CoS-SIS: Convergence of Sciences
Strengthening Innovation Systems

Towards Enhancing Innovation Systems Performance in Smallholder African Agriculture

Proceedings of the first CoS-SIS International Conference, Elmina, Ghana 22 – 26, June 2009

Editors: Arnold van Hius and Anthony Youdeowei




CoS-SIS: Convergence of Sciences
Strengthening Innovation Systems

Towards Enhancing Innovation Systems Performance in Smallholder African Agriculture

Proceedings of the first CoS-SIS International Conference, Elmina, Ghana 22 – 26, June 2009

Editors: Arnold van Huis
and
Anthony Youdeowei

October 2009

WAGENINGEN UNIVERSITY
WAGENINGEN UR

CoS-SIS: Convergence of Sciences Strengthening Innovation Systems Programme

Contacts

International Coordination – International Coordinator
Arnold van Huis
Wageningen University
P.O. Box 8031, 6700 AA Wageningen,
The Netherlands
email: arnold vanhuis@wur.nl
Tel: + 31 317484653

Regional Coordination – Regional Coordinator
Dominique Hounkonnou
CoS-SIS Regional Office
03 B P 3030,Cotonou, Benin
email: dhounk2@yahoo.fr, dhounk@intnet.bj
Tel + 229 21 33 22 84; + 229 90901007

National Coordination – National Coordinators

Benin – Dansou Kossou
Faculté des Sciences Agronomiques,
Université d'Abomey Calavi
01 BP 526
Cotonou, Bénin
email: kossoudansou@yahoo.com
Tel + 229 21 33 13 45 ; + 229 95 95 47 92

Ghana – Owuraku Sakyi-Dawson
Agricultural Extension Department,
School of Agriculture, College of Agriculture and Consumer Sciences
P.O. Box 68, Legon, Ghana
e-mail: osakyid@gmail.com
Tel + 233 244090460

Mali – Mamoudou Traoré
Institut Polytechnique Rural de Formation et
de Recherche Appliquée (IPR/IFRA) de Katibougou
BP 12 Koulikoro Ba, Mali
Tel: + 223 76041740 ; + 223 65552337
email: mamoudoutraore@yahoo.fr

CONTENTS

Participants at the 1st International CoS-SIS Conference Elmina Cape Coast, Ghana

1. FRAMEWORK FOR THIS CONFERENCE

1.1 Background to this conference

The Scientific Coordination Committee
Arnold van Huis, International Coordinator
Dominique Hounkonnou, Regional Coordinator
Niels Röling, Consultant
Barbara Sterk, Postdoc

These Proceedings report on the second International Conference of the Convergence of Sciences (CoS) programme in Elmina. The first International Conference was four years earlier in the same location, where we discussed how to follow up on the findings of the first CoS Programme phase (entitled CoS1 running from 2001 to 2006). Now that the second phase (entitled CoS-SIS) is operational, this international conference at the beginning of the five year programme (2008-2013) is intended to introduce the focus on "innovation systems", and how to enhance these systems for smallholder farmers' development. During the Conference, the post-doctoral Research Associates presented the reports of their exploratory studies into opportunities for smallholder development.

During the first phase of the CoS Programme, (CoS1, 2001-2006), we explored the potential, with small farmers and other stakeholders in Benin and Ghana, to develop technologies in a participatory manner. The aim was to ensure that the technologies developed, in soil fertility and weed management, crop protection, and crop agro-biodiversity, would be effective, appropriate and desirable from the farmers' point of view. Although CoS1 established that it is possible to develop such technologies with farmers, the overwhelming conclusion was that farmers have very small windows of opportunity that can be captured by on-farm technological innovation. Therefore, our nine PhD students started experimenting with changing the institutional conditions that frame small farmers' opportunities at the higher-than-farm level. Some students experimented with changing tenure arrangements between tenants and landlords, others engaged in developing farmers' internal organisation and labour division, while others worked on developing value chains or on identifying the constraints to small farm development in marketing chains.

In June 2008, the Directorate General of International Cooperation (DGIS) of the Dutch Ministry of Foreign Affairs approved funding (€ 4.5 million) for a second

phase of the CoS Programme that focuses on Strengthening Innovation Systems (CoS-SIS) in Benin, Ghana and Mali. It takes off from where the first phase ended and seeks to experiment with approaches that can improve opportunities for small-scale farmers.

As in CoS1, the assumption is that smallholders, who produce the bulk of Africa's food, hold most of its productive resources, constitute up to 70% or more of the continent's poor, and are currently mostly engaged in unproductive subsistence farming, and provide the most promising opportunities for increasing Africa's food security and sovereignty.

The CoS Programme phase 2 titled CoS-SIS, consists of a research programme which starts off with a deliberate effort to make as few 'pre-analytical choices' as possible. Hence the research proposal did not state clear measurable targets and did not provide a logical framework. This explains why it took two years to approve. But now we are up and going, largely due to the track-record established in CoS1, the support of the Royal Netherlands Embassies in the three countries, and the enthusiasm of the African organisations that were involved in the programme identification and formulation.

In CoS-SIS, we work in Benin, Ghana and Mali. In each country, national working groups selected three domains according to national priorities.

- *Benin:* cotton; oil palm production system; water management.
- *Ghana:* cocoa; food security (northern systems for cowpea, millet, sorghum, Shea Butter Nut and livestock); oil palm production system.
- *Mali:* agricultural surface water management; non-woody forest products (shea butter/karité); integrated livestock and fodder management.

For each domain, a post-doctoral Research Associate was recruited – ex-CoS PhDs wherever possible, to identify opportunities for smallholder development. Meanwhile, we have recruited eleven PhD students, five in Benin (two financed by NUFFIC), three in Ghana and three in Mali, who are currently doing course work, proposal writing, etc., in Wageningen University.

The purpose of CoS-SIS is to carry out inter-disciplinary experiments with a view to elaborate, apply and assess a development approach to sustainable rural poverty reduction and food security, based on Innovation System (IS) thinking. A key issue for CoS-SIS is to operationalize institutional change. Given the widespread assumption

that raising productivity per hectare is sufficient for agricultural development, the research issue that has been surprisingly left unattended is the relationship between institutional and technological development. We now realise that much can be gained by making the relationship between institutional and technological development an explicit research concern for CoS-SIS.

For that reason it is required to *scope the innovation landscape* to identify opportunities that could be mobilised, focussing on institutional and technical constraints in the three domains per country. During the past half of this year, the Research Associates have scoped the possible opportunities.

This first international CoS-SIS conference was a unique occasion. CoS-SIS was introduced. We brainstormed about the meaning and relevance of the system innovation, how to achieve institutional and technical change and how to measure it. The Research Associates presented their preliminary results for public scrutiny and discussion (see their contributions in section 3 of these Proceedings). The PhD students and Research Associates met for the first time, and with their potential African and Dutch academic supervisors, and discussed the way forward. All participants were part of this process and contributed with their vision, expertise and experience to help the CoS-SIS partners converge on a significant contribution.

It is a tremendous challenge to the CoS-SIS Programme to adapt and develop a methodological and theoretical approach to enhance the capacity of development actors to combine technological understanding with the creation of institutional space for change within nested stakeholder networks. With this approach we envision to capture and enlarge opportunities for rural poverty reduction.

1.2 Specific objectives of the conference

The specific objectives of this 1st International CoS-SIS conference were:

- To provide a forum at which PhD students, RAs, CoS-SIS Coordinators, scientific supervisors, domain experts, and chair persons of CoS-SIS Programme Management Teams can meet and discuss issues.
- To create an opportunity for all the CoS-SIS actors to get a broad view and a common understanding of the CoS-SIS research programme and its background.
- To begin to create a common perspective on institutional change, the Innovation Systems Approach, Multi-Stakeholder Processes and other key concepts.

- To present, discuss and agree on the overall 'quasi-experimental' research design of CoS-SIS and its use of Causal Process Tracing (CPT).
- For the Research Associates (RAs) to present the results of the opportunity scoping study in each of the CoS-SIS domains and for the results to be critically discussed and decided upon by the CoS-SIS actors.
- For the CoS-SIS partners to discuss and provide guidance on the next steps of the CoS-SIS process and to define the work of PhDs and RAs.

1.3 The conference process

Anthony Youdeowei
International Consultant, CoS-SIS

Nature: a working Conference

Consistent with, and to fulfil the objectives of this first international conference of the CoS-SIS Programme, a working model was adopted for management of the conference sessions. Through this mode, presentations commissioned were made to plenary sessions and issues were extensively discussed in break up working group sessions. The outcome of this approach is that emerging issues were progressively developed during the course of the conference; in effect consensus was reached on a "live operational framework" for approaches to be adopted for the implementation of the selected domains of the CoS-SIS Programme.

The conference Process

The conference process consisted of presentations, in plenary sessions, by specialists in three themes, reports by the Research Associates of the results of their exploratory studies in the different selected domains, followed by well facilitated break up working group sessions to discuss the issues emerging from the presentations. Special discussion panels facilitated plenary discussions of the theme presentations by specialists.

There were four major sequential Conference Themes as follows:

Theme 1 summarized the programme development from CoS1 to CoS-SIS outlining the critical outputs and lessons learned in CoS 1 that informed the formulation of the second phase of CoS which is now called CoS-SIS.

Theme 2 discussed issues of the Innovation systems Approach and its relevance to African agricultural development.

In **Theme 3**, the presentations of the Research Associates outlined the opportunities identified, during the exploratory studies, for the different domains selected for implementation of the CoS-SIS Programme.

Theme 4 explored issues of opportunities to institutional and technological change.

Following these presentations and discussions, the conference considered strategies for implementation of the CoS-SIS Programme and Research Plans, and the way forward for further development of the CoS-SIS programme.

This Conference Proceedings has been intentionally published in an abridged format which contains the background and framework for this conference as well as executive summaries of the theme presentations. Plans have been concluded to post the PowerPoint presentations in the CoS-SIS website for wide scale dissemination and information to CoS-SIS Programme partners.

2. SUMMARIES OF PRESENTATIONS

Theme 1 From CoS1 to CoS-SIS

Irrