CoS

Convergence of Sciences: Strengthening agricultural innovation systems in Benin, Ghana and Mali (CoS-SIS)

New Pathways to Innovation:

Creating conditions in which West African smallholders can capture opportunity

Summary

West Africa's smallholders are dynamic and innovative and, if given the opportunity, could easily and sustainably double or treble their productivity. This would have a huge impact on the region's food security and economic growth. The Convergence of Sciences programme has spent the past decade exploring new pathways for agricultural innovation that focus on enabling smallholders to capture opportunity. Its approach relies on bringing together different actors who can achieve major change in an agriculture sector and create new conditions at system levels higher than those of the field and the farm. The interaction of farmers, scientists, administrators, policymakers and other decision makers can remove constraints and create opportunities at these levels. This publication documents some of the programme's outcomes, approaches and methods so as to allow others to draw out lessons for future programme design and further research.

CoS

Cover: CoS-SIS cotton domain experimental site with staff and farmers. Man in blue shirt on left is Prof. Dansou Kossou, CoS-SIS National Programme Coordinator for Benin

Right: Petty trading is an important additional livelihood strategy for smallholder families (here in Mali)

1. A new approach to smallholder innovation

'Convergence of Sciences: Strengthening agricultural innovation systems in Benin, Ghana and Mali' (CoS-SIS) aims to unlock the potential of smallholder farming in West Africa by creating enabling conditions for farmers to innovate (see Box 1). Since 2002, the programme has been experimenting with this approach, which takes a different track to mainstream research. Rather than focusing on technical innovations, CoS-SIS helps national, sub-regional and African agricultural research organisations, universities and other public and private sector agencies, including non-governmental organisations (NGOs), to strengthen their programmes. It supports university curriculum development and informs decision makers at district and national levels about ways to encourage smallholder innovation.

CoS-SIS has developed from a first phase (2001–2006) that focused on participatory technology development. This work showed that smallholders are unable to benefit fully from appropriate and desirable technologies because of their limited opportunities. So the researchers

Experimental maize farmers in Benin. Man on right holding his chin is Dr Dominique Hounkonnou, CoS-SIS Regional Coodinator

Box 1: What do African smallholders need?

Like all farmers, smallholders can only develop their farming systems if they have the following:

- 'Voice': avenues and procedures for exerting influence on decisions that affect them directly
- Services: e.g., access to production inputs, extension, information and credit
- Land tenure arrangements that allow them to invest in land and soil health
- Regulatory frameworks that help protect them from corruption, cheating, land-grabbing, profiteering, etc., and that encourage fair competition
- Integrated value chains that give them access to markets and a share in the rewards conveyed by adding value
- Access to transparent and free information
- Infrastructure: including roads, irrigation and drainage, laboratories for produce testing and facilities for seed multiplication.

started to experiment with institutional change – the 'rules of the game' that govern smallholders' environments, constraints and opportunities. By demonstrating that such change is both important and feasible, the work inspired a second phase (CoS-SIS 2008–2013), which explored institutional change more fully.

The programme is based on comparative action research across eight case studies, each set in a different agricultural domain (Box 2). It makes use of diagnostic studies, innovation system analyses and participatory field experiments involving many different stakeholders at local, district and national levels (Box 3). CoS-SIS employs eight post-doc research associates, recruited part-time from national agencies, and nine West African PhD researchers. The post-docs work with key actors from the agriculture sector on innovation platforms to experiment with institutional change, while the PhDs work with local people and communities to analyse constraints and develop livelihood opportunities through an experimental approach. Their research feeds into the deliberations of the platforms. Responsibility for the programme in each country rests with a management team comprising senior representatives from universities, ministries, research and development organisations, the private sector, NGOs and farmers' organisations. The National Programme Coordinator is an ex-officio member and convener.

CoS-SIS is a partnership involving the Université d'Abomey-Calavi, Benin; the University of Ghana at Legon; the Institut Polytechnique Rural de Formation et Recherche Appliquée at Katibougou, Mali and, in the Netherlands, Wageningen University and the Royal Tropical Institute. It is funded by the Netherlands Ministry of Foreign Affairs.

Box 2: CoS-SIS agricultural domains

Working groups comprising senior agriculturalists identified the following agricultural domains to reflect national priorities:

- Benin: cotton, oil palm (intercropping with annual crops and the seed system) and water management (agro-pastoral dams, rice production in valley bottoms)
- Ghana: palm oil and cocoa, with some work on small ruminants
- Mali: water management, integrated crop and livestock production and shea butter (karité).

Box 3: What do the CoS-SIS partners do?

- Identify the main constraints experienced by smallholders
- Identify and diagnose the institutional reasons for these constraints at different levels
- Highlight the key actors, networks and mechanisms that maintain the constraints, as well as entry points for bypassing or transforming them
- Assemble platforms of the key actors who need to be involved to influence change (known as 'Concerted action and Innovation Groups' or CIGs)
- Help the platforms to experiment with new ways of working
- Influence university curricula, research institute programmes, government policies and the structure of value chains as well as agricultural industries, enterprises and services through evidence on how institutional change can be achieved
- Conduct research into the processes of change
- Ensure that the programme's outcomes are widely publicised and shared with government agencies and policymakers.

2. Why take a different approach?

Smallholders are amazingly innovative and entrepreneurial

All farmers continually examine their systems to see where they can make improvements. Smallholders (women and men) are no different and, in conducive conditions, will constantly strive to optimise productivity and expand their livelihood options.

