



An innovation systems approach to institutional change: Smallholder development in West Africa

Dominique Hounkonnou ^{a,b,c,1}, Dansou Kossou ^{d,2}, Thomas W. Kuyper ^{e,3}, Cees Leeuwis ^{f,4}, E. Suzanne Nederlof ^{g,5}, Niels Röling ^{h,*}, Owuraku Sakyi-Dawson ^{i,6}, Mamoudou Traoré ^{j,7}, Arnold van Huis ^{k,8,9}

^a Centre International d'Etudes pour le Développement Local, Lyon, France

^b Fondation Rurale de l'Afrique de l'Ouest, Dakar, Senegal

^c BP 3030, Cotonou 03, Benin

^d Entomology and Crop Protection, Graduate school at the Université d'Abomey-Calavi (UAC), 01 BP 256, Benin

^e Fungal Ecology and Diversity, Department of Soil Quality, Wageningen University, Bodemkwaliteit, Droevenaalsesteeg 4, 6708 BP, Wageningen, The Netherlands

^f Communication and Innovation Studies, Wageningen University, Hollandseweg 1, 6707 KN Wageningen, The Netherlands

^g Royal Tropical Institute (KIT), P.O. Box 95001, 1090 HA Amsterdam, The Netherlands

^h Communication and Innovation Studies, Wageningen University, De Dellen 4, 6673 MD Andelst, The Netherlands

ⁱ Agricultural Extension Department, College of Agriculture and Consumer Science, P.O. Box LG 68, University of Ghana, Legon, Ghana

^j Institut Polytechnique Rural de Formation et Recherche Appliquée de Katibougou, BP 06 Koulikoro, Mali

^k Laboratory of Entomology, Wageningen University, P.O. Box 8031, 6700 EH Wageningen, The Netherlands

ARTICLE INFO

Article history:

Received 24 February 2011

Received in revised form 23 December 2011

Accepted 11 January 2012

Available online 25 February 2012

Keywords:

Innovation platforms

IAR4D

Opportunities

Benin

Ghana

Mali

ABSTRACT

Sustainable intensification of smallholder farming is a serious option for satisfying 2050 global cereal requirements and alleviating persistent poverty. That option seems far off for Sub-Saharan Africa (SSA) where technology-driven productivity growth has largely failed. The article revisits this issue from a number of angles: current approaches to enlisting SSA smallholders in agricultural development; the history of the phenomenal productivity growth in the USA, The Netherlands and Green Revolution Asia; and the current framework conditions for SSA productivity growth. This analysis shows that (1) the development of an enabling institutional context was a necessary condition that preceded the phenomenal productivity growth in industrial and Green Revolution countries; and that (2) such a context is also present for successful SSA export crop production, but that (3) the context is pervasively biased against SSA's smallholder food production. The article traces the origins of technology supply push (TSP) as a dominant paradigm that hinders recognition of the role of enabling institutions. The article then reviews the literature on institutional change and zooms in on Innovation Platforms (IPs) as a promising

* Corresponding author. Tel.: +31 488451016.

E-mail addresses: dhounk2@yahoo.fr (D. Hounkonnou), kossoudansou@yahoo.com (D. Kossou), thom.kuyper@wur.nl (T.W. Kuyper), kees.leeuwis@wur.nl (C. Leeuwis), S.Nederlof@kit.nl (E.S. Nederlof), n.roling@inter.nl.net (N. Röling), osakyid@ug.edu.gh (O. Sakyi-Dawson), mamoudoutraore@yahoo.fr (M. Traoré), Arnold.vanHuis@wur.nl (A. van Huis).

¹ Tel.: +229 90901007.

² Tel.: +229 95964792.

³ Tel.: +31 317 482332.

⁴ Tel.: +31 317 484310.

⁵ Tel.: +31 648074249.

⁶ Tel.: +233 208115826.

⁷ Tel.: +223 76041740.

⁸ Tel.: +31 317 484653.

⁹ The authors, in alphabetical order, make up the Programme Management Committee (PMC) of the research programme Convergence of Sciences: Strengthening Innovation Systems (CoS-SIS), except Profs. Kuyper and Leeuwis who are members of its Scientific Advisory Committee (SAC). CoS-SIS is a partnership of the Université d'Abomey-Calavi (UAC) in Benin, the University of Ghana at Legon, the Institut Polytechnique Rural de Formation et de Recherche Appliquée (IPR/IFRA) at Katibougou in Mali, and Wageningen University, the Royal Tropical Institute (KIT) and Agriterra, in The Netherlands. It is funded by the Dutch Ministry of Foreign Affairs: Directorate General of International Cooperation (DGIS).

innovation system approach to such change. We describe the concrete experience with IP in the Sub-Saharan Challenge Program (SSA-CP) and in the Convergence of Sciences: Strengthening Innovation Systems (CoS-SIS) Program. The former has demonstrated proof of concept. The latter is designed to trace causal mechanisms. We describe its institutional experimentation and research methodology, including causal process tracing.

© 2012 Elsevier Ltd. All rights reserved.

1. Introduction

Increasing the productivity of smallholder farmers in Africa, Asia and Latin America has been called the best bet for global food security in 2050 (McIntyre et al., 2009). Technically it would be relatively easy to double or treble their yields through sustainable intensification (Godfray et al., 2010). Tilman et al. (2011) compare the environmental impact of meeting global crop demand in 2050 for two scenarios: (a) current trends of greater intensification in rich nations and greater land clearing in poorer nations, and (b) moderate intensification on existing crop lands in under-yielding nations. The second option would reduce land clearing from 1 billion ha to 0.2 billion ha, cut green house gas emissions from 3 to around 1 Gt y^{-1} and reduce global N use from around 250 to 225 Mt y^{-1} .

Moderate intensification of smallholder farming remains elusive, especially for Sub-Saharan Africa (SSA). The sub-continent continues to be marked by low productivity, typically of one ton ha^{-1} for cereals (De Janvry and Sadoulet, 2010a; Paillard et al., 2011). The amount of food per person has not increased over the last 50 years (Pretty et al., 2011). Notwithstanding decades of attempts, both land and labor productivity have hardly increased. SSA's agriculture is therefore called stagnant (Inter-Academy Council, 2004, p. 158; Pretty et al., 2011). To the extent that African smallholders have kept up with the rapid population growth on the continent, this was achieved mainly through expansion of agricultural land rather than through intensification (Alene and Coulibaly, 2009). Land scarcity is now a serious issue in many parts of SSA. Rural people are not pulled to urban areas but pushed there by lack of income opportunities in agriculture (De Janvry and Sadoulet, 2010b). Annual cereal imports into Africa have steadily increased from 2.5 million tons in the 1960s to more than 15 million tons in 2000 and 2001 (Djurfeldt et al., 2005, p. 2). These imports are expected to increase by a factor 5 during 2000–2050 (Ringler et al., 2010, p. 7).

These circumstances have given rise to 'foreign direct investments' (FDI), also known as land deals or land grabs: the practice by which foreign governments and companies acquire rights to land and water in Africa to invest in large-scale, input-intensive, mechanized management (Cotula, 2011). FDI is defended by the argument that food production by SSA smallholders cannot keep up with population growth. However, in the absence of secure and transparent rights to land and water, alternative employment or adequate compensation for dispossession, land deals usually mean that smallholders and pastoralists lose their livelihoods. After a comprehensive literature review, the World Bank (2009, p. 8) concluded that there are few arguments for the claim that large-scale farming is necessary or particularly promising in Africa. The report also notes that, except for settler economies, there have been very few instances in which such large-scale farming was competitive in producing food crops for export. The main challenge is, therefore, to transform SSA's smallholdings into sustainable and productive family farms.

