the professionals of World Vision Agroforestry Project (WVAIP), these farmers provided continuous first-hand contact with the communities. After training, the lead farmers go out to recruit other farmers. Each lead farmer recruits on average 125 peers per year.
	b. Contact farmer (CF) under Conservation Agriculture Programme (CAP).	Each CF is responsible for mobilizing his/her group of 30 farmers for the training sessions, which are conducted in the field by the Field Coordinators (FC) of CAP. Two CFs mobilize their 30 farmers to form a training group of 60.
	c. Own Farm Facilitators (OFFs) under CASPP.	These lead farmers are trained by the camp extension officers/block extension officers of the Department of Agriculture (DoA), which deploys the Farmer Field Schools (FFS) approach.[2]
	d. CLUSA ZAMBIA outgrower scheme.	Under this scheme, CLUSA group facilitators organize smallholder famers into groups, mainly for the promotion of agribusiness.
GART (Golden Valley Agricultural Research Trust)	On-farm trials.	GART conducts trials with mechanical and animal draft powered (ADP) low-till equipment.
Programme for Luapula Agriculture and Rural Development (PLARD)	Promotion of CA in the Laupula Province. The programme (PLARD I, 2006-10) encompassed four components: agriculture, agribusiness, fisheries and the policy, regulatory and institutional environment. For PLARD II 2010-14, an agribusiness component was added.	Under this programme, season-long assistance is provided to farmers keen to improve their performance in producing various commodities. The programme uses a participatory group method, called the Commodity Study Group approach, to raise the level of participation.
Land Management and Conservation Farming (LM&CF) and Soil Conservation and Agroforestry Extension Project	The development and integration of soil conservation, agroforestry and pasture technology packages into various farming systems in Zambia. Delivery of extension advice to subsistence and commercial farmers.	The project was rolled out in 1985 with the financial support of SIDA and the technical backstopping of the Regional Soil Conservation Unit (RSCU) in Nairobi. Together with CFU, it forms two of the core elements of Agricultural Sector Investment Programme. The project provides technical support to farmers for improving soil fertility and managing farms, forestry and water resources; it organizes staff training, education and public-awareness campaigns; and it strengthens management and coordination.

[2] Under the current organizational structure, the camp staff is implementing extension activities at the grassroots level. They are supported by a block officer at the block level and by a subject-matter specialist at the district level (MACO, 2009)

ACTOR	ROLES/FUNCTIONS	ACTIVITIES
Zambia Agricultural Research Institute (ZARI)	Research on conservation agriculture.	ZARI implements research programmes on conservation farming methods that focus on good tillage practices and the development of different seed varieties to increase food production.
United States Agency for International Development (USAID)	Investing in cutting-edge scientific and technological agricultural research. Developing sustainable agriculture strategies Offering extension services.	Implemented the Zambia Integrated Agroforestry Project (WVAIP) in 1998 along with World Vision. Facilitated the e-voucher programme of Zoona.
World Vision	Relief, development and advocacy.	World Vision implemented the Zambia Integrated Agroforestry Project (WVIAP) in 1998 with the financial backing of USAID and in close collaboration with the MACO, ICRAF and local communities. It promoted CF technologies, especially the improved fallow technologies (IFT); it provided extension work by making contacts with farmers, discovering and affirming local cropping strategies, promoting improved fallow technologies (IFTs), carrying out on-farm demonstrations, promoting improved crop varieties and encouraging the development of an improved market infrastructure.
International Centre for Research in Agroforestry (ICRAF)	Developing agroforestry technologies (AFTs). Technical advice and field visits, supply of seeds.	ICRAF conducted field trials to disseminate AFTs; it delivered on-field demonstrations to WVIAP farmers, trained trainers, and provided literature (extension material, some of which was translated into the local language) in nursery development and management to WVIAP staff, lead farmers (LFs), camp extension officers (CEOs) and block extension officers (BEOs). ICRAF also organized joint field days with WVIAP and took part in monitoring and evaluation. It co-hosted students researching pathways for the adoption of agroforestry technology.
African Conservation Tillage Network (ACT)	Dedicated to improving agricultural productivity through sustainable management of natural resources in African farming systems. To promote conservation agriculture in Africa, it facilitates the sharing of information, knowledge and lessons learned through experience.	ACT serves as a networking, knowledge and information management platform. It documents and disseminates CA information materials, raises public awareness, and advocates for conservation tillage. ACT stimulates and facilitates coalition building and partnerships. ACT promotes learning through education and training.

ACTOR	ROLES/FUNCTIONS	ACTIVITIES
Food and Agriculture Organization of the United Nations (FAO)	To support members in their efforts to ensure that people have regular access to enough high-quality food. Supporting policies and political commitments that promote food security and good nutrition.	FAO supported the e-voucher project of the Zambian Government. It set up a revolving fund and financed a number of CA programmes such as CASPP and the Farmer Input Support Response Initiative (FISRI).
Development aid from people to people (DAPP)	Implemented the Farmers' Club Programme (FCP).	Implemented a number of projects under FCP, including the upscaling of the Integrated Soil Fertility Management Technologies project. The project worked towards increasing smallholder farmers' awareness of integrated soil fertility management (ISFM) and technologies, and towards strengthening the capacities of public and private partners to transfer the research findings of ISFM to farmers, and to increase smallholder access both to farm inputs and to the output market. Rural resilience initiative. The project mobilized farmers to improve crop production through diversification and soil management. It encouraged improvements in the financial literacy of farmer club members by linking farmers to finance and insurance services, setting up saving clubs and creating market linkages.
Kasisi Agricultural Training Centre (KATC)	KATC is involved in training, extension, research, production, lobbying and advocacy (awareness, education and communication).	KATC deploys a variety of extension methods (training, demonstration plots, field days, follow-up visits, regular visits to trained farmers, radio broadcasts) to enhance farmers' capacities.

Sources: Irin, 2002; Parker, 2003; FASAZ, 2002; Lasaine, 2015; African Conservation Tillage Network, 2015; Whitefield *et al.*, 2015; Itano, 2002; KATC, 2016.

Donor support

Several donors supported CA projects in Zambia, including the Swedish International Development Cooperation (SIDA), the Canadian International Development Agency (CIDA), the World Bank, FAO, the EU, the Governments of Norway (NORAD) and Finland. Norway has funded the Conservation Agriculture Scaling-up Project (CASPP), implemented by the Ministry of Agriculture and Cooperatives (MACO). CFU received private-sector support from the Lonrho Group, while the World Bank funded the Agricultural Sector Investment Programme (ASIP) through MAFF, which involved carrying out on-farm trials with maize and cotton farmers of the Central and Southern Provinces.

Role of the private sector

The private sector played a very important role in promoting CA in Zambia. Private Cotton companies worked closely with CFU to train outgrowers in CA practices, using a lead-farmer model, mainly in the cotton belt of the Central Province. For instance, Dunavant provided training programmes and market (purchasing-price) incentives for CF best practices. A number of CA-related research activities are being carried out at GART in response to critical CA demands in Zambia (Martin and Selvendran, 2013). The programmes refer to conservation agriculture, seed multiplication, smallholder dairying, village poultry and biofortification. GART was also one of the main stakeholders of the CASP project for the upscaling of CA technologies.

The Conservation Agriculture Programme (CAP) promoted the direct engagement of the private sector and agro-dealer networks. CAP also worked closely with GART on research and with the Zambia National Farmers' Union (ZNFU) on the Production, Finance and Improved Technology (PROFIT)[3] programme relating to the private sector. Most notably, CAP also configured a lead-farmer extension and training system, which included a field officer who was in charge of 13-15 regions and oversaw field coordinators (FCs) and contact farmers (CFs). Each field officer was responsible for mobilizing his/her group of 30 farmers for the training sessions, which were conducted in the field by the FCs. In this way, FCs and CFs "work" for the Conservation Farming Unit, and are paid for their services with electronic vouchers. The following figure portrays the timeline of events in the innovation history of CA in Zambia (Figure 2).

Zambian farmers received incentives to promote CA (Umar, 2012). Under CAP, redeemable input vouchers of substantial value (sometimes USD 100 per lead-farmer) were provided. Community Markets for Conservation (COMACO) evolved from the idea that the aid-dependent rural poor in Zambia could partner with a company to sustain their livelihood. In exchange for agreeing to use conservation farming techniques, farmers were given access to farming inputs and training to improve their skills, and were guaranteed a high market value for their goods (Shula, 2012). In a further notable example of private-sector participation, Zoona, an electronic-payments company based in Zambia, partnered with Dunavant Cotton Company to make e-voucher payments ("ag vouchers") to smallholder farmers in exchange for their goods.

[3] PROFIT is a USAID-funded programme, implemented by CLUSA. It seeks to strengthen connections within selected value chains to increase the provision of farming inputs and services with a view to improving productive output and quality, and thereby increasing the incomes of enterprises and households (DAI, 2010).

NGOs

Since CA programmes began in Zambia, several NGOs have promoted it by supplying inputs (CARE, CRS, PAM), mobilizing groups (clubs), offering services through Development Aid from People to People (DAPP), delivering training courses through the Kasisi Agricultural Training Centre (KATC), facilitating private-sector participation though Musika[4], and fostering value-chain development through Community Markets for Conservation (COMACO).

In collaboration with the national Crop Research Institute (CRI) and a private company, the Sasakawa Global 2000 (SG 2000) project[5] has developed a "no-till with mulch" cultivation system that is especially well suited to small-scale farmers. Although the CA projects of the NGO are based in Ghana, the CA technology packages were widely adopted by the farmers of Zambia (Ito, 2007). Musika has a single objective, which is to stimulate private sector investment in the smallholder markets (Musika, 2017), to which end it has supported the e-voucher programme of the Zambian Government to improve the distribution of subsidized inputs to smallholder farmers. The DAPP Farmers' Club project seeks to raise the living conditions of rural families by increasing and diversifying production and improving marketing (Sinkala, 2017). Farmers' Club members are given training sessions, instructed in model farming and receive field visits. They receive the benefits of low-cost technical solutions and technical assistance, and enjoy the opportunities flowing from the exchange of collective experiences, links to microfinancing and markets, and, generally, from the support that club membership implies (Sinkala, 2017).

COMACO forms business partnerships with rural communities and links villagers to urban consumers through a value chain of environmentally smart products. It offers solutions for land management, food security, and improved rural incomes (Stenquist, 2017). The Kasisi Agricultural Training Centre (KATC) offers a range of courses relating to sustainable organic agriculture (SOA) for, among others, small-scale farmers, school teachers, extension staff, community-based extension workers and leaders. KATC also verifies the results of trials of both indigenous and exotic technology, and conducts technology-generation trials in which new farming ideas are tested. Many NGOs, including the Catholic Archdiocese of Monze, Development Aid from People to People, CARE and AFRICARE have also involved themselves in the extension of CA technologies (Haggblade and Tembo, 2003). The association of NGOs with agribusiness firms is to be welcomed because it produces a high degree of complementarity, as evidenced by the partnership between CLUSA and Cheetha paprika growers[6].

[4] Musika is a Zambian non-profit company that works to stimulate private sector investment in the smallholder markets.

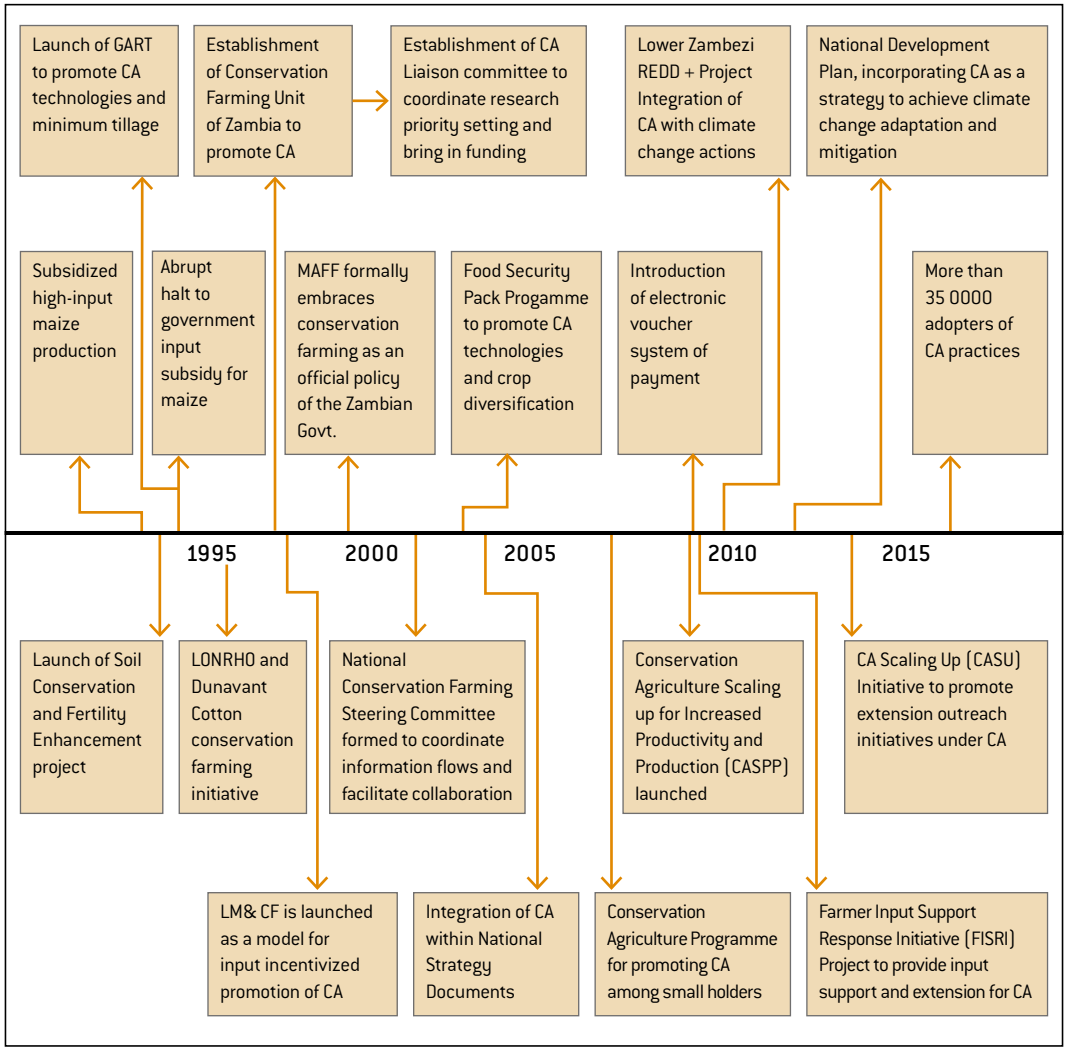
[5] The SG 2000 project was initiated in Ethiopia during the spring of 1993. It aimed at upgrading the capacity of the extension services to disseminate proven research technology to small-scale farmers.

