

INNOVATION SYSTEMS AND INSTITUTIONAL CHANGE

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ABSTRACT

Moderate intensification of African smallholder farming would improve food security and reduce rural poverty on the continent. It would mobilise the substantially underutilised human and natural resources under smallholder management for global food security. The pathways are controversial, which has its roots in the history of the phenomenal productivity growth in industrial agriculture, especially in the US since the 1940s. This growth has commonly been attributed to investment in science-based technology and its promotion through extension. However, careful analysis shows that a system of interlocking institutions that enabled farm development was in place well before the growth took off. Based on international literature, preliminary experiences in a

three-country West African research programme, and on the disappointing impact of agricultural research on African farm innovation, the current paper argues that institutional change demands rethinking the pathways to innovation so as to acknowledge the role of rules, distribution of power and wealth, interaction and positions. The time is opportune: climate change, food insecurity, high food prices and concomitant riots are turning national food production into a political issue also for African leaders. The paper presents innovation systems as an approach to institutional change based on learning, new patterns of interaction and new configurations of key actors. Institutions are embedded in local history and contexts and must emerge from them. Rather than as a tool for promoting technology, extension can more usefully

be deployed to facilitate innovation system dynamics that accompany investment in stakeholder interaction.

KEY WORDS: *INTERLOCKING, PATHWAYS, OPPORTUNITIES, NEW INTERACTIONS, SMALLHOLDER FARMING*

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INTRODUCTION AND OBJECTIVES

One of the authors remembers meeting Daniel Benor, the father of the training and visit system of extension (T&V) at Cotonou airport. Knowing his audience was not entirely convinced he said triumphantly: 'I hope you realise that we now cover the whole of Africa'. A few years later, the World Bank decided to stop funding, partly because the T&V system was not 'fiscally sustainable' (Anderson *et al.*, 2006). Since then, most public extension departments in Africa have led a fairly marginal existence with greatly diminished staff, budgets, capacity and political priority. But that does not mean extension is dead. Partly in reaction to the lessons learned from T&V as an expensive, uniform, top-down effort to transfer technology, a plethora of initiatives and experiments have been initiated across Africa, which can be described as participatory, pluralistic, catering for (women) farmers and for well-defined remunerative markets and forming part of an integrated approach. In the 1990s, the authors were involved in CTA's attempts to draw lessons from these experiments in alternatives to T&V during seminars in Wageningen and Cameroon. It is fitting that CTA and its partners have now taken the initiative for the Nairobi conference. Many of the papers for the conference report on current initiatives and experiments.

The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD, 2009) has greatly

increased the relevance of such experiments. This international platform, endorsed by 56 governments, concluded that doubling or trebling the productivity of smallholder farming – technically a relatively simple challenge – represents a major option for global food security. What is more, institutions matter a great deal in developing smallholder farming. Taking IAASTD's lead, the present paper assumes that the future of African agriculture is best served by smallholder development and not by foreign direct investment (FDI) in 'land grab', i.e. making available large tracts of land used by smallholder farmers or pastoralists to foreign governments or companies to practise intensive 'modern' agriculture (Kugelmann and Leuvenstein, 2009; von Braun and Meinzen-Dick, 2009; World Bank, 2009; Hall, 2010).

One of the new approaches that is being trialled across Africa is the innovation systems (IS) approach to institutional innovation (Bonnen, 1987; Hall *et al.*, 2003; Klerkx *et al.*, 2009; Hounkonnou *et al.*, 2012), operationalised through innovation platforms (IPs). The most prominent of these field experiments with IPs is the US\$ 25 million plus sub-Saharan African Challenge Programme (SSA-CP) of the CGIAR, administered by FARA. Some publications have become available that allow preliminary conclusions to be drawn from this field experiment, designed according to the 'golden standard' of field experimental methods (Lynam *et al.*, 2010; Pamuk *et al.*, in prep.; van Rijn and Bulte,

in prep.). Because some of them have not been published yet, they have been used here only to draw some general conclusions, with permission from the authors. A second research programme that deliberately experiments with IP is the €4.5 million Convergence of Sciences-Strengthening Innovation Systems (CoS-SIS) research programme in Benin, Ghana and Mali funded by DGIS, the Dutch Directorate General for International Cooperation, in which both authors are involved (Hounkonnou *et al.*, 2012).

