

Triggering regime change: A comparative analysis of the performance of innovation platforms that attempted to change the institutional context for nine agricultural domains in West Africa

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ABSTRACT

The article synthesises the experiences of innovation platforms (IPs) that engaged in open-ended experimental action to improve the institutional context for smallholder farm development in West Africa. The IPs sought change at the level of the institutional regime covering an entire agricultural domain (such as cocoa, cotton, oil palm or water management). Their purpose was therefore not to 'roll out' farm-level technologies across rural communities. The IPs's outcomes were documented and analysed throughout by means of theory-based process tracing in each of seven of the nine domains in which regime change was attempted. The evidence shows that by means of exploratory scoping and diagnosis, socio-technical and institutional experimentation, and guided facilitation IPs can remove, by-pass, or modify domain-specific institutional constraints and/or create new institutional conditions that allow smallholders to capture opportunity. The article describes the 5-year, €4.5 million research programme in Benin, Ghana and Mali, covering theory, design, methods and results. It is the sequel to Hounkonnou et al. in *AGSY* 108 (2012): 74–83.

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1. Introduction

The development of African smallholder agriculture has long been framed in terms of the promotion and adoption of technologies, and agricultural research has played a leading role in setting this agenda. The Sub-Sahara Africa Challenge Programmes of CGIAR managed by FARA (Adekunle et al., 2016; Pamuk et al., 2014), Integrated Agricultural Research for Development (IAR4D) (Hawkins et al., 2009; Sanyang et al., 2014) and similar initiatives (e.g., Vall et al., 2016) implicitly assume that research drives agricultural development. In recent years, there

has been some shift toward *creating conditions* that enable technology adoption. For example, the Alliance for a Green Revolution in Africa (AGRA) has launched a US\$180-million programme supporting value chain development (input distribution, credit, distribution of seed packages, etc.) (*New Scientist* 223 (2985): 12–13, 6 Sept. 2014). If technology drives agricultural development, the appropriate criterion variables for assessing impact are adoption of innovations, yields per hectare, farm incomes, or aggregates of such measures i.e. criterion variables that are based on the implicit assumptions of methodological individualism according to which societal outcomes result from the *aggregation* of countless *individual* decisions, instead of from attributes of the collective (such as institutions).

The research reported upon in this article has taken a different line inspired by four considerations. The *first* is the failure of the Green Revolution in Africa, i.e. pervasive disappointment with technology adoption by smallholder farmers, the persistent under-performance of the

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smallholder sector in terms of feeding Africa's growing cities, and the under-utilisation of the productive resources under African smallholder management (e.g., Djurfeldt et al., 2005; Bold et al., 2015).

The *second* is the history of the development of industrial agricultures. Their phenomenal agricultural productivity growth occurred at least half a century *after* major and deliberate institutional development had created enabling conditions in terms of land tenure, land development, regulatory frameworks, value chain development, fiscal policies, credit, extension, etc. (Hounkonnou et al., 2012). For example, in The Netherlands, the tenure law of 1917 for the first time made it attractive for tenants to invest in land improvement, 40 years *before* the take-off of farm productivity in that country. Collective management of ground water levels allowed modern farm machines to operate on peat land and is said, by some, to be responsible for at least half of the productivity increase of Dutch agriculture since World War 2. Nowadays, industrial farms are embedded in, and would be unable to survive without, dense institutional networks, including farmer organisations with political clout, elaborate value chains, research, regulatory frameworks, public sector support in terms of energy and other subsidies, land development, water management, transport and other infrastructure, and political tolerance of cost externalisation in terms of emissions, ecological degradation and toxification. We do not imply that the development pathway of WA farms necessarily is the same as that of industrial agriculture and are fully aware of the contested nature of 'sustainable intensification' (Kuyper and Struik, 2014). We realise that rapid productivity increase coupled to scale enlargement gives rise to serious second-generation problems, such as high rates of dropout and destruction of ecosystem services. But we highlight the importance of enabling conditions in agricultural development that have been more or less totally ignored as a result of the blinding experience of the diffusion hybrid maize in the US in the early forties and the focus on internal rates of return to investment in agricultural research and extension ever since the *Science* article by Evenson et al. (1979).

The *third* is the work of institutional economists, such as North (1990) and Williamson (2000), and anthropologists such as Douglas (e.g., Hood, 1998), who created broader and deeper understanding of norms, rules, agreements and other attributes of collectivities, and anthropologists such as Blundo and Olivier de Sardan (2006) who have analysed the institutional constituents of corruption in West Africa.

The *fourth* consideration is the experience of the predecessor of the research programme reported here, called Convergence of Sciences (CoS, 2002–2006). It had experimented with participatory technology development (PTD) in Benin and Ghana and concluded that farmers' windows of opportunity were too small to capture significant benefits from 'appropriate' technology. In other words, farmers did not have the required access to land, labour, credit, inputs and markets to utilise the technology. Sterk et al. (2013) who carried out an impact study four years after the end of CoS found that technologies whose use by farmers depended on external conditions were no longer used. The PhD students involved in the eight CoS PTD projects had started to experiment with institutional innovations (Van Huis et al., 2007), such as formal agreements between tenants and landowners that would allow former to invest in the land instead of mining it out of fear that the latter would take it back.

These four considerations led us to ask: What if change at system levels higher than crop, field and farm is a crucial necessary condition for smallholder development (see also Schut et al., 2016)? What if the pervasive assumption that technological innovation is sufficient for such development for decades has held back African agricultural entrepreneurship?

The article synthesises performance assessment across nine innovation platforms (IPs) in Benin, Ghana and Mali. They formed the core of an experimental action research programme (€4.5 million, 2008–mid 2014), called Convergence of Sciences–Strengthening Innovation Systems (CoS-SIS, www.cos-sis.org), to establish whether multi-stakeholder interaction on an IP can trigger institutional change, that is, change in

rules, norms, values, regulatory frameworks, governance and other forms of human coordination. The IPs focused on enabling smallholder innovation through changing institutions that condition opportunity beyond the crop, field and farm and correcting 'the pervasive bias against the small farm sector' in Africa (Djurfeldt et al., 2005:4). Hence the purpose of the present article is to examine whether, and if so under what conditions, the IPs brought about institutional change. The article presents the outcomes of the research, as a follow-up to Hounkonnou et al. (2012) who grounded the programme in the international literature on the state of African agriculture. By way of summary, Table 1 compares IPs that aim to promote adoption of science-based technologies by individual farmers and the kind of IPs that are the object of the study reported upon below (see also Toillier et al., 2013).

The objectives of the current article are (1) to examine whether the IPs enacted change in domain-wide institutional regimes, (2) to report the researching process that was used to assess performance across the IPs, and (3) to discuss the wider applicability of these experiences.

2. Materials and methods

2.1. Domains

In each of three countries, the domains for experimental action were chosen from a short-list of national development priorities, which had been provided by senior national agricultural decision makers. They included major export crops (cocoa, cotton), indigenous cash crops (oil palm, Shea nut (Karité)) and important issues (water management, food security, crop/livestock integration). (See Table 2 and the map in Fig. 1 for location of the domains.)

The Programme considered a domain as a potential system of interest and action among professional and political actors who have a stake in the domain, i.e. as a potential space for negotiation and concerted action (Ison, 2016; Röling et al., 2014). This use of domain is conceptually different from a 'recommendation domain', defined as 'a group of roughly homogeneous farmers with similar circumstances for whom we can make more or less the same recommendation' (Byerlee et al., 1980). A recommendation domain comprises a population of farmers who are homogeneous in terms of the appropriateness of some practice, typically based on technical criteria (goodness of fit with soils, climate, cropping system), but sometimes also on the availability of markets and other socio-economic characteristics. Scaling in this latter frame means 'rolling out' the technology across the domain.

If, as we assumed in CoS-SIS, not only technology adoption but also the enabling context explains variance in farm output, and development is also a question of institutional innovation, a domain is better seen as the context for multi-stakeholder interactions and relationships among those engaged in purposive development processes. An IP, from this perspective, is an opportunity for selecting, convening, and fostering interaction and concerted action among selected stakeholders, who have an interest in developing the domain. Evaluations of programmes that use IPs to promote the adoption of, for instance, HYVs by individual farmers through arranging access to seeds, inputs, credit and markets, often report unexpected social dynamics at scales beyond the individual farm (e.g., Sanyang et al., 2014). The IPs on which we report were deliberately set up to optimise such dynamic effects.