[6] In Zambia, Cheetah Ltd. processes and exports paprika as the primary ingredient in food colouring. It is the largest processor of paprika in Zambia. Paprika is a high-value, quality-sensitive but nonperishable crop (Colorado State University, 2017).

Policy support

In 1998, the Ministry of Agriculture, Food and Fisheries (then MAFF, now renamed MACO) formally embraced conservation farming as an official policy of the Zambian Government (GART, 2002; MAFF, 2001). Their partners at LM&CF likewise stepped up promotional efforts for both CF rippers and hand-hoe basins. Consequently, both MAFF and LM&CF have devoted increasing attention to extending conservation farming technologies. MACO currently hosts the Secretariat of the National Conservation Agriculture Task Force.

Figure 2: Timeline of events in the innovation history of CA in Zambia



Sources: Shula *et al.*, 2012; Whitefield *et al.*, 2015; Abdulai and Abdulai, 2016; Haggblade and Tembo, 2003; Mwanza, 2016

In 2004, the Government of Zambia recognized conservation farming as an important component of national strategy for increasing crop production, as set forth in its National Agricultural Policy (2004-2015). The sixth National Development Plan (2011-2015) cites CA as part of the government strategy for climate-change adaptation and mitigation, diversification, the attainment of national and household food security, and soil management for sustainable agricultural production and growth. The CA scaling-up (CASU) initiative, which was started in 2013 with EU/FAO support and implemented by MAL through its extension services in Zambia's provinces, is expected to extend the outreach of CA practices to more than 300 000 small-scale farmers.

INNOVATION MANAGEMENT BEHIND UPSCALING CA IN ZAMBIA

Several donors supported CA upscaling, which was beneficial to the CA "innovation trajectory" in Zambia (Reddy ***et al.***, 2011). Many of the initiatives built on previous efforts, to which both CFU and MAFF (now MACO) provided links. Of particular benefit was the long-term engagement of donors (notably, the Royal Norwegian Government's support of CFU for nearly two decades), the government, the private sector, NGOs and farmer organizations. The use of tools and techniques such as farmer groups, lead-farmers, steering committees, CA task forces, regional conservation tillage networks and the like advanced the upscaling of CA in Zambia. Table 6 lists the various actors and approaches.

Table 6: Adoption approaches for enhancing CA uptake

CATEGORY	APPROACH	PROMOTER
Financial incentives	Free inputs	PAM, CLUSA, CARE, CRS
	Input subsidy	FISP, FRA
	Revolving fund	FAO
Voluntary compliance	Training and extension services	Department of Agriculture, LM and CF – SCAFE, ASP, CFU
		Zambia Agricultural Research Institute, Golden Valley Agriculture Research Trust
Cross-compliance	Support for CA intervention in exchange for undertaking related projects/ programmes	Mainly NGOs such as PAM, CLUSA, CARE and CRS

Source: Shula, 2012; Mwanza (2016)

A qualitative analysis of the results indicates that the adoption of CA was positively influenced by the development of a good responsive relationship with farmers achieved through confidence-building, extension strategies, household approaches, performance monitoring

and evaluations, the engagement of traditional leadership, the quality and extent of technical knowledge and artificial incentives (Haggblade and Tembo, 2003; Mwanza, 2011; Nyanga, 2012; Ng'ombe ***et al.***, 2014). Extension support to households, cattle ownership and asset holding were significant determinants for the adoption of CA practices.

An analysis of this case using the Innovation Management Framework revealed the breadth of the functions that were performed by the various agencies for the scaling-up of CA in Zambia. They are considered in detail below.

Continuous technology adaptation The upscaling of CA necessitated the testing and on-farm trials of several techniques, such as improved fallow systems, good tillage practices and the use of mechanical-powered and animal-draft low-till equipment suited to the vagaries of the different agroclimatic and socio-economic conditions of farmers across the country. Taking the lead from the CFU, which pioneered this type of research at GART, the Zambian Agricultural Research Institute (ZARI) and the Kasisi Agricultural Training Centre continued with the adaptation of CA practices.

Enhancing farmers' access to knowledge and expertise: Most of the actors organized several demonstrations, on-farm trials, field days and training to expand farmers' access to CA knowledge. Radio broadcasts also disseminated information about CA. To sponsor farmer-to-farmer extension, the programmes identified and trained farmers, including in the promotion of CA among their peers. The programmes were delivered to lead farmers and contact farmers operating under the tutelage of WVIAP, contact farmers under CAP, and own farmer facilitators under CASPP.

Developing the capacities of knowledge-intermediaries: Several projects were undertaken to develop the capacities of knowledge-intermediaries in the public-, private- and NGO-sectors to upscale CA among farmers. For instance, the CFU trained government extension staff, farmer distributors of Dunavant Cotton and several NGOs. The CFU devoted increasing time and resources to strengthening the capacities of other organizations to promote CA, and, along with the Cooperative League of the USA (CLUSA), developed field manuals and instructional videos for intermediaries.

Setting up user/client groups: The formation of farmer groups and the utilization of group-based approaches accelerated the upscaling of CA in Zambia. Programmes such as CAP and CASPP and organizations such as CLUSA set up farmer groups dedicated to the promotion of CA and capacity-building.

Networking and coordination: The CFU of the Zambia National Farmers' Union (ZNFU) served as the initial platform for the networking of different CA actors in Zambia. Private-sector entities, NGOs, farmer organizations and public-sector agencies joined forces to organize several activities (research work, on-farm trials, demonstrations, training courses etc.) for the promotion of CA. In view of the need for regular stakeholder consultations and for the co-ordination of the efforts of the various stakeholders engaged in CA, the Technical Service Branch of the Ministry of Agriculture set up the National Conservation Farming Steering Committee, whose secretariat is under the aegis of the Ministry. In addition, the National Conservation Agriculture Task Force of Zambia advocates for CA policies and influences agricultural and other related policies.

At the continental level, the African Conservation Tillage Network (ACT) stimulates and facilitates the uptake of CA and encourages the sharing of information and knowledge about CA experiences, as well as of lessons learned. Farmers, entrepreneurs, policy-makers, researchers, learners, academics and other stakeholders are thus enabled to design better and more appropriate policies and programmes for the upscaling of CA in Africa.

Policy advocacy and recognition: The Zambian Government's adoption of CA as official policy in 1998 led the MAFF (now MACO) to step up its efforts to extend CA technologies. With the integration of CA into the National Development Plan (2011-2015) as part of the Government's strategy for climate-change adaptation and mitigation, the efforts to promote CA were substantially expanded, and the ZNFU, CFU and KATC played a very important role in this process.

CASE 3.2 SRI IN VIETNAM

PRACTICE

The System of Rice Intensification (SRI) is a climate-smart agro-ecological methodology for increasing the productivity of rice (and more recently other crops) by changing the manner in which plants, soil, water and nutrients are managed. The SRI methodology is based on four interlocking key principles: (i) early, quick and healthy plant establishment; (ii) reduced plant density; (iii) improved soil conditions through enrichment with organic matter; and (iv) reduced and controlled water application (SRI Rice, 2015). Globally, SRI has increased crop productivity, while also reducing inputs such as seed, water, fertilizer and pesticides. Although it is effective, SRI represents such a radical break from the traditional farming practices of most rice-growing regions that it requires effective education and awareness-building before it can be implemented successfully (SRI in Vietnam, 2008).

CONTEXT

In Vietnam, rice is grown on 85 percent of cultivated land. Rice production in the country has been continuously rising, from 25 million tons in 1995 to almost 40 million tons in 2010. Part of the increase is attributable to the expansion of land under cultivation, and part to higher yields, which improved from 3.7 tons per hectare in 1995 to 5.3 tons per hectare in 2010. The use of input-intensive modern varieties of rice, combined with the balanced application of fertilizer and an increase in the amount of land under irrigation (now 93.4 percent) has produced rising yields in recent years (Ricepedia, 2012).While the higher yields were made possible partly by the use improved seeds, they also reflect the increased use of fertilizer, herbicides and pesticides, to the detriment of the environment and community health (Belfort, 2016). The Vietnamese Government is a major provider of farming services and controls access to inputs and credit. Farmer groups consisting of 20 to 30 families operate in rural villages, and are organized and trained by agricultural technicians and extension agents.

In 2003, Vietnam's Plant Protection Department (PPD) began conducting SRI training sessions as part of its FAO-funded integrated pest management (IPM) programme. The training, delivered through farmer field schools (FFS), enabled participants to trial SRI in experimental fields and witnesses first-hand the potential of the methodology. Follow-up trials in additional areas were funded by the Biodiversity Use and Conservation in Asia Programme (BUCAP) and the Danish International Development Agency (DANIDA). In 2004, PPD developed and disseminated technical guidelines for SRI adoption for different rice cultivation conditions. Using some of the resources earmarked for the IPM component of the DANIDA-funded Agricultural Sector Investment Programme, in 2005-06 SRI was tested on larger tracts of land of 2-5 ha in 12 provinces (Plant Protection Department, 2013). In 2006, Oxfam, the PPD, the Centre for Sustainable Rural Development (Vietnam) and the Hanoi University of Agriculture formed an SRI-extension partnership that emphasized experiential learning and knowledge-sharing. The first phase of their joint extension programme tested SRI in various local contexts both with a view to building up a solid base of evidence-based knowledge and with a view to helping farmers and local technicians adapt SRI principles to their particular circumstances.

In 2007, the Ministry of Agriculture and Rural Development (MARD) issued a formal decision acknowledging SRI as a "technical advance" and directing government agencies to "guide and disseminate" the innovative methodology. In the same year, the PPD, with the support of Oxfam

America, launched an SRI dissemination effort in Ha Tay Province and, in one year, increased the use of SRI there from 3 000 ha to 33 000 ha. The community-based SRI model was also successfully rolled out on 170ha located in the Dai commune. Oxfam America also supported initiatives such as "The System of Rice Intensification (SRI): Advancing small rice farmers in Mekong region" in 2007, and the "Farmer-Led Agricultural Innovation for Resilience" (FLAIR) of 2010 – 2022.

In 2009, the PPD with the support of Oxfam America and Oxfam Quebec and the assistance of the Centre for Sustainable Rural Development (SRD), launched an SRI programme in 12 communes in six provinces involving coordinated action between local rural organizations, local government, service-providers and farmers. The PPD also raised funds from the provincial government for field-level implementation.

IMPACT

By 2009, 440 833 farmers in 21 provinces were using SRI methods on 232 365 ha, of which 85 422 ha produced during the winter-spring season, and 146 943 ha during the summer season (SRI in Vietnam, 2010). The Ministry of Agriculture and Rural Development reported that more than a million farmers (1 070 384, 70 percent of whom women) were applying SRI methods on 185 065 ha (457 110 acres). By 2011, one million farmers, some 10 percent of the national total, had adopted SRI and were following all or some of its principles. The PPD reported that the SRI methodology was being used on 16 percent of the rice-growing fields of the north of the country, and on 6 percent of the rice-growing fields of the country as a whole. SRI farmers increased their collective income by USD 18.35 million (VND 370 billion) in the spring crop season of 2011. As of 2015, SRI had reached over 1.8 million people.

