

# ***Agricultural Research: From Recommendation Domains to Arenas for interaction. Experiences from West Africa***

Röling, N.<sup>1</sup>, Jiggins, J.<sup>2</sup>, Hounkonnou D.<sup>3</sup> and van Huis, A.<sup>4</sup>

<sup>1</sup> *Emeritus Professor, Wageningen University, The Netherlands. Member CoS-SIS Programme Management Committee (PMC), n.roling@inter.nl.net*

<sup>2</sup> *Guest Researcher, Dept. of Knowledge, Technology and Innovation, Wageningen University, Member CoS-SIS RA Social Science Support Team (RAST)*

<sup>3</sup> *Chairman Fondation Berceaux d'Afrique. CoS-SIS Regional Coordinator, member PMC*

<sup>4</sup> *Professor of Entomology, Wageningen University. CoS-SIS International Coordinator, Chair PMC*

**Abstract:** Agricultural research designs tend to be bounded by agro-ecological conditions, farming systems and other dimensions assumed to be homogeneous for the population of interest (a recommendation domain or population for whom a technology or practice is expected to be relevant). Scaling is a question of 'rolling out' results across the domain.

What if not only technology adoption but also institutional context explains the variance in the output of smallholders, and agricultural development is also of question of institutional innovation? What if a domain is seen as a system of interest among actors who have a stake in the system and its performance as an arena for concerted action and institutional innovation?

The paper reports almost six years of action research that tried to answer these questions. It compares experimental interventions and subsequent systemic changes within each of nine domains. It suggests that the research approach used can explain variance in smallholder output that, in present-day West Africa, is not explained by technology adoption.

**Keywords:** innovation, niche, institutional regime, Benin, Ghana, Mali

## **Introduction**

Sites for agricultural research and pilot projects usually are selected to represent agro-ecological zones, farming systems, and sometimes homogeneity in specific farmer characteristics. Such site selection assumes that (1) outcomes of the research, experiment or pilot project are relevant for and applicable to specific farm-level conditions as determined by the farming system (usually called a recommendation domain); (2) the contribution of agricultural research is to develop technologies and practices that individual farmers adopt; (3) institutional conditions at the higher than farm-level are taken as given and (4) some external agent will ensure that the research outcomes are widely applied.

Our research in contrast was based on these premises:

The presence or absence of an enabling institutional context explains a neglected proportion of the variance in the output of smallholders. Creation of enabling conditions precedes productivity growth.

The domain is a social space bounded by an industry, value chain, commodity, irrigation scheme or food security polity, in which key actors can meet, interact, negotiate and take concerted action to bring about systemic change in institutional conditions

The key intervention is not technology development but investment in informed and facilitated interaction (on an innovation platform or IP) among key stakeholders in a domain.

This paper first presents the programme, the theoretical framework and methodology. It then highlights selected findings and distils propositions supported by the study.

### **The Programme**

Convergence of Sciences-Strengthening Innovation Systems (CoS-SIS, 2008-2014, €4.5 million) and its predecessor CoS (2002-2007, €2.5 million) were executed in West Africa (WA). They aimed through comparative field experiments to establish more effective pathways for innovation in smallholder farming ([www.cos-sis.org](http://www.cos-sis.org)).

### **Background**

CoS was implemented in eight sites in Benin and Ghana and focused on participatory technology development (PTD). During CoS the participants began to experiment with institutional change e.g., the adaptation of tenure contracts so that it became more attractive for tenants to engage in sustainable soil management (Saïdu et al. 2007; Adjei-Nsiah et al. 2007), and random control of the weighing scales used by cocoa produce buyers. This stopped the doctoring of scales by up to 15% of the bean weight (Dormon et al. 2007). A study of CoS' impact five years after its termination (Sterk et al. 2013) however showed that farmers stopped using the practices and technologies developed through PTD when their utilisation depended on conditions beyond their control.

A comparative historical analysis carried out by Hounkonnou et al. (2012) showed that countries considered successful in terms of industrial agriculture started creating the institutional conditions for the development of family farming 50 to 100 years prior to the take-off of agricultural productivity growth. Hounkonnou et al. (op cit.) further showed that reliance on technology development and transfer as the mainstream innovation pathway had its origins in neo-liberal agricultural economics, notably work on the agricultural treadmill (Cochrane 1958), and calculation of the internal rate of return to investment in agricultural research and extension (Evenson et al. 1979), both inspired by the specific conditions in the American mid-West during the decades of rapid productivity growth following the introduction and diffusion of hybrid maize in the 1940s. This work took for granted the institutional conditions that allowed the technology to become a driver of farm development. The model was transposed into the Green Revolution (GR). It became apparent over time that the GR was effective in Asian countries because they had created the required institutional supports (Biggs 2007) and failed in African countries because they did not. Djurfeldt et al. (2005:4) observed a 'pervasive bias against smallholder farming' in Sub-Saharan Africa (SSA). In WA fragile public services were weakened or removed under Structural Adjustment programmes. Economic liberalisation has not led to the provision of private sector services and strong market development. West African smallholders remain embedded in dense institutional networks that have evolved over the years to extract as much wealth as farming can bear (Djurfeldt et al. op. cit.).

## The CoS-SIS Programme

CoS-SIS assumed that to innovate, smallholders need all or some combination of the following enabling conditions:

- Voice: procedures for exerting influence on the decisions that affect them;
- Services: access to quality planting materials, production inputs, advice and information, machine repairs, credit, veterinary services, etc.;
- Tenure security that allows farmers to invest in land improvement and soil health;
- Legal frameworks that protect them from corruption, cheating, land-grabbing, unfair competition and profiteering;
- Integrated value chains that create access to remunerative produce markets and give farmers a fair share in the value added;
- Transparent and free information on prices, taxes, subsidies and policies;
- Infrastructure including roads, irrigation and drainage, laboratories for testing and certification, facilities for seed multiplication, etc.

CoS-SIS experimented with interventions that sought to make institutions more supportive of smallholder innovation, in nine domains selected by national experts, in line with national priorities (Table 1).

Table 1: CoS-SIS countries and domains

Country	Domain
Benin	Oil palm (seed system)
	Cotton
	Water management (rice in inland valley bottoms)
Ghana	Palm oil
	Cocoa
	Small Ruminants (North)
Mali	Shea Nut
	Crop/Livestock integration (Office du Niger (ON))
	Water management (ON)

Action research in CoS-SIS had two meanings: (i) Research was seen as a crucial component of the action, and included scoping (Adjei-Nsiah et al. 2013) and diagnostic studies (Jiggins 2012), Ph.D. studies, and institutional analysis and experimentation at a range of levels (Struik & Klerkx in press); (ii) Part-time post-doc Research Associates (RAs) applied Theory-Guided Causal Process methods to track the innovation pathways led by the IPs (Jiggins et al., in prep.) Within and cross-domain analyses and assessments by the RAs, who also facilitated the Innovation Platforms or IPs), National Programme Coordinators, and a RA social science support team (RAST) are beginning to be published. The present article focuses on CoS-SIS' research in sense ii), and specifically on the relationship between the activities carried out by the IPs and subsequent systemic change in the domains.

### Theoretical considerations

The relations between experiment and population can be conceptualised from different perspectives. Under assumptions of methodological individualism, higher-level phenomena are positioned as aggregations of individual behaviour. A market can be seen as the aggregation of supply and demand resulting from the (rational) choices of many individuals. Similarly, the widespread adoption by farmers ('diffusion') of a technology is seen as an aggregation of individual decisions. In this perspective, scaling or rolling out is a replication of experimental results by individual farmers.

System thinking applies a different perspective. At a higher system level, properties can emerge that cannot be predicted from the lower level. For example, the rational decision of each of the

fishermen around a lake to catch as many fish as possible before others get them leads to the collapse of fish stocks (e.g., Dangbegnon 1998). Similarly, the adoption by farmers of a productivity enhancing technology leads to oversupply of the commodity concerned and a crash in its price, undermining the calculation of returns to investment made under aggregation assumptions. Research interventions at lower system levels typically try to induce emergence of desirable properties at higher levels. However, such emergent problems can be solved only at a system level at which the parameters at the lower level become variable (Fresco & Kroonenberg 1992). They typically require institutional solutions, such as common property management regimes to regulate the off-take from a lake (Ostrom 1990; 1991; 1992), and policies to regulate prices and tariffs, provide subsidies, or limit the supply of the commodity (Koning 2013).

Following the soft systems tradition of Checkland (1981), we define a domain as a potential 'system of interest' among stakeholders in a concrete situation, who, as a result of negotiating concerted action, attempt to change (unfreeze, by-pass, develop) the situation (Ison in press; Colvin et al. in press). There is increasing interest in the mechanisms that hinder or facilitate realisation of such potential (Roux et al. 2010).

In this paper, we use the distinction between niche, regime and landscape made by Geels (2005). These categories do not refer to levels but to 'space for change' (Leeuwis & Aarts 2010). In niches, it is possible to experiment and try things out. There are relatively few constraints and few sources of resistance but the change achieved is often fragile and unstable. The regime refers to more stable and entrenched norms, rules, relationships and networks, patterns and practices. These are difficult to change but changes in the regime tend to be stable and durable. The landscape sets the trends and conditions within which regimes exist. The landscape can undergo sudden changes over which regimes have no control. We focus specifically on how activities in the niche effect changes in the regime in a given context.

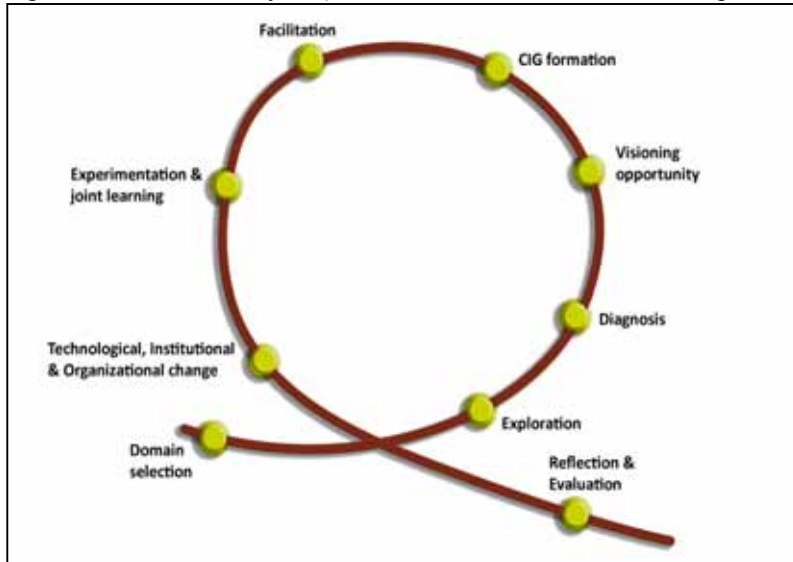
## **Methodology**

This paper is based on an exploratory realist evaluation (Pawson & Tilley 1997). It seeks to develop (middle-range) theory through case-based theorising about what interventions lead to what institutional changes. The information about the niches and regimes in focus are dense qualitative descriptions, based on intimate involvement of the authors in the programme as members of the Programme Management Committee and the RAST, and on the materials presented at regional and international workshops and conferences over the course of the programme.

Evidence for attributing observed domain changes to experimental actions (internal validity) is not pursued here but will be reported by others. Also external validity is not systematically pursued. The fact that we worked in nine domains in three WA countries, two of which were Francophone, suggests the results may be relevant to others. Construct validity is an issue, in that we claim that the changes observed represent changes in the respective regimes.

Fig. 1 presents the CoS-SIS time-path/process. (The word 'CIG' in the Figure stands for 'Concertation and Innovation Group', the term the programme used for the IPs). We emphasise here that Figure 1 was constructed two-and-a-half years into the programme by its Curriculum Development team to explain CoS-SIS to others. CoS-SIS did not have a pre-determined 'design'. The institutional options that the platforms developed and tested emerged on the basis of scoping and diagnostic studies, Ph.D. field and laboratory work, and facilitation of IP-led inquiries (documented in the casual process data).

Figure 1: The CoS-SIS cycle (source: CoS-SIS Curriculum Development Team)



### Findings & Analysis

This section presents first the main changes in the regimes in some of the nine domains and secondly the bundle of programme interventions that might be said to have caused these, under seven headings: staff deployment; system analysis; choosing entry points for action; the nature of the innovation actors involved in the experiments; the IP activities in the niche; and institutionalisation.

#### **The nature of the changes in the regime observed in the domains**

Table 2 presents an overview of the changes in the regime of three selected domains as a result of the interventions by the IPs that have resulted from the niche experiments.

The three examples show significant (i.e. institutionalised) changes. These are qualitatively different from rolling out technologies in that they represent changes in rules, procedures, governance practices, national plans, etc. In the cocoa case, the institutional changes amount to ‘regime change’ in the cocoa domain; in some other cases, the potential for regime change has been opened through by-pass strategies (e.g., cotton, Benin). The IPs for cocoa, Ghana; and in the ON, Mali are investigating the continuation of their IPs.

Table 2: Examples of institutional innovations in selected domains

Domain	Local government regimes	National regimes
<b>B: Oil palm (seed system)</b>	New certified nurseries have been established in two Communes, filling spatial gaps in coverage; nursery owners have been trained in hybrid seedling management. Local government has assumed responsibility for licensing and regulating the seed system	Seed system improvement has been included in new 5-year National Dev. Plan. Research station is working with stakeholders to regulate the seed system. Two IPs, together with PMT, have held a meeting with national stakeholders & officials to discuss how to extend the innovations supported by the IPs
<b>G: Cocoa</b>	Following the IP's investigation of the composition of cocoa price formulation, three price mechanisms for rewarding farmers for producing & selling quality beans have been tested at local level	IP has led drive for transparency in price formation. Producer price is now announced in time and has been increased. Further investigations by the IP have contributed to changes in local announcement & publication of dates of delivery and quantities of inputs that are needed for cocoa production. Evidence assembled by IP has contributed to decision to abolish CODAPEC, to review pesticide recommendations and abandon the mass spraying campaign. Cocoa Research Institute has embarked on an action-learning pathway guided by Ghanaian COS-SIS partners in order to improve its own impact. Platform is accepted as a legitimate voice of the industry
<b>M: crop-livestock integration (Office du Niger)</b>	Analysis & sharing of information by the IP on formal & informal rules for cattle husbandry & movement in the ON, in 3 communes in Niono Zone. Following public assemblies, sharp reduction in litigation and conflict between rice farmers, cattle keepers & herders, based on measures negotiated among these actors, codified in local conventions. Disputes now settled at village & communal levels, based on the conventions. Bill boards erected to present the agreed rules of good behaviour. Fodder experiments demonstrate potential for increasing tenants' incomes, & milk yields to supply a new commercial dairy	Five other zones have requested support to implement the process of negotiating similar local conventions. Adoption of the revised measures into the new 5-year zonal <i>Contrat Plan</i> (2013-18). The ON administration offered to take over support to the platform but platform members prefer to remain independent. They are considering registering as an apex co-op, that can support the development of other IPs in additional zones

Three Ghanaian agricultural research institutes have requested support to incorporate CoS-SIS procedures into their own work, and have embarked on a series of trainings, reflection meetings, and 'learning by doing' initiatives, so as to enhance their impact on the ground. All three historically have focused on developing technologies, of which only a small number have been adopted by farmers.

New curricula at the University of Ghana have been developed and registered, that incorporate the programme's research methodology and the lessons learned. In Benin, the COS-SIS group at the university of Abomey-Calavi has led discussions across three faculties on the generic lessons of the methodology and outcomes of the programme, leading to new MSc and Ph.D. methodology courses; and courses for professionals.

### **Staff deployment**

In each domain, CoS-SIS used a combination of (1) a Research Associate (RA), a post-doc professional, who was recruited part-time from a national university, research institute, government department, or NGO to facilitate each IP and research the process and actions taken; (2) a Ph.D. student who worked at the local level to analyse constraints and opportunities of smallholders and carried out participatory socio-technical and institutional experiments. The experience of recruiting and installing the RAs has been mixed: two of those originally recruited found greener pastures elsewhere. Replacing them led to delays and lack of synchronisation of the doctoral and IP work. Another could not release sufficient time. No IP materialised in this domain.

The recruitment of Ph.D. students also did not unfold as desired. One candidate was identified only a year after the programme got under way. Without his diagnostic and other exploratory research, the IP lacked in-depth information on practices and relations along the value chain. In Mali, two of the three students failed to pass their qualifying examinations. However, in both domains, the institutional experiments carried out by the IPs delivered systemic changes. In Benin, two additional Ph.D. researchers were recruited, but the RAs were too busy to establish IPs also in their areas of work. All Ph.D. students were required to write two research-based chapters for the programme: a diagnostic study and an institutional analysis related to their domain. By December 2013, eight doctoral dissertations had been successfully defended.

Most RAs and Ph.D. students had an agronomy background and required training in institutional thinking. Value chain analysis proved effective in bringing about appreciation of the role of institutions, a concept otherwise difficult to communicate. The Marxist training promoted in Mali in earlier times had sensitised two of the Malian RAs to the role of institutions to a much greater degree than the natural science training of the others. The RAs were trained and coached in facilitation skills by the Dutch Royal Tropical Institute and assisted through a write-shop to publish their facilitation experiences (Nederlof & Pyburn 2012).

CoS-SIS worked in each of the three countries also with a National Programme Coordinator (NPC), who was supported by a national Programme Management Team (PMT) composed of senior national agricultural decision makers.

### **Situational analysis**

A programme that wants to improve conditions for WA smallholders must invest in situational analysis. Little contextualised information about grounded realities in the smallholder sector is available. Smallholders are not organised and, as a professional category, politically not of interest. In each domain, CoS-SIS over nearly a year at the start of the programme supported scoping studies by RAs to provide a broad reconnaissance and identify likely entry points for programme activity in the domain, as well as diagnostic studies carried out by Ph.D. students that analysed prevailing institutional conditions and opportunities for smallholders in each domain, as well as the actors, their networks and stakes. CoS-SIS invested throughout the programme in multi-level national and international workshops with its university partners and technical and policy stakeholders, to discuss innovation pathways and institutional change, ways of researching and influencing these processes, and interim results.

### **Choosing entry points for action**

Entry point selection, i.e. selection of initial focus for niche action in each domain, was based on information about smallholders' conditions, but also required foresight to identify opportunity, based on analyses of international markets, value chains, urban markets, new technologies, etc.,

and potential entrepreneurial activity. Final selection took place during an international workshop, in a participatory exercise involving key actors in the domain, thus also beginning the process of institutionalisation.

### The IPs and their composition

Table 3 presents an overview of the IP for the three selected cases. CoS-SIS worked on the premise that institutions cannot be transferred but must emerge from and be embedded in the context. Institutional innovation in this perspective emerges in negotiation and inter-action among key stakeholders in a domain, informed by shared learning around concerted action to change institutional conditions and/or create new opportunities.

Table 3: The IPs and other groups in selected domains

Domain	Learning groups working with Ph.D. student	Local Government	National
<b>B: Oil Palm Seed System</b>		Platforms formed in two Communes with farmers and Commune actors; both including national actors	PMT included national oil palm industry & research. National restitution meetings debated outcomes
<b>G: Cocoa</b>	Experimenting farmers, licensed buying agents & NGOs tested incentives for quality beans		Platform comprised key national cocoa actors. PMT included commercial, official & research actors
<b>M. Crop/Livestock Integration</b>	Commune mayors, pastoralists, & villagers in 3 Communes discussed & negotiated local conventions to govern livestock movements and husbandry. Farmers and others tested off-season fodder production	Zonal platform of ON officials, state agencies, farmers, Commune mayors and dairy company	Higher level ON officials & other Zones and Communes became involved. PMT included higher level officials responsible for ON & livestock experts

Table 3 shows that the IPs were positioned differently in their respective administrative hierarchies. The IP for cocoa (G) was located toward the national level. It was embedded in the national cocoa regime; its members drawn from all the major organisations involved in the governance of the cocoa industry. In the cases of oil palm (B), and crop/livestock integration (M), the IPs were located at the District, Municipal and Zonal levels. The causal process data enable us to claim that the positioning of the IPs was crucial in the kinds of spaces for innovation the IPs were able to exploit and the institutional changes they effected. The PMTs, by periodically visiting the field activities, served as the link with national decision-makers, and used their own networks to share information, provide access and support, and help remove or by-pass bottlenecks.

### IP activities in the niches

It came as a surprise that the € 20,000, which had been budgeted annually for the IPs' socio-technical and institutional experiments mostly was not used. The programme in the event paid only for meeting and some training costs; for the rest, the IPs mostly used resources mobilised by their members i.e. IPs can be cost-effective interventions that do not depend on external finance.

A second surprise was that, after initial guidance, programme management had little say in what IPs chose to do. The members assumed responsibility for bringing about the institutional changes they themselves considered necessary. For instance, the entry point in the Palm Oil (G) case had



been identified as enabling artisanal palm oil woman processors to access high-value markets. However, the platform first focused on the harmful effects to health and the environment of the common practice of using old car tyres as fuel for boiling palm nuts. They negotiated a ban throughout the local government area. Indigenous rulers in the District became involved in upholding the ban. The Interim Evaluation Mission (June 2012) saw this activity as irrelevant and reported that the IP showed little promise. Subsequently, a Ghanaian professor in toxicology at the request of the IP showed that tyre burning affects the quality of the oil and not only the health of the processors. The use of processed waste as an alternative fuel led to reduction of effluent and opened a new source of income. The IP, informed by this research and experimentation of the Ph.D. student (Osei-Amponsah et al. in press) and the RA (Adjei-Nsiah et al 2012), then showed that with appropriate training the women processors could produce export-quality oil and facilitated contact between the processors, the Export Promotion Authority and an external oil trader looking for new sources of supply. The women currently are organising themselves to register as co-ops, thus becoming eligible for credit to purchase mechanised processing equipment that would enable them to fulfil export orders. Before the CoS-SIS experiments, policy had favoured export development based on large-scale companies.

### **Institutionalisation**

CoS-SIS made considerable additional effort to institutionalise its approach. The main programme-wide strategies were: supporting the PMTs; Ph.D. supervisory teams that mixed disciplines and nationalities; holding the doctoral defence ceremonies in Benin and Ghana; organising (international and national) conferences and workshops throughout; and sharing information via the CoS-SIS website, Proceedings, Fact Sheets and the Brochure. The CoS-SIS approach has been chosen to help operationalise CORAF/WECARD's Integrated Agricultural Research for Development (IAR4D) in its 22 members countries during its second Operational Plan.

### **Conclusions**

We suggest that in present-day WA the following propositions have validity:

1. It is possible deliberately to induce significant changes in the regime of a given domain.
2. Such changes emerge from process-oriented investment in interaction and shared learning.
3. Niches are temporally and spatially circumscribed opportunities for domain actors to do things differently and to do different things; niche processes are open-ended; they are purposeful but the purpose is defined by the actors concerned.
4. IPs provide the social space in which opportunities can be created, tested and transformed into changes in institutional regimes.
5. Employing, training and coaching facilitators are necessary to support IP formation and functioning.
6. Effective platforms require investment in gathering intelligence about the institutional and socio-technical conditions in which smallholders operate.
7. Changing institutions is likely to affect negatively the interests of some stakeholders and hence requires strategic insight into who the champions of change might be (Klerkx et al. 2013).
8. Landscape changes can open opportunity for institutional change: change in world prices for rice and cotton, for instance, created scope for new alliances that favoured institutional change.
9. The type of agricultural research described in the present paper can explain a proportion of the variance in smallholder output that, in the current WA, is not explained by technology adoption.

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