This paper revisits this challenge. Given that continuous efforts over several decades by African governments, multi- and bilateral donors, UN organizations, and the Consultative Group for International Agricultural Research (CGIAR) have failed to realize an

African Green Revolution (Djurfeldt et al., 2005), it is time to investigate new approaches. We draw on the international literature to explain current approaches to smallholder productivity growth; and on independent attempts to test an IS approach to SSA smallholder development by (1) The \$ 26 million 2006–2010/12 SSA Challenge Programme (SSA-CP) that features 32 multi-stakeholder Innovation Platforms (IPs) in eight countries, and (2) a Dutch-financed € 4.5 million, 2008–2013 research programme called Convergence of Sciences: Strengthening Innovation Systems (CoS-SIS) that features nine IPs in Mali, Benin, and Ghana.

CoS-SIS builds explicitly on earlier research, Convergence of Sciences (CoS, Van Huis et al., 2007) that focused on participatory technology development (PTD). That programme showed that PTD could make considerable impact locally, but that smallholders have very few opportunities that they can capture by using new technologies. An impact study of CoS 5 years after showed that technologies that depend for their continued adoption on conditions over which farmers had no control did not persist (Sterk et al., in preparation). As a result, CoS researchers started experimenting with institutional change to enlarge farmers' opportunities (Van Huis et al., 2007). CoS inspired CoS-SIS to focus on experimenting with an IS approach to institutional change.

The objective of this paper is to review the role of institutional change in the global experience with pathways towards productivity growth and to zoom in on what this means for the development of SSA smallholder farming. We describe the experience with enlisting African smallholders in agricultural development, disentangle a major controversy about pathways to farm innovation, and analyze the (disabling) institutional conditions currently facing African farmers. Finally, we describe how SSA-CP and CoS-SIS respectively test and operationalise an IS approach to smallholder development.

2. Experience with enlisting African smallholders in market production

In addition to plantation agriculture and compulsory labor schemes, African farmers were enlisted to serve colonial interests in producing export crops. Companies or parastatals provided farmers with credit, planting materials, inputs and extension, and collected, transformed and marketed the produce. The costs of service provision and marketing were deducted from the price farmers received. Since farmers were not organized, had few alternative sources of cash income, and could not sell products like cocoa or cotton elsewhere, the cash crop well deserved the name. Independence made little difference. Farmers continued to be paid as little as 30% of the Free on Board (FOB) price of exported crops. In recent years, this strategy has backfired. As farmers gained access to other sources of income, they stopped producing cash crops or diverted the harvest to local markets. For instance, Ghana's cocoa output gradually decreased until, under international pressure, the Government over 2002–2004 increased the price paid to producers from 40% to 70% of the FOB price. This, together with high world market prices, led farmers to double cocoa production without major technological change (Ayenor et al., 2007; Dorman et al., 2007).

Whatever its continuing shortcomings, cash crop production tied to interlinked credit and service provision over the years has generated significant development revenues and put money into the pockets of millions of farmers. Jayne et al. (2004) provide evidence that in some cases it also had positive spill-over effects leading to intensified food farming. We have made similar observations in an oil palm plantation and factory in Ghana whose out-growers now also send food crops to markets. Cotton farmers in Benin benefit from the direct or residual effects on food crops of fertilisers provided through cotton contracts. In fact, a major reason why farmers grow cotton is to gain access to fertilisers for their subsistence food (Sinzogan et al., 2007; Togbe et al., in preparation-a). Even if cotton does not pay, it at least ensures that one can eat.

When Structural Adjustment forced the liberalization of export trade and privatization of interlinked cash crop systems, in most SSA countries the private sector failed to step in effectively (De Janvry and Sadoulet, 2010a), leaving many export crop industries in disarray. Nevertheless, if there is one thing that has 'worked' in Africa, it is the production of export commodities on the basis of 'supervised credit' or interlinked services to smallholders, organized as outgrowers to some centrally managed enterprise, be it public or private. Thanks to such schemes, SSA smallholders now produce the bulk of such export crops as cut flowers, tea, coffee, cocoa, and cotton.

The experience with food crops is different. The problem seems not to be with the smallholders, who seem generally responsive to realistic opportunity (Rey and Waters-Bayer, 2001). For example, in the early seventies a rural development programme in Tetu, Kenya, carried out an experiment with smallholders who were selected because they were 'laggards' as defined by the diffusion of innovations theory (Rogers, 1961), then in its heyday. The programme provided training and inputs on credit in kind required for a quarter of an acre of hybrid maize. Nine-tenths of those smallholders adopted the package and more than 80% repaid the loan (Röling, 1988, pp. 118–141). Similar, larger-scale programmes, which create special circumstances in terms of interlinked services for the production of food staples, have been successful in ensuring national food security, as demonstrated for Malawi (Dorward and Chirwa, 2011) and Mali (Sasakawa Africa Association, 2010, p. 10). However, the subsidy element in these efforts renders them vulnerable to changes in donor or government support and affects their sustainability.

Most efforts to enhance the productivity of food production in SSA do not provide interlinked services (of e.g., extension, credit, inputs, planting material, marketing) but focus on technology transfer in an approach called technology supply push (TSP). This approach is commonly perceived as having been the pathway to the phenomenal productivity growth in OECD countries and Green Revolution Asia. In Africa, the pursuit of TSP is perhaps best illustrated by the Training and Visit System of Extension (T&V, Benor, 1987). Introduced into virtually every country in SSA with support from the World Bank, T&V sought to create a smooth flow of information and knowledge through a chain linking agricultural research, through subject matter specialists, village level workers and contact farmers, to 'ultimate users'. In the early 2000s, T&V proved too expensive for what it delivered, was judged to be 'financially unsustainable', and terminated (Anderson et al., 2006). It had not made a dent in the low productivity of smallholder food crop farming.

TSP is based on the assumption that in order to boost yields we need research so that farmers can make most of its results. Governments need to invest in the sciences that increase yields and in infrastructure to get the resulting technologies to the farmers who need them (Inter-Academy Council, 2004). Agricultural research is seen as the source of innovation and productivity growth results from the transfer of science-based technologies to farmers.

The *locus classicus* for this mechanism is Evenson et al. (1979), who reviewed the evidence for the high rates of return to investment in agricultural science. We come back to TSP in the section below.

An important approach to enlisting SSA smallholders is participatory technology development (PTD) (Chambers and Jiggins, 1987; Reintjes et al., 1992). PTD owes a great deal to Farming Systems research (Collinson, 2000; Bawden, 1995). Those seeking alternatives to 'top-down', 'linear' TSP advocated participatory approaches to ensure that technologies not only are effective, but also appropriate to the context and desired by smallholders, given their circumstances and needs (Nederlof et al., 2007; National Research Council, 2010). However, PTD as a stand-alone effort seems insufficient. Farmers might be knowledgeable, skilled, motivated, and empowered, and have participated in developing technologies that are suited to their circumstances and farm management objectives, but if opportunity is lacking, these technologies still allow only marginal improvement. That, at least, was the conclusion from the eight field experiments with PTD in Benin and Ghana by the CoS Programme that we described before (Röling, 2010). The programme concluded that institutional change at higher levels than the field and farm is required. Smallholders themselves have insufficient power to change rules, norms, procedures, and laws, and to 'pull down' the provision of interlinked services and access to value chains – in brief, the institutions – that determine their opportunities. Unchangeable parameters at the farm level can become manipulable variables at higher system levels (Fresco and Kroonenberg, 1992).

Our review of current approaches to increase the productivity of food production in SSA must mention recent hope-giving efforts by such organizations as the Alliance for the Green Revolution in Africa (AGRA), the IFDC (International Fertiliser Development Centre) and Forum for Agricultural Research in Africa (FARA) that seek to support smallholders in term of access to providers of inputs, such as fertilisers and seeds, and incorporation into value chains. These efforts implicitly recognize that smallholder productivity growth cannot be achieved by TSP alone.