ACTORS AND THEIR ROLES

Several actors contributed to the upscaling of SRI in Vietnam (Table 7). PPD spearheaded the initial testing of SRI (with FAO support), which was predicated on five technical principles, namely: the use of healthy young seedlings and the transplantation of single seedlings; early weeding; rational water management; aeration of the soil; and the application of manure and compost. Later, the SRI Extension Partnership between Oxfam, PPD, the Centre for Sustainable Rural Development (Vietnam) and the Hanoi University of Agriculture expanded SRI on a trial basis to various local contexts with the aim of building up an evidence base and, at the same time, teaching farmers and local technicians how to adapt SRI principles

to the peculiarities of their local circumstances. The partnership then developed technical and extension materials and, by a combination of the FFS approach and farmer-to-farmer extension activities with appropriate backstopping from PPD technicians, expanded the scope and uptake of SRI (Belfort, 2016). Several other projects were also undertaken to encourage the adoption of the SRI methodology.

Table 7: Key actors instrumental in promotion SRI in Vietnam

ACTORS	ROLE/FUNCTIONS	ACTIVITIES
Oxfam America	Working with civil society partners and the Government of Vietnam to promote SRI among smallholder rice producers. Financing SRI promotion. Promoting equity, human development and economic well-being through social and economic change by working with other partners.	Local testing and confirming of SRI benefits through Farmer Field Schools. Developed the key farmers' extension partnership with Vietnam's Plant Protection Department (PPD). Tested models for enhancing local capacities in "Innovation in agriculture and adaptation to climate change". Member of the SRI Extension Partnership along with PPD, the Centre for Sustainable Rural Development (Vietnam), and the Hanoi University of Agriculture. Organized farmer innovation forums under the FLAIR project to promote farmers' innovative ideas. Developed joint work plans with provincial service-providers to make the extension more effective.
Plant Protection Department (PPD)	Carrying out plant-protection extension activities. Administering plant quarantine activities at the national level. Pesticide management activities, including pesticide registration and residue control. Handling of food safety concerns. Providing technical and financial support for SRI implementation.	With support from FAO, PPD launched SRI training in three provinces in 2003. Organized extension approaches, including intensive farmer field schools and farmer-to-farmer training for the upscaling of SRI. Partnered with Oxfam, the Centre for Sustainable Rural Development (Vietnam) and the Hanoi University of Agriculture for SRI extension.

ACTORS	ROLE/FUNCTIONS	ACTIVITIES
Poverty Alleviation in Rural Areas (PARA): a German Government-funded project (GIZ) implemented in two phases: a: 2007; b: 2010	The PARA project was implemented in combination with the "Improving Market Participation of the Poor" (IMPP) programme of financial assistance funded by the International Fund for Agricultural Development (IFAD). Its main functions are: › developing sustainable, market-oriented agriculture through the promotion of the rice value-chain; › strengthening market linkages throughout the rice value-chain; › poverty eradication.	Gesellschaft für Internationale Zusammenarbeit (GIZ) financed and supported the SRI pilot phase. The GIZ-backed PARA project delivered presentations and organized discussions (2011) to raise the level of knowledge of DARD staff, who were trained in the technical aspects of SRI and in the organization of Farmer Field Schools (FFS) dedicated to SRI. Weekly FFS were used to introduce SRI to farmers and train them in its use. Hand-weeders, seeds, biofertilizer (for the first and second crop seasons only) and fungicides were made available, and the labour costs of transplantation activities were subsidized. Compensation was paid for any shortfalls in SRI yields for the first two crop seasons compared with control plots. GIZ collaborated with DARD and the Mekong Delta Rice Research Institute on the installation of equipment for measuring the greenhouse gas (GHG) emissions from SRI-managed plots and from control plots. Open SRI harvest events were held for the presentation of results and to provide an opportunity for critical self-reflection by the many parties involved in the project. Compost-making techniques were demonstrated. The project provided support for the formation of groups of quality seed growers (seed rice production).
International Rice Research Institute (IRRI)	Varietal improvement, conservation of rice diversity, sustainable farming systems and capacity-building.	Organized the "1 must do, 5 reductions" campaign with the Vietnamese Ministry of Agriculture and Rural Development (MARD) to promote SRI (2009). Crafted a "rice restructuring plan" for Vietnam relating to the production of high-quality and specialty rice for the domestic and export markets, the branding of Vietnamese rice, loss reduction, climate-change adaptation, support for small farmers, and policy advice. IRRI has been a key collaborator in developing the award-winning "Three Reductions, Three Gains" (3R3G) project that helped farmers improve their rice crop management practices.

ACTORS	ROLE/FUNCTIONS	ACTIVITIES
Department of Agriculture and Rural Development (DARD)/ Ministry of Agriculture and Rural Development (MARD)	Building awareness and identifying SRI promoters. Adjusting SRI to local conditions. Establishing market linkages	In cooperation with GIZ, DARD developed 14 modules illustrating a complete rice crop season under the SRI method. Worked with the farmers on analysing and adjusting SRI. Allocated funds for SRI upscaling. Held field demonstrations and training sessions. Selected an SRI champion from the department to spearhead uptake. Used FFS and volunteer farmers to convince farmers of the benefits of SRI principles. Produced TV programmes to promote SRI with the support of PARA. Conducted, with the participation of PARA, open SRI harvest events for the presentation of results and critical self-reflection among participants. Covered labour costs of transplanting crops to demonstration fields. The payments were later halved. Trained members in seed purification techniques. Facilitated market linkage for SRI rice seed growers. Worked with IRRI on the "1 must do, 5 reductions" campaign. In 2011, MARD published a climate-change action plan in which SRI was specifically recognized as a priority adaptation method for the reduction of greenhouse gas emissions.
SRI - Lower Mekong River Basin (LMB), an EU - financed regional project (2013)	Enhancing the resilience of rainfed farmers facing climate change in the Lower Mekong River Basin (LMB). Sustainably increasing smallholder crop yields, productivity and profitability on a in rainfed areas of LMB.	Several capacity-building activities were organized, including training workshops and exchange visits. Farmers' participatory action research (FPAR) activities were conducted on 405 trial sites in 2014, 2015 and 2016. Central farmers' participatory action research (CFPAR) projects were carried out. The project also arranged a regional training-of-trainers course, two regional workshops, six national workshops, ten season-long Central Farmer's Participatory Action Research (CFPAR) training courses, regional farmer exchange visits, 17 provincial workshops and a farmers' congress. Organized SRI field demonstrations and field experiments.

ACTORS	ROLE/FUNCTIONS	ACTIVITIES
Centre for Sustainable Rural Development (CSRD)	Organizing technical and institutional interventions to empower farmers and strengthen community-based organizations. Focusing on gender equality, climate change, rights for people living with disabilities, policy advocacy and capacity-building.	Organized field-based training sessions on SRI practices using an FFS approach. Supported the campaign "Protecting our children from toxic pesticides" through the promotion of SRI cultivation (reducing pesticide use), in collaboration with People's Committee (PC) and Department of Education and Training (DOET)
Asian Institute of Technology- Vietnam (AIT-VN)	The mission of AIT-VN is to provide future leaders with high-quality education and training that will enable them to undertake research (in sciences, education, engineering and management) and to contribute to sustainable development in Vietnam.	Implemented the SRI-LMB project in partnership with FAO, Oxfam, SRI - Rice of Cornell University and the University of Queensland. Set up workshops for the partner organizations for the sharing of SRI knowledge. AIT-VN was a major implementer of the project "Sustaining and enhancing the momentum for innovation and learning around the system of rice intensification in the Lower Mekong River Basin" (SRI-LMB).

Sources: Poverty Alleviation in Rural Areas (2013); CCAFS (2016); International Cooperation and Development (2017); Asian Institute of Technology (2017); Neate (2013).

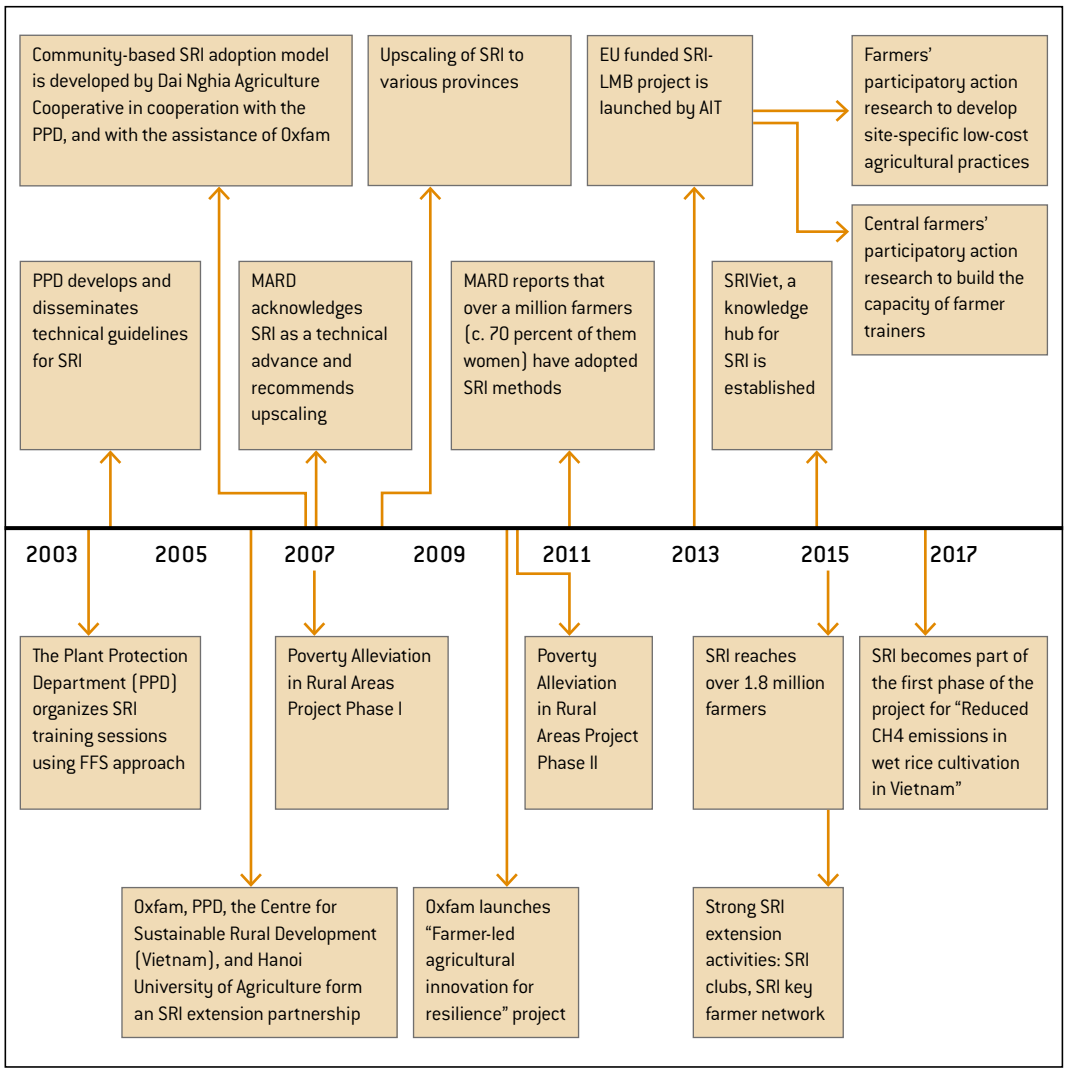
In 2015, SRIViet, a foundation for organizations and individuals interested in SRI, was established in Vietnam. The founding members include Oxfam, SNV (a Dutch non-profit international development organization), Thai Nguyen University (ICC-TNU), the Field Crops Research Institute (FCRI), the Center for Agrarian System Research and Development (CASRAD), the Institute of Agricultural Environment (IAE), Vredeseilanden in Vietnam (VECO), the Foundation for International Development/Relief (FIDR), PPDs and the Centre for Sustainable Rural Development (CSRD). SRIViet arranges and leads regional exchanges, dialogue sessions and collaborative work among national SRI networks in the Southeast Asia region. The foundation brings together organizations and individuals interested in SRI and sustainable rice systems so that they may share information and research findings, cooperate on ways of giving greater voice to rice producers, and work together on policy advocacy and the mobilization of support.

The long-term investments and policy advocacy work of PPD and Oxfam furthered the expansion SRI by securing political endorsement and backing. At the start of 2011, the government allocated USD 383 000 to support SRI and foster other low-input, low-carbon agricultural methods in the six provinces included in the programme. The Government's allocation was one-third higher than the total value of Oxfam's contribution.

INNOVATION MANAGEMENT FOSTERING SRI UPSCALING IN VIETNAM

The Government of Vietnam, especially PPD, with FAO support, introduced SRI into the country. It was not promoted as a "ready-made" technology recommended for wide adoption. Instead, the SRI principles were first tested and adapted through participatory methods before being promoted through experimental learning and knowledge-sharing conducted through farmer field schools. The following figure depicts the timeline of events in the innovation history of SRI in Vietnam (Figure 3).

Figure 3: Timeline of events in the innovation history of SRI in Vietnam



Sources: CCFAS, 2016; Linn, 2012

In Vietnam, SRI has progressed through three interlinked phases, as follows.