When domains are considered as systems of interest, the following issues become relevant:

- The extent to which IP members come to agree on the boundaries of the domain, share some vision or objective for its development and are willing to give priority to domain interests;
- The extent to which they form, build on and use differentiated but inter-linked networks that create synergy by building on complementary contributions (they might be linear as in a value chain, or involve multiple cross-cutting relationships);

Table 1
Comparison of Innovation Platforms that promote adoption of High Yielding Varieties (HYVs) and those convened by CoS-SIS.

| | IPs that promote adoption of HYVs | CoS-SIS IPs promoting institutional change |
|-----------------------|---|--|
| Entry point | Preconceived: adoption of science-based technologies | Semi-open: depends on scoping, diagnostic studies and system analysis but focus on institutional context |
| Actors | Pre-determined: scientists, input suppliers, credit and marketing organisations create conditions to make adoption possible | Open: depends on scoping, actor analysis, strategic selection of champion stakeholders in domain, and entry point |
| Subsidy element | (Usually) free package of seeds, subsidised fertiliser, facilitated access to credit and markets | Investment in exploratory research, convening and facilitating of IPs and interaction on IPs, but no development funding |
| Target unit of change | (Selected) farmers in selected rural communities | Agricultural domain as unit of concerted action |
| Criterion variables | Farm-level adoption, yields, and incomes | Domain-level changes in laws, rules, norms, governance, organisation, power that enable farm innovation |

- The extent to which IP members over time form a ‘community’ in terms of sharing a set of rules, agreed governance practices, and ways of collecting and distributing resources;
- The distribution of power among IP members.

The domains in this study differ a great deal on these points. For example, cocoa in Ghana is an old industry, with established practices, strong management, and a high sense of domain awareness among its actors, from farmers to COCOBOD directors. At the time of study, the cotton domain in Benin, though an old cash crop with a high level of actor differentiation and organisation, was in disarray after reform measures were introduced, and increasingly operated in the interest of a businessman who had taken control of input distribution, transport and ginning. The small ruminant domain in Northern Ghana, on the other hand, could hardly be called even a nascent system of interest: producers, traders, veterinary officers and other actors did not share awareness of a domain boundary, did not form integrated networks, nor operated in the context of a coherent policy for small ruminant development.

2.2. Using research associates for facilitating IPs

The CoS-SIS programme had two main components: (1) a PhD training programme with 11 doctoral candidates of whom two dropped out after two years. They each worked in a single domain on a specific topic, were supervised by independent teams of scientists drawn from West African universities and research institutes, and a Dutch university, but contributed to the programme-wide research, as we shall see below. (2) A *programme-wide* comparative assessment of outcomes of the work of the IPs across seven of the nine domains in which IPs could be successfully established and their impact traced (see Table 2). The IPs formed the main action-researching component of CoS-SIS. Post-doctoral Research Associates (RAs) were the principal researchers who traced the IPs’ actions, performance and outcomes, in addition to convening and facilitating them. The action-researching component

was welcomed by the donor, who had criticised CoS for delivering a ‘stack of dissertations’ without contributing to knowledge relevant for development policy and investment.

The RAs were recruited on part-time secondment from universities or research institutes (see Table 2) to carry out exploratory scoping studies of domains, convene and facilitate the IPs and, from mid-term onwards, record the processes of change in which the IPs were involved. The Programme recruited three RAs out of the eight post-docs who had obtained their doctorates in CoS (two in Benin and one in Ghana). In Mali, it contracted a new set of RAs. Recruitment on the basis of secondment initially seemed unproblematic. However, some of the RAs were in continual danger of over-extending themselves by working on multiple projects, leading to conflicting time demands. In Northern Ghana the RA had to drop out because his host organisation re-assigned him to another region. The RA to the rice/water management domain in Benin after a while ceased to maintain the tracing documentation and attend the RAST workshops (see below) so that the performance and outcomes of that IP’s activities could not be assessed. We consider these negative experiences as lessons of the CoS-SIS programme and thus continue to speak of nine domains, although IP impact could only be assessed for seven.

The RAs had all been educated as natural scientists (agronomy, soil & weed science, plant protection, animal husbandry, hydrology, etc.) so from the beginning of the Programme were supported and counselled to think in terms of institutional change. The Royal Tropical Institute in Amsterdam organised training in value chain management (because this proved to be a suitable way to begin to discuss multi-actor thinking and institutional arrangements), and platform facilitation and, later, organised a write-shop to capture the initial experiences of the RAs with establishing and facilitating IPs (Nederlof and Pyburn, 2012). The RAs spent their first year carrying out exploratory scoping studies of their domains, synthesised in Adjei-Nsiah et al. (2013), which provided ample opportunity to strengthen their institutional understanding. The objective of the studies was to identify possible entry points for concerted action by the IPs. These entry points (Table 2) therefore were not chosen a priori but emerged on the basis of exploratory field research.

Table 2
Countries, domains, entry points and Research Associates (RA) (numbers: locations on Fig. 1).

| Country | Domain | Entry point and RA |
|---------|-------------------------------|---|
| Benin | 1. Oil palm | Integrity of system for distributing hybrid (Tenera) oil palm seedlings. RA: Dr. P. Vissoh, University, ex-CoS PhD |
| | 2. Cotton | Access to affordable less harmful plant protection (Integrated Pest Management). RA: Dr. E. Zannou, University, new after CoS PhD left for other work |
| | 3. Water management | Rice production in inland valley bottoms. Helping rice producers capture expanding national market. RA: Dr. A. Saïdu, University, ex-CoS PhD. He could not maintain event tracking or participate in RAST workshops. Domain could not be used for IP impact study |
| Ghana | 4. Palm oil | Artisanal processing. Helping women processors improve quality of crude palm oil (CPO) and access domestic and export markets for quality CPO. RA: Dr. S. Adjei-Nsiah, Research Institute, ex-CoS PhD |
| | 5. Cocoa | Formation of prices that farmers receive for their cocoa. RA: Dr. R. Adu-Acheampong, Research Institute, new after CoS PhD left for other work |
| Mali | 6. Food security | Marketing of small ruminants in Northern Ghana. Unable to arrange secondment of intended RA. No IP formed. Domain could not be used |
| | 7. Shea nut/Karité | Improving the inclusiveness of women’s cooperatives involved in buying and refining Shea butter. RA: Dr. F. Dembele, University |
| | 8. Crop/livestock integration | Conflict resolution; breakdown of discipline following devolution of the Office du Niger and development of zero grazing dairying. RA: Dr. B. Ouologuem, Research Institute |
| | 9. Water management | Maintenance of tertiary canals by Water Users’ Groups; breakdown of discipline after devolution of the Office du Niger. RA: Dr. L. Soumano, University |

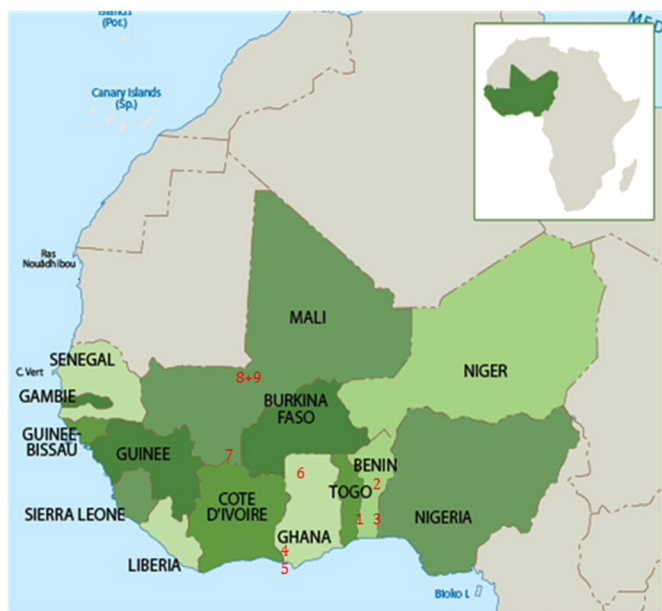


Fig. 1. Map of West Africa (for numbers, see Table 2).
(Source: African Development Bank Group www.afdb.org/en/countries/west-africa).

The natural science background of the RAs in fact strengthened their standing vis-à-vis the other platform members and proved no hindrance to their ability to learn how to facilitate the IPs' performance. The earlier CoS experience of three of the RAs gave them confidence in the early months but, by their own documented accounts, was not decisive in the performance that emerged. Some of the most imaginative institutional innovations evolved in Mali, which had not been part of the CoS programme. Two of the Malian RAs claimed that the thorough Marxist training they had received in the USSR had given them valuable theoretical and empirical insight into purposeful institutional change (and its difficulties and limitations).