Our review of approaches to enhancing smallholder productivity growth suggests that two major pathways have been followed: (1) a relatively successful pathway focussing on export crops and (2) another so far unsuccessful pathway, which focuses on food crop production through TSP. Given the persistence of TSP in the strategies of scientists, economists, donors, governments and NGOs to date, the section below seeks to understand where TSP came from.

3. Background to TSP

TSP has been contested (e.g., Jiggins et al., 1996; Barrett et al., 2009). They reject the conventional, neo-classical economic idea that exogenous technological change drives social and economic development. As an alternative they propose technological change and learning as the endogenous outcomes of institutional arrangements that they consider key drivers of development. Barrett et al.'s (2009) plea to test IAR4D as an alternative to TSP follows from this analysis.

To understand the persistence and resilience of TSP notwithstanding such detractors, we must go back to the context in which it emerged: the US Mid-West in the early 1940s when hybrid maize very rapidly spread among farmers. The classic study that started the diffusion of innovations research tradition (Ryan and Gross, 1943) tracked the rapid and autonomous diffusion of hybrid maize in Iowa. Diffusion seemed like a magical multiplier of the effort that went into the development of hybrid maize. The first paper on the rates of return to investment in agricultural research (Griliches, 1958) dealt with hybrid maize in the US between 1940 and 1955. In their classic article, Evenson et al. (1979) presented

the accumulating evidence for the high rates of return to investment in agricultural research. In 1958, Cochrane had formulated an economic mechanism, the agricultural treadmill, to explain these high returns:

- Farms are small firms in a free market, all producing the same commodities.
- Each farm is too small to affect the price: farmers are price takers who produce as much as possible against the going price. Consequently, there is a constant downward pressure on prices.
- Introduction of an innovation allows early adopters to capture a windfall profit because overall prices are still dictated by the prevailing state of the art.
- Soon diffusion leads to over-production and further price squeeze. Adoption becomes necessary for staying in the market place while it is no longer profitable.
- Farmers who cannot keep up drop out. The survivors absorb their resources and capture economies of scale.

Policy makers and economists throughout the world have embraced this mechanism as the driver of agricultural modernization. Given that farmers cannot hold onto the rewards for their productivity gains, the treadmill leads to lower food prices. Scale enlargement forces labor to leave agriculture for other pursuits. The treadmill increases the efficiency of the farm sector, leading to greater competitiveness in international markets. Without considering externalities generated by the treadmill – these effects together indeed yield high internal rates of return to investment in research and extension. All a government apparently needs to do is feed the treadmill by investing in the development of new technologies. Thus was born a paradigm that became dominant as evidence accumulated of unprecedented science-based productivity increase in the USA and other industrial and Green Revolution countries. The Common Agricultural Policy of the European Union has since its inception until recently explicitly used the treadmill to drive agricultural development.

However powerful the treadmill paradigm and the TSP strategy based on it, it overlooks an important issue: an effective treadmill mechanism assumes a specific institutional context. By the time the treadmill took off in the US in the early 1940s, farmers had become embedded in a suite of institutional supports. Land Grant colleges and county agents provided publicly funded access to research, information, organizational development and training of farmers. Farmer Unions were recognized as partners in rural and farm development and exerted political and lobbying power. Agri-business had developed to create integrated markets and market information support. Insurance, input delivery services, land markets, mechanization, market protection, and subsidy schemes were in place.

The situation in The Netherlands was no different (Schelhaas, 2009). After the crisis induced by the import of cheap grain from America in the 1880s, a State Commission was set up in 1886 to create enabling conditions for family farm development. One of its achievements was the tenure law of 1917 that made it rational for tenants to invest in land. A tiered system of fundamental, applied and adaptive research, extension and education was set in place. After World War II, government subsidy and land improvement programmes became available for drainage, land re-adjudication and consolidation, infrastructure development, farm building improvement, etc. In these conditions, the treadmill works like a charm, with an average loss of farms and concomitant scale enlargement at about 2% annually since the 1960s. A Dutch farm, in its current form, cannot be imagined without its network of support institutions, including banks, book keepers, farmer unions and cooperatives, agri-businesses, value chains, specialized transport services, regulatory frameworks, subsidies, insurance

schemes, auction houses, and a special Ministry that looks after farm interests.

The experience of the two countries suggests that the creation of enabling institutional conditions *predated* their phenomenal productivity growth as a result of TSP. Bonnen's (1987) analysis of the growth of agricultural productivity in the US amplifies this analysis. He mentions five kinds of institutions as being central to the enabling context created for productivity growth: (1) a network of diverse farm organizations, (2) the land-grant colleges, (3) The US Department of Agriculture, (4) the private sector markets and firms that both provided inputs to farmers and marketed the farm produce, and (5) the federal and state institutions that had their mandate in agricultural policy. These institutions, both public and private, increasingly interacted, resulting in a situation where the line between public and private became increasingly vague. Bonnen (op. cit.) speaks of a *system of institutions* (italics in the original), which often remains inadequately understood. The inter-linked nature of this system should not be taken to mean harmony. Tension and competition between USDA, land grant colleges and farm organizations regarding appropriate roles and activities have persisted. Nevertheless, a common vision of agricultural development among these institutions resulted in a coherent science-based system for agriculture. The key to its systemic nature was a shared understanding of the system by the actors who created and maintained it. Such an understanding is the hallmark of a soft system (Checkland, 1989; Checkland and Poulter, 2006): it exists to the extent that the actors realize they are part of a system, and thus appreciate their inter-dependence and mutuality, and coordinate their actions accordingly.

We refer to Bonnen because he (like other authors, such as Rogers, 1989; Havelock, 1986; Swanson and Peterson, 1989; Nagel, 1980) articulated an explicit IS perspective, well before the current interest in IS based on Asian industrial experience (Lundvall, 1985; Freeman, 1988) and the efforts of Hall et al. (2003) to kindle interest in IS for agricultural development. The articulated system of agricultural support institutions in the Netherlands also attracted the interest of researchers (e.g., Röling, 1986). Engel and Salomon (1997) developed a toolbox called Rapid Analysis of Agricultural Knowledge Systems (RAAKS) that provides methods to analyze configurations of institutional actors, their linkages and interactions so as to help those actors improve their concerted action. In Australia, people like Bawden (1995) and Ison and Russell (2007) provided early leadership by developing soft systems approaches to agricultural development, which among others fed the Landcare movement (Campbell, 1994).

The need for an articulated system of institutions as a condition for agricultural productivity growth in developing countries is raised by the analysis by Biggs (2007) of the success factors for the Green Revolution in Asia, as well as by the study by Djurfeldt et al. (2005) comparing the impact of the Green Revolution in Asia and SSA. Both conclude that, in Asia, the Green Revolution was made possible through state-driven creation of institutional conditions in which new technologies could lead to productivity growth of the smallholder sector. In the 1960s, the food situation in Asia was bleak compared to that of Africa. Whereas at the time of independence many African countries were food self-sufficient, famine and persistent hunger still threatened large parts of Asia. The Green Revolution changed all that. It is often regarded as a major success of TSP. However, Djurfeldt et al. (2005) warn against this narrow perspective. In their view the Green Revolution has to be understood as the result of a state-driven, market-mediated and small-farmer (family-farmer) based strategy to increase food sufficiency for cereals. They place institutional change at the heart of the analysis with three major institutions implicitly indicated: a transparent state, functioning markets, and farmer organizations that represent the interests of family farmers. So the question

posed by these authors “*If Asia could do it, why not Africa?*” seems to demand an institutional rather than a purely technological answer. Djurfeldt et al. (op. cit., p. 4) explicitly refer to ‘a pervasive bias against the small farm sector’ on the sub-continent. This judgement is supported by other studies of African agricultural institutions (e.g., Eicher (1999: 8) on the institutional reasons for what he calls Africa’s ‘empty harvest’; Scott (1998) on Ujamaa villages in Tanzania; Kydd and Dorward (2004) and Poulton et al. (2006) on coordination problems; Winter-Nelson and Temu (2005) on transaction costs of coffee production in Tanzania; Fulginiti et al. (2004) on differential legacies of colonial history; Obi (2011) on institutional constraints of smallholders; Ngwena and Hagmann, 2011 on facilitation; and Sumberg (2005), Alene and Coulibaly (2009); and Oluoch-Kosura (2010) on institutional support systems for agricultural research).