Box 2
THREE INTERLINKING PHASES OF SRI IN VIETNAM

Phase I
Local testing and confirmation of the potential of SRI:

SRI was tested in a range of local contexts to assess crop performance, profitability and scope for local adaptation. The aim was twofold:

(i) to build an evidence base confirming the potential of SRI, and

(ii) to embed local experience in extension approaches so that farmers and local technicians might more easily adapt SRI principles and learn how to maximize benefits for themselves.

Phase II
Expanding upon the experience and the evidence base to build critical mass.

Oxfam and PPD focused on refining the SRI technical and extension materials and making them widely available to technicians and agencies. A tiered extension model was developed with intensive farmer field schools (FFS) at one end of the spectrum and extensive farmer-to-farmer extension approaches at the other. This allowed the programme to accumulate a critical mass of experienced farmers and technicians.

Phase III
Aligning with the government and mobilizing resources.

As the first two phases progressed, the programme increasingly prioritized the documentation of field results to engage researchers and policymakers. The programme was able to align with and influence various policy mandates and persuade government to invest in it.

Source: Linn (2012)

Significant effort went into developing evidence and enhancing the ability of farmers and technicians to understand, appreciate and adapt SRI. FAO, DANIDA and Oxfam played a key role in testing SRI in different contexts, while Government support in the form of policy recognition and enhanced public investments through DARD ensured its rapid upscaling. SRI became an important component in the GIZ-funded poverty alleviation programme and in the EU-funded programme for promoting the resilience of rainfed farmers. The Government of Vietnam currently recognizes SRI as a tool for reducing greenhouse gas emissions. Farmer field schools, farmer volunteers and sharing workshops were among the approaches and techniques used.

An analysis of this case study through the prism of the Innovation Management Framework revealed that the various agencies committed to the upscaling SRI in Vietnam carried out a wide array of different functions and tasks, which are considered in detail below:

Experimentation, adaptation and promotion of technologies: SRI was promoted through FFS, which allowed participants to trial SRI methods and learn from them. This approach, whereby

SRI was tested and solid empirical base of evidence was established before roll-out, enabled the development of detailed technical guidelines, extension promotion materials and modules, and stimulated the adoption of SRI by farmers in different regions. PPD, operating initially with FAO support and later as part of the SRI Extension Partnership with Oxfam, CSRF and the Hanoi University of Agriculture, promoted this experiential learning and knowledge-sharing approach.

Enhancing farmers' access to knowledge and expertise: Most of the actors organized FFS, provided weekly advice at FFS meetings, supported farmer-to-farmer training and organized SRI harvest events, demonstrations, screening of videos on SRI, campaigns ("1 must do, 5 reductions")[7], training sessions, participatory action research training and exchange visits, with the object of enhancing knowledge and encouraging farmers to try out, experiment with and eventually adopt SRI.

Developing the capacities of knowledge-intermediaries: DARD staff were trained both in the technical aspects of SRI as well as in the organization of farmer field schools dedicated to SRI. Partner organizations set up courses for the training of trainers and workshops for the sharing of SRI knowledge.

Provision of incentives and inputs: To promote the adoption of SRI, farmers received incentives for a limited period (the first and second crop seasons). These included inputs such as hand-weeders, seeds, biofertilizer and fungicides, as well as cash incentives to compensate for the labour costs of transplantation (the payments were later halved). To ensure quality seed production, seed producer groups were set up and linked to markets.

Learning and knowledge-sharing: Multi-level learning was an important component of SRI upscaling in Vietnam. In addition to fostering self-learning among farmers on the basis of the experience with experimental and trial plots, the projects poured significant effort into documenting SRI experiences and sharing them among actors from different regions of the country. The establishment of SRIViet in 2015 expanded the reach of the learning process to a regional level through exchanges within Southeast Asia, and to a global level through national SRI networks. The networks shared SRI experiences and research findings, engaged in dialogue and worked together.

Partnerships: One of the defining features of the SRI programme in Vietnam was the development of partnerships between the various participating organizations. For instance, the SRI Extension Partnership between Oxfam, PPD, the Centre for Sustainable Rural Development (CSRD) of Vietnam and Hanoi University of Agriculture that began in 2006, as well as the more recent FLAIR project (2010-2022) jointly involving Oxfam, PPD, and CSRD, both advanced the process of SRI upscaling.

Policy advocacy and recognition: Advocacy has been helpful to expansion of SRI as it has garnered support for the method, leveraged resources (from government and other donors) and improved dialogue between farmers and policymakers. Oxfam, PPD and CSRD fulfilled the important task of generating evidence that could be adduced for the purposes of policy advocacy. The cause of SRI in Vietnam was strengthened by political support, which ensured that SRI was recognized as a technical advance, with the result that public funds became available for its promotion in several provinces.

CASE 3.3 DROUGHT-TOLERANT MAIZE IN SUB-SAHARAN AFRICA (DTMA)

PRACTICE

Maize is a major staple in sub-Saharan Africa (SSA), with over 300 million people depending on the crop for their food security and livelihood (Tesfaye ***et al.***, 2015). Maize production in Africa is almost completely rainfed, and droughts ravage approximately a quarter of the crop, resulting in losses of up to half the harvests in affected areas. Extended periods of drought adversely affect not only crop yields but also the livelihoods of African farmers. Economic analyses suggest that, if widely adopted, drought-tolerant (DT) maize seed could help African farmers cope with these adversities (Ellul, 2013). Based on technological breakthroughs in the 1990s and a strong breeding programme on drought tolerance initiated by the International Maize and Wheat Improvement Center (CIMMYT) and subsequently continued by IITA, more than 200 DT maize varieties have been developed and released across SSA over the last two decades. Intensive efforts to strengthen SSA maize seed systems, including through public-private partnerships

and the capacity development of national agricultural research systems (NARS) and seed companies, led to the introduction of DT maize varieties in 13 SSA countries, and thus offset the failure of the market to scale up DT varieties (Prasanna ***et al.***, 2017).

CONTEXT

Maize is grown on nearly 35 million hectares across Africa under rainfed conditions and is thus vulnerable to the vagaries of the weather, which are set to become more challenging as climate change takes hold. Around 40 percent of maize-growing areas in the region face occasional drought stress and suffer yield losses that are 10-25 percent above non-stressed areas, while an additional 25 percent of the crop suffers frequent drought, with losses of up to 50 percent (Edmeades ***et al.***, 1997).

Launched in 2006, the Drought Tolerant Maize for Africa (DTMA) project aims to mitigate drought damage and other constraints on maize production in sub-Saharan Africa, and thus increase yields by at least one ton per hectare under moderate drought conditions, corresponding to a 20-30 percent increase over current yields, which will benefit 30-40 million people in 13 African countries. The project has been jointly implemented by the International Maize and Wheat Improvement Center (CIMMYT) and the International Institute for Tropical Agriculture (IITA), with the close collaboration of the national agricultural research systems (NARS) of participating nations. Millions of farmers in the region are already benefiting from the partnership, whose outputs include support and training for African seed producers and the promotion of vibrant, competitive seed markets (DTMA, n.d).

IMPACT

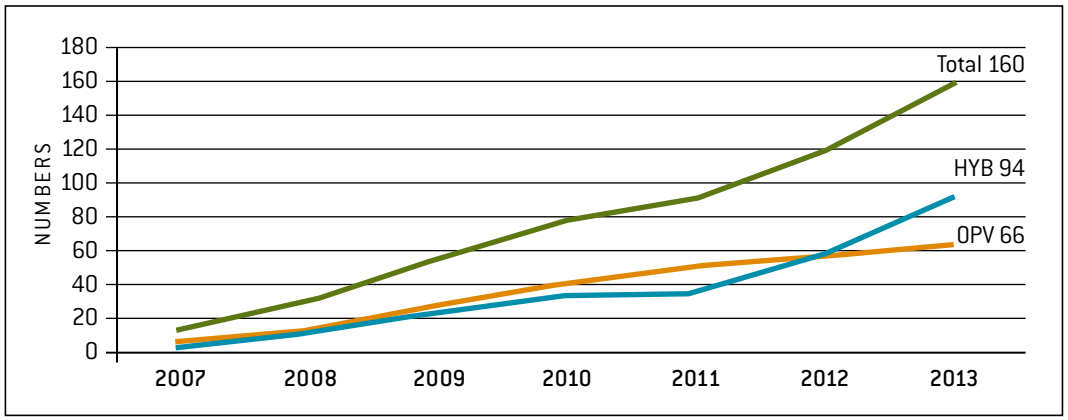
In 2016, more than 100 seed companies (local, regional and international) upscaled elite DT maize varieties in SSA, with more than 60 000 tons of certified seed of DT maize varieties delivered, covering nearly 2.75 million hectares and benefitting an estimated 6 million households, or 53 million people. At least 60 percent of the beneficiaries were women and children (Prasanna, 2017). The project in its entirety will benefit approximately 30-40 million people in 13 or more countries in Africa by raising yields by at least one ton per hectare, even in periods of moderate drought (Ellul, 2013). Figure 4 depicts the cumulative growth in the number of DT maize varieties over the years. For the time being, DT maize covers less than

[7] The one "must do" refers to using certified rice seeds; the five reductions concern efforts to reduce the amount of seeds, pesticides, fertilizers, water, and post-harvest losses (IRRI, 2012).

3 million hectares out of the total of 35 million hectares. Accordingly, SSA has tremendous potential for further upscaling and for deploying elite climate resilient maize varieties.

Table 8 below depicts the DT seed multiplied in the SSA countries in 2012, which invariably contributed to the upscaling of DT maize.

Figure 4: Cumulative numbers of drought- tolerant maize varieties released under the DTMA project between 2007 and 2013 (HYB: Hybrids, OPV: Open Pollinated Variety)



Source: DT MAIZE, 2014

Table 8: Drought-tolerant seed multiplied in DTMA countries in 2012

COUNTRY	QUANTITY (MT)			AREA COVERED (000 HA)*	HOUSEHOLDS COVERED (000)*
	New	Old	Total		
Angola	511	0	511	20	51
Benin	45	0	45	2	4
Ethiopia	0	1 544	1 544	62	154
Ghana	55	0	55	2	6
Kenya	0	5 050	5 050	202	505
Malawi	4 385	31	4 416	177	442
Mali	800	0	800	32	80
Mozambique	855	0	855	34	86
Nigeria	735	0	735	29	74
Tanzania	619	1 757	2 376	95	238
Uganda	527	1 045	1 572	63	157
Zambia	3 331	91	3 422	137	342
Zimbabwe	4 961	2 507	7 468	299	747
Total	16 824	12 025	28 848	1 154	2 885

Source: Drought Tolerant Maize for Africa Initiative, 2015

ACTORS AND THEIR ROLES

A broad spectrum of actors is engaged in upscaling DTM in SSA countries, and are listed below (Table 9).

Table 9: Key actors instrumental in the promotion of DT maize in SSA

ACTORS	ROLES/FUNCTIONS	ACTIVITIES
CGIAR Centers (CIMMYT and IITA) and CGIAR Research Programme Maize (CRP-Maize)	Development and deployment of elite DT, disease-resistant and nutrient-use efficient maize varieties adapted to diverse production environments in SSA. Collaborating with other research-focused partners such as the Syngenta Foundation, the University of Hohenheim etc. CIMMYT develops and deploys maize germplasm with high yield, stress resilience and nutritional quality. The CGIAR Research Program "MAIZE" is an international collaboration between more than 300 partners from the public and private sectors, national institutions, international research organizations and seed companies. This unique partnership seeks to mobilize global resources in maize research and development to achieve a greater strategic impact on maize-based farming systems in Africa, south Asia and Latin America.	Formation of maize breeding and seed system teams. Development of more than 200 maize varieties/hybrids. Intensive capacity strengthening of: a. NARS institutions in breeding climate-resilient maize varieties b. SME seed companies in DT maize seed production c. Seed road map implementation d. Upscaling and marketing in target agro-ecologies. Coordinated the mother-baby trial system in southern and eastern Africa as a means of generating farmer participation in varietal selection, adoption and production along with seed companies and NARS. Systematic collaboration with NARS and farming communities for participatory, on-farm selection of seed varieties. The introduction of the annual "Best Maize Breeding" and "Technology Dissemination Team" awards in 2007 to recognize output orientation and teamwork. Workshops/meetings for the country launch of drought-tolerant maize for Africa seed scaling (DTMASS). The workshops raise awareness about DTMASS and offer opportunities for the planning of activities. Several seed companies have undertaken to contribute to the capacity development of producers. Seed systems annual meeting. A presentation was made of the progress achieved by various projects in seed systems research and development across Africa and farther afield.