2.3. Selected experiences with establishing IPs for institutional change

Given the available publication of the experiences of the RAs with facilitating IPs (Nederlof and Pyburn, 2012), we focus here on a number of experiences with establishing IPs that are relevant for understanding institutional change.

It took about a year for all parties to understand that responsibility for performance resided with the IPs, and that experiments that did not turn out as intended could be opportunities for learning. IPs brought together experienced and often senior people who were prepared to take responsibility for and act upon the IPs' decisions. Given the entry point for the domain and the information generated by PhD studies, they commissioned further studies and engaged in institutional experiments. Programme Management intervened in the IPs' choices and decisions only in a limited number of instances.

The case of the cocoa IP (Ghana) illustrates the difficulty of intervening in the autonomous process that emerged once IPs were convened. From the start, the cocoa IP included powerful industry actors. When it proposed expenditures that could not be covered by the Programme, their rejection by the programme management placed the RA, who was junior to many of the IP's members, in a difficult position. He skillfully turned this initial 'crisis' into an opportunity to build understanding of what the IP might achieve through institutional change. But the case illustrates the sensitivity to issues of autonomy and authority: participation in an IP was voluntary and the often quite senior people involved resented what they perceived as 'external correction'.

In Benin, the National Programme Coordinator's mistrust of official interference and fear of political contamination led the national programme to build the IPs on the empowered farmer groups that had emerged from the CoS PTD field experiments. Hence the Benin IPs started with a local-to-commune level membership and did not initially include national-level actors. Once the Benin IPs had established their own capacities, agendas and initial achievements, programme management encouraged gradual inclusion of national-level actors as the IPs' activities expanded and ran into parameters that could be changed into variables only at higher levels.

Access to such higher levels was facilitated in each of the three countries by Programme Management Teams (PMTs), which were composed of professors, research directors, ministry officials and NGO representatives, and chaired by senior CoS-SIS champions (including two Deans and a Director of a National Agricultural Research Organisation). The PMTs proved essential in linking the experimental work of the IPs to the wider institutional context.

In a third case Programme management intervened when the proposed initial actions of an IP were cast in the form of a 'development project' (e.g., an extension project for introducing parboiling rice among farmers) rather than as an experimental action to enable institutional change. In general it took some time for the IPs to focus on institutional change. Initially Programme management sought to 'keep control' of the focus through approval of the IPs' proposals for experimental action. The Programme's budget for IPs contained two main lines. One provided funds for the facilitation and interaction of the IPs (operational costs) based on budgets submitted by National Programme Coordinators. The second made available to each IP a significant (€20,000 per annum) budget to support its experimental activities, allocated on the basis of proposals. As it happened, none of the IPs submitted proposals because, as their members became engaged in their chosen activities, they themselves mobilised whatever resources they needed. The funds saved were re-allocated when a radical change in research design that we shall describe below offered opportunities to develop research capacity across the domains.

2.4. Rejection of initial research design

At about the time when we were designing CoS-SIS as a research programme, the then Science Council of the CGIAR had insisted that the Sub-Saharan Africa Challenge Programmes (SSA-CP) should establish 'proof of concept' following a classic experimental design, the 'golden standard' of empirical research (Lynam et al., 2010). In SSA-CPs' experimental set-up, the 'treatment' in randomly selected communities would be the existence of an IP; control communities would not be exposed to an IP. Pamuk et al. (2014), who carried out a regression analysis comparing the SSA-CP data on roughly 3000 households in the baseline (2008) and the same number on the 'midline' (2010–2011) (before/after), in communities that had and that had not been exposed to an IP (with/without), found 'little evidence for robust impact', except for crop innovations. The mechanisms that explain the outcomes observed were not part of the research. Pamuk et al. (2014) conclude: 'While we provide tentative evidence regarding the factors determining the success of IPs, identifying the institutional, technological or organisational factors that determine the performance of IPs should be a priority'.

Encouraged by the idea that we could also provide 'proof of concept', we initially believed that it would be possible to assess IP performance through what we called a 'Triple Delta' design i.e. before and after studies, with and without intervention, and comparison across the domains. This quasi-experimental design (Campbell and Stanley, 1963) would have included control groups as well as baseline and post intervention measures across the nine cases. In this set-up, the PhD students funded by the Programme were accorded a major role in carrying out the baseline and post intervention measurements in both the experimental and control communities.

The proposed research design and methodology were discussed in one of the first annual international meetings of the entire CoS-SIS community, including scholars from universities and research institutes in the four countries who were involved in supervising the 11 PhD students. The PhD students had completed their course work at Wageningen University, and the members of the CoS-SIS community had begun to discuss what the Programme was all about. The meeting's participants rejected the triple delta design on the basis of the following arguments:

- It would be impossible to establish credible control groups *within* the domains since an IP's eventual scale of operations and position in the hierarchy of domain governance could not be known beforehand, and since the experiments aimed to change existing institutional regimes in the domains themselves;
- Baseline studies assume that interventions are known beforehand but a core element of the programme was the open-ended, emergent nature of the IPs' actions and relationships;
- Before and after studies of control groups would involve high costs and a major time input by the PhD students. As it was, the programme had to negotiate with PhD supervisors about the extent to which the PhD research funded by the Programme would be in direct service of the Programme's cross-domain research. In the end it was agreed that each dissertation would include one chapter reporting a diagnostic study of a domain (published in Jiggins, 2012) and one chapter reporting a study of institutional change in the domain (published in Struik and Klerkx, 2014). This agreement precluded the possibility of using the PhD students for baseline and post-treatment studies, especially in control groups (even if these had been feasible);
- 'Treatments', i.e. the experimental actions undertaken by the IPs, necessarily would be unique for each IP, emerging from scoping and diagnostic studies, institutional change strategies and contextualised histories. Treatment groups (i.e., domains) would not be comparable (as demanded in a controlled experimental design).
- A statistical comparison of impacts of experimental treatments would detract from attention to understanding *the mechanisms* underlying observed changes;
- It would be a mistake to expect that all changes in the domain, even if brought about by the actions of the IP, could be attributable solely to those actions. The effects and outcomes would be amplified and influenced by individual platform members' interactions with their pre-existing networks of influence and other contextual factors. This accords with the realist evaluation formula in which 'mechanism + context = outcome' (Pawson and Tilley, 1997), the rising academic and policy interest in contribution analysis (e.g., Befani and Mayne, 2014), and the distinction between attribution and contribution in impact evaluation (Anonymous, 2014);
- The limited number of domains precluded statistical analysis at domain level.

The rejection forced a rethink of the research design. The level of rigour that could be achieved is that of comparison: synthesis of the performances of seven independent cases that were set up to test a shared hypothesis, based on similar procedures, and researched on the basis of a common methodology.

2.5. Comparative performance assessment across the IPs

The rejection of the proposed design forced us also to develop (initially unbudgeted) research capacity. Fortunately, the fact that the IPs did not use the generous experimental funds budgeted for them, coupled to the flexibility of the donor, gave space for manoeuvre. The new methodology for comparative performance assessment emerged over time. It was inspired by a seminar on methodology in the social sciences held in Wageningen at which Perry 6 (Perry 6 and Bellamy, 2012)

introduced causal process tracing as an emerging research method in political science to explain events similar to those we wanted to study. It took concrete shape in discussions at CoS-SIS scientific meetings. The Mid-Term Evaluation Mission (summer/autumn 2011) had suggested that we hire senior social scientists in each country to carry out the research. This proposal was rejected by the RAs, researchers and professionals involved, principally because it would distance the research from the experimental activity and the IPs. In the end, a procedure was implemented from January 2011 onwards (described in detail in Jiggins et al. 2016) that was based on adoption of theoretically derived causal hypotheses and standard sets of data and experiences documented by the RAs and national coordinators. These were analysed throughout the remainder of the programme at periodic workshops, supported by six researchers drawn from Wageningen University, the Royal Tropical Institute, and a West African research institute and university. This group of scientists was called the RA Support Team or RAST.

Over three years this team met a total of nine times at approximately four-month intervals. Two explicit theoretically derived causal statements were adopted: (a) observed changes could be traced to the IPs' interventions, and (b) observed changes were the outcome of power relationships within and external to the IPs. The iterated analyses included national events and changes in the domain context; the types of institutional elements that the IPs were trying to change (Avelino and Rotmans, 2009; Fuchs and Glaab, 2012); the IPs' activities and their immediate effects; changes in power relations within and external to the IPs; how power was exercised by the IPs to effect change; the nature of the institutional experiments (Hall and Taylor, 1996); the positioning of IPs in the hierarchy of governance in each context; and the positioning of the IPs in the innovation space between niche and regime (Geels, 2005). This researching practice became refined as *theory-based process inquiry* (TGPI), based on a political science methodology, which relies for its claims of the plausibility of its interpretation of causality on the goodness of fit of the observed events and processes with outcomes predicted by declared causal hypotheses (e.g., Perry 6 and Bellamy C.A., 2012; Befani and Mayne, 2014).