Our effort to understand the persistence of TSP suggests that it is based on a powerful paradigm grounded in the phenomenal growth of agricultural productivity in the US. To this day, Evenson et al.’s (1979) study has remained the cornerstone for the popularity of TSP (Alston et al., 2009). Notwithstanding this continued support by many neo-classical economists and agricultural scientists, it fails to recognize the importance of the institutional conditions that allow the treadmill to function. As a result, TSP has been persistently but inappropriately applied in Africa to boost the productivity of food farming. Methodological individualism is the assumption that the collective, if not the public good, is the emergent property of aggregated individual (rational) choices (Weber, 1968, p. 13). Given the dominance of this assumption during the last several decades, in hindsight one can understand how ‘on the battlefields of knowledge’ (Long and Long, 1992) the recognition of systems of institutions lost out.

Though skirmishes are still going on, the battlefield seems to be changing, with increased attention for institutions. This is visible in the scientific literature. A Web of Science search with the keywords agricult*, innovati* and Africa yielded less than 10 papers annually between 1990 and 2000, whereas during the last 5 years around 40–50 papers were published annually. One major reason for this shifting focus is the recognized failure of African smallholders to adopt science-based technologies (Gabre-Madhin and Haggblade, 2004). Examples abound. Officials of the Cocoa Research Institute Ghana (CRIG) admit that farmers have adopted no more than 3% of the technologies it has produced (Ayenor et al., 2007; quoting Donkor et al., 1991). 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 (pers. com. M. Leo Sidibe, Director General of Agriculture, January 2011). Such learning creates space for a change.

4. Institutions: some theoretical considerations

Institutions have positive or negative effects on different people. They can be exclusive or inclusive, extractive or wealth creating, oppressive or liberating. At best, they provide historically evolved checks and balances that define an equitable civil society, limit corruption, level the playing field, and create sustainable opportunities. Notwithstanding their importance, most people have difficulty in recognizing the role of institutions in their lives.

Research on institutions has been pursued in a long-standing tradition in sociology and anthropology that started with Durkheim (Durkheim and Traugott, 1994) and was elaborated by people like Giddens (1984) and Douglas (1986) and her followers (e.g., Hood, 1998). The economist who placed institutions on the map was North (1990) who realized that markets are not ‘natural phenomena’ but bundles of agreed rules, such as money, that reduce

transaction costs. Accordingly, he defined institutions as the rules of the game that reduce uncertainty in human interaction (North, 2005). 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, networks, value chains, etc. that govern individual behavior. This is not to deny the role of individual agency but to highlight ‘the social’ in influencing the individual.

With the crises of banking and finance upon us, it is becoming clear that we lack the institutions to control the consequences of unfettered capitalism. Such an analysis suggests that institutions allow collectivities at different levels to operate rationally and beneficially. Different authors have warned against this implicit assumption. Cleaver (2002) points to the fact that many institutional contexts can be called ‘bricolage’, a hodgepotch of pluralistic formal and informal institutions that often conflict, represent the interests of different groups of actors, and serve to protect the power of the powerful. Grindle (2011) warns against ‘one size fits all’ approaches, idealized 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’.

For us, the specific question is whether and how it is possible to change the often inimical institutional conditions that constrain SSA smallholdings. Because institutions cannot be transferred like technologies, they must emerge from the historical context (Biggs, 2007). As the SSA-CP and CoS-SIS that we discuss below demonstrate, improving the opportunities for smallholders through institutional change can be pursued by a strategy that focuses on engaging key actors in dominant networks on innovation platforms (IPs) for multi-stakeholder learning to explore changes that could be of common interest (Spielman et al., 2009; Woodhill, 2010). Innovation brokers (Klerkx et al., 2009; Klerkx et al., 2010) can help mediate such interaction. Learning occurs in niches in which institutional experiments can be implemented and assessed by the stakeholders (Geels, 2005). It is relatively easy, with special funding and expertise, to create such niches in which proof of principle can be demonstrated but it is usually hard to scale up such lessons to landscape or regime level. Could IPs ‘work’ in practice?

5. Institutional conditions facing African smallholders

We earlier quoted Djurfeldt et al. (2005) who spoke of ‘a pervasive bias against the small farm sector’ in SSA. ‘The capacity of African government bureaucracies to create and maintain a competitive environment for value chains remains underdeveloped’ (World Bank, 2009, p. 15). On average, African countries spend only 4% of their national budgets on agriculture, compared to 8–14% in Asia (Fan et al., 2008), even if the New Partnership for Africa’s Development (NEPAD) in 2002 set a target of 10%. What are the reasons behind the inimical environment?

It is not that SSA agriculture lacks formal or informal institutions in the agricultural sector. In fact, one can speak of a dense network of, often pluralistic, institutions, e.g., of indigenous and colonial legal frameworks that do not always ‘reduce uncertainty

in human interaction'. We are increasingly able to analyze these institutions, partly because of painstaking anthropological research that reveals how they work. Many of them have formal purposes that have very little to do with their actual functioning as farmers experience it. A credit scheme for small farmers may ostensibly function to provide seasonal credit for farm activities. But 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' (Blundo and Olivier de Sardan, 2006, p. 85). '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 privatization and informalization of public services' (*op. cit.*, p. 101). 'The 'informal privatization 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' (*op. cit.*, p. 109).

Talk of service provision, credit, subsidy schemes, value chain integration, etc., in practice often seems to mask highly intricate mechanisms that extract value from smallholders. How else can one explain the in-transparent and 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 on the rapidly growing urban and middle-class markets for quality foods?

Part of this institutional framework that has been considered typically African is 'the big man syndrome'. This syndrome favors acceptance and support of a big man as he seeks patrimonial power in exchange for patronage. A patrimonial ruler does not distinguish between personal and public property and treats matters and resources under his command as personal assets that offer opportunity for patronage. In such patrimonial networks, wealth accumulates at the top, with few benefits distributed among farmers and farm workers. However, Aiyittey (2006) claims that the 'big man syndrome' is not indigenous in Africa, but rather the result of colonial history that reshaped the role of traditional chief without maintaining the checks and balances that characterized the indigenous system. Hounkonnou (2001) has investigated in West Africa cradles of local initiative and dynamism that eventually challenged local big men. However, in most African countries, farming remains an important if not the main source of wealth and formal and informal institutions have evolved to extract it.

In a survey, 1200 smallholders were asked why they had not sold food crops to Ghana's school feeding programme (Eenhoorn and Becx, 2009). The programme politically is a success; more school children have received in-school meals and their intellectual performance has improved. However, the procurement of the food from local farmers has been a failure. Reasons that smallholders mentioned included the following institutional issues: insecurity of land tenure; lack of infrastructure; uncertain markets and variable prices; corruption; lack of farmer organizations that can defend farmers' interests; probability that other people (including state officials) will cream off profits. Other reasons were also mentioned, but the overwhelming impression is that the institutional environment discouraged entrepreneurship and innovation. Productive and remunerative family farming in West Africa can come about only once more adequate checks and balances substantially reduce the bias against smallholders.

It is important to realize that this bias does not stop at national boundaries. Globalization of trade and the import of cheap food to

satisfy urban electorates has exposed African smallholders to pre-emptive competition from OECD farmers who for over 50 years have received state support that allowed them to capture economies of scale. An example is the export from the Netherlands to Ghana of chicken wings that are a cheap by-product of capital-intensive Dutch farming and market demand for filets and drumsticks. The trade puts meat into the pots of urban Ghanaians but has under-cut the local broiler industry. A key tenet of neo-classical economics, that goods should be produced where they can be produced most cheaply (the theory of comparative advantage) is unhelpful when it comes to increasing the productivity of Africa's vast agricultural resources. There is increasing recognition within the economics profession of the desirability for tariffs to protect fledgling smallholder farming in developing countries (McIntyre et al., 2009, p. 455).