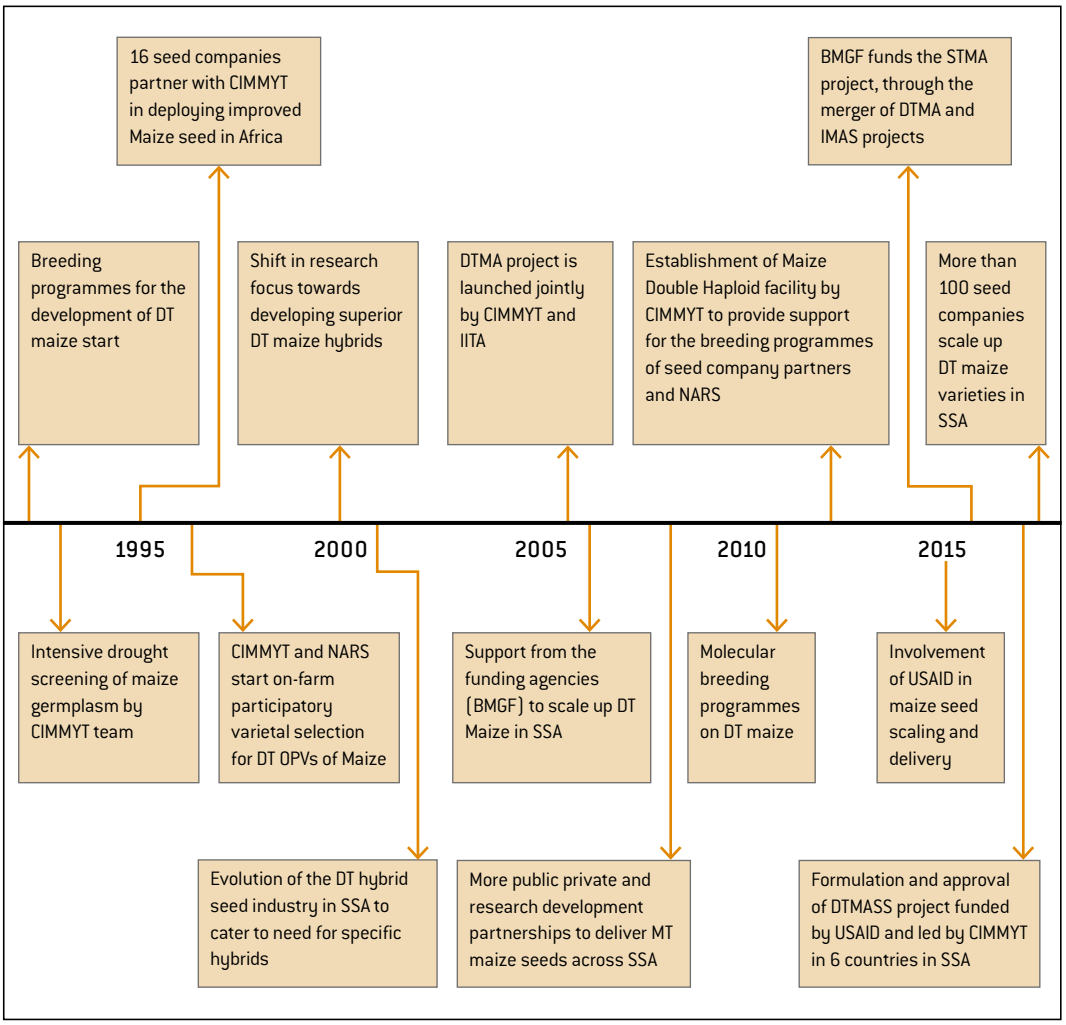
ACTORS	ROLES/FUNCTIONS	ACTIVITIES
DTMA Project Innovation Learning Platform (ILeP)	The ILeP is led by the Ministry of Agriculture and Food Security, and involves national maize breeders and extension agents, private and community seed producers, agro-dealers, grain marketing companies, microfinance institutions, non-governmental organizations and farmers, all of whom collaborate across the entire maize value chain.	By linking with the country's Agricultural Input Subsidy Programme, ILeP has enabled more farmers to access ZM 309 seed, and grow the variety in six of the most drought-prone districts of Malawi, thus contributing to improved food security for thousands of farming households.
Bill and Melinda Gates Foundation (BMGF)	Fostering sustainable agricultural practices. Strategic partnerships and advocacy. Access and market systems.	Funding for scaling the development of improved DT maize hybrids/ varieties, delivery of DT maize seed across SSA. Allocated grants to the Stress-Tolerant Maize for Africa Project. Funded the IMAS project. Organized workshops for project participants.
Seed company partners	Promoting the use of high-quality improved seed and planting materials that conform to national and international standards Upgrading the knowledge and skills of members engaged in the production, distribution and commercial trade of seeds. Providing a forum for the exchange of information and facilitating communications among members and seed-chain actors. Engaging in dialogue and lobbying for the harmonization of the seed policies, laws and regulations of the region.	Stocking of drought-tolerant seeds. Scaling and marketing of maize varieties. Partner in the implementation of DTMASS project.
United States Agency for International Development (USAID)	Investing in cutting-edge scientific and technological agricultural research. Developing sustainable agriculture strategies. Offering extension services.	Funded the DTMASS project to scale up seed availability in select countries. Funded the IMAS project.
Kenyan Agricultural Research Institute (KARI)	Conducting research in crop and livestock production and marketing. Improving livelihoods and commercializing agriculture by increasing productivity and fostering value chains.	KARI has set up local facilities for doubled haploid (DH) production from tropical and sub-tropical maize germplasm. The Ministry of Agriculture and KARI set up a precise drought-screening site in Kiboko, Kenya for the evaluation of 5 000 new DT varieties per year. Organized training workshops for maize technicians (seed companies, NGOs, CIMMYT field stations) as part of the DTMA project.

ACTORS	ROLES/FUNCTIONS	ACTIVITIES
Seed Enterprise Management Institute (SEMI)	Set up in March 2010, SEMI seeks to alleviate food insecurity by expanding the capacities of the seed supply chain in SSA.	Training modules that focus on: seed production, drying, processing, conditioning and storage; seed testing and quality assurance; seed marketing and business management; seed policies and regulations; information management. Courses in seed production, drying, processing and storage for representatives of seed companies operating in 13 SSA countries.
The Kenya Plant Health Inspectorate Services (KEPHIS)	Seed inspection and certification body in Kenya. Phytosanitary services. Seed certification servicers.	Viability testing of the newly developed improved seed varieties at the national performance trials (NPT) of KEPHIS. Organizing field days. Dissemination of information on plant health management.
Farmer Voice Radio (FVR)	FVR is a consortium of radio broadcasters, agricultural experts and farmers, who provide a variety of agriculture-related radio programming, and serve as a megaphone for two-way extension priorities from content providers.	FVR produces a series of radio programmes whose content is developed collaboratively by experts, farmers and radio extension officers. The DTMA project generated content and provided expert interviews.

Sources: CIMMYT (2016); Prasanna, 2017; Ellul, 2013; African Agricultural Technology Foundation, 2012; BMGF, 2017; Miruka *et al*., 2012; Drought-Tolerant Maize for Africa Initiative, 2015; DT Maize, 2015; Abdulai and Abdulai, 2016.

The following figure portrays the timeline of events in the innovation history of Drought Tolerant Maize in Africa (Figure 5).

Figure 5: Timeline of events in the innovation history of DTMA



Sources: CIMMYT (2016); Prasanna, 2017; Ellul, 2013; DT Maize, 2015

INNOVATION MANAGEMENT IN THE UPSCALING OF DTMA

DTMA was designed as an ambitious programme to reach 30-40 million people in over 13 countries. It received long-term (nine-year) support from the Bill and Melinda Gates Foundation (BMGF) that helped CIMMYT and IITA, the lead partners in the project, to work with public and private entities and NGOs to address technology development, assessment and promotion.

Ellul (2013) identified the following elements as essential contributors to the success of DTMA:

- **Knowledge**: a thorough understanding of the targeted value chain;
- **Networks**: identifying the partners best placed to deliver the objectives (i.e. a target-based network of partners);
- **Metrics:** a performance-management system based on key metrics, performance indicators and targets;
- **Strategy:** a well-designed, professionally developed strategy; and,
- **Responsiveness**: the ability to respond promptly to emerging environmental shocks.

An analysis of the performance of DTMA using the Innovation Management Framework revealed that DTMA had achieved its desired impact by successfully executing the following functions.

Research: Research, mainly headed by CIMMYT and IITA in collaboration with NARS, has been central to the successful development and deployment of DT maize. Until the late 1990s, CIMMYT collaborated with NARS, various national programmes and seed companies to develop open- pollinated DT varieties in several countries. The approach emphasized the importance of farmer participation in seed selection, adoption and production. By late 2000, the focus had shifted to developing and scaling elite DT maize hybrids with the funding support of global non-governmental organizations such as BMGF, which worked with NARS partners.

By the end of 2010, the focus had shifted to on-farm performance and multi-disciplinary research for development, which included geospatial targeting and market segmentation. CIMMYT began to oversee the implementation of more advanced maize breeding programmes that were facilitated by cutting-edge biotechnology. A strong MAIZE breeding pipeline that was focused on increasing genetic gains in the stress-prone environments of SSA by effectively integrating innovative tools and technologies eventually led to the development of elite stress-tolerant maize varieties with specific traits that were preferred by farmers as being best suited to their particular agro-ecological context. A total of 233 varieties, including about 200 distinct DT maize varieties, were released under DTMA and made available to the target communities as of January 2016. The success of the DTMA project led to the formulation and approval of the DTMASS project, which is funded by USAID and led by CIMMYT in SSA.

Capacity development: The capacity for maize research varied significantly from one SSA country to the next. While some countries had well qualified researchers, others had to rely on basic level degree-holders to initiate the DTMA programme. Generally, however, the programme contributed significantly to enhancing the research capacities of public- and private-sector

research institutions. For instance, the DTMA maize working group provided training on hybrid seed production and marketing to the staff of registered seed companies, who received lessons on new breeding methods and technologies for early-career maize breeders. Training in the use of up-to-date maize information tools (IMIS Field Book) was also organized for public- and private-sector breeders. Further, unique facilities such as the DTMA project drought-screening site afforded opportunities for direct learning, and programme participants could observe the ongoing drought trials of CIMMYT and the Zambian Agricultural Research Institute (ZARI). DTMASS country-launch workshops increased awareness about the project, and SME seed companies were helped to build up their capacities for quality assessment/ control, seed business management and marketing.

Strengthening the research infrastructure: The close collaboration between DTMA participants, national agricultural research and extension systems and seed companies facilitated the expansion of the programme. Some innovative initiatives, such as the DTMA drought-screening site in Zambia, entailed significant investment both by CIMMYT and ZARI. Similarly, the Kenyan Agricultural Research Institute (KARI) set up local facilities for doubled haploid (DH) production from tropical and sub-tropical maize germplasm.

Alliance with the private sector: Public-private partnerships (PPPs) were crucial for the development and upscaling of DT maize in the SSA countries. For the DTMASS project, CIMMYT forged strong alliances between public and private seed companies, community-based organizations, NGOs and national extension systems. The DTMASS project was therefore rolled out in close partnership with around 50 seed companies. Extensive PPPs in the area of DT maize production boosted the nascent seed sector in SSA, and local maize companies were able to reap the benefits. Meanwhile, seed companies have been investing in DT maize marketing and in the commercialization of their produce. As part of the DTMASS project, several innovations were pioneered, including DT maize market segmentation and territory planning in target countries, the use of digital platforms for the real-time exchange of information about DT maize varieties, and the extension of improved DT agronomic practices to stakeholders.

Policy review and advocacy: DTMA commissioned reviews of the seed laws in the target countries with a view to harmonizing them and thus shortening the delay between the development and the release of new varieties. DTMA is also engaged in continuous dialogue with policymakers on the inclusion of special traits in maize varieties. Farmers in countries such as Nigeria and Malawi are spearheading the adoption of DT maize varieties, largely thanks to favourable government policies that have made improved varieties much easier to obtain and more affordable (Wawa, 2015).

DTMA used several innovative tools, such as annual review and planning meetings and advisory boards, to share experiences and knowledge among all partners. To promote excellence and teamwork among national partners, the DTMA project assigns awards to the teams that prove best at DT maize breeding and technology dissemination. Adoption monitoring surveys identify problems relating to farmers' access to and use of improved maize varieties. DT Maize, the quarterly bulletin of the DTMA project, publishes progress reports and articles on the challenges facing not just partner institutions but also those outside the project coalition.

CASE 3.4 AGRICULTURE AND CLIMATE RISK ENTERPRISE (ACRE), EAST AFRICA

PRACTICE

ACRE Africa, the brand name used by Agriculture and Climate Risk Enterprise Ltd. (ACRE), is a registered insurance surveyor in Kenya and an insurance agent in Rwanda and in Tanzania. ACRE links insurance to credit arrangements tailored to farmers who wish to improve their crop and/or dairy production. Farmers can take out policies against undesirable weather events such as delayed or excess rainfall and drought. Farmers need to apply for insurance cover before planting, must specify their physical location, acreage and the risks they want to insure against, and must pay an appropriate premium to the insurance company. In the event of loss, the insured farmer will be compensated.