The outcomes of the RAST work have been written up in domain-specific articles (with RAs as senior authors), various thematic articles (with RAST members as senior authors) and two country-based syntheses with National Programme Coordinators (professors in national universities) as senior authors. These articles that synthesise experiences within domains, across domains within countries, and by theme, will be published in 2016 in *Cahiers Agricultures*, special issue on CoS-SIS (Jiggins & Jamin, in press). They present the main findings with respect to institutional innovation in each IP and domain. The current article is based on a retrospective analysis by the authors to harvest what can be learned from cross-case comparison of the whole set of cases. Other specific findings have been published in 54 journal articles, nine PhD theses, and two books (see www.cos-sis.org).

2.6. Assessing institutional change

Two key questions guided the comparison: (1) Did significant institutional change occur? (2) If so, how was it brought about? These questions assume that we knew how to assess performance in terms of institutional change and how to define criterion variables that are attributes of collectivities. At the time, we felt we were exploring uncharted terrain. Ostrom (1992) had elaborated criteria for effective governance of the commons, that included agreement concerning the boundary of the commons, membership of the group with access to the commons, procedures for interaction among the members, rules for access and for the size of each member's off-take, funded procedures for surveillance of adherence to these rules, and sanctions for breaking them. Williamson (2000) had provided a useful hierarchy of institutions in terms of the time required and difficulty of changing them. Scale was identified as a key dimension: it is one thing to change local village rules, quite another to effect changes at the level of an industry, a district

or a nation. We also found useful the distinction made by Geels (2005) between niches, regimes and landscapes. In niches, IPs can experiment and generate change relatively easily but with little guarantee of ‘institutionalisation’, i.e. of effecting more permanent and robust change in regimes that are constituted by the established and embedded rules, norms, laws, routine practices and so on. Landscapes, e.g., markets, climate change, etc., create contexts and are sources of exogenous change. Niche activity can occur at any relevant scale and at any point in a hierarchy of governance. Using such ideas, we adopted the following indicators for assessing institutional change across our cases (Table 3).

The following points should be kept in mind. Programme support was offered to the IPs for at most four years. The work of the RAST stopped when the programme funding ended in April 2014. We have not assessed longer-term impacts and can say nothing about longer-term sustainability of the IPs or of the observed institutional changes, nor about their impacts on livelihoods. Our performance assessment is based on the events traced and reported by RAs and National Programme Coordinators at RAST meetings during which each of their research reports were analysed and critiqued. The set of indicators adopted for comparison is a nominal checklist to support informed judgment rather than an ordinal or interval scale. This means that we cannot attach figures to describe the ‘amount’ of institutional change or indicate whether some changes are smaller or greater than others. Table 4 summarises CoS-SIS’ overall research design.

3. Findings and assessments

3.1. Outcomes of diagnostic and scoping studies: overview of the entry points

This section introduces the findings by describing the outcomes of the diagnostic and other exploratory work in each domain that identified the initial entry points for the IP in that domain.

3.1.1. Oil palm, Benin

It is only possible to distinguish a hybrid (*Tenera*) oil palm seedling from one of the ordinary varieties or from the sterile offspring of hybrid palms by examining the fruit. Motivated by the early maturity and high productivity of *Tenera*, the idea of planting hybrids had diffused among farmers and led to a non-linear increase in the demand for hybrid seedlings that could not be met by the ‘official’ seed system. The PhD student’s random sample survey of fruiting trees in smallholder plantations of presumed hybrids revealed that *the younger* the plantation, the *higher* the percentage of non-hybrid material planted. The seed system had become corrupted through the activities of ‘unofficial’ nurseries and crooked extension workers. Bold et al. (2015) describe similar outcomes for hybrid maize seed and chemical inputs in Uganda: urea fertilisers contain 33% less nitrogen than what is on the label, and ‘hybrid maize seed’ contains only 50% genuine hybrids. The authors conclude that, with this quality of inputs, it is entirely rational for farmers not to adopt HYV technology.

3.1.2. Cotton, Benin

The PhD student carried out experiments with a group of cotton farmers to test different approaches to pest control, especially of cotton

Table 3
Indicators CoS-SIS used to assess institutional change.

| | |
|---|---|
| 1 | Positioning of IP: local, district and national and change over time (Fig. 2) |
| 2 | IP Composition: diversity of members and its change during IP’s operation |
| 3 | Evolution of IP’s main activities compared to initial entry point (Tables 5 & 6) |
| 4 | Extent to which IP’s activities can be considered to have affected the regime (Table 7) |
| 5 | Extent to which the actions of the IP contributed to the observed changes |
| 6 | Extent to which observed change can be expected to benefit smallholder farmers/processors/traders |

Table 4
Synthesis of CoS-SIS design and outcomes.

| | 2009–2011 | 2009–2011 | 2011–2013 | 2012–2014 | Expected farm-level impacts |
|----------------------------------|---|--|--|--|---|
| Chain of inference in the domain | Understand farm-level constraints and opportunities | Understand domain-level institutions that affect farmers | IPs take strategic action in niche to affect regime | Institutional regime change creates enabling context | |
| Research in the domain | Diagnostic study, experiments with farmers (PhD stud.) | Scoping study, actor analysis, system analysis (PhD & RA) | Action research (recording of IP events and outcomes) (RA) | Events record and theory-based process inquiry (RA and RA Support Team) | |
| Outcomes in the domain | Constraints and opportunities identified (e.g. adulterated seeds; no access to appropriate inputs or remunerative markets; conflict and litigation) | Institutions identified and analysed (e.g. seed system integrity, collapse of discipline after Structural Adjustment, lack of domain governance, nontransparent price formation) | Informed by studies and choice of entry point, IPs take concerted action (e.g., experiment with by-pass of official system, bring together stakeholders, involve regime-level actors, analyse price setting mechanism) | Changes in domain rules and governance (e.g. certification, inspection, transparent input distribution, inter professional decision making ability, by-taws) | Anecdotal evidence of e.g. processors’ and farmers’ greater access to markets, inputs, services, better prices, conflict resolution |
| Control population | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable |

bollworms. He was specifically interested in an integrated pest management (IPM) approach called 'Lutte Étagée Ciblée (LEC), which requires less toxic and less expensive pesticides than current practice. LEC was officially promoted during cotton campaigns, but the company, which had captured control of input delivery, the ginneries and transport after the devolution of the cotton industry under Structural Adjustment, refused to sell LEC pesticides because they were less profitable than the conventional ones. A major crisis erupted when its owner fled the country for political reasons. Lorries had to be brought in from Mali to transport the cotton harvest, and the army was called in to assist. In these circumstances, the IP focused on bypassing the formal system by promoting the use of locally available Neem oil as a pesticide, the effectiveness of which had been demonstrated in the PhD student's experiments.

3.1.3. Palm oil, Ghana

The RA's scoping study had shown that the majority of the oil palm fruits produced in the country were sold to artisanal processors, local women who worked with Kramer mill owners to extract the crude palm oil (CPO) that forms a key ingredient in the cooking of most Ghanaian households. The Free Fatty Acid (FFA) content of this CPO was too high to allow the women to enter lucrative domestic and international markets for high quality oil, of which the country imports a large amount. The PhD student's experiments with artisanal processors showed that the women could improve their CPO to the required standard by reducing the storage period of palm fruits. She also experienced that artisanal processing was officially ignored and seen as undesirable competition for the large mills favoured by policy.

3.1.4. Cocoa, Ghana

The PhD student documented the very sharp rise in production of cocoa beans (and reduction in smuggling of beans to the Ivory Coast) in response to a rise in the percentage of the FOB (free on board) price paid to farmers, from 40% to 70%. He also established that it was wholly unclear how the price paid to farmers was related to world market prices. Furthermore, he noted that farmers had received the same price whatever the quality of their beans, ever since grading had been abolished to stop corruption at the point of delivery. On the basis of this information the RA, a research officer at the Cocoa Research Institute of Ghana (CRIG), identified price formation mechanisms as the key entry point for the IP.