Improving smallholder productivity is a sensible and practical way to attain broad-scale food security

Technically it is relatively easy to improve smallholder productivity, because the predominantly low yields can be doubled or tripled by applying existing agro-ecological principles, with a limited need for expensive or unavailable fertilisers and synthetic pesticides. At the same time, smallholders can access vast and under-utilised natural and human resources, once the mechanisms that prohibit their effective deployment are removed.

Improving the productivity of smallholder farming globally has environmental benefits too, since it reduces the need to clear additional land for agriculture: reducing land-clearing from 1 to 0.2 billion ha per year, greenhouse gas emissions from 3 to 1 Gt per year, and global nitrogen use from 250 to 225 Mt per year (Tilman et al., 2011). Compared with large-scale, technology-intensive agriculture in developing nations based on 'land-grabbing' and foreign direct investment, efforts to enhance smallholder innovation generate more diversity and therefore better resilience in the face of market and climate shocks. They also generate greater employment and more inclusive wealth.

Smallholders (pictured here in Ghana) are always keen to learn

Smallholders need to compete in a globalised world

Globalisation is driving further intensification of large-scale, 'industrial' farming with its associated economies of scale. West African smallholders cannot compete, since they have only poorly developed infrastructure, knowledge systems, tenure security, support services, farmer organisations and agri-business facilities. This perpetuates the region's dependence on food imports and prevents smallholders benefiting from growing urban markets, trapping them in a downward spiral of poverty and hunger. On the positive side, recent agricultural price crises have raised local food prices and created opportunities for smallholders and the private sector.

Traditional agricultural research has had disappointing results

The phenomenal growth of agricultural productivity in industrial and Green Revolution countries is generally attributed to widespread

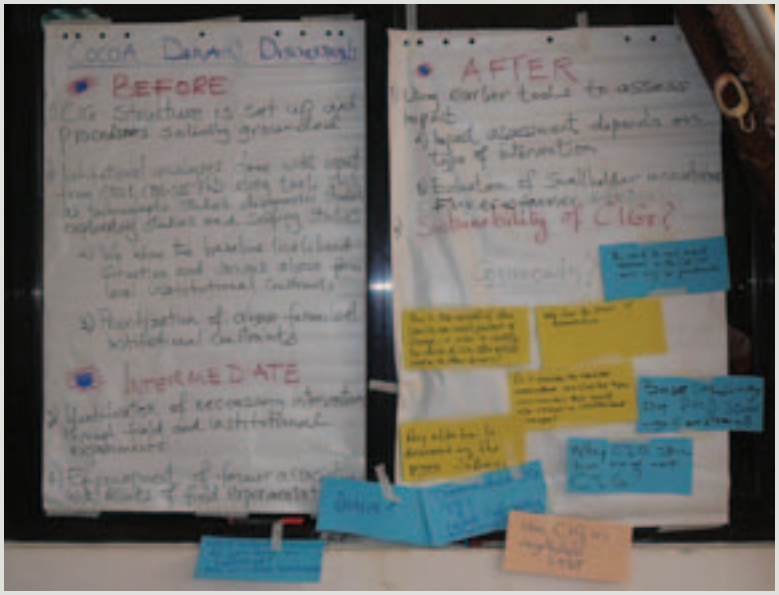
adoption of science-based technologies. Programmes for smallholder development have therefore emphasised technology as the key to increasing yields. In West Africa, nearly every agricultural sector has a dedicated research institute (oil palm, cereals, etc.) focusing on agronomy, genetics, soils and other scientific issues. International, continental, regional and national research capacity has been created. Yet technology uptake remains very limited and increased regional food production has occurred largely as a result of taking new land into production.

Smallholders need an enabling institutional environment

Careful analysis of the phenomenal growth in productivity in the United States, France and the Netherlands (the world's three largest agricultural exporters by value) shows that deliberately creating an enabling institutional context preceded agricultural productivity growth by decades (Hounkonnou et al., 2012). "It was the enabling environment of human and institutional capacity that interviewees flagged as the stumbling block impeding farmers' access and adoption" (Meridian Institute, 2013) (see Figure 1). Box 1 lists the required conditions, which are not impossible.

Institutions currently create a 'pervasive bias' against smallholder farming in sub-Saharan Africa

This was the conclusion of a comparison between Asian and African agriculture that attempted to explain why the Green Revolution had failed in sub-Saharan Africa (Djurfeldt et al., 2005). There are several reasons for this bias. Firstly, African smallholders have little political power and are not organised effectively. Rural suffering has little political consequence for the ruling regime, and smallholders are powerless to deal with extractive policies, rent-seeking and corruption. Meanwhile, the colonial era left behind commodity structures and mechanisms



Workshops and meetings helped the CoS-SIS teams to improve their understanding of the interactions among different stakeholders

to extract wealth from the smallholder sector. Post-independence governments have perpetuated these in order to support their own political and, all too often, private ambitions.

Secondly, public support services for smallholders, which include extension services, veterinary advice and irrigation scheme management, were greatly reduced or demolished during the 1980s as a result of structural adjustment policies, and private enterprise has not stepped in to fill the gap. Thirdly, in many countries, the development of smallholder farming is actively opposed by large-scale 'modern' agri-businesses, such as large-scale processing factories and marketing companies with their own plantations or contract growers. Finally, many West African policymakers consider the smallholder sector to be too backward for development and believe it should be replaced by foreign direct investment in intensive agriculture, despite the lack of evidence that this would be effective.