Our review suggests a plausible hypothesis: institutional conditions explain a large proportion of the variance in the quantity and quality of SSA's agricultural output. It is worth exploring how institutional change could be realized. Below we present the approach developed by the SSA-CP and CoS-SIS.

6. Innovation platforms and institutional change

Of special interest is the Sub-Saharan Africa Challenge Programme (SSA-CP) that is implemented in eight countries by the FARA for the CGIAR. This programme has been described as promising by its External Review panel (Lynam et al., 2010) and in need of extension for two reasons: (1) It experiments with a novel approach inspired by innovation systems (ISs) thinking (Hall et al., 2003), that provides an alternative to conventional linear approaches. This Integrated Agricultural Research for Development (IAR4D – see Hawkins et al., 2009 for its four 'defining' principles) is tested through 32 multi-stakeholder Innovation Platforms (IPs). (2) It has established a rigorous research methodology to measure the impact of IAR4D. The econometric analysis of the data shows that communities with IPs achieved more poverty reduction than controls or communities with conventional extension approaches. In communities with IPs innovative activity is more diverse (Pamuk et al., in preparation). Subsequent analysis by Van Rijn and Bulte (in preparation) suggests that IP-served communities have more linkages with external actors than those without. IAR4D and the IS approach on which it is based seem worth further exploration.

Like the SSA-CP, CoS-SIS has two components: (1) experimental development (implementing an IS approach to foment institutional change) and (2) research (monitoring and evaluating the impact of that IS approach).

6.1. Experimental development

CoS-SIS has following points of departure:

- Institutions are negotiated agreements among actors about some social purpose. They are dynamic and constantly reproduced or adapted through interaction in networks.
- Changing institutions implies mapping and analyzing these networks so as to identify the actors and understand the mechanisms that shape the institutions and the constraints and opportunities experienced by smallholders. Such analyses can help those actors to become aware of their roles and responsibilities.
- Changing institutions requires brokers who strategically facilitate formation of, and interaction in, temporary configurations of key actors carefully selected as champions for some social purpose. These configurations are called IPs. Members are not selected with some preconceived functional boundaries

- (e.g., research, extension) or system levels in mind, but on the basis of analysis of networks and identification of actors who matter for realizing the social purpose. They are not permanent structures.
- Institutional change is expected to emerge from interaction on such IPs. To that end, their members engage in learning with respect to the social purpose through experiments with institutional change. They need funds to cover the costs of experimentation and interaction. It is important to ensure that IPs engage in institutional experimentation and not in implementing an extension programme.
 - One can influence the social purposes pursued by such IPs and the nature of the experiments by supporting their learning, providing them with diagnoses of and feedback from the institutional context, providing them with results from natural experiments, and suggesting entry points for concerted action. When they start to act independently from facilitation, IPs become niches of institutional innovation and themselves take on a brokerage role.
 - One can seek to affect dominant institutional regimes by embedding or nesting platform experiments in dense interaction among national policy makers, senior officials, scientists, NGOs, civil society representatives and donors in the domain or the agricultural sector as a whole (some of the actors selected as members of the IPs belong to these categories).

A question for both researchers and practitioners is whether the institutional context (and hence the locus of IPs) refers to a commodity or domain, or to the national agricultural sector. In CoS-SIS, for each of the three countries, potential domains were first listed and then three domains were selected by national working groups of experts and officials as relevant to national development priorities and smallholder interests. However, representatives of smallholder farmers were not directly consulted.

In each domain a post-doctoral researcher and a PhD student work together. The first year of CoS-SIS has been devoted to scoping, diagnostic and baseline studies to identify and analyze promising opportunities, as well as disabling constraints for smallholders in the domain, translate the constraints into institutional conditions, map networks and coalitions of key actors who can make a difference, and identify local areas for experimentation. The results of the scoping studies have been published ([Adjei-Nsiah et al., in preparation](#)), while the diagnostic studies will be published separately (in 2012 in a special issue of NJAS – Wageningen Journal of Agricultural Research). **Table 1** lists entry points identified for each domain that form the basis for institutional experimentation.

Table 1
CoS-SIS entry points for institutional experimentation by domain and country.

| Country | Domain/focus | Entry point |
|---------|--|--|
| Benin | Cotton: pest management | Creating capacity and opportunity for farmers to use LEC (<i>Lutte Etagée Ciblée</i>) for integrated pest management |
| Benin | Oil Palm: seed system | Improving the distribution of improved (<i>Tenera</i>) oil palm seedlings to smallholders |
| Benin | Oil Palm: cropping | Improving and securing access to agricultural land in the oil palm based cropping system on the Adja plateau |
| Benin | Water management: rice in valley bottoms | Improving irrigation management to allow smallholders to capture the expanding markets for local rice |
| Benin | Water management: agro-pastoral dams | Improving multi-actor management of the multi-functional use of dams |
| Ghana | Oil Palm: oil quality | Improving the quality of, and value chains for, oil produced by small-scale women processors to allow them to access the demand for high-quality oil |
| Ghana | Food Security: value chain for small ruminants | Developing value chains so as to allow smallholders to benefit from markets for small ruminants |
| Ghana | Cocoa: price formation | Developing arrangements to allow differential farm gate prices for different categories of bean quality |
| Mali | Crop-Livestock Integration: dairy farming | Zero grazing dairy production based on irrigated fodder crops and crop residues |
| Mali | Water management: water users associations | Improving the management of tertiary canals by water users' associations |
| Mali | Shea Nut: market access | Improving the performance of cooperatives to allow more women to market high-quality butter |

A crucial issue for CoS-SIS has been the choice of system levels at which we seek to make impact. With respect to the entry point chosen for each domain, PhD projects focus on the *local* level and experiment with smallholders and other local stakeholders on concrete socio-technical and institutional issues. These projects adhere to academic standards with respect to doctoral studies. The CoS-SIS Programme works at levels higher than local, i.e., at district and/or national levels, with IPs of institutional actors. These are facilitated by the post-doc researcher and monitored and evaluated to enable the CoS-SIS Programme to draw conclusions about the effectiveness of an IS approach to institutional change.

At first sight, both levels with different forms of experimentation seem to sit together uncomfortably in one programme. However, the two levels are intimately related: the work with smallholders and other local actors ensures that the work at the higher levels focuses on and is informed by data on smallholder issues. The complementary activities of the PhD and post-doc researchers vary in each case. In all three countries, it has been difficult to ensure effective farmer representation on the platforms.

An example of unexpected ways in which such platforms can affect smallholder opportunities comes from the cocoa domain in Ghana. Through interaction among platform members it became apparent that the price difference between Ghana and Ivory Coast had led to extensive smuggling of Ghana's cocoa, which in turn had forced the country to pay for expensive border controls. This insight was conveyed to the Ministry in charge of setting the regulated price paid to farmers. The Minister was assured by the fact that the Platform's recommendation meant it was carried by the industry. The Government's decision in 2011 to increase the price farmers receive for their cocoa by 33%, and to forward the time of announcing that price to give farmers more opportunity to efficiently allocate their resources and investments is consistent with (though not necessarily exclusively caused by) the Platform's advice.

6.2. Research

CoS-SIS requires a research design that allows plausible inferences to be drawn about the impact of the Innovation Platforms. At the PhD project level, various research designs have been adopted, among them the randomized control trial design used in the SSA-CP. At the CoS-SIS programme level that design proved impractical. Unlike the IPs of the SSA-CP, the CoS-SIS IPs operate across entire domains and, even when they focus on the district level, they can include national actors. It became apparent that it is impossible to find matching 'without' contexts and to ensure comparable starting points. Basically, at the programme level, CoS-SIS

thus follows a comparative case study design: before/after (a time comparison by case) and comparison across nine domains bounded by common concepts and operating practices.