In their analysis of the impact of the SSA-CP in the Democratic Republic of Congo, Rwanda and Uganda that features 36 innovation platforms (IP) covering 2200 households in 244 villages, Pamuk *et al.* (in prep.) draw the following conclusion:

Conventional extension efforts have by and large failed to generate the widespread adoption of innovations that is considered necessary to advance the agricultural development agenda... We report short-term evidence of the effectiveness of ... decentralised and participatory innovation systems... On average innovation systems reduce poverty... The participatory approach appears to be more effective than traditional extension in alleviating poverty.

According to this study, the areas in which IPs operate show significantly more poverty reduction and more and more diverse innovative activity than areas under conventional extension approaches.

A second study based on the same data (Van



Rijn and Bulte, in prep.) looked at the mechanisms to explain the impact of the IPs. They found structural social capital to be associated with more extensive adoption of innovations, while the cognitive social capital was associated with less adoption. Similar evidence comes from an impact study five years after a forerunner of CoS-SIS, which found that technologies which relied on factors beyond the control of farmers (such as input provision) were not sustainable (Sterk *et al.*, in press).

CoS-SIS, based on a comparative case study methodology across nine agricultural domains, has yet to produce clear-cut evidence of impact, but has devoted considerable time and energy to analysing African institutions involved in smallholder agriculture and to elaborating the mechanisms of institutional change in the nine IPs. From the diagnostic report (Jiggins, 2012) and scoping studies (Adjei-Nsiah *et al.*, in press) produced by this programme, it is clear that a substantial proportion of the variance in the quality and quantity of agricultural production by smallholders in domains such as cotton in Benin, cocoa in Ghana and rice in Mali, can be explained by institutional change

These experimental studies together provide evidence that supports our contention that institutional innovation opens up substantial new opportunities for extension professionals and policies to break through the current impasse in smallholder development that marks most of

African agriculture. However, understanding institutions in our experience is challenging. To grasp the opportunities offered by the IS approach, extension professionals and policies must relinquish some limiting ideas about extension (Röling and Wagemakers, 1998; Leeuwis and van den Ban, 2004), as follows.

- Extension is about technology; it is a policy instrument to transfer technologies from researchers to farmers.
- Extension is part of a knowledge system comprising fundamental and applied researchers, subject matter specialists, village level workers, contact farmers and followers, that links researchers to ‘ultimate users’.
- Extension can be effective on its own, i.e., separate from creating enabling conditions including e.g., credit, market development and input delivery.
- Extension is about productivity per hectare at the farm level and influences the decision-making of individual clients. If clients are carefully selected, diffusion of innovations (the magic multiplier) will ensure adoption by the rest. Agricultural development is the aggregate of the adoption decisions of individual farmers (methodological individualism).
- ‘It is not worth listening to farmers because we extension officers have told them everything they know’ (Indian official to mission evaluating FAO’s IPM in cotton programme, 2008).

In the current paper we use the term ‘extension’ to represent a different understanding. We consider extension as a strategy for public, private and civil society organisations to enhance innovation processes and build the capacity of individuals and groups of clients. It is only effective through voluntary decision change and cannot make use of coercion. Therefore its impact depends on its ability to make offerings that clients are willing to voluntarily accept because they consider them in their interest. This means that to be effective, extension must be closely attuned to what clients want and need within the contexts in which they operate. In this sense, extension is a form of social marketing (Kotler and Andreasen, 2003): the art and science of enhancing ‘voluntary exchange of values’. Because of these inherent characteristics, it is usually more effective to use extension in combination with other policy instruments, or at least to make sure that it is supported by the context. Extension, far from being limited to technological innovation, has a major role to play in institutional innovation through facilitating concerted decision-making among actors at different aggregation levels and in different domains with respect to new rules, ways of organising, forms of governance, co-ordination and synergy among complementarities.

In ministries of agriculture, agri-business firms or agricultural NGOs, the extension department usually is the only professional service that



employs social science professionals. Smallholder farmer development based on institutional innovation through IPs places a high premium on this social understanding and support.