3.1.5. Shea nuts in Mali

Shea (Karité) butter is produced from the nuts of a tree that covers vast swathes of the Sahel, probably as a result of selective farming practices. It is the main domestic source of cooking oil and cosmetics and a major cash crop. The nuts are collected and processed by women. The butter is sold to itinerant merchants and cooperatives, for refinement, product marketing and export. The PhD student analysed one women's cooperative that, with foreign NGO support, had established a thriving business in producing high quality soaps and other products for export. He concluded that foreign support had led to inequity in terms of who had access to the membership benefits offered by the cooperative, and to an over-reliance on foreign sources of funding. These became the entry points for the IP.

3.1.6. Crop/livestock integration, Office du Niger (ON), Mali

The ON, Mali's large irrigation scheme, is officially dedicated to rice production. At the time of the scoping study the movement of pastoral herds into the scheme during the dry season, as well as cattle keeping and dairying within the scheme were forbidden (Balié et al., 2013). Many plot-holders none the less owned flocks of cattle, which grazed outside the scheme during the cropping season, and permanently kept some dairy cows. Climate change was forcing pastoralists to move south into arable farming areas. The devolution arrangements enforced by Structural Adjustment had encouraged commercial marketing of rice but also led scheme discipline to break down, leading to conflict,

(official) court cases, local litigation, and increasing violence between pastoralists, rice growers and livestock owners that paralysed tenant communities. A private commercial dairy had been established in the study area, but the potential for increasing milk output through fodder production by the small scale tenants, had not been demonstrated.

3.1.7. Water management, Mali

The devolution of powers to the ON also led to the breakdown of water users associations, who were responsible for cleaning tertiary canals. The unwillingness of absentee plot holders to contribute, the neglect of secondary canals by ON management, and the high fees charged by the scheme for water management services, had led to resentment and a breakdown of discipline, already weakened by continued plot fragmentation, reduced production and harvest losses.

The Malian proposal to choose, in addition to the Shea domain, two domains in the ON led to conflict within the Programme. One participating Wageningen University department considered the ON a hopeless case of bad management, collapsed discipline and land grabbing (Blondeau, 2011) and thought it unlikely that the Programme could make an impact. Nevertheless, the Programme supported the choice of the Chairman of the Malian PMT and the WUR department dropped out. This was an important decision in that it demonstrated to the COS-SIS community the Programme's willingness to adhere to the agreements made among the partners. As we shall see, the domains in the ON proved to be important cases of institutional change.

3.2. Positioning and composition of the IPs

The first two indicators presented in Table 3 were analysed in the comparison study using the material emerging from the RAST workshops. For instance, analysis of the hierarchies of governance, from district to national, showed that the cocoa IP from the start was operating at national level, while the Ghana palm oil¹ IP began with a focus on District level changes in domain governance. In contrast, the oil palm and cotton IPs in Benin started as the CoS groups of empowered experimental farmers at the *commune* (local government) level. The IPs in the ON in Mali similarly began at *commune* levels, encompassing village and irrigation zone authorities and municipalities. The IP for Shea nut started at the level of the Management Committee of the cooperative. As the IPs' activities expanded, in all cases they started incorporating a (wider) diversity of national-level actors, such as individuals from ministries, parastatals, or authorities who had proved essential for changing domain-wide conditions. They were identified on the basis of the kinds of purposeful changes sought in the spectrum niche-regime, and the kinds of institutional elements each IP desired to change. The cocoa IP in Ghana from the start was composed of senior regime actors in the cocoa industry; over time it expanded the diversity of such individuals to cover the spectrum of key concerns of the stakeholders. The palm oil IP in Ghana and the cotton and oil palm IPs in Benin over time, guided by the PMTs, reached out to involve leading scientific, educational and technical champions positioned in national hierarchies of governance. Relations with national government and political figures were seen as best handled through inter-personal networks. The crop-livestock and water management IPs in Mali initially set out to test what could be achieved within a defined niche. Their demonstrated success in their chosen niches later led to expansion of IP memberships so as to extend their scope and influence across other irrigation circles and the ON regime itself.

Analysis by means of the four-cell matrix presented in Fig. 2 showed that the set of IPs spread across all cells. The cocoa (Ghana), oil palm

¹ Although in both Benin and Ghana oil palm was suggested as a suitable domain that would be comparable across the two countries, we speak of the *oil palm* domain in Benin because it deals with the seed system, and the *palm oil* domain in Ghana because its focus was on processing. As it turns out, the findings from Benin are highly relevant for Ghana (also for the cocoa domain), and vice versa.

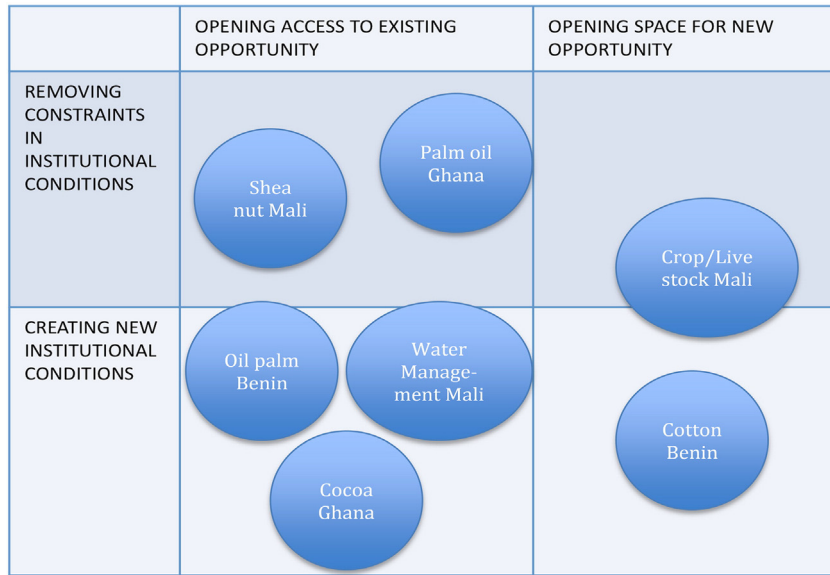


Fig. 2. Matrix of positions of innovation platforms by opportunity/institutional change. (Source: Jiggins et al. 2016).

(Benin) and water management (Mali) IP sought to effect change that created new institutional conditions as well as opening access to existing opportunity, whereas the cotton IP (Benin) sought to create new institutional conditions. The IPs for Sheanut (Mali) and palm oil (Ghana) were focused on opening access to existing opportunity and removing constraints in the existing institutional regimes.

The positioning of the IPs shifted over time. Most IPs, especially those in Benin, moved from their initial local government niches to embrace players at higher levels of administrative hierarchies who could be expected to affect the regime governing the domain as a whole. For example, the cotton IP changed from being an empowered farmers' group when the Mayor of a municipality became interested in the IP's work and persuaded a cotton entrepreneur based in the study area to begin selling the Neem oil produced by local women's groups to the cotton farmers who supplied his ginneries. Subsequently, the IP sought official recognition of Neem as an approved cotton pesticide, and of a farmer-preferred cotton variety through the *Centre de Recherches Agricoles-Coton et Fibres (CRA-CF)*.

3.3. Evolution of the IPs' main activities

Each IP developed actions and experiments to address different constituents of the pre-existing institutional regime (Table 5).

Over time the mix and the emphasis given to each element evolved as the IPs monitored the effects of their first actions and the contextual dynamics that closed or opened spaces for further change. For example, the two commune-level IPs in Benin's oil palm domain together with the municipal authorities first created five new official nurseries and provided these nursery owners with a limited number of certified seedlings, so as to improve the access of farmers to good quality seedlings. They then negotiated with the *Centre Recherches Agricoles-Plantes Pérennes (CRA-PP)*, which was based in the study area and had championed the efforts of the IP from the start, to provide regular inspection and certification of all nurseries, with powers of sanction (removal of certification) for poor performance. Through participatory co-learning together with approved nursery growers, the CRA-PP researchers also developed training modules in good nursery management practices and seedling establishment, which were then promoted through the IP and the extension service. The IPs, national coordinator and PMT then shared these results with key officials and political authorities at national level in a series of workshops. By the end of the Programme, seed system integrity had been included in the new 5-year National Development Plan. Table 6 gives an overview of the main activities each IP engaged in.

Some of the initial entry points described in section 3.1 had a socio-technical flavour, such as improving the distribution of hybrid planting material, improving the quality of crude palm oil, and maintaining

Table 5

Which institutional elements have the IPs tried to change?