Without change, food insecurity and rural poverty will continue to rise

Smallholders are West Africa's single largest professional category, producing most of the region's food and commanding the majority

of its natural resources. Despite the large sums of money invested over the past few decades and the huge efforts of scientists and others, smallholder productivity has failed to respond, presenting a major challenge for scientists, the international community and the region's politicians. There is therefore a strong need to find new theories, new pathways, new strategies and new approaches.

Working at the interface between the farmer and the agro-ecological context is no longer sufficient. We need to understand the interactions among farmers, between producers and consumers, and among actors in value chains, political systems and international trade. Our knowledge needs to combine understanding of the globalising world and trends in terms of climate, natural resources and ecological services, as well as the localised contexts that create incentives and disincentives to development. We must be willing to collaborate with farmers and other stakeholders to find new ways forward that are appropriate in the local context. However, testing new approaches to innovation and providing reliable evidence for their relative effectiveness remain major challenges.

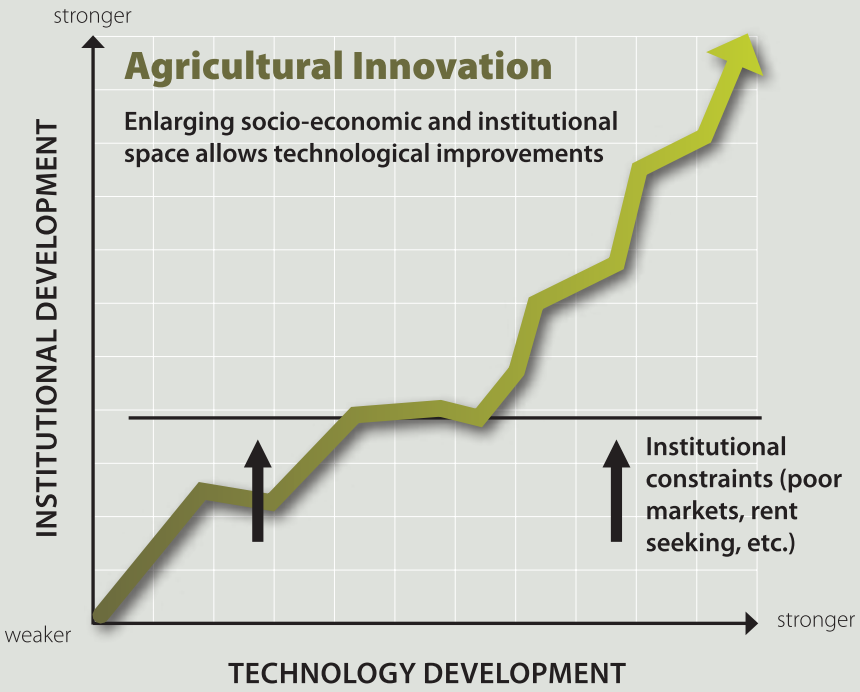


Figure 1. Innovation is the result of both institutional and technological change. Neglect of institutional development creates a ceiling to technological innovation (Adapted from Dorward et al., 1998)

3. Technology is not enough: Learning from Phase 1

During the first phase of CoS (2001–2006), the researchers worked under the assumption that developing technology together with the farmers was the key. The programme supported eight PhD students from Benin and Ghana to work with groups of farmers in carefully selected sites, where they developed technologies that were appropriate to the local agro-ecological conditions and farming systems, as well as being in line with the farmers' own goals. This section sets out the main lessons learned from this phase.

Diagnostic research

This is essential for formulating relevant research questions and selecting entry points for effective intervention. Each of the eight PhD students carried out a diagnostic study with the aim of understanding the issues from the perspective of the smallholders (Röling et al., 2004). This was designed to avoid pre-analytical choices and to select realistic opportunities for technology development. To ensure a broad spectrum of perspectives, the students were supervised by natural and social scientists from both European and African universities.

More than just technology

Technology development alone cannot expand smallholders' opportunities significantly. Within the means available to them, they could realise only marginal improvements, and the farmers quickly stopped using any technologies that required conditions for effective use that were beyond their control (Sterk et al., in press).

Benin cotton farmers learn about integrated pest management

Participants at a CoS-SIS workshop in Mali, June 2010. Tall European in the middle is Prof. Arnold van Huis, CoS-SIS International Coordinator

Farmers can be empowered

Participation in experimental groups mobilised the farmers and increased their self-confidence in interacting with their peers as well as with officials and researchers. At the same time, participation enhanced their ability to experiment and question.

Removing constraints

The projects showed that it is possible to remove institutional constraints and broaden smallholders' windows of opportunity. The PhD students became frustrated with the limited impact of technology development and were hurt by accusations that they were wasting the farmers' time by encouraging them to produce crops for which there was no market. As a result, the students and their supervisors began to try to change the enabling environment. They looked at the following areas (Van Huis et al., 2007):

- Land tenure agreements between landlords and migrant tenants that allowed tenants to invest in soil fertility management
- Collaborative arrangements among farmers to process neem seeds into affordable pesticides
- Random checks on the accuracy of weighing scales, executed in a three-way agreement between cocoa farmers, licensed buying companies and the district administration
- An agreement with a brewing company to buy sorghum of a new high-yielding variety
- Working groups of cocoa farmers who helped each other to clear away piles of rejected cocoa pods that were a source of Black Pod fungus.

Leaving a legacy

However, the institutional conditions created by the programme did not survive the departure of the students (Sterk et al., in press). The islands of success, based on creating the special conditions that allow an innovation to be adopted, did not persist. Institutional changes that enable smallholder innovation therefore need to be embedded in agricultural policy, administration and management at the national, district and local levels.