Lynam et al. (2010) observe that the SSA-CP's randomized control design was suitable for proof of concept, but would not allow attribution of causality. In CoS-SIS we therefore added a third element: Causal Process Tracing (CPT) (George and Bennett, 2005). CPT is a methodology developed in sciences in which historical understanding is necessary. Event ecology (Walters and Vayda, 2009) is a comparable methodology. Both seek retrospectively to understand why innovation (if any) took place by fitting the most plausible explanatory theory to observations of both intended and unintended events, and thereby trace the causal processes involved. It relies on counterfactuals and hypothetical observations that would invalidate the most plausible theory compared to alternative theories. In other words, CPT adds *mechanism* to observations of relationships between events (including deliberate interventions) and outcomes and so helps avoid spurious attribution. De Janvry and Sadoulet (2010b) also made a plea for systematic evaluation and causal analysis of impacts of successful experiences with agricultural innovation. CPT requires the following data sets, which are at the time of writing being collected in all nine domains: (a) information about actions undertaken to facilitate IPs; (b) information about the interventions by those IPs as part of their institutional experimentation; (c) intended and unintended events and processes that appear to the platform members to be significant; and (d) baseline and final measures.

Smith et al. (2008) provided an example of CPT in practice, recording events that mark the pathway between initial intentions and eventual outcomes in a 16-year programme (1990–2006) to develop urban agriculture for public health in Kampala. CoS-SIS will provide nine comparable CPT analyses. It remains a challenge to apply CPT to changes that will occur in a much shorter time frame, as in CoS-SIS.

7. Conclusion

It is time to address the real cost to nations' GDPs, government revenues, and especially to rural livelihoods of the failure to recognize the key role of institutions in developing the SSA smallholder sector. Institutions cannot be transferred like technologies. Institutional transformation is fraught with political pitfalls because it directly affects the distribution of value among stakeholders. Because SSA smallholders on the whole as yet have not gained sufficient power to countervail the prevalent institutional bias against them, it seems difficult to change the situation. While acknowledging that the powerful might resist institutional change, we argue against such Afro-pessimism (Eicher, 1999). Successful change might be easier under win-win than under zero-sum conditions. In the three African countries we work in, senior decision makers have embraced the CoS-SIS concept and expect it to deliver. In all three countries the question seems to be: how can we change disabling institutional contexts? Our example from Ghana's cocoa industry shows that industry leaders are searching for ways to create and strengthen institutions that could support an internationally competitive industry. In Benin, the choice of cotton farmers to switch to subsidized food crops a few years ago motivated institutional reforms to create more realistic opportunities for cotton growers, a natural experiment that we document in detail (Togbe et al., in preparation-b).

Can institutional contexts be changed? Neither the outcomes nor the processes of change are predetermined in the CoS-SIS Programme. The platforms, the agents of change, are nested in dense interaction among domain decision makers. This interaction will, we expect, affect mutual learning and effective decision-making

about institutional reforms that benefit not only the smallholders, but also the longer-term interest of the countries concerned.

Acknowledgements

We thank Dr. Janice Jiggins for extensive suggestions for rewriting, as well as three anonymous reviewers and the editor of Agricultural Systems for constructive comments. We are grateful to Prof. Erwin Bulte and Dr Barbara Sterk for preprints of important articles. CoS-SIS is funded by DGIS, the Directorate General for Development Cooperation of the Ministry of Foreign Affairs of The Netherlands. Without that support the article could not have been written.

References

- Adjei-Nsiah, S., Adu-Acheampong, R., Debrah, K., Dembele, F., Lassine, S., Ouologuem, B., Saïdou, A., Vissoh, P., Zannou, E., in preparation. Finding space for change: spotting opportunities for smallholder innovation.
- Alene, A.D., Coulibaly, O., 2009. The impact of agricultural research on productivity and poverty in sub-Saharan Africa. *Food Policy* 34, 198–209.
- Alston, J.M., Beddow, J.M., Pardey, P.G., 2009. Agricultural research, productivity, and food prices in the long run. *Science* 325, 1209–1210.
- Anderson, J., Feder, G., Ganguly, S., 2006. Analysing the demise of the training and visit system of extension. In: van den Ban, A., Samantha, R.K. (Eds.), *Changing Roles of Agricultural Extension in Asian Nations*. B.R. Publishing Corp., Delhi, pp. 149–174.
- Ayenor, G.K., Röling, N.G., van Huis, A., Padi, B., Obeng-Ofori, D., 2007. Assessing the effectiveness of a local agricultural research committee in diffusing sustainable cocoa production practices: the case of capsid control in Ghana. *IJAS International Journal of Agricultural Sustainability* 5 (2–3), 109–123.
- Ayittey, G.B.N., 2006. *Indigenous African Institutions*, second ed. Transnational Publishers, Ardsley, NY.
- Barrett, C., Agrawal, A., Coomes, O., Platteau, J.-P., 2009. *Stripe Review of Social Sciences in CGIAR*. CGIAR, Science Council Secretariat, Rome.
- Bawden, R., 1995. On the systems dimension of FSR. *Journal for Farming Systems Research and Extension* 5 (2), 1–19.
- Benor, D., 1987. Training and visit extension. back to basics. In: Rivera, W., Schramm, S. (Eds.), *Agricultural Extension Worldwide*. Croom Helm, New York, pp. 137–149.
- Biggs, S., 2007. Building on the positive: an actor innovation approach to finding and promoting pro-poor institutional and technical innovations. *International Journal Agricultural Resources, Governance and Ecology* 6 (2), 144–164 (special issue on institutional change in agricultural innovation systems).
- Blundo, G., Olivier de Sardan, J.P., 2006. *Everyday Corruption and the State. Citizens and Public Officials in Africa*. Zed Books, London; David Philip, Cape Town.
- Bonnen, J.T., 1987. US agricultural development: transforming human capital, technology and institutions. In: Johnson, B.F., Luiselli, C., Contreran, C., Norton, R. (Eds.), *US-Mexico Relations: Agriculture and Rural Development*. Stanford CA, Stanford, UP, pp. 267–300.
- Campbell, A., 1994. *Landcare. Communities Shaping the Land and the Future*. Allan and Unwin, St. Leonards, Australia.
- Chambers, R., Jiggins, J., 1987. Agricultural Research for resource-poor farmers. Part I: transfer-of-technology and farming systems research. Part II: a parsimonious paradigm. *Agricultural Administration and Extension*, 27(Part I), 35–52; 27(Part II), 109–128.
- Checkland, P., 1989. Soft systems methodology. *Human Systems Management* 8, 273–289.
- Checkland, P., Poulter, J., 2006. *Learning for Action: A Short Definitive Account of Soft Systems Methodology and Its Use for Practitioners, Teachers and Students*. John Wiley, Chichester.
- Cleaver, F., 2002. Reinventing institutions: bricolage and the social embeddedness of natural resource management. *The European Journal of Development Research*, 14(2), 11–30. <<http://dx.doi.org/10.1080/714000425>>.
- Cochrane, W., 1958. *Farm Prices, Myth and Reality*. Univ. of Minnesota Press, Minneapolis (Especially Chapter 5: The Agricultural Treadmill, pp. 85–107).
- Collinson, M. (Ed.), 2000. *History of Farming Systems Research*. CABI, Wallingford.
- Cotula, L., 2011. *Land Deals in Africa. What is in the Contracts?* IIED, London (Institute for Environment and Development).
- De Janvry, A., Sadoulet, E., 2010a. Agricultural development in sub-Saharan Africa: an update. *African Journal of Agricultural Resource Economics* 5, 194–204.
- De Janvry, A., Sadoulet, E., 2010b. Agriculture for development in Africa: business-as-usual or new departures? *Journal of African Economies* 19 (Suppl.), 7–13.
- Djurfeldt, G., Holmes, H., Jirström, M., Larsson, R. (Eds.), 2005. *The African Food Crisis: Lessons from the Asian Green Revolution*. CABI, Wallingford, UK.
- Donkor, M., Henderson, C., Jones, A., 1991. Survey to Quantify Adoption of CRIG Recommendations. *Farming Systems Research Paper No. 3, Interim Working Document*. CRIG, Tafo, Ghana, 29pp (unpublished).
- Dormon, E.N.A., Leeuwis, C., Fiadjoe, F.Y., Sakyi-Dawson, O., van Huis, A., 2007. Creating space for innovation: the case of cocoa production in the Suhum-