Source: TGPI data, analysed by RAs, national coordinators and RAST team, mid 2013, based on institutional elements identified in Avelino and Rotmans (2009) and Fuchs and Glaab (2011).

| Country | Domain | Official & informal rules legitimising behaviour & activity | Norms legitimising behaviour & activity | Socio-technologies, Constituting material structures | Practices constituting material structures | Incentives constituting material structures | Relationships determining significance of data & information, & shaping sense-making | Rules for interpretation of meaning & knowledge determining significance of data and information, & shaping sense-making |
|---------|----------------------------|---|---|--|--|---|--|--|
| Benin | Cotton | X | X | X | X | | X | X |
| | Oil palm | X | X | X | X | | X | X |
| Ghana | Palm oil | X | X | X | X | X | X | X |
| | Cocoa | X | | | X | | | |
| Mali | Shea-nut | X | X | X | X | X | X | X |
| | Crop-livestock integration | X | | X | X | | | |
| | Water management | | | X | X | | | |

Table 6
Main activities related to institutional experiments catalysed by IPs, by domain.

| Domain | Experimental activities catalysed by the innovation platform |
|----------------------|--|
| Oil palm Benin | <p>*Two IPs at commune level train five new nurserymen</p> <p>*These communes supported by municipality, introduce a nursery licensing scheme backed by training and annual compliance review and certification by oil palm research station</p> <p>*IPs promote awareness among national actors of importance of seed system integrity for policy impact</p> <p>*IPs hold a 'restitution' meeting with national stakeholders & officials to discuss how to extend the innovations supported by the IPs</p> |
| Cotton Benin | <p>*IP provides information on impact of reforms and crisis on farmers to officials, policy makers and media</p> <p>*IP trains women's groups to produce Neem oil as alternative pesticide.</p> <p>*Production and marketing of the oil by the groups</p> <p>*IP supports procedure for approval of Neem as official pesticide by cotton research centre</p> |
| Palm oil Ghana | <p>*IP supports participatory selection and official testing and evaluation of new variety</p> <p>*IP commissions research on effect of using old tyres as fuel to boil nuts</p> <p>*IP works with District Government and traditional rulers to prohibit use of old tyres as fuel to boil nuts and relocate processing sites to edge of settlements</p> <p>*IP promotes use of pressed cake as cost-efficient alternative</p> <p>*IP works closely with PhD researcher to test ways of improving artisanal CPO processing</p> <p>*IP builds access to markets for high quality oil for improved artisanal palm oil (e.g., works with Export Promotion Board to support organisation of groups of women processors) and helps them negotiate with exporters</p> <p>*IP promotes artisanal processing as research issue for Oil Palm Research Institute</p> |
| Cocoa Ghana | <p>*IP examines price formation in cocoa and finds it is not transparent and not based on actual costs</p> <p>*IP's understanding of price formation is passed to the Cabinet</p> <p>*IP's analysis of CODAPEC (crop protection scheme) shows it to be expensive and ineffective</p> |
| Shea nut Mali | <p>*IP provides information to government that contributes to annual announcement of time, type and quantity of delivery of chemicals to each locality</p> <p>*IP brokers access to credit from micro-finance institution for Cooperative and assists resulting evolution of its management and organisational arrangements</p> <p>*IP trains eight other cooperatives to access credit and develop their capacities to source, process and market butter from local women</p> <p>*IP supports coop to investigate product packaging options</p> <p>*IP supports women coop leaders to attend trade-fair in Paris</p> |
| C/L integration Mali | <p>*IP analyses and shares information on formal & informal rules for cattle husbandry & movement in the ON, in three communes in Niono Zone.</p> <p>*IP promotes understanding of Contrat Plan rules and national law through campaign in villages, translation of documents into local languages, etc., in order to reduce conflicts between cattle keepers, transhumant herders and crop farmers</p> <p>*IP supports codification of resulting agreements for cattle movement, resource sharing and conflict resolution</p> <p>*IP places signboards in communities explaining the agreed rules in local language</p> |
| Water Mali | <p>*IP carries out multi-stakeholder experiment on tertiary canal cleaning</p> <p>*IP supports stakeholder enquiries into license fee arrangements, the terms of tenancy and eviction, and illegal land sales</p> <p>*IP supports multi-stakeholder development of options to resolve the issues identified; prioritised options are codified in local agreements and their effects are monitored by stakeholders</p> |

tertiary canals in irrigation schemes. However, each of the IPs, assisted by the RAs, National Programme Coordinators and visits by members of the PMTs, in the first two years coupled this work to analysis of the institutional reasons why socio-technical effort alone would not make significant progress, and planned their initial strategies and institutional experiments to by-pass, modify or remove the identified institutional hindrances. This meant in turn analysing the relationships among key actors and organisations, wider influences in the domain context, and various issues of conflict and power. The insights generated by such analyses enabled IP members to be responsive to contextual changes, negotiate key changes and change the quality and diversity of personal and organisational relationships to achieve effective collaboration on domain performance. As a result, compared to their initial entry points, Table 6 shows that the IPs all moved a considerable distance so as to embrace issues of institutional change.

The IPs over time began to act rather independently of the Programme, opening up changes that COS-SIS had neither anticipated to be possible, nor planned. The strongest example of this is provided by the palm oil IP in Ghana. Its initial priority was to stop the pollution, and the damage to human health and the environment as well as to the quality of the processed oil, caused by the women's use of discarded lorry tyres as a fuel for boiling the palm fruits. This choice led the CoS-SIS Mid-Term Evaluation team to dismiss the IP as having little relevance or promise. However, the resolution of the tyre burning issue through provision of evidence of the harm, engagement with the District Council, and subsequent enactment of a by-law that banned this use of tyres, led to the wider involvement of stakeholders in the local government and among traditional authorities, women processors and oil millers – a network that eventually opened the potential for women processors to supply export markets and high-profit domestic markets. As we shall see below, all IPs became autonomous decision-making groups bringing about significant institutional change. The possible exception

to this claim is cotton in Benin, which experienced the collapse of domain governance and policy changes.

The RAs, national coordinators and RAST team members identified six pathways that were common to all the IPs that catalysed significant institutional innovations. These were:

- The role of the facilitator (RA) in creating inter-personal trust among IP members through open sharing of information and evidence-based data, and by negotiating with members the rules and norms for their interaction. Mutual trust in turn helped the IPs to evolve conditions of compliance with these member-determined rules and norms for how the IPs would conduct their work, and to establish the legitimacy of each IP as an evidence-based informed voice.
- The ways in which IP members used their pre-existing networks of influence to work across levels of governance. They did so primarily through initiating discreet conversations, and by liaising with members of their respective PMTs in order to gain access to and share information with official and political decision-makers in local, district, provincial and national hierarchies and with domain leaders.
- Sharing the evidence generated by special studies and action-researching among new, widely built academic, professional and organisational relationships within and beyond the niches in which the experimental actions were tested. The IPs in general aimed to develop and supply evidence-based information, presented in a range of media, that responded to the issues and needs of these 'constituencies', thereby increasing their perceived relevance.
- Seizing opportunities in response to contextual dynamics enabled IPs to act quickly on the basis of their empirical evidences, strategic analyses and networked relationships.

Table 7
Institutional changes at local government and national levels (Dec. 2014).