4. Phase 2 (CoS-SIS): Experimenting with institutional change

This section describes the experiments with institutional change conducted by the innovation platform (CIG) in each of the eight CoS-SIS domains (see Box 2). Three of the experiments are described in more detail in the case studies. It is beyond the scope of this publication to also describe the work of the PhD students, although they contributed considerably through their diagnostic studies (Jiggins, 2012), analyses of the institutional context in each domain (Struik and Klerkx, 2014) and other articles published through their dissertations. Some carried out their own experiments with farmers and artisan processors.

Cotton, Benin

Since the privatisation of the cotton sector in the 1980s, Benin's cotton industry has staggered from crisis to crisis. The number of cotton producers and level of production have declined sharply and many smallholders have lost one of their main sources of income. The CIG has been working with reform-minded national actors to steer the industry back towards profitability by sharing evidence-based information on conditions in the growing areas. They are also helping women's groups to produce neem oil as a less costly, more readily available and less toxic pesticide for cotton and food crops. Meanwhile, they are building links with cotton research institutes as a means to get neem accepted as an officially approved pesticide. These activities will allow farmers to bypass the chaotic and corrupt national pesticide distribution system.

Cotton could be a reliable cash crop for smalholders in Benin

Small-scale rice farmers in Benin could benefit from growing urban markets

Valley bottom rice production, Benin

Growing urban populations are creating an increasing demand for rice, which could be partly met by the smallholders who grow irrigated rice in Benin's inland valley bottoms. However, until recently, lack of access to processing facilities meant they could not compete with large-scale growers. The CIG has helped the farmers build better links throughout the rice value chain, which include access to new, large-scale and more efficient rice processing facilities.

Oil Palm, Benin

See case study on page 9.

Towards a reliable seed system: Improving the quality of oil palm seedlings in Benin

The oil palm (*Elaeis guineensis*) is native to West Africa and palm oil is an important ingredient in local diets. While the demand for palm oil in Benin has risen strongly over the past decade, the country's production has remained static and today, Benin produces only about a third of its needs. However, there is considerable potential for expanding smallholder production, principally by ensuring farmers can obtain hybrid planting material. Benin has 40 official nurseries supplying certified planting material, but many smallholders who want to plant hybrids have no access to them. These farmers are forced to rely on unofficial sources, many of which are supplying seedlings of dubious quality. It is impossible for farmers to identify hybrid plants until the tree bears fruit after three to four years.

CoS-SIS sponsored a PhD student, Essegbemon Akpo, who surveyed a range of smallholder oil palm plots to determine the extent of the problem. He discovered a high incidence of non-hybrid oil palm with only just over half (58%) the plots planted with the pure tenera hybrid. Interestingly, the plots planted most recently had the lowest genetic quality, indicating that, not only are the unofficial nurseries supplying poor quality seedlings, but also the quality of the stock in smallholder plantations is deteriorating. Since oil palms remain productive for 30 years, this has important consequences for the future of Benin's oil palm production and smallholder income potential.

Following these studies, the CoS-SIS post-doc, Dr Pierre Vissoh, convened a multi-stakeholder platform, bringing together representatives from the Centre de Recherches Agricoles – Plantes Pérennes at Pobè, the Ministry of Agriculture, district administrators, nursery owners and farmers. The members embarked on several activities:

- Compiling an inventory of existing official oil palm nurseries and revising the criteria for selecting nurserymen and sites
- Conducting global positioning system (GPS) mapping of the nursery sites to highlight areas without access, and identifying new sites and farmers who could fill the gaps
- Training existing nurserymen and selecting 28 farmers to receive training as new nurserymen
- Estimating seedling demand in different areas and planning how to fill this demand
- Helping nursery owners to become organised into a cooperative so they can access sources of finance
- Developing the multi-stakeholder platform into a more permanent network at the national level and organising joint meetings and workshops to raise awareness among decision makers of the need to develop a more effective seedling distribution system
- Holding a national meeting where stakeholders discussed improved management of the seed system as a means to modernise smallholder palm oil production.

The platform's activities have created lasting impact: its findings have been included in the new five-year National Development Plan. Stakeholders are now aware of the importance of the oil palm seedling supply system in efforts to develop the sector. The results of this work are also relevant for the oil palm and cocoa sectors in Ghana.

Reference: Akpo, E., Crane, T., Stomph, T-J., Tossou, R.C., Kossou, D.K., Vissoh, P.V. and Struik, P.C. (in press) 2014. Drivers of a reliable seed system: Case study of oil palm (*Elaeis guineensis*) in Benin. In: Struik, P.C. and Klerx, L. (Eds) Institutional change towards sustainable agriculture in West Africa. Special Issue of International Journal of Sustainable Agriculture.

Comparing the fruits of the three types of oil palm: *Dura* (top) with a thick kernel shell and little fruit flesh. *Dura* is the traditional oil palm on most farms; *Pisifera* (middle) with no kernel shell; and Tenera (bottom), a hybrid between *Dura* and *Pisifera*, which has a thin kernel shell and plenty of oil-bearing fruit flesh.

Oil palm, Ghana

Palm oil is an important part of the diet for most Ghanaians and top quality oil can fetch a good price. Artisanal women processors have traditionally lacked the knowledge they need to produce oil of the best quality, due in part to inefficient and polluting processing methods; for example use of old motor tyres as fuel for boiling the palm fruits. CoS-SIS researchers and the CIG created experiments that allowed the small-scale processors to learn how to control the fatty acid and water content of the palm oil they produce, allowing them to access more remunerative markets. Negotiations with buyers are ongoing. In the participating areas, all parties have agreed to stop using old tyres as fuel.

Learning better processing techniques enables women in Ghana to produce better quality palm oil

Cocoa, Ghana

See case study on page 11.

Water management, Mali

The Office du Niger administers Mali's large-scale irrigation scheme that draws water from the Niger River. Devolution of responsibilities following structural adjustment policies left key tasks, such as cleaning canals, to water users' associations. These were never very effective, resulting in silted and weedy canals, falling rice yields and frequent conflict and litigation among water users. The CIG worked hard to bring stakeholders together, building a sense of joint ownership and a willingness to engage in canal clearing. The result of CIG-supported experimental canal cleaning was to make water available to all farmers along a tertiary canal and it became possible to drain the fields in time to dry the crop for harvest. Incidences of conflict were reduced, and the yield and quality of the rice improved. Furthermore, the activities of the CIG have inspired a change in water management policies.

Shea butter, Mali

Shea butter is becoming increasingly sought after as an ingredient in cosmetics and food, and smallholders are well placed to benefit from this market growth when they become organised into groups. The CIG brokered an injection of working capital into a women's shea butter cooperative, to help the cooperative and its member groups to evolve and increase the number of women who have access to lucrative markets for quality shea butter. The intervention has also allowed the cooperative to manage the supply schedule to allow for natural fluctuations in the productivity of the trees. Furthermore, this example has made the government aware of the potential of the smallholder-based shea industry.

Crop–livestock systems in Mali

See case study on page 12.

A women's shea butter cooperative in Mali has increased in numbers and capacity since CoS-SIS helped form an innovation group of stakeholders

Improving incentives: Ensuring a fair price for cocoa farmers in Ghana

Ghana's smallholders produce one fifth of the world's cocoa and most of the premium quality cocoa. Cocoa accounts for 30% of Ghana's export earnings and 4% of its gross domestic product (GDP). However, farmers suffer from many pre- and post-harvest problems, which cause a large proportion of the harvest to be rejected, and the percentage of this 'cocoa waste' appears to be increasing. Farmers also have to deal with complicated landholding arrangements and their incentives to produce a quality harvest have been eroded by inefficiencies and malpractices in the cocoa value chain.

The entry point for CoS-SIS activities was provided by the need to improve farmers' incentives to produce top-quality cocoa. Hence the multi-stakeholder platform (CIG) focused on the interrelated issues of pricing (analysis of price formation in Ghana and neighbouring countries, and how the price paid to farmers is calculated) and bean quality (including pest control measures).

CIG membership changed as understanding grew and new information needs were identified. The members, who belong to influential networks with the power to make industry-wide decisions, evidently favour the platform as a neutral space in which to meet and discuss new information. For example, when a member responsible for warehousing the beans prior to export learned from a person responsible for phytosanitary regulations that the fumigants used in the warehouses were banned in the European Union (the major export market), the chemicals were changed within a week. In another instance, a CIG study clarified the composition of the price paid to farmers for all countries in West Africa in which Cargill (the main bean trader) operates. The platform was then in a position to make price recommendations and to ensure these were conveyed to the relevant government minister. The minister listened to the CIG's advice because its members were recognised as comprising the industry's major stakeholders.

The information gathered has allowed the CoS-SIS post-doc, Dr Richard Adu-Acheampong, to investigate the use and cost of cocoa pesticides.

CoS-SIS PhD student, William Quarmine, discusses cocoa bean drying techniques with a Ghanaian farmer

The Government of Ghana concluded that the input supply programme (including mass spraying) was inefficient and plans to bring it to an end by 2018. To stop malpractice, the amount, type and recommended prices of cocoa inputs delivered to local distributors, and the dates of delivery, are now advertised in the national newspapers and the Government's monopoly on fertiliser distribution has been removed. As a result, 30% of fertilisers are now distributed by the private sector.

To ensure lasting impact, the CIG members are further exploring other information asymmetries, pesticide policy, cocoa pricing mechanisms and transparency in input distribution. They are negotiating with West African partners to link the cocoa CIG to the new African Cocoa Initiative (a regional platform of national stakeholders). In addition, the Cocoa Research Institute of Ghana has asked CoS-SIS to help develop its capacity to work with innovation platform processes, facilitate multi-stakeholder initiatives and understand 'research into use' on the basis of client-oriented, joint generation of knowledge.

References: Quarmine, W., Haagsma, R., Sakyi-Dawson, O., Asante, F., van Huis, A. and Obeng-Ofori, D. 2012. Incentives for cocoa bean production in Ghana: does quality matter? In: Jiggins, J. (Guest Editor). Diagnosing the scope for innovation: Linking smallholder practices and institutional context. Special Issue of Netherlands Journal of Life Sciences, 60–63: 1–121. Available at: http://www.journals.elsevier.com/njas-wageningen-journal-of-life-sciences/recent-articles

Mitigating conflict and litigation: Overcoming barriers to crop–livestock systems in Mali

The Office du Niger, a semi-autonomous government agency, administers a large irrigation scheme that takes water from the Niger River for rice production. Important aspects of management, such as rice marketing and cleaning of tertiary canals, have been devolved to farmers. Water and land use are now regulated through the *Contrat Plan*, which is renegotiated every five years. Despite government efforts to intensify rice production, the results have not lived up to expectations and rice yields are falling, encouraging farmers to invest in livestock. Conflicts between crop farmers, livestock keepers and pastoralist herders are common and, in many villages, these are leading to disabling litigation.

The CoS-SIS intervention began with scoping and diagnostic studies to identify the principal constraints and opportunities relating to the development of more productive crop–livestock systems. The researchers found that the importance of livestock to rice growing (through manure and draught power), household incomes and food security is not recognised, despite the fact that over half of all households own livestock. Meanwhile, there is little public sector investment in livestock infrastructure or services. On the positive side, there is a large domestic market for milk and a large private dairy company has begun providing an outlet for milk processing. The growth in livestock has also created a larger market for fodder crops.

The studies also found that farmers and pastoralists knew very little about government regulations, laws and conditions in the *Contrat Plan* regarding the management of livestock, the development of livestock-based enterprises and the official and unofficial norms and practices governing livestock management. The CoS-SIS post-doc, Dr Bara Ouologuem, therefore convened a multi-stakeholder innovation platform (CIG) to address this knowledge gap.

The CoS-SIS Mali team and the Programme Management Committee met for a budget mission in February 2011. Third from the left is Alhadji Mamoudou Traoré, the Mali National Programme Coordinator

The platform members have accomplished the following activities:

- All relevant official and legal documents relating to crop–livestock integration have been compiled and the main points translated into local languages
- Copies of the key documents, summaries and translations have been disseminated to the study villages and promoted by local media and theatre groups
- Village chiefs have been supported to convene a series of public discussions on the official and legal requirements and any problems with compliance
- Follow-up workshops at communal, zonal and district level have led to the identification of a series of options that could form the basis of local conventions to govern improved livestock management and movement
- The draft conventions have been negotiated and endorsed in village meetings, held during the dry season when the Fulani pastoralists could also be present, and involving zonal and district-level officials
- Experiments have demonstrated additional income opportunities for farmers by supplying fodder to the dairy industry.

In the villages where the programme has operated, compliance with the livestock conventions is high and litigation has ended, all issues being solved at village level. Mayors are requesting that the process is replicated in additional villages. Furthermore, the Office du Niger wants to incorporate the CIG in its structure. The membership of the CIG was expanded in 2012 as the initial members' experience matured and data became available that attracted the attention of additional stakeholders. These include members of local government, officials from the Office du Niger and representatives from the local dairy unit and cooperative. At the end of 2012, the CIG organised a workshop to finalise the writing of the local conventions and, with support from Office du Niger management, the text was submitted to the negotiators of the next *Contrat Plan*.

Reference: Doumbia, D., van Paassen, A., Oosting, S.J. and van der Zijpp, A.J. 2012. Livestock in the rice-based economy of the Office du Niger: The development potential for increased crop–livestock integration through multi-actor processes. In: Jiggins, J. (Guest Editor) Diagnosing the scope for innovation: Linking smallholder practices and institutional context. Special Issue of Netherlands Journal of Life Sciences, 60–63: 1–121. Available at: http://www.journals.elsevier.com/njas-wageningen-journal-of-life-sciences/recent-articles)

Cattle are an important part of the farming system of settlers in the Office du Niger, Mali

5. Looking at the big picture: Learning from CoS-SIS

The development impact of CoS-SIS is based on a coherent and holistic strategy that combines many different elements, as shown in the CoS-SIS cycle (see Figure 2). To enable each element to contribute, the programme invested in generating reliable information, training staff in institutional thinking, promoting interaction among stakeholders at different levels, and supporting institutionalisation – the essential process of embedding the new way of thinking among farmers, researchers, decision makers and opinion leaders – to create a lasting impact.

Domain selection

Choosing the right domains helps focus activities on the institutions that require change. Because they were chosen by authoritative national figures, they reflected national priorities and gave legitimacy to the programme. The domains also set boundaries to what could otherwise have become limitless concerns. This allowed for scoping studies to identify entry points for action, diagnostic studies to elucidate smallholder constraints and opportunities, and actor analyses to highlight potential participants in the innovation platforms. The domains coincided with policy concerns, budget lines and administrative infrastructure. They formed arenas for learning around which to build the process of institutional change. However, there is a danger that export crops could be selected as priority domains to the exclusion of food crops serving domestic markets.

Exploration

Scoping studies are essential to ensure efficacy. Given the absence of reliable contextualised information about the domains, it was worth investing time and energy in scoping studies (Adjei-Nsiah et al., 2013). They were carried out by the post-docs: post-graduates hired from universities, research institutes, government offices and NGOs who became part-time staff members of the programme, participated in training and reporting sessions, and were assisted in completing their studies. This set-up encouraged shared learning between the programme and the post-docs' host organisations, a spin-off in terms of institutionalisation. The scoping studies allowed all staff to learn about the purposes of the programme.

Scoping studies are essential for identifying entry points for programme activities. The studies were designed to analyse numerous aspects of a domain, including global, regional and national markets, value chains, government policies, the history of interventions to develop the domain, the main actors operating in the domain, smallholder enterprises, technological options and rural–urban relationships. They were all based around smallholder interests. It

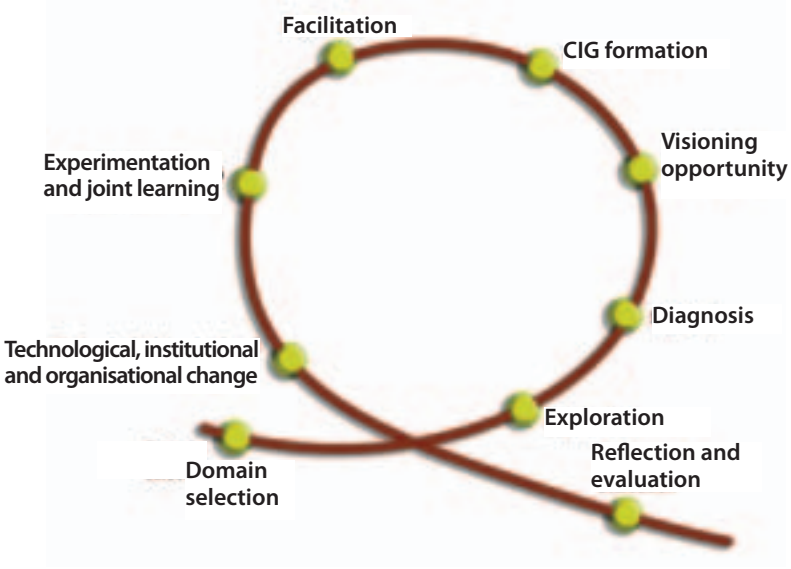


Figure 2. The CoS-SIS cycle, showing the different components of the programme and how they relate to each other

is important to remember that scoping studies require supervision of field research to prevent regurgitation of stock issues.

Diagnosis

Diagnostic studies allow in-depth investigation of institutional and socio-technical constraints and opportunities. They provided essential information that helped the CIGs to understand the domain and choose activities for action. Diagnostic analysis may require additional training of researchers. For example, while it may be well-known that 'lack of access to credit' is a constraint experienced by smallholders, the researchers were encouraged to diagnose the institutional reasons behind the decades-long persistence of the constraint, and that have to change to relieve the constraint.

Visioning opportunity

Choosing entry points determines the initial activities that the programme will pursue within the domain. The choice of entry points was based on understanding the constraints and opportunities of different categories of smallholders, and this proved important for selecting the initial activities to be supported. In each case, the activites reflected entrepreneurial decisions that would be relevant and feasible within the resources available, and that were rich in opportunity for learning and experimentation. Decisions on entry points are made best in programme-wide or domain-wide negotiations (i.e., during workshops or seminars). Collective decision making about entry points is a key opportunity for programme building and engaging the interest of staff, stakeholders and partners.

CIG formation

The innovation platform or CIG is a powerful instrument for change. It is "an impermanent platform for interaction among actors who seem able to make key contributions to innovation with respect to the entry point". Many actors within the domain met for the first time at the CIG and they began to realise the need for cooperation towards common goals. "Diversity trumps expertise every time" (Hong and Page, 2004).

It is crucial to form the CIG at the right level. It was tempting to go local, give space to empowered farmers, and hope to by-pass dominant structures. However, such CIGs strengthened the articulation of farmers' demands but not the ability to respond to them. CIGs work more effectively at the district or comparable level, where they can reach out to national and other actors.

The CIGs provided a niche in which to experiment with institutional change. For lasting impact, a change has to affect the regime: the more permanent rules, procedures and structures (Geels, 2005). This required documented evidence of effects and impacts, advocacy, networking, commitment from powerful players and recognition of the CIG's legitimacy in representing the domain. The CIGs also had to learn how to deal with those in each domain who benefited from exploiting smallholders and wanted to keep it that way. Innovation implies "creative destruction of the status quo" (Acemoglu and Robinson, 2012).

Cocoa farmers attend a village meeting in Ghana

Facilitation

The CIG is an opportunity for senior and responsible people in a domain to deal with the priority issues identified by the scoping and diagnostic studies. Its main task is to experiment with institutional change to address those issues. Such experimentation is not the same as implementing a regular development programme. The programme management teams and the post-docs played important roles in the early stages by protecting the CIG as a space for mutual learning and experimentation. The management teams sometimes intervened to correct the course a CIG had taken.

Over time, effective CIGs took ownership of their activities and continued without programme support. The post-docs required training and coaching in facilitation skills. They struggled initially with their loosely defined roles in setting up and supporting the functioning of the CIGs. In addition, the post-doc role changed through the lifecycle of the CIG, from scoping, preparation and establishment to process management, then to learning and restructuring, and finally to renegotiating. This role change demanded considerable adaptability on the part of the post-docs in their role as facilitators. Nederlof and Pyburn (2012) capture the experiences of the CoS-SIS post-docs in facilitating the CIGs.

Experimentation and joint learning

The CIGs, facilitated by the post-docs, sometimes with substantial input from the PhD students, chose unexpected but highly relevant subjects for experimentation and neither the management team nor the programme staff could have foreseen or promoted these (see Box 4 and case studies).

The CoS-SIS 'family' in Cape Coast, Ghana, November 2012: PhD students, post-docs, programme management and science support team. The man with the white cap is Dr Sidi Sanyang of CORAF/WECARD, guest of honour at the meeting

Institutional change, technical innovation and organisational change

CoS-SIS initiated change beyond its initial expectations, in directions that were unforeseen, and with a lasting impact that defied any initial misgivings and doubts (see Box 4).

Dr Owuraku Sakyi-Dawson, the CoS-SIS National Programme Coodinator for Ghana, in discussion with a cocoa farmer

Box 4: Creating lasting change: The challenge of 'going to scale'

CoS-SIS was able to promote improvement in the institutional environment for innovation by creating multi-stakeholder platforms (the CIGs) that allowed key domain actors to take informed and concerted action towards changing smallholder opportunities and constraints. This investment in interaction was not expensive, but it had a high pay-off in terms of impact. In all domains, in some more clearly than others, the platforms have initiated changes that have attracted widespread attention and buy-in.

Innovation emerges from interaction: CIG deliberations in Benin

From the start, CoS-SIS focused on building the capacity to influence change in existing structures, procedures and practices. The programme promoted its activities through publications (see page 20); interaction in workshops, seminars and conferences; by building networks and strategic alliances; and by involving local actors in PhD studies and as post-graduate researchers, supervisors, managers, overseers and experts. The CIGs became accepted as a legitimate source of expertise and a representative voice. These impacts prompted the CIG members to remain together as an active group, even after the end of the programme.

CoS-SIS has helped connect the academic work done by MSc and PhD students with relevant research in the national agricultural research systems (NARS). This has strengthened the links between universities and agricultural research institutes, which have traditionally been weak. CoS-SIS is helping NARS to make their work more relevant to the needs of smallholders. In the past, research institutes have tended to focus on technical topics and have become frustrated by their lack of impact on the ground, having little capacity for analysis or to create better conditions for smallholder innovation. CoS-SIS has provided a strategy to guide and add value to their work, thereby helping to bring their 'research into use'.

At the same time, the CoS-SIS approach is being built into the curricula of university graduate training programmes that stand out due to their inter-disciplinary nature. These programmes will ensure that future generations of policymakers, researchers, administrators, economists, extension workers and other professionals will maintain the same approach.

6. Providing evidence

It is one thing for an enthusiastic programme officer to claim success, quite another to convince sceptical peers who know how difficult it is to 'get things moving'. From the start, CoS-SIS has been designed as a research programme that aims to provide evidence for the impact it claims to have achieved.

On the one hand, CoS-SIS cannot deliver 'proof of concept' according to the criteria of randomised experimental design. Given its open-ended nature, the programme could not carry out baseline studies in the strict sense, since the researchers did not know beforehand what needed to be measured. Diagnostic studies were sometimes used as crude baselines, but that did not work for the stakeholder innovation platform (CIG) experiments. It is impossible to randomly assign treatments to groups and to credibly use matched controls where the purpose is facilitation of change processes. Local histories and contexts matter to outcomes, 'contamination' is difficult to prevent and may indeed be considered as part of the process of purposeful change, and the arenas in which change was pursued extended not only beyond the village but also beyond district boundaries. The inclusive deliberation and learning pursued by the programme conflicted with a one-sided extraction of knowledge.

On the other hand, the nature of the evidence produced by CoS-SIS can be used by other populations and in other situations, and it can generate hypotheses for testing elsewhere. By documenting and analysing (approximately every four months) what changes occurred and how they were brought about by the CIGs and others, the programme can make plausible claims about causation, but cannot claim proof of cause-and-effect relationships.

The strength of the evidence produced by CoS-SIS is based on the following elements:

- The programme features eight independent case studies and its claims are based on comparative outcomes across these cases.
- The impact of the experimental work conducted by each of the eight CIGs has been traced, tested against declared theories of change and assessed by using a modified form of Causal or Theory-guided Process Tracing (Falleti, 2006). CoS-SIS has applied two theories of change: intervention theory, which explains observed change in terms of intervention (by the CIG), and power relations theory, explaining observed change in terms of the exercise of power.
- Additional studies by social scientists and PhD students (e.g., processes of institutionalisation and the role of champions) underpin the outcomes of the comparative studies.

A high-level support team helped to ensure the post-docs carried out analysis of impact that could lead to fruitful cross-case comparison. Their experimental work and research leading to peer-reviewed publications fits with the professional demands made on the post-docs as researchers and academics.

Children at a meeting in a CoS-SIS experiment village

7. Looking ahead

In recent years, many organisations have started to question the efficacy of the single-minded pursuit of technology development and transfer, implicit in so many past development approaches. CoS-SIS is one initiative that has sought to formulate and test new ideas.

It fits well with the Comprehensive Africa Agriculture Development Programme (CAADP), which calls for "robust engagement of broad-based agricultural research and development stakeholders in partnership with other actors in rethinking enabling rural policies and institutions, supportive infrastructure and access to markets and resources, such as land and water, to training and education, and to ICT". Similarly, the Forum for Agricultural Research in Africa (FARA) and the West African regional agricultural research organisation CORAF/WECARD have adopted a paradigm shift in agricultural research for development and branded it 'integrated agricultural research for development' or IAR4D.

The ideas that have taken shape and been tested within CoS-SIS are helping CORAF/WECARD and its 22 NARS partners to embed IAR4D in the regional organisation's Second Operational Plan (2014–2019). Through building capacity among its PhD students, administrators, coordinators and many other participants, the programme will therefore leave a lasting legacy beyond its end in 2014.

Improved access to markets is one of the targets set by the Comprehensive Africa Agriculture Development Programme, and is in line with the work of CoS-SIS

Selected CoS-SIS publications

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About 'Convergence of Sciences: Strengthening agricultural innovation systems in Benin, Ghana and Mali' (CoS-SIS)

CoS-SIS is a programme of comparative action research, which aims to gain a better understanding of the conditions that enable smallholders to innovate and improve their farming systems. It features diagnostic studies, innovation system analyses and participatory field and institutional experiments, working with multi-stakeholder innovation platforms at the local, district and national levels. It is a partnership involving the Université d'Abomey-Calavi, Benin; the University of Ghana at Legon; the Institut Polytechnique Rural de Formation et Recherche Appliquée at Katibougou, Mali; and, in the Netherlands, Wageningen University and the Royal Tropical Institute. It is funded for € 4.5 million by the Directorate General for International Cooperation (DGIS) of the Netherlands Ministry of Foreign Affairs.

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