MATERIALS, METHODS AND DATA SOURCES

Institutions have been defined as the rules of the game that reduce uncertainty in human interaction (North, 2005). This definition is associated with the realisation that markets are not ‘natural phenomena’ but bundles of agreed rules that reduce transaction costs. For Williamson (2000), institutions refer to the ensemble of deeply embedded norms and values, constitutions, legal and regulatory frameworks, policies, governance and negotiated agreements that are ‘institutionalised’ in various structures and networks that govern individual behaviour. This is not to deny the role of an individual agency but to highlight ‘the social’ in influencing the individual. The last several decades were dominated by methodological individualism – the assumption that the collective, if not the public good, is the emergent property of aggregated individual (rational) choices (Douglas, 1986). The experience of the banking and finance crises is making us painfully aware that we lack the institutions to control the consequences of unfettered capitalism. In 1984 Giddens recognised structuration as a process by which individual action influences the social and vice versa. Once the important role

institutions play in creating and mediating relations is recognised, their role in shaping social outcomes is also becoming more widely accepted. This change in perspective was recently described in a publication on the (still controversial) role of group selection (as opposed to ‘the selfish gene’) in the biology of evolution:

It is probably not an accident that the individualistic swing in evolutionary theory coincided with similar swings in economics, the human social sciences and Western culture at large. While evolutionists were interpreting all social adaptations as varieties of self-interest, economists were explaining all human behaviour as individual utility maximisation.... The new consensus states definitely that the individual organism is not a privileged level of biological hierarchy. The harmony and coordination associated with the word ‘organism’ can exist at any level.... (Wilson, 2011).

The words ‘harmony’ and ‘co-ordination’ suggest that institutions allow collectivities at different levels to operate rationally and beneficially. Does institutional innovation promise the next wave of ‘progress’ and suggest unidirectional development towards increased institutional coherence and collective efficacy? Different authors have warned against such deliverability and against the implicit notion that institutions are benign. Cleaver (2002) points to the fact that many institutional contexts can be called ‘bricolage’ – a mix of pluralistic formal and informal institutions

that often conflict with each other – represent the interests of different groups of actors and serve to increase or protect the power of the powerful. Grindle (2011) warns against ‘one size fits all’ approaches, idealised end-states and setting universal standards for ‘getting the institutions right’. Instead, she observes that:

...development scholars and practitioners increasingly embrace a common theme of seeking appropriate responses for given problems in a specific context. In this new thinking, next steps, good enough, bottlenecks, contextualised diagnosis, and binding constraints are in; variable processes of getting to development are more often acknowledged to be critical to understanding than the end state of development.

This perspective emphasises the importance of knowing the context through ‘contextually sensitive analytics’, the fact that informal institutions are as important as formal ones and the importance of politics often as ‘a spanner in the works’.

Based on our experience in CoS-SIS and with our perspective on institutional change, the current paper explores how an innovation systems approach can be used for the development of African smallholder agriculture with a new style extension. CoS-SIS works with the following entry points in nine domains in three countries (Table 1).

CoS-SIS (2008–2013) is the second phase of CoS (2002–2006), an inter-university collaborative research programme in Benin and Ghana that