- Kraboaa-Coalter District of Ghana. IJAS, Special Issue Convergence of Sciences Research West Africa 5 (2&3), 232–246.
- Dorward, A., Chirwa, E., 2011. The Malawi agricultural input subsidy programme: 2005–6 to 2008–9. International Journal of Agricultural Sustainability 9, 232–247.
- Douglas, M., 1986. How Institutions Think. University of Syracuse Press, Syracuse, NY.
- Durkheim, E., Traugott, M., 1994. Emile Durkheim on Institutional Analysis. University of Chicago Press, Heritage Sociology Series, Chicago.
- Eenhoorn, H., Beex, G., 2009. Constraint constraints: a study into real and perceived constraints and opportunities for the development of smallholder farmers in Sub-Saharan Africa. Public lecture supported by unpublished document. Wageningen University (February 17th 2009).
- Eicher, C.K., 1999. Institutions and the African Farmer. Issues in Agriculture 14, 1–60.
- Engel, P.G.H., Salomon, M., 1997. Facilitating Innovation for Development. A RAAKS Resource Box. KIT, Amsterdam.
- Evenson, R.E., Waggoner, P.E., Ruttan, V.W., 1979. Economic benefits from research: an example from agriculture. Science, 205, pp. 1101–1107 (14 September).
- Fan, S., Johnson, M., Saurkar, A., Makombo, T., 2008. Investing in Africa to Halve Poverty by 2015. IFPRI, Washington (Discussion Paper 751).
- Freeman, C., 1988. Japan: a new national innovation system? In: Dosi, G., Freeman, C., Nelson, R., Soete, T. (Eds.), Technology and Economic Theory. Pinter, London, pp. 330–348.
- Fresco, L., Kroonenberg, S., 1992. Time and spatial scales in ecological sustainability. Land Use Policy 9 (3), 155–168.
- Fulginiti, L.E., Perrin, R.K., Yu, B., 2004. Institutions and agricultural productivity in Sub-Saharan Africa. Agricultural Economics 3, 169–180.
- Gabre-Madhin, E.Z., Haggblade, S., 2004. Successes in African agriculture: results of an expert survey. World Development 32, 745–766.
- Geels, F.W., 2005. Processes and patterns in transitions and system innovation. Refining the co-evolutionary multi-level perspective. Technology Forecasting and Social Change 72, 681–696.
- George, A., Bennett, A., 2005. Case Studies and Theory Development in the Social Sciences. OUP, Oxford, pp. 205–233 (also 2004. MIT Press, Cambridge, Mass., Chapter 10).
- Giddens, A., 1984. The Constitution of Society: Outline of the Theory of Structuration. Policy Press, Oxford.
- Godfray, H.C.J., Beddington, J.R., Crute, I.R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M., Toulmin, C., 2010. Food security: the challenge of feeding 9 billion people. Review Science, 327, 81 (Subject: 2–818).
- Griliches, Z., 1958. Research costs and social returns. Hybrid corn and related innovations. Journal of Political Economy 66, 419–431.
- Grindle, M., 2011. Governance reform: the new analytics of next steps. Governance: An International Journal of Policy, Administration and Institutions 24 (3), 415–418.
- Hall, A., Sulaiman, V.R., Clark, N., Yoganand, B., 2003. From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research. Agricultural Systems 78, 213–241.
- Havelock, R.G., 1986. Modelling the knowledge system. In: Beal, G.M., Dissanayake, W., Konoshima, S. (Eds.), Knowledge, Generation, Exchange and Utilisation. Westview Press, Boulder, CO, pp. 77–105.
- Hawkins, R., Heemskerk, W., Booth, R., Daane, J., Maatman, A., Adekunle, A.A., 2009. Integrated Agricultural Research for Development (IAR4D). A Concept Paper for the Forum for Agricultural Research in Africa (FARA). Sub-Saharan Africa Challenge Programme (SSA CP). FARA, Accra, Ghana, 92pp.
- Hood, C., 1998. The Art of the State. Culture, Rhetoric, and Public Management. Clarendon Press, Oxford.
- Hounkonnou, D., 2001. Listen to the Cradle. Local Dynamics for African Renaissance: Case Studies from Benin and Ghana. Published Doctoral Dissertation, University, Wageningen.
- Inter-Academic Council, 2004. Realising the Promise and Potential of African Agriculture. Science and Technology Strategies for Improving Agricultural Productivity and Food Security in Africa. Inter-Academy Council, Amsterdam.
- Ison, R.L., Russell, D.B. (Eds.), 2007. Agricultural Extension and Rural Development: Breaking Out of Knowledge Transfer Traditions. CUP, Cambridge, UK.
- Jayne, T., Yamano, T., Nyoro, J., 2004. Interlinked Credit and Farm Intensification. Evidence from Kenya. Agricultural Economics 31 (2–3), 209–218.
- Jiggins, J., Lightfoot, C., Reintjes, C., 1996. Mobilising science and technology to get agriculture moving in Africa: a response to Borlaug and Dowswell. Development Policy Review 13 (1), 89–103.
- Klerkx, L., Hall, A., Leeuwis, C., 2009. Strengthening agricultural innovation capacity. Are innovation brokers the answer? Journal of Agricultural Resources, Governance and Ecology (IJARGE) 8 (5–6), 409–438.
- Klerkx, L., Aarts, N., Leeuwis, C., 2010. Adapative management in agricultural innovation systems: the interaction between innovation networks and their environment. Agricultural Systems 103, 390–400.
- Kydd, J., Dorward, A., 2004. Implications of market and coordination failures for rural development in least developed countries. Journal of International Development 16, 951–970.
- Long, N., Long, A. (Eds.), 1992. Battlefields of Knowledge: The Interlocking of Theory and Practice in Research and Development. Routledge, London.
- Lundvall, B.-Å., 1985. Product Innovation and User-product Interaction, Industrial Development. Aalborg University Press, Aalborg (Research Series 31).
- Lynam, J., Harmsen, K., Sachdeva, P., 2010. Report of the Second External Review of the Sub-Saharan Africa Challenge Programme (SSA-CP). CGIAR/ISPC Secretariat, Washington (Downloaded on April 27 2011 at <<http://www.sciencecouncil.cgiar.org/publications/reviews/challenge-programs/en/>>).
- McIntyre, B.D., Herren, H.R., Wakhungu, J., Watson, R.T. (Eds.), 2009. Agriculture at a Crossroads, Global Report. IAASTD. Island Press, Washington (International Assessment of Agricultural Knowledge, Science and Technology for Development).
- Nagel, U.J., 1980. Institutionalisation of knowledge flows. An analysis of the extension role of two agricultural universities in India. Quarterly Journal of International Agriculture, 30, 375–386 (special issue, DLG Verlag, Frankfurt (Main)).
- National Research Council, 2010. Committee on 21st Century Systems Agriculture. Towards Sustainable Agricultural Systems in the 21st Century. National Academic Press, Washington. <http://www.nap.edu/catalog.php?record_id=12832> (accessed 31.08.10).
- Nederlof, E.S., Röling, N., van Huis, A., 2007. Pathway for agricultural science impact in West Africa. Lessons from the convergence of sciences programme. IJAS Special Issue Convergence of Sciences Research West Africa 5 (2–3), 247–264.
- Ngwanya, H., Hagmann, J., 2011. Making innovation systems work in practice. Experiences in developing and facilitating innovation platforms. Knowledge Management for Development Journal 6, 109–124.
- North, D.C., 1990. Institutions, Institutional Change and Economic Performance. Cambridge University Press, New York.
- North, D.C., 2005. Understanding the Process of Economic Change. Princeton University Press, Princeton.
- Obi, A. (Ed.), 2011. Institutional constraints for small farmers in Southern Africa. Wageningen Academic Publishers, Wageningen.
- Oluoch-Kosura, W., 2010. Institutional innovations for smallholder farmers' competitiveness in Africa. African Journal of Agricultural Resource Economics 5, 227–242.
- Paillard, S., Tregas, S., Dorin, B., 2011. Agrimonde: Scenarios and Challenges for Feeding the World in 2050. Editions Quae for INRA and CIRAD, Paris.
- Pamuk, H., Bulte, E., Adekunle, A., in preparation. Decentralised Innovation Systems and Poverty Reduction: Quasi-Experimental Evidence from Central Africa. FARA, Accra; WUR/Development Economics, Wageningen.
- Poulton, C., Kydd, J., Dorward, A., 2006. Overcoming market constraints on pro-poor agricultural growth in Sub-Saharan Africa. Development Policy Review 24 (3), 243–277.
- Pretty, J., Toulmin, C., Williams, S., 2011. Sustainable intensification in African agriculture. International Journal of Agricultural Sustainability 9, 5–24.
- Reijntjes, C., Haverkort, B., Waters-Bayer, A., 1992. Farming for the Future. An introduction to Low-External Input and Sustainable Agriculture. Macmillan, London; ILEIA, Leusden.
- Rey, C., Waters-Bayer, A., 2001. Farmer Innovation in Africa: A Source of Inspiration for Agricultural Development. Earthscan, London.
- Ringler, C., Zhu, T., Cai, X., Koo, J., Wang, D., 2010. Climate Change Impact on Food Security in Sub-Saharan Africa: Insights from Comprehensive Climate Change Scenarios. IFPRI, Washington. Discussion Paper 01042. <<http://www.ifpri.org/sites/default/.../ifpridp01042.pdf>> (accessed 22.11.11).
- Rogers, E.M., (1961, 1972, 1985, 2003). Diffusion of Innovations. The Free Press, New York.
- Rogers, E.M., 1989. Evolution and Transfer of the US Extension Model. In: Compton, J.L. (Ed.), The Transformation of International Agricultural Research and Development. Lynne Rienner Publishers, Boulder, CO, pp. 137–152.
- Röling, N., 1986. Extension Science. Increasingly Preoccupied with Knowledge Systems. Sociologia Ruralis 25, 269–290.
- Röling, N., 1988. Extension Science. Information Systems in Agricultural Development. CUP, Cambridge.
- Röling, N., 2010. The impact of agricultural research: evidence from West Africa. Development in Practice 20 (8), 959–971.
- Ryan, B., Gross, N., 1943. The Diffusion of Hybrid Seed Corn in Two Iowa Communities. Rural Sociology 8, 15–24.
- Sasakawa Africa Association, 2010. Progress Report 2009. SAA, Addis Abeba, p. 10.
- Schelhaas, H., 2009. De Landbouw tussen Voedselcrisis en Overschotten. Academic Publishers, Wageningen.
- Scott, J.C., 1998. Seeing Like a State. How Certain Schemes to Improve the Human Condition Have Failed. Yale University Press, New Haven and London.
- Sinzogan, A., Jiggins, J., Vodouhé, S., Kossou, D., Totin, E., van Huis, A., 2007. An analysis of the organisational linkages in the cotton industry in Benin. IJAS 5 (2–3), 213–232.
- Smith, D.L., Musisi, J.M., Kawesa, M., Nasinyama, G., 2008. The story of the Health Coordinating Committee and the urban agriculture ordinances (how urban agriculture in Kampala led to institutional innovation). In: Cole, D., Lee-Smith, D., Nasinyama, G. (Eds.), Healthy City Harvest: Generating Evidence to Guide Policy on Urban Agriculture. CIP/Urban Harvest and Makerere University Press, Lima, Peru, pp. 219–229 <<http://www.uharvest.org/uh/>>.
- Spielman, D., Ekboir, J., Davis, K., 2009. Developing the art and science of innovation systems enquiry: alternative tools and methods, and applications to Sub-Saharan African agriculture In: Singinga, P., Waters-Bayer, A., Kaaria, S., Njuki, J., Wettasingha, C. (Eds.), Innovation Africa: Enriching Farmers' Livelihoods. Earthscan, London, pp. 72–88 (2008).
- Sterk, B., Kobina, C., Gogan, A.C., Kossou, D., Sakyi-Dawson, O., in preparation. Five Years After: The Impact of a Participatory Technology Development Programme as Perceived by Smallholders in Benin and Ghana. WUR/Cos-SIS, Wageningen (article submitted to AJAR).

- Sumberg, J., 2005. Systems of innovation theory and the changing architecture of agricultural research in Africa. *Food Policy* 30, 21–41.
- Swanson, B., Peterson, W., 1989. A field Manual for Analysing Technology Development and Transfer Systems. Urbana, Champaign (III). University of Illinois, Office of International Agriculture, INTERPAKS Report.
- Tilman, D., Balzer, C., Hill, J., Belfort, B., 2011. Global Food Demand and the Sustainable Intensification of Agriculture. *PNAS*. <www.pnas.org/cgi/doi/10.1073/pnas.1116437108> (accessed 21.11.11).
- Togbe, C., Zannou, E., Vodouhe, S., Haagsma, R., Gbehounou, G., Kossou, D., Röling, N., Jiggins, J., Bulte, E., van Huis, A., in preparation-a. Analysing Technological Transition of "Lutte Étagée Ciblée" (LEC) in the Cotton Sector in Benin. Diagnostic Study to be Published in a Special Issue of NJAS.
- Togbe, C., Zannou, E., Vodouhe, S., Haagsma, R., Gbehounou, G., Kossou, D., Bulte, E., van Huis, A., in preparation-b. Analysis of a Natural Experiment: Measures to Make Cotton Production Attractive for Benin Smallholders. UAC, Calavi, Benin; WUR, Wageningen (article in preparation).
- Van Huis, A., Jiggins, J., Kossou, D., Leeuwis, C., Röling, N., Sakyi-Dawson, O., Struik, P., Tossou, R., 2007. Agricultural research to reduce rural poverty. can convergence of sciences support innovation by resource-poor farmers in Benin and Ghana? Special Issue of International Journal of Agricultural Sustainability (IJAS) 5 (2–3), 91–108.
- Van Rijn, F., Bulte, E., in preparation. Social Capital and Agricultural Innovation in Sub-Saharan Africa. WUR/Development Economics, Wageningen.
- Walters, B., Vayda, A., 2009. Event ecology, causal historical analysis and human-environment research. *Annals of American Geographers*, 99(3), 534–553. <<http://dx.doi.org/10.1080/0004560092931827>>.
- Weber, M., 1968, 1922. In: Ross, Günther, Wittich, C. (Eds.), *Economy and Society*. University of California Press, Berkeley.
- Williamson, O., 2000. The New Institutional Economics: taking stock, looking ahead. *Journal of Economic Literature* 38 (3), 595–613.
- Winter-Nelson, A., Temu, A., 2005. Impact of prices and transaction costs on input usage in a liberalising economy: evidence from Tanzanian coffee growers. *Agricultural Economics* 33, 243–253.
- Woodhill, J., 2010. Capacities for institutional innovation: a complexity perspective. *IDS Bulletin* 41 (3), 47–54.
- World Bank, 2009. *Awakening Africa's Sleeping Giant: Prospects for Commercial Agriculture in the Guinea Savannah Zone*. World Bank, Washington.