There are three pillars to ACRE's approach (ACRE 2014b). The first is made up of a broad array of insurance products that are based on several data sources, including automatic weather stations and remote sensing technologies. The second is ACRE's role as an intermediary between insurance companies, reinsurers and distribution channels/aggregators, which include microfinance institutions, agribusiness and agricultural input suppliers. This second pillar provides a link to the mobile money market, particularly the M-PESA scheme in east Africa, which allows quick enrollment and the rapid payment of claims without the need for physical visits to farmers. In this way, the programme can quickly reach the many millions of farmers enrolled in M-PESA.

The third pillar, index insurance, is a relatively new but innovative approach to insurance provision. It pays out compensation on the basis of a predetermined index (e.g. rainfall level) for the loss of assets and investments caused by the weather or catastrophic events, and does not require the traditional services of insurance-claim assessors. Indexes have been developed for maize, beans, wheat, sorghum, millet, soybeans, sunflowers, coffee and potatoes.

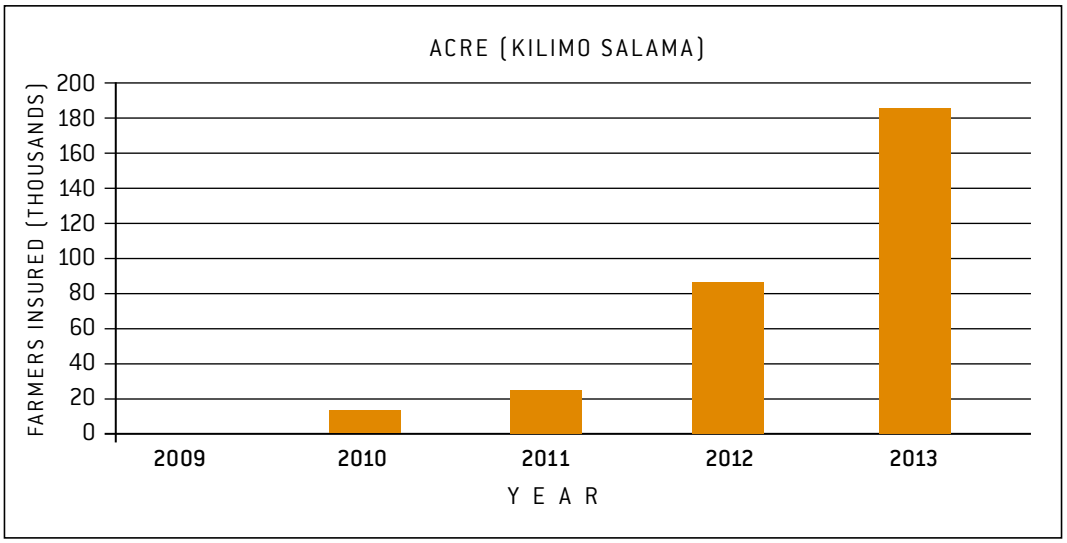
CONTEXT

The ACRE insurance scheme addresses the problem of farmer vulnerability to weather unpredictability. In particular, a drought or excess rain can devastate crops, not only ruining a farmer's harvest for that year but also affecting prospects for recovery in the future. The Syngenta Foundation wanted to develop an insurance product that could reach small-scale farmers yet still be economically sustainable, and found that an index-based product was most fit for purpose. The product is structured so that premiums and payouts are calculated by comparing actual data to an index based on historical data. Typically, this is done through the use of rainfall measurements from local weather stations, whose reports are compared against the minimal amount (the trigger level) of rainfall necessary for normal plant growth. This design was seen as advantageous because it relied on objective measurements to determine damage. The Syngenta Foundation for Sustainable Agriculture launched ACRE in June 2014 as a commercial company advising African smallholders on crop protection strategies (ACRE,n.d).

IMPACT

ACRE, which covered about 233 000 farmers in east Africa in 2014 and 400 000 small farmers in Kenya, Rwanda and Tanzania in 2015, is projected to reach 3 million farmers across 10 countries by 2018 (ACRE 2014b, FGCA,2017). Its rapid advance is charted in Figure 6 below. In 2013, the total sum insured reached USD 12.3 million and payouts USD 370 405. The average cost of insurance was 5-25 percent of harvest value (IFC, 2014). After two years of offering

Figure 6: Number of farmers covered by the ACRE programme in east Africa



Source: Greatrex *et al.* (2015)

index-based agricultural policies in Kenya, Syngenta surveyed 455 farmers with cover and 181 without. The results revealed that insured farmers invested 16 percent more in their farms than their uninsured counterparts (Syngenta Foundation for Sustainable Agriculture, 2017).

Of the farmers insured by ACRE in 2013, 97 percent also received loans linked to their insurance cover. Having insurance increased the likelihood that growers would invest more in agriculture, even in the face of impending risks.

ACTORS AND THEIR ROLES

ACRE evolved from the Kilimo Salama project (established in 2009), which was funded by the Syngenta Foundation and the Global Index Insurance Facility (GIIF). ACRE was launched in partnership with Safaricom (the largest mobile network operator in Kenya) and UAP (a large insurance company based in Kenya). Kilimo Salama is an index-based insurance plan that covers farmers' inputs in the event of drought or excessive rainfall. It helps farmers avoid the risks associated with rainfall variability that directly affect their livelihoods. The product is index-based, meaning payouts are determined on the basis of a comparison with historical, regional rainfall patterns. It is supported by an "in-house knowledge hub" of 30 local and international specialists, who work on all aspects of the plan, from designing the reference index to distributing the product and educating farmers. A summary of actors and their roles is given in Table 10 below.

Table 10: Key actors instrumental in the promotion of ACRE in East Africa

ACTOR	ROLES/ FUNCTIONS	ACTIVITIES
The Agriculture and Climate Risk Enterprise (ACRE) Africa	Acre Africa is a micro-insurance product designer and insurance intermediary, recently incorporated as a brokerage company with support from the Syngenta Foundation for Sustainable Agriculture.	Offered credit-linked insurance through microfinance institutions (MFIs). Offered insurance to large-scale (> 20 acres) contract seed growers. Offered dairy livestock insurance in partnership with a dairy cooperative (for farmers who already own cattle) or in partnership with lending institutions (for farmers who want to purchase them). Incorporated insurance coverage into a replanting guarantee by a seed company, linking ACRE, UAP Insurance and Safaricom. Organized farmer education and capacity development. Developed customized insurance products using mobile technology, bundled with agricultural advisory services, weather data, local access to quality inputs, and input credit. Secured investments from the Lundin Foundation, Grameen Crédit Agricole Foundation and LGT Venture Philanthropy.

ACTOR	ROLES/ FUNCTIONS	ACTIVITIES
Syngenta Foundation for Sustainable Agriculture (SFSA)	Launched the Kilimo Salama index insurance project in partnership with UAP and Safaricom.	Kilimo Salama offered MFIs indirect coverage by backstopping their debtors. i.e. farmers. This practice encouraged farmers to take out insurance if they wanted a loan.
Kenya Agricultural & Livestock Research Organization (KALRO)	Contributes to increased productivity, commercialization and competitiveness of the agricultural sector through the generation and promotion of knowledge, information and technologies.	A memorandum of understanding was signed between KALRO and ACRE Africa in February 2017 by which the parties agreed to cooperate within the scope of their mandates and sphere of competencies to provide agricultural-risk management solutions to Kenyan farmers. Proposed linking insurance coverage to KALRO products such as improved breed/ seeds.
Global Index Insurance Facility (GIIF)	Facilitates access to finance for smallholders, micro-entrepreneurs and microfinance institutions through the provisions of catastrophic risk transfer solutions and index-based insurance in developing countries. GIIF, a multi-donor trust fund, provided capital for Kilimo Salama	GIIF supported ACRE Africa along with Syngenta Foundation for Sustainable Agriculture. It also helped establish index insurance markets through: › *Information campaigns*: education on index insurance for farmers, small businesses, banks and other clients, distributors, etc.; › *Capacity building:* grants to brokers for the training of local insurers and financial institutions in the design of index insurance policies and claims processing; › *Technical advice on products and pricing:* provided by a team of GIIF technical specialists and Swiss Re (GIIF's technical partner); › *An enabling regulatory and policy environment*: the GIIF team finances implementing partners in the private sector, namely intermediary brokers/ agents who develop index insurance products with local and regional insurance companies, which then sell them.
UAP Insurance (Kenya)	UAP offers a broad range of short-term term products, including motor vehicle insurance, personal accident, fire, theft, marine and worker compensation policies, and livestock and crop coverage.	Pioneered the Agricultural Index Insurance Initiative in partnership with Syngenta. The initiative developed products for agri-businesses committed to working with smallholders. In 2010, the businesses in question were MEA Limited (fertilizers) and Syngenta East Africa (chemicals and seeds on behalf of Seed Co.).
Century UAP (Tanzania)	A large insurance company providing general insurance services. Financial Services such as insurance premium financing, financial advisory and securities brokerage.	Organized financial education campaigns. It also promoted: › the use of mobile money; › the use of educational SMS (educational text messages are sent out at the beginning of each of the two planting seasons); › radio advertisements.

ACTOR	ROLES/ FUNCTIONS	ACTIVITIES
Safaricom	The largest mobile network operator in Kenya. Mobile banking services.	M-PESA Safaricom's mobile banking system was actively leveraged by ACRE for the financial transactions. Both premiums and payouts are paid instantly using M-PESA mobile banking. The M-PESA system supports the easy registration and tracking of individual clients.
Swiss Re; Africa Re	Provision of reinsurance products, insurance-based capital market instruments and risk-management services.	Served as international risk-takers and reinsurers for Kilimo Salama. Swiss Re is the technical partner of the Global Index Insurance Facility (GIIF).
Stockist networks and distributors of Syngenta products	Sale of inputs.	Served as a product distribution channel and received a portion of the related profits.
Lending institutions and banks, microfinance institutions; savings and credit cooperatives (SACCOs) providing loans for the purchase of inputs	Credit lending.	Acted as a delivery channel of the ACRE Africa by linking insurance to loan origination.
Cultivating New Frontiers in Agriculture/ the Agricultural Market Development Trust (AGMARK) (NGOs in Kenya)	Building agrodealer capacity to serve farmers. Facilitating access to financial services by agrodealers and farmers. Agricultural policy advocacy. Improving farmer's access to output markets	Selected and trained stockists.
Kenya Meteorological Department	Provision of meteorological and climatological services for agriculture, forestry and water resources management	Provided infrastructure for the collection of weather data.

Sources: Syngenta Foundation for Sustainable Agriculture (2017); ACRE Africa (2017); Global Index Insurance Facility (2014); Swiss Re Website (2017); Grameen Crédit Agricole Foundation (2017); CCAFS (n.d.); Swiss Re (2013).

In 2012, Access to Finance Rwanda (AFR) and the Ministry of Agriculture and Animal Resources (MINAGRI) contracted the Syngenta Foundation for Sustainable Agriculture (SFSA) to carry out a feasibility study into the development of crop and livestock insurance in Rwanda. For the study, 10 crop value chains were analysed for their commercial potential and insurance viability, and were then grouped according to their potential. Livestock came second after maize in order of importance, thus narrowing down the number of priority value chains. ACRE Rwanda worked with farmers, cooperatives, aggregators, government officials and stakeholders along the priority value chain (Table 11).

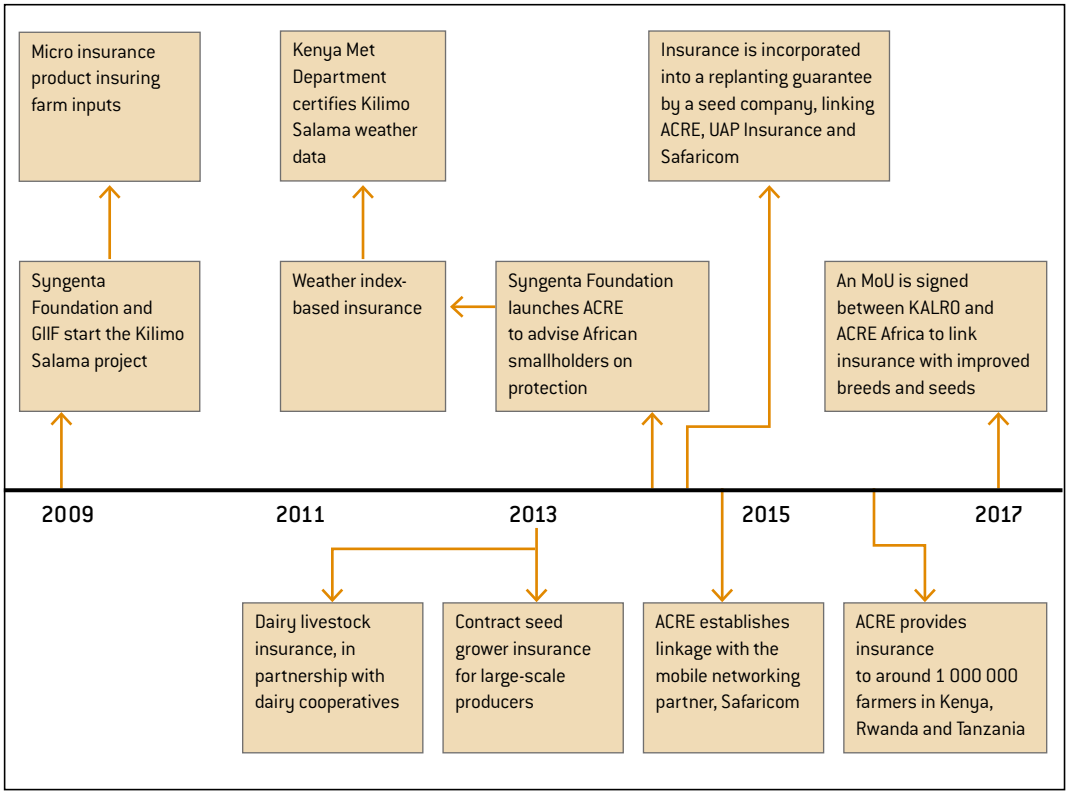
Table 11: Key actors promoting ACRE in Rwanda