| Domain | Local government level | National level |
|--|---|---|
| Benin: Oil palm | Five new certified nurseries have been established in two communes, filling spatial gaps in coverage; nursery owners have been trained in hybrid seedling management; licensing, certification and inspection (with powers to remove certification) established by local government and CRA-PP. Extension enlisted to support use of licensed seedlings. Micro-finance organisations now willing to extend credit to nurseries and farmers | Seed system improvement has been included in new 5-year National Development Plan. CRA-PP is working with the stakeholders in the seed system and has become responsible for certification |
| Benin: Cotton | Women groups in three communes are producing and selling Neem oil to cotton farmers who supply the ginneries of a regional cotton entrepreneur. The women have registered their groups as co-ops and are negotiating a loan to buy mechanised processing equipment | Neem oil passes test for registration as an official pesticide for cotton, creating potential by-pass for the dysfunctional input regime. Approval of alternative cotton variety pending |
| Ghana: Palm oil | Local government has passed by-law to ban use of spent tyres as fuel following evidence-based discussion with IP. Women processors in one district have learned to improve the quality of their oil, opening up new domestic markets for quality oil and alternative use of waste as fuel. The Export Promotion Authority has assisted the women to form co-ops and access a loan for improved equipment. The women are negotiating with a foreign trader, and developing their capacity to meet the requirements of an export contract | Export Promotion Authority has trained the organised groups of women processors and is supporting them to access the export market for high quality oil. Negotiations with export companies under way. The Oil Palm Research Institute has embarked on an action-learning pathway guided by Ghanaian COS-SIS partners in order to improve the impact of its research. The artisanal palm oil processing sector has been officially recognised by government |
| Ghana: Cocoa | IP worked with PhD researcher to test response of farmers and licensed buying agents to price differentiation for quality beans. | IP has led drive for transparency in price formation. Producer price now announced in time and price paid to farmers has been increased. Further investigations by the IP have contributed to changes in local announcement & publication of dates of delivery of types and quantities of inputs that are needed for cocoa production. Evidence assembled by IP has contributed to decision to abolish CODAPEC, and to review the mass spraying campaign and has updated pesticide recommendations. Cocoa Research Institute has embarked on an action-learning pathway guided by Ghanaian COS-SIS partners in order to improve its own impact. IP accepted as the legitimate voice of the industry and is participating in World Bank-led discussions of a regional cocoa producers' platform. Discussions in the IP led to adoption of EU-approved chemicals in major cocoa exporter's warehouses |
| Mali: Shea nut | IP enabled cooperative to receive two cycles of credit that have been used to transform its management, regulations & organisational & production capacities. The founder co-op has trained on request 8 other co-ops that have joined the network and learned how to schedule supply by also sourcing butter and kernels from non-members | The eight additional cooperatives have accessed working capital & production credit. Banks have learned that cooperatives, which transform local Shea artisanal butter into high value products can be a sound investment, notwithstanding the irregular fruiting of the trees. |
| Mali: crop/live-stock integration | Following public assemblies and finalisation of local agreements, sharp reduction in litigation and conflict between rice farmers, cattle keepers and herders. Agreements are codified in local conventions and compliance monitored by stakeholders. Most disputes now settled at village and communal levels, based on the conventions. The role of traditional authorities to ensure compliance has been strengthened. Bill boards have been erected along cattle movement routes to present the agreed rules. Fodder experiments demonstrate potential for small tenants to increase milk yields to supply a new commercial dairy | Cattle keeping and dairying have been recognised as legitimate activities within the ON. Five other zones have requested support to implement the process of negotiating similar local conventions. The local conventions were adopted into the new 5-year zonal Contrat Plan (2013–18). The Office du Niger 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 |
| Mali: Water management & tenancy rules | On-going investigations of improved options for resolving tensions between ON and tenants | Local conventions were adopted into the new 5-year zonal Contrat Plan (2013–18). IP members have joined Crop/Livestock Integration IP to develop an apex organisation to support other IPs |

- Deliberate efforts to recognise, understand and resolve (moderate, by-pass) conflicts and power plays.
- Favouring experiment over un-evidenced opinion, focused on iterative experiments and analyses of opportunity for opening up spaces for change, and data-based feedback on what was working (and what was not, and why).

3.4. The extent to which the IP's activities can be considered to have affected the regime

We speak of regime change when we conclude that the activities of an IP (Table 6) has led to significant changes in some combination of official and informal rules, norms, socio-technologies, practices, incentives, relationships, and rules for interpreting meaning and knowledge development. Table 7 reports regime changes registered at two governance levels, local government and national, by December 2014. For

the national level, the table reports rule changes that *affect all farmers* in the domain and can be expected to do so *after termination of the activities of the IP*.

We conclude that institutional innovation at the national level occurred in all domains, with the exception of cotton in Benin, which experienced considerable turbulence. The outcomes in the seven IP cases differ a great deal. We provide snapshots of these outcomes for each, corresponding to the snapshots of entry points presented in Section 3.1.

3.4.1. Benin: oil palm

The diagnostic study stimulated two *communes* to train and establish a total of five new nursery managers to fill the spatial gaps in access to official nurseries. In addition to its mandate of producing germinated hybrid seeds to nurseries (and for export), CRA-Plantés Pérennes became responsible for certifying official nurseries and issuing them with annually renewable licences. By sharing the outcomes of the research and the IP's experiences in workshops with officials, policy makers and

professionals, measures for strengthening the seed system as a national priority were included in the subsequent 5-year National Development Plan.

3.4.2. Benin: cotton

The collapse of the official regime forced the IP to focus on a by-pass: local women's groups, which produce Neem oil for sale to farmers. These groups moved from informal tests of the market to registration as cooperatives. They formed a federation to negotiate with a cotton entrepreneur to regularly supply the farmers who produced cotton for his ginneries. The Programme successfully negotiated with the *CRA-Coton et Fibres* to recognise Neem as an official pesticide for cotton (and thus eligible for production credit). The procedures for registering a farmer-preferred cotton variety had not been finalised when CoS-SIS ended but continued to be pursued by the IP. The reason for demanding this variety is illustrative of the prevailing cotton regime. Researchers had developed a variety that produced considerably more lint and less seed than previous varieties. This variety had been distributed to farmers as part of the official cotton campaign. The weight of cotton bolls is largely determined by the number of seeds, not by the lint. With far fewer seeds per boll, farmers have to pick more bolls of the new variety to make up a kilo. However, the price was not adjusted to compensate for this extra work and lower weight, demonstrating the weak position of farmers in the so-called 'inter-profession' that governed the cotton domain, especially in contrast to the situation in Burkina Faso (Faure and Vognan, 2012).

3.4.3. Ghana: palm oil

By mid-2014 negotiations were on-going between the women processors, who had been trained by the PhD student to improve the quality of their CPO, the RA and a foreign trader to develop a stable supply for export from the artisanal sector. The women were receiving training from the Export Promotion Authority and were forming a cooperative to access loans for equipment that would allow them to process the quantities required to fulfil an export contract. The Oil Palm Research Institute had taken up the challenge of expanding the supply of quality oil from the artisanal sector for both domestic and export markets. The government announced that it no longer prioritised large-scale industrial processing and plantations with out-growers, and officially recognised the importance of the artisanal sector, which handles the bulk of the palm fruits produced by Ghana's farmers.

3.4.4. Ghana: cocoa

The IP from the start comprised the key actors in the industry, with pre-existing access to higher officials and Cabinet, and competence under their own authority to directly bring about innovations in the cocoa regime. The IP's activities contributed already in the first year to a significant innovation in the Free On Board (FOB) price estimations, and subsequently to changes in pest management and input supply arrangements, innovations that were fed by the IP into an emergent regional IP for cocoa producer countries in West Africa. The IP's analysis of the process of FOB price formation in West Africa's cocoa producing countries had direct impact on the timing of announcement and the prices paid to farmers in Ghana. Their subsequent investigations contributed significantly to the government's decision to terminate the CODAPEC programme (enforced collective spraying with a given pesticide package, free at the point of service but with the cost deducted from the price paid to farmers), and to the decision to publish in the media the timing, type and quantities of pesticide deliveries to local distribution centres. Research commissioned by the IP (Adu-Acheampong et al., 2014) also contributed to a radical updating of the pesticides recommended for use on cocoa.

3.4.5. Mali: Shea nut

The IP had considerable impact on the local cooperative with which it worked most closely. This cooperative first was assisted to overcome

the institutional blocks to accessing bank credit. In the view of the banks, there was no basis for investing in developing a modern value chain: Shea nuts were a women's business, based on harvesting 'from the wild'; the products served only local markets, and individual trees produced nuts irregularly. The IP helped secure an initial credit line provided by a micro-finance agency, that allowed the cooperative to expand its membership by adjusting the terms of participation; to overcome the variable harvest problem by sourcing butter from a wider area that included also butter produced by poor women non-members; develop value adding products; and strengthen the management of the cooperative. The first loan was repaid in full, on time; subsequent loans allowed the cooperative to develop training support, equipment purchases, and participate in domestic and export-oriented trade fairs. At the national level, this work led leading banks to reconsider their policies and view the emergent value chain more favourably; they began developing a variety of financial services for the Shea sector and women's Shea cooperatives. The IP subsequently helped eight other cooperatives to access credit and use it effectively. These experiences also influenced other national actors and agencies to consider Shea as a promising sector for investment and support.

3.4.6. Mali: Office du Niger (ON)

As it turned out, the Programme's work in the ON proved to have considerable impact. The crop-livestock integration IP led community-wide discussions of the sources of conflict, explanation of the existing rules for the keeping and movement of livestock (laid down in the *Zonal Contrat Plan*), and translation of the relevant legislation and regulations into local languages. This led eventually to agreements that codified new rules for cattle movement, resource use, and conflict management. Within a year this had led to a drop in the number of court cases to almost zero in the action-researching villages. Subsequently, small-scale tenants were supported to try out fodder production in the rice off-season, to support the emerging dairying industry, and for sale to transhumant cattle herders in the dry season. In the water case, the learning group formed around the initial experimentation with how to implement canal maintenance, moved on to experiment with new options for dealing with issues such as compensation payments for collective tasks if a tenancy contract was cancelled, the terms of the tenure contracts, and (illegal) land sales, that were codified in local agreements. As the experiences and evidence documented by the two IPs were shared with wider circles of stakeholders they fed into the on-going negotiation of the new five-year *Contrat Plan* that governs relations between the ON and tenants and eventually the suggestions that had emerged were codified in the new *Contrat Plan*. Over time interest in the processes followed in the initial study sites spread to other *communes*, leading by mid-2014 to consideration of forming an independent 'umbrella' IP, supported but not controlled by the zonal authorities.