TABLE 1: COS-SIS DOMAINS AND ENTRY POINTS FOR COS-SIS ACTION RESEARCH

Country	Domain	Entry point for CoS-SIS
Benin	Cotton	Creating capacity and opportunity for farmers to use the LEC (<i>Lutte Etagée Ciblée</i>), an adapted integrated pest management (IPM) strategy that depends on the availability of certain pesticides, as well as on regular IPM
	Oil palm (1)	Improving the quality of the system of distribution of improved (tenera) oil palm seedlings to smallholders
	Oil palm (2)	Improving access to fertile land using the oil palm fallow (agroforestry) practices developed by Adja farmers
	Water management (1)	In the south, to improve irrigation practices to allow smallholders to capture the expanding market for local rice as world market prices rise
	Water management (2)	In the north, to improve the multi-actor management of the multifunctional use (for livestock, drinking water, irrigation, crocodile conservation, fisheries, swimming) of agro-pastoral dams
Ghana	Oil palm	Improving the quality of crude palm oil produced by small-scale women processors to allow them to access the strong demand for high quality oil
	Food security	Focusing on the savannah zone of northern Ghana, to develop technical practices and value chains that would allow smallholders to benefit from markets for small ruminants (currently exploited by the Burkinabe)
	Cocoa	Differential farm-gate payment for different categories of bean quality (currently farmers get the same price, whatever the quality of their beans)
Mali	Crop–livestock integration	In an <i>Office du Niger</i> (ON) irrigated area, to establish viable zero grazing dairy farming, based on crop residues and fodder made possible through new technical practices and ON management changes
	Water management	In an <i>Office de Niger</i> (ON) irrigated area, to improve management of tertiary canals after their devolution to water users' associations
	Shea nut (<i>Karité</i>)	To improve inclusiveness of women's co-operatives that benefit from marketing high quality butter

focused on participatory technology development (PTD). A comparison of studies of eight experiments by and with farmers highlighted the fact that African smallholders face small windows of opportunity; the benefits that they can capture from improved technologies at the farm level are fairly marginal, however effective the process of

technology development (Röling, 2010). This insight led CoS researchers to begin experimenting with institutional innovation at levels higher than the farm (van Huis *et al.*, 2007).

CoS-SIS has been designed to focus on the interface between the opportunities and constraints experienced by smallholders and the institutional

conditions at levels higher than the farm. PhD researchers in each of the domains focused on farm-level practices and on the constraints and opportunities experienced at that level, together with analysis of the institutional context related to those constraints and opportunities. Post-doctoral researchers analysed the institutional contexts at levels higher than the farm and also convened and facilitated innovation platforms (IP) of key district and national institutional actors. These actors were selected for their ability to make change happen in the domain. The IPs, now armed with research information provided by the PhD and post-doc researchers, engaged in institutional innovation. Working with IPs is a feature that CoS-SIS shares with the SSA-CP.

In the sections that follow, we focus on the mechanisms that can explain the observed effectiveness of the IS approach, compared to conventional extension, drawing on the results of the CoS-SIS programme gained so far.

RESULTS AND DISCUSSION

Industrial agriculture is marked by a dense network of formal enabling institutions, including farmer unions, universities, farmer training, banks, regulatory frameworks, agribusiness firms covering inputs and outputs, marketing, insurance, bookkeeping support, specialist water and irrigation management agencies, land registration and tenure laws, produce quality controls, etc.



Often these institutions are arranged to support commodities or specific industries, such as mushrooms, greenhouse tomatoes, dairying, etc. The actors in such networks are aware that they will benefit most if their industry thrives *as a whole*, which expresses itself, for example, by competitiveness in the world market. In such networks, producers have considerable influence. Industrial agriculture often experiences second-generation problems, such as the concentration of power in few input and output companies and unsustainable practices in terms of fossil fuel use, CO₂ emissions, loss of biodiversity, etc. Industrial agriculture could never have reached a point where it suffered second-generation problems if it had not first achieved rapid growth in productivity by creating supportive institutional contexts in which farmers could capture opportunity and economies of scale. These supportive institutions did not fall from heaven; they were painstakingly created by agricultural leaders with vision and drive. Hounkonnou *et al.* (2012) provide a detailed overview of this history. It shows that in the US and in the Netherlands (the second biggest agricultural exporter by value), the development of enabling institutions *preceded* the wave of farm-level technological modernisation.

It seems unlikely that – after decades of effort – the development of African smallholder agriculture can be kick-started by introducing new technologies at the farm level. Of course, new

varieties of seeds, which are better adapted to local conditions, farmer training in the control of *Striga* spp., and other local technologies and practices can be beneficial but as we have learned from the earlier quoted impact study of CoS five years after (Sterk *et al.*, in press), innovations that depend on conditions over which farmers have no control (such as inputs, produce markets, road blocks, commodity price manipulation by governments and commodity boards) are not sustainable. Perfectly viable industries such as cotton in Benin (Togbe *et al.*, 2012) and cocoa in Ghana (Quarmin *et al.*, 2012) have in the past sharply declined when farmers, faced by inimical institutional conditions, refused to produce the quality and quantity required to maintain the country's competitive position. Their current rebound as a result of improvement of institutional conditions stands testimony to the importance of institutional reform. Meanwhile, food production by smallholder farmers on the whole continues to be a coping strategy rather than a remunerative professional activity.

Nothing is encouraging African farmers to produce more than they currently do, so they produce just enough to meet the needs of their families. Offer them the right price and build the road to the market, and they will surprise you ... And if the extension staff is not efficient enough, they will go directly to the research station to ask them whether they have got a better variety

because the market is good! (an Italian expert at CTA meeting in Côte d'Ivoire in 1987).

Notwithstanding Africa's vast under-utilised productive resources, most African countries import an increasing proportion of their food, and seem unable to create opportunities for their smallholders to supply it themselves (Djurfeldt *et al.*, 2005).

It is not that African agriculture lacks formal or informal institutions in the agricultural sector. In fact, one can speak of a dense network of such institutions. But by and large, they are unhelpful. It is time to face this situation squarely. We are increasingly able to do so, partly because of painstaking anthropological research that reveals how these institutions work. Many have formal purposes that have very little to do with their actual functioning as farmers experience it. The classical example of this phenomenon is Checkland's (1989) description of a prison. Formally and ostensibly, a prison's function is to protect society from criminals but, says Checkland, prison can be better described as a training school for turning first-time offenders into professional criminals. Similarly, a credit scheme for small farmers may ostensibly function to provide seasonal credit for farm activities. It can be experienced quite differently: as a procedure for gaining a hand-out from the State, based on giving a part to the official in charge of allocating the credit.

'Thus it could be said that a minimal command



of 'two languages' – the language of official rules and the language of 'informal' practices – is required...Embedded in a 'dysfunctional' context of the supply of public services, and legitimised by social and cultural logics, the corrupt practices outlined here are ultimately part of the profound process of transformation under way in the African state. This transformation is currently heading in the direction of the progressive privatisation and informalisation of public services' (p. 101).

'The 'informal privatisation of the state' as it emerges overwhelmingly from our studies well and truly indicates an increase in the private profits of the agents of state and at the same time a deterioration in the supply of public goods and services from the perspective of the user' (pp: 109). (Blundo and de Sardan, 2006).

Glib talk of input supply, credit, subsidy schemes, value chain integration, etc., may satisfy donors and naïve observers, but such schemes often mask highly intricate mechanisms which extract value from smallholders. How else can one explain the unaccountable arrangements for marketing and revenue management of high-value export crops, or the fact that local farmers have found it so difficult to compete with imports in the rapidly growing urban and middle class markets for quality foods? The police roadblocks that raise 'informal tolls' on farm produce are typical examples of mechanisms which extract value from smallholders.

A study on road transport in Benin carried out

by the World Bank noted that the existence of over twenty control points on the road linking Cotonou and the border with Niger raises the annual cost of transport on this route by 20 to 30 per cent, or two billion CFA francs (World Bank, 1996; Blundo and de Sardan, 2006).

The high-level actors who agreed to form the CoS-SIS IP for cocoa in Ghana realised after a few meetings that the price for export quota varied significantly between West African cocoa exporters, yet none of them could explain the variation. It transpired that none of them were aware of how price formation in cocoa actually occurred, so lacking in transparency had the mechanisms become. They made it the first order of business of the platform to find out about it (Dr Richard Adu-Acheampong, *pers. com.*).

What has all this to do with extension? It would be naïve to assume that the current 'unhelpful' institutional context can be changed by quick-fix 'win-win' solutions. Too many powerful actors stand to lose from changing the status quo. On the other hand, institutional reform has hardly been attempted, if only because of the myopic assumption that technology development and transfer is *the* pathway for developing Africa's agriculture. Thus the three countries have very well equipped and staffed commodity research stations that focus on technology development but no capacity to carry out institutional diagnosis, experimentation or evaluation of 'natural

experiments'. Of the roughly one thousand technologies mentioned in a booklet produced by the *Institut d'Economie Rurale* (IER) at the 50th anniversary of Mali's independence, perhaps a dozen have been applied at the farm level (Moussa Léo Sidibé, Secretary General of the Ministry of Agriculture, *pers. com.*, February 2011). We cannot believe African agriculture is doomed to remain ineffective because of poorly functioning institutions. Something can be done. One incentive is that everyone will be better off if the stakeholders collaborate to create the conditions for smallholder farming to become productive and remunerative. The increasingly volatile global market for foodstuffs, the low global stocks for emergency relief, the increasingly visible effects of climate change on local food production, and the spectre of protest movements as a result of high food prices and urban discontent are making food security politically relevant – no longer so easily dealt with by imports of cheap food that satisfy urban consumers but undermine local farmers.

But there is a long way to go. A three-year comparative study across Asian and African countries by Djurfeldt *et al.* (2005) to discover why the Green Revolution did not take off in Africa showed that, in Asia, it was made possible through the State-driven creation of institutional conditions in which new technologies could lead to growth of the smallholder sector. These conditions are largely absent in SSA. Djurfeldt *et al.* (2005) speak of 'a



pervasive bias against the small farm sector (that) is a major hindrance to increased food security on the sub-continent'. The question becomes: how can SSA governments, private actors and civil society transform into enabling contexts the institutional frameworks that constrain smallholder farming? This is where the innovation systems approach comes in.

CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS

Institutions cannot be transferred as if they were varieties of short-straw wheat (Biggs, 2007). Cleaver (2002) explicitly asks: 'whether local institutions are amenable to design'. The general experience is that institutions, such as agricultural co-operatives, that were successful in their countries of origin, do not transplant without major adaptations to their local context, adaptations, which may make them ineffective. Vodouhé (1996) gives the example of the audit committee, a device to check the books that is a standard safeguard of the business viability in an agricultural co-operative. However, in the African context, the members of an audit committee are likely to have close and many-stranded ties and loyalties to the chairman, so that the key requirement of independence of the members is not guaranteed.

Such experiences raise the question of how institutional innovation can be achieved. The CoS-SIS and the Challenge Programmes are running a trial IP

mechanism. An IP brings together actors, including farmers, in an agricultural domain (sector, industry, category of farmers, region or market) who can be expected to make a difference because of their profession, responsibilities, power or vision. The IP is not a formal committee nor does it have a uniform design. It is a loose and temporary coalition that can vary in composition and ambition according to the circumstances. Members are identified by actor network analysis (carried out by e.g., extension researchers). It is important that members show requisite diversity. 'Diversity trumps ability' (Hong and Page, 2004): experiments with agent-based modelling show that groups of agents with diverse understanding of the world will solve difficult problems better than narrowly focused groups with higher expertise. The mandate of an IP is to generate opportunities for smallholder development in the domain, based on insights gained from scoping and diagnostic studies (by e.g., extension researchers) that identify promising entry points for concerted action by the IP. The experience is that the nature of the current institutional context of smallholder agriculture makes it rather easy to identify concerted action with a high pay-off. The effects and outcomes of the decisions taken by the IP are monitored and the information is fed back to the members (a job for e.g., extension researchers) in cycles of shared learning. The facilitation of the IP, i.e. convening the members, helping them to run meetings, keeping minutes, etc., is a role new-style extension agents

may play. However, this kind of extension is unlikely to work in political contexts in which the elites are not committed to agricultural reform. The type of extension we are advocating needs political backing and priority. It also requires retooling of extension professionalism, from the current focus on technology transfer, to facilitation of innovation processes, for example through introducing curricula for academic training of agricultural scientists. What we found in CoS-SIS is that institutional change does not require huge investments. What it does require is funding of interaction.

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enlisting smallholders in creating remunerative, equitable and sustainable agricultural industries that support national and local food security and market development. The main partners are universities in four countries: the *Université d'Abomey Calavi* (UAC) in Bénin; the University of Ghana (UOG) at Legon, Accra, Ghana; the *Institut Polytechnique Rural de Formation et Recherche Appliquée* (IPR/IFRA) at Katibougou, Mali; and Wageningen University and Research (WUR) in The Netherlands. Other Dutch partners are the Royal Tropical Institute (KIT) and Agriterra.

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