OTHER PARTNERS IN RWANDA	ROLES/ FUNCTIONS	ACTIVITIES
ACRE Rwanda	ACRE Rwanda was incorporated in 2013 and is regulated as an insurance agent in Rwanda. It aims to provide affordable insurance products to Rwandese smallholders, who can thus reduce their risk exposure and gain access to credit.	Its activities include: › interfacing with clients; › product development; › field implementation; › sales of insurance products linked to MINAGRI programmes; › climate-risk mitigation advisory services that also drive the sale of its insurance product; › the training of insurers, clients, farmers, MINAGRI and potential partners in insurance policy management and new products; › financial education courses and sessions. The direct approach involves in-person training at cooperatives and farmer groups, while the indirect approach involves workshops for the training of trainers, and audio and SMS messaging.
Rwandan Ministry of Agriculture and Animal Resources (MINAGRI)	Agriculture and animal resource intensification research; technology transfer and the professionalization of farmers; value chain development and private sector investment; institutional development and cross-cutting agricultural issues.	A key partner for implementing the project, MINAGRI: › calculates yields per area; › provides subsidized farm inputs.
SORAS Insurance (Rwanda)	Various insurance products including weather index insurance.	Primary insurer.
One Acre Fund	Asset-based loans. Input supply. Training and market facilitation.	Kilimo Salama bundled insurance policies with loans from the One Acre Fund for fertilizer and other farm-related items. The insurance premium is paid as part of the loan repayment. One Acre Fund: › issues insurance policies; › evaluates farm losses; › distributes compensation payouts.
Swiss Re Corporate Solutions	Provides reinsurance products, insurance-based capital market instruments and risk management services.	Supported Kilimo Salama as the international risk-taker. Engaged in product development. Acted as a reinsurer.
Access to Finance Rwanda	Capacity-building. Project funding. Commissioning research.	Capacity-building for actors in the financial system, namely: financial service providers (FSPs), consumers, infrastructure and market-support providers, regulators and other policymakers.

Sources: Swiss Re Website (2017)

The following figure depicts the timeline of events in the innovation history of ACRE in Africa (Figure 7).

Figure 7: Timeline of events in the innovation history of ACRE in Africa



Sources: Syngenta Foundation for Sustainable Agriculture (2017); ACRE Africa (2017); Global Index Insurance Facility (2014).

Distribution channels of ACRE

In Kenya, Kilimo Salama insurance is distributed through local stockists of farming inputs, which makes it easier for customers to acquire the new product. The distribution channel capitalizes on existing relationships, since farmers are more likely to take advice from someone they know and trust (Kilimo Salama, 2011). Currently ACRE uses the following channels for the placement of its insurance products (Table 12).

Table 12: Distribution channels of ACRE

FINANCIAL INSTITUTIONS	› Community-based organizations › Savings and Credit Cooperatives › Banks › MFIs Savings & Loans Groups
AGRIBUSINESSES	› Traders › Chemical companies › Seed/fertilizer suppliers › Marketers/ Off-takers › Processors › Exporters › NGOs/Donors › Commercial farmers
RETAIL BUSINESS	› Insurance Brokers & Agents › Vets › Agro-vets › Farmer associations

Factors of success

- The ability to conduct most transactions by mobile phone is key to the success of this product. Mobile phones offer a cheap distribution mechanism for the insurer and easy access for the customer.
- In addition to reaching small-scale farmers through mobile technology, Kilimo Salama has been successful in overcoming a key barrier to selling insurance, namely establishing trust with customers.
- The product is marketed to farmers over the radio and at group training sessions. The radio announcements, which are how most farmers get their information, explain the benefits of Kilimo Salama and say which local stockists are selling the product.
- Group training sessions are held in each region before the start of each planting season. Where possible, trainers are assigned to the region they are from since knowledge of the local culture and dialect are of the utmost importance.
- Kilimo Salama also runs a helpline on which agents are available to answer questions about the product. The line is open both to existing and to potential customers.
- The Foundation took account of the cultural differences of each region when setting up the helpline. Agents are trained to deal with customers from different regions. For instance, they are taught the proper greeting for each region.

Source: International Finance Corporation, n.d.

INNOVATION MANAGEMENT BEHIND THE UPSCALING OF ACRE

ACRE is the largest index insurance programme in the developing world in which farmers pay a market-rate premium, and the largest agricultural insurance programme in sub-Saharan Africa (Greatrex ***et al.***, 2015). It also boasts the distinction of being the first agricultural insurance programme in the world to reach smallholders through mobile technologies (IFC, 2013).

First Klimo Salama and now ACRE have successfully developed and promoted an index-based insurance product for farmers who have never had coverage before. In Kenya and Rwanda, where more than 96 percent of agricultural land is rainfed and thus vulnerable to drought and erratic weather patterns, reducing the risk exposure of smallholders is an important preliminary to unlocking credit (World Bank, 2017). The availability of insurance cover will give small farmers and pastoralists greater access to capital and encourage the development of new farming techniques and technologies (Global Index Insurance Facility,n.d). It proved difficult to persuade farmers to acquire insurance policies because past dealings with insurers had created mistrust, and farmers were resistant to the idea of having to pay premiums on inputs. Farmers were also taking their own mitigation measures, such as crop diversification each season. ACRE nonetheless succeeded in penetrating the market thanks to an approach based on the following functions.

Partnership Development: The rapid upscaling of ACRE among farmers in east Africa was made possible by the strong partnership between lending institutions and input providers, and by innovative approaches to addressing the needs of different farmers. The partnership with the M-PESA mobile banking community facilitated payment processing and product distribution. ACRE's partners include banks and MFIs, mobile network operators (Safaricom), seed companies, government agencies (ministries of agriculture and national meteorological services), research institutes, including IRI, insurance and reinsurance companies (UAP in Kenya, Societé Rwandaise Assurance (SORAS) in Rwanda, Swiss Re, Africa Re) and global donors (the Global Index Insurance Fund, GIIF). ACRE leveraged the expertise of this network of partners to implement new and innovative solutions for the challenges faced by farmers.

Farmer education and trust building: Farmer education and capacity development were key components of the programme. In 2011, 40 percent of the project's budget went into funding courses for trainers working with farmers, a telephone helpline and radio broadcasts on the subject of insurance (Rosenburg, 2011). The extensive use of radio announcements and group-training sessions held before the start of each planting seasons taught farmers about index-based insurance.

Capacity development of intermediaries (brokers, stockists and distributors): Technical advice and training on designing index-based insurance policies, processing claims etc. was provided to brokers, distributors, local underwriters, aggregators, small business banks, microfinance institutions (MFI), ministries of agriculture and others.

Building on the strength of existing networks: ACRE used M-PESA, Safaricom's mobile banking system, for financial transactions, which ensured that the product reached farmers throughout Kenya and that the related electronic transactions could be effected without the need for much infrastructure. Similarly, insurance was mainly distributed through local stockists from whom farmers buy inputs. ACRE thus capitalized on existing relationships, as farmers are more likely to take advice from someone they know and trust (Kilimo Salama, 2011). In addition to stockists, ACRE currently uses a variety of distributors such as financial institutions, agribusiness companies and retailers.

Learning: By responding to customer demands and responses to its products, Kilimo Salama could innovate its product. To begin with, insurance premiums were paid for in full by the Syngenta Company and offered to farmers for free. Later, after this approach had failed to entice farmers, Kilimo Salama introduced a 10-percent charge on the value of the input as the cost of the premium. It also rolled out several new products in response to consumer demand, such as policies for contract seed-growers, dairy and livestock farmers etc.

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CHAPTER 4

DISCUSSION: INNOVATION MANAGEMENT FOR SCALING UP CSA

In Chapter 2, we discussed the importance of the various functions and tools that underpin the process of Innovation Management, by which new knowledge is widely disseminated and upscaled. Our analysis of the four cases in the previous chapter revealed the breadth and range of the functions and tools that were mobilized for the upscaling of CSA practices, and they are summarized in Table 13 below:

FUNCTIONS TO PROMOTE UPSCALING

Testing and adaptation of new practices

One of the primary reasons for the wide uptake of new practices was the successful drive to adapt them to the target region or client. On the basis of feedback and results from field experimentation and on-farm trials, often conducted in partnership with users (CA, SRI, and Maize Varieties), researchers adapted and recalibrated practices to suit each specific context. In the case of SRI and CA, the intense effort made to come up with the right mix of approaches eventually led to the development and promotion of several variations and combinations customized for each specific location. Index-based insurance also evolved as new versions and new promotional strategies were tested, and the information and intelligence gathered from the field proved very useful for adapting to new challenges and opportunities. The benefits flowing from this adaptive approach contributed significantly to the upscaling process in the four cases we considered.

Capacity development of all stakeholders

In all four cases, there was a tight focus on developing the capacities of a broad array of stakeholders, including farmers. The capacity-development activities were addressed to various knowledge-intermediaries (lead/contact farmers, government extension staff, NGOs and, in the

case of CA and SRI, private-sector entities), public- and private-sector researchers and service providers, such as brokers, distributors, microfinance institutions, government officials etc. Capacity development took several forms, including training sessions (one-to-one and group-based), on-site demonstrations, field days, radio broadcasts, video shows, farmer field schools, farmer-to-farmer training, farmer clubs, campaigns, exchange visits, and the development and distribution of technical guidelines and promotional literature.

Setting up user/client groups

Organizing farmers into groups through which they develop not only technical capacities (CA and SRI), but also business management skills (CLUSA) and seed productivity (SRI) is increasingly recognized as the best way forward. In Vietnam, SRI was promoted mainly through farmer field schools.

Partnership development and co-ordination

In all four cases, the success of the upscaling depended on the formation of partnerships that encompassed a large number of actors, including donors, government, the private sector, NGOs and farmer organizations. Various donors and international development agencies provided sustained and long-term support for CA upscaling (NORAD, FAO, EU, SIDA, CIDA, World Bank), for SRI upscaling (FAO, Oxfam, GIZ, EU), for DTMA (BMGF, USAID), and for ACRE (Syngenta Foundation, GIIF). All four cases also presented a wide spectrum of additional partnership arrangements, such as: a civil society-government-donor-private sector-NGO partnership for the upscaling of CA in Zambia; a government-donor-NGO-university partnership for the upscaling of SRI; CGIAR-NARS-private sector-government partnerships to promote DTMA; and, in the case of ACRE, an ample cross-section of private-sector interests working in partnership with government.

All partners had knowledge and expertise to contribute. For the coordination of information and the sharing of experiences among partners, the projects made use of several different tools, including: steering committees and task forces in Zambia; sharing workshops and the Country SRI Network in Vietnam; and annual review and planning meetings, innovation platforms and advisory boards in the DTMA upscaling project. Initiatives such as ACRE leveraged the strengths of existing partners and their networks to build new relations.

Incentives, inputs and infrastructure

In Vietnam, farmers were incentivized to test, evaluate and adopt SRI. Generally, incentives were used for a limited period only. In the case of ACRE, the index-based insurance premiums were originally paid for in full by Syngenta. In Zambia, smallholder farmers received subsidies in a bid to get them to follow CA practices. Likewise, the DTMA, CIMMYT/DTMA project envisaged the delivery, free-of-charge, of seed to small and medium-sized seed companies. A further input boost to the programmes came in the form of new infrastructure provided to NARS to support breeding efforts (supply of double haploids, drought- screening facilities) under the DTMA initiative.

Policy engagement and advocacy

Steering and influencing policy is an important part of the process of upscaling knowledge. Almost all the projects tried to engage with policymakers in a bid to gain political and financial backing. For instance, the CFU of the Zambia National Farmers Union conducted a successful advocacy campaign that led to conservation agriculture becoming official policy of Zambian Government. Evidence-based advocacy efforts by Oxfam, PPD and CSRD in Vietnam for promoting SRI resulted in the Vietnamese Government's recognition of SRI as a technical advancement in rice production, which led to a consequent increase in public investment. The DTMA project in sub-Saharan Africa has been working with policymakers in partner institutions to harmonize seed laws so as to shorten the time taken to announce, release and promote improved seed varieties.

Reflective learning

Multi-level learning was an important component of SRI upscaling in Vietnam. In addition to fostering self-learning among farmers from the use of experimental and trial plots, the projects poured significant effort into documenting SRI experiences and sharing them among actors from different regions of the country. In Zambia, the National Conservation Agricultural Task Force facilitated stakeholder consultations for the sharing of experience and the planning of actions conducive to the promotion of CA. SRIViet (for SRI) and the African Conservation Tillage Network (for CA) were set up to promote cross-learning based on experience. Annual review planning meetings were organized so that the difficulties of promoting DTMA and the solutions to them could be discussed and shared among partners. Adoption monitoring surveys fed back information about the performance and popularity of newly released varieties, and the DTMA's Quarterly Update enabled a wide range of stakeholders to keep abreast of the latest progress in the field. The regional-level innovation platforms were also pivotal to fostering cross-learning. Finally, ACRE used feedback from customers and distributors to design and promote new index-based insurance products.

Table 13: Innovation management features in upscaling CSA practices

CASES	FUNCTIONS	ACTIONS	TOOLS
Conservation Agriculture (Zambia)	**Adaptation of knowledge** (continuous technology assessment and refinement through multi-locational on-farm trials. **Enhancing farmer access to knowledge and expertise** (a wide range of methods such as demonstrations, training, field days, use of lead/ contact farmers). **Developing the capacities of knowledge-intermediaries** (training public, private and NGO staff to upscale CA). **Setting up user/client groups** (setting up farmer groups and using the group approach to spread knowledge). **Partnership development** (building networks of every public, private and NGO actor interested in developing and promoting CA. **Policy Advocacy** (lobbying government to adopt CA as a policy, and urging CA upscaling through several other agricultural/rural development initiatives.	Undertaking adaptive research. Training. Convening. Organizing. Advocacy. Facilitating.	On-farm testing and evaluation. Farmer groups. Lead/contact farmers. Specialized units (e.g. CFU). Steering committees. Task forces. Regional networks (e.g. RCTN).
System of Rice Intensification (Vietnam)	**Experimentation and adaptation of knowledge** (farmer trials in their own fields/trial plots, participatory action research, and learning through FFS). **Enhancing farmer access to knowledge and expertise** (a wide range of methods are used, including FFS, farmer-to-farmer training, harvest events, demonstrations, campaigns, training sessions, exchange visits). **Developing the capacities of knowledge-intermediaries** (developing capacities relating both to the technical aspects of SRI and to the organizing of FFS and workshops). **Incentives and inputs** (distribution of free and subsidized inputs and tools, the allocation of cash incentives to promote SRI). **Learning and knowledge-sharing** (documentation and sharing of experiences among different actors across the regions). **Partnership development** (e.g. the SRI Extension Partnership that encompassed diverse actors including NGOs, GOs and international organizations). **Policy advocacy** (actions to win the support of government and other institutions, and thus leverage resources and gain policy recognition).	Undertaking participatory action research. Knowledge-sharing. Facilitation. Convening. Provisioning. Training. Information dissemination. Learning. Advocating.	Farmer Field Schools. Sharing Workshops. Farmer volunteers. Country networks (e.g. SRIViet).

CASES	FUNCTIONS	ACTIONS	TOOLS
Drought Tolerance Maize (Africa)	**Research** (for the development, field-testing and deployment of elite DT maize varieties for dissemination through public- and private sector breeders). **Capacity Development:** (training the maize breeders of NARS and private-sector seed companies in DT breeding and seed production, processing, testing, marketing and business management, using the IMIS Field Book and holding regular workshops for project participants). **Strengthening research infrastructure** (setting up facilities for drought screening and double haploid production). **Promotion of knowledge** (through radio broadcasts and instructional videos). **Policy review and advocacy** (review and regional harmonization of seed laws to shorten delays in the release of improved varieties).	Convening. Training. Provisioning. Advocating. Learning.	Annual review and planning meetings. Advisory board. Performance awards. Adoption monitoring survey. Quarterly newsletter. Innovation learning platform.
Index based weather insurance (ACRE), Africa	**Partnership Development** (among insurance and re-insurance companies, lending institutions, input providers and mobile service providers). **Farmer education and trust building** (individual and group training, telephone helpline, radio broadcasts). **Developing the capacities of intermediaries** (technical advice and training for brokers, distributors, local underwriters, aggregators, small business banks, microfinance institutions and staff of Ministry of Agriculture). **Explore and build on existing strengths** (use of existing mobile banking system and local stockists). **Learning** (varying products and approaches according to user feedback and demand).	Convening. Training. Learning.	Helplines. Mobile banking services.

ACTIONS TO PROMOTE UPSCALING

The upscaling of CSA practices in the four cases we have looked at involved a broad array of activities, as listed below:

a. Convening (i.e. setting up platforms for stakeholder interaction and forming networks of strategic partners);

b. Facilitating (dialogue and the exchange of knowledge among operational partners);

c. Organizing (joint events for implementing specific activities, and setting up user/client groups);

d. Training (farmers, knowledge-intermediaries and service-providers from the public and private sector, civil society and NGOs);

e. Provisioning (of incentives, inputs and infrastructure to encourage adoption and partnerships);

f. Sharing knowledge (and experiences to hone policies and practices);

g. Disseminating information (on new knowledge/practices/products through various media channels and person-to-person outreach);

h. Undertaking adaptive research (through on-station and on-farm trials and participatory action research);

i. Advocating (for policy recognition, greater public investments and the harmonization of laws and guidelines to accelerate the process of upscaling).

TOOLS TO SUPPORT UPSCALING

A wide range of tools (i.e. formats and mechanisms) were used to manage innovation in the four cases. They include tools for co-ordination (task forces, steering committees, advisory boards); tools for encouraging interaction, planning and knowledge-sharing, such as the CFU in Zambia; country networks (SRIViet in Vietnam) and regional networks (RCTN); annual review and planning meetings, quarterly updates, innovation learning platforms (DTMA); tools for learning and evaluation, such as the adoption survey used for the DTMA project, as well as tools for collective learning and action by farmers (FFS and other farmer groups formed for the diffusion of knowledge); and tools to incentivize production and performance, such as subventions and the provision of free or subsidized inputs.

CHAPTER 5

UPSCALING CSA: LESSONS FOR EXTENSION AND ADVISORY SERVICES

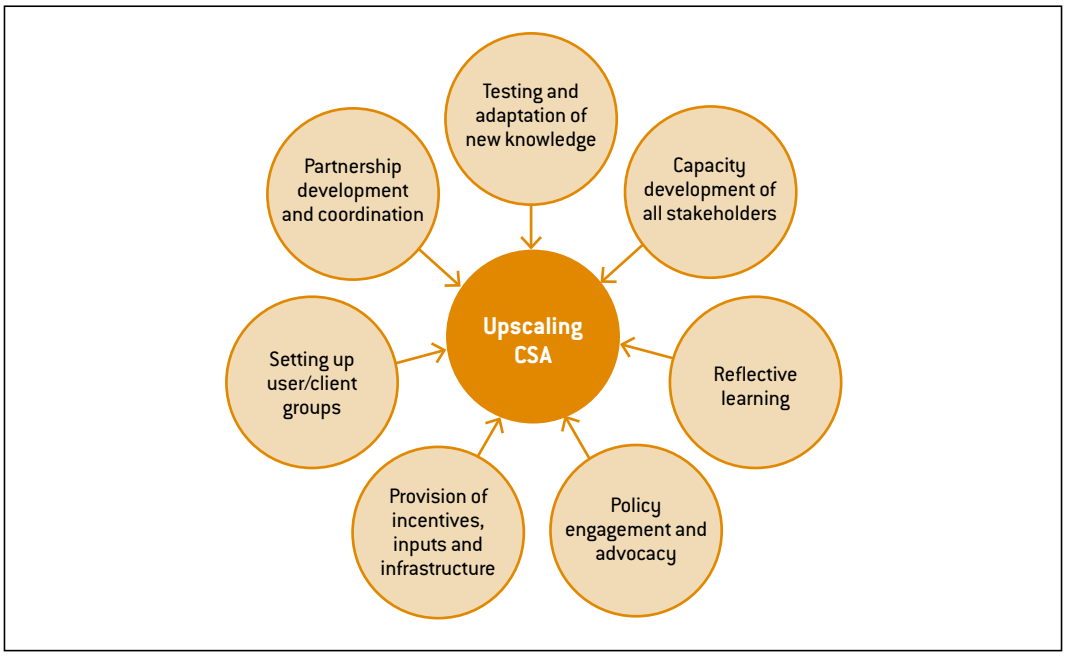
The main purpose of this paper has been to draw lessons on how better to organize extension and advisory services that will support the upscaling of CSA. We applied an Innovation Management Framework to the analysis of the four cases corresponding to four aspects of CSA upscaling, namely: (a) natural resource management (b) crop management (c) varietal improvement and (d) weather insurance. Consequently, the paper has also considered the broad range of functions and activities carried out with a view to CSA upscaling and the tools used to this end. While the findings contain important lessons about the organization of EAS for upscaling CSA, they also carry several other implications that merit attention. Many of these implications relate to the need to supersede conventional approaches to EAS, and are summarized below:

BROADENING THE MANDATE AND FUNCTIONS OF EAS

For extension and advisory services (EAS) to result in the successful upscaling of CSA, they will need to encompass a broad array of different functions, as illustrated in Figure 8.

Not all these functions need to be fulfilled within the context of EAS. The point is that EAS form an important part of the Agricultural Innovation System (AIS), and so EAS providers need to be able to identify, support, facilitate and co-ordinate all existing and potential actors who can contribute to upscaling. That said, the upscaling of CSA knowledge is no longer a question of merely disseminating information or advising farmers on how to adopt a new variety, practice or product. Though this function remains important, it is a necessary but not sufficient precondition for achieving sustained impact at a scale and, to be fully effective, must be combined with several other equally or more important Innovation Management functions. So, apart from the need to develop the capacities of EAS providers to discharge the responsibilities already implicit in EAS, the mandate and functions of EAS themselves need to be broadened.

Figure 8: Innovation management functions in upscaling CSA



BUILDING PARTNERSHIPS

Upscaling CSA practices involves technical, institutional and policy changes. Several actors capable of bringing about the necessary changes already exist in the AIS, and EAS providers need to partner with them. Upscaling is a collective effort, hence the importance of building effective teams at different levels (field, meso and macro) when attempting to scale up CSA. It is therefore important to forge partnerships among the various AIS participants, be they from government, the private sector, an NGO or a farmer organization engaged in research work, or, indeed, from any organization or group involved in knowledge intermediation, financing, policymaking, co-ordination activities, market intermediation (dealing with both inputs and outputs) or community mobilization.

CLOSER ENGAGEMENT WITH RESEARCH TO ADAPT KNOWLEDGE TO VARIABLE AND EVOLVING CONTEXTS

Upscaling CSA practices will necessitate the continuous adaptation of knowledge to calibrate it to diverse and evolving contexts. It follows that providers of EAS will need to engage much more with the research process than at present, for it is by now clear that no such thing exists as a universal product that can be upscaled everywhere. Clients and recipients need to be able to appraise and evaluate knowledge through on-station, on-farm and participatory research,

and the results of the evaluations need to be fed back into the design and delivery of EAS, which will thus become more adaptive to circumstances. There needs to be much closer engagement between research and extension beyond the routine interface meetings organized every year or at the beginning of each season. Research is essential for upscaling and for dealing with the new challenges that will emerge as innovation advances.

LONG-TERM STRATEGIES AND FUNDING FOR EAS TO SUPPORT UPSCALING

As upscaling even a single CSA practice takes several years, EAS need to be backed by a far-sighted vision, a long-term strategy and sustained funding, and should include mechanisms for periodical reviews and modifications. This is not to say that every intervention has to last around 10 years, but as innovation advances, it will be necessary to have a strategy for securing additional support from different sources. In other words, EAS need to have inbuilt mechanisms for gathering information through a process of monitoring, evaluation and learning (MEL) that starts from the very beginning of the programme or project, and they also need a clear communication and knowledge-management strategy for the sharing of knowledge and propagation of learning.

EVIDENCE-BASED POLICY ENGAGEMENT AND ADVOCACY

Upscaling CSA practices definitely needs political and financial support from governments. Several CSA interventions started out as pilots implemented by researchers, EAS providers, NGOs and the private sector, but upscaling only really happened when the practices became a state/national policy and started receiving public investments and programmatic support from state agencies. The upscaling of CA in Zambia and of SRI in Vietnam show this quite clearly. DTMA and ACRE are likewise dependent on state support, since their upscaling is contingent on the presence of favourable regulations relating to seed certification, insurance and the use of weather data. In the case of DTMA, upscaling is also subject to the support accorded by NARS and public extension bodies to adaptive research activities, germplasm exchange, the screening of varieties and the promotion of seeds.

To summarize, it takes an ample range of different actors to carry out the various different Innovation Management functions that the upscaling of CSA demands. If EAS are to contribute significantly to the upscaling of CSA, the providers of the services need to broaden their mandate, partner with other relevant AIS actors, deepen their level of engagement with the research aspects, prepare for a long-term effort and seek to influence the enabling environment through policy advocacy.

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