Three additional regime-scale impacts must be mentioned. In Ghana, the directors of three national research institutes, CRIG for cocoa, OPRI for oil palm and ARI for animal production were inspired by the results of the programme to negotiate support from the Ghana RAs, National Programme Coordinator and PMT to review their existing procedures, learn how to carry out scoping and diagnostic studies and use the results to shape their research agendas, and to support their staff in learning how to facilitate IPs responsive to the development needs in their respective domains. In the case of OPRI, the recognition of the importance of institutional issues changed its erstwhile purely technological orientation to a more holistic one. The academic staff involved in the programme at the universities of Abomey-Calavi in Benin and in Ghana at Legon worked closely together with other champions within their universities, and with education ministries at national and regional levels, to develop and adopt graduate interdisciplinary MSc and PhD curricula that draw on the programme's experience. Thirdly, CORAF/WECARD, the West African regional agricultural research organisation, adopted the programme's approach to operationalise the IAR4D approach of its new 5-year

Operational Plan, which is to be supported by an inter-disciplinary research programme called 'Converging to Innovate'.

3.5. Extent to which the actions of the IP contributed to the observed changes

We already referred to the realist evaluation formula, 'mechanism + context = outcome' (Pawson and Tilley, 1997). The seven cases all show the importance of context, with at one extreme cotton domain in Benin, governed by a dysfunctional regime, and at the other, cocoa in Ghana, a domain that recognised the need for significant change. Even in the ON, with its history of messy devolution and conflict, it proved possible to achieve noteworthy institutional changes, codified in the *Contrat Plan* regime. On the whole, the evidences documented and analysed against hypotheses drawn from declared bodies of theory allow us to claim with a reasonable degree of certainty that the regime changes described in section 3.4 would not have taken place without the activities of the IPs, (with the possible exception of the phasing out of the CODAPEC programme in the cocoa domain, for which other actors also claim responsibility). We must emphasise here that the regime changes were in considerable part informed by the studies carried out by MSc and PhD students, and by studies commissioned by the IPs.

The RAs, national coordinators and RAST team also analysed the perceived 'failures', where intended changes failed to materialise, were blocked, or surprise events occurred. They identified three main reasons for these:

- Failure to institutionalise an IP (in northern Ghana, linked to RA recruitment), and in the rice-water value chain, Benin, because IP members chose to act as a project group that favoured development projects with immediate short-term benefits rather than institutional experiments.
- Failures of facilitation, linked in one case to the temperament of an RA (this proved an enduring issue) and in two other more temporary instances to an initial lack of clarity concerning where responsibility for decision-making and acting might lie and a lack of confidence that members would evolve toward an effective platform.
- A highly politicised national dynamic. In the case of cotton, politics overtook the implementation of the industry's reform measures and eventually led to a crisis with national consequences. In both Benin and Mali all the IPs suspended their work for about a year because of pre- and post-election troubles and/or national security concerns.

3.6. Extent to which observed change can be expected to benefit smallholders

This is the final question in Table 3. We set out to change conditions at the domain level, i.e. create a more enabling context for all farmers or processors in the domain. We did not set out to 'roll out innovations' among households in rural communities (see Table 1). However, the 'chain of inference' of the Programme (Table 4) suggests that a logical phase in the Programme's research would have been a post-Programme assessment of impact 'on the ground'. We did not carry out such an assessment. Even with five years and funding of 4.5 million Euros, the programme did not have the resources to carry out such an impact study, quite apart from the fact that we did not build in the kinds of controls that would have satisfied requirements for a counterfactual. We none the less provide some relevant observations.

In some of the domains, especially *cocoa*, the institutional changes had a direct impact on all farmers in the domain, including the increase in the price paid to farmers, the information taken into account and procedures by which the f.o.b. price is calculated, timely announcement of the producer price for the coming year, and changes in pest management arrangements. In other contexts, the situation is more complex. Ghana's artisanal *palm oil* producers in Kweabirem District learned

how to improve oil quality but postponed applying this knowledge until a contract with an exporter had been signed. In the meantime, they continued to use the old method of storing oil palm seeds for a fortnight or more, a practice, which allowed them to extract more oil, be it of inferior quality for the traditional market. However, the effective implementation of the prohibition on using tyres as fuel for boiling nuts positively affected the health of all processors in the District. The bypass infrastructure in Benin's *cotton* domain comprising local women's cooperatives producing Neem oil for sale to farmers, on the other hand, is likely to face significant challenges as the governance of the domain evolves under national political direction. Evaluation of the impact of the changes in the Benin *oil palm seed system* would require a repeat of the PhD student's study of the percentage of *Tenera seedlings* planted; this would need to be conducted at least three years after their establishment because the nature of the seedling can be determined only when the first fruits appear. However, the fact that some nursery owners have had their licences removed, and that some of the new nurserymen are taking credit from micro-finance organisations, shows that there is much interest in sustaining the integrity of the new certified seed system. The fact that the *Shea butter* cooperatives used their loans in part to buy lorries to source butter from a greatly expanded clientele of local women is an indicator that more women are gaining access to more lucrative markets. The new zonal *Contrat Plan*, that incorporates the results of the two ON IPs' institutional and socio-technical experiments, applies to all tenants, reinforced by the codified agreements reached at commune and village levels. The active negotiation of a new expanded role for the IPs as an umbrella for comparable action in other parts of the scheme indicates stakeholders' determination in this case also to 'institutionalise' the IP approach.

4. Discussion and conclusions

In the first phase, CoS, a separately funded PhD student compared the outcomes documented by eight other doctoral studies. This was not an ideal set-up, if only because her study necessarily coincided with the studies she was comparing. In CoS-SIS, the doctoral students, in addition to their two programme-oriented studies, also carried out household studies and field experiments that were focused on their individual thesis goals. The participating supervisors from the four partner universities and some national research institutes did contribute to developing a shared understanding of, support for, and cooperative effort around the comparative work, even though their organisational and professional incentives gave priority to PhD research and project evaluation. It was mainly the post-doc RAs and national coordinators, together with the RAST researchers, who analysed over the nine RAST workshops the collective effort both within and across the domains and iteratively probed the accumulating evidence to assess whether and how the IPs were changing institutional regimes. At the same time, the programme invested in a series of national, regional and international symposia, that every year brought together the PMT members and national coordinators, leading domain experts, academics, members of farmer organisations, thesis supervisors, specialist researchers, and officials, who critically and robustly reviewed presentations by the PhD students and RAs from a broad stakeholder perspective and in the light of the programme's main research questions.

CoS-SIS' focus on the institutional context as a major and neglected constraint in African smallholder development became possible only because the donor provided funding to follow-up CoS, thus offering opportunities to act on the lessons learned during what effectively became a 12-year research programme. In the event, the IPs' achievements in terms of irreversible institutional regime change and the diversity of the experiences they generated exceeded initial expectations. The comparison of the outcomes presented here, as well as the (ongoing) activity by stakeholders in their respective domains, should stimulate appreciation of the institutional innovations needed to create the enabling conditions for socio-technical changes at farm level.

Theoretically, the comparison of the IPs' performances draws attention to the fact that agricultural innovation has an important institutional dimension that takes time and purposive effort. It contributes to recent work on innovation systems, which accepts that innovation is an emergent property of purposive interaction among stakeholders in a system of interest, such as an agricultural domain. An IP, in this perspective, is the social space in which relations of power play a part, collective purposes can be identified, and experiments in institutional innovations can be designed, supported and assessed as they co-evolve with their context. This cross-domain assessment further indicates that while agricultural research was an important component of the achievements documented, it was neither a privileged identifier of the 'problem', nor the driver of change, nor the sole judge of the outcomes.

These findings are relevant for all those seeking to realise the potential of West African smallholder farming. At a time when agriculture and food systems in all parts of the world are struggling with the evidence of pervasive market failure in terms of, for instance, greenhouse gas emissions from farming, the role of soils, grasslands and forests in CO₂ sequestration, agriculture's use of limited fresh water, obesity, persistent hunger, the loss of ecosystem services, global food security and rural poverty (McIntyre et al., 2009), this study perhaps offers insight into how appropriate institutional innovations might be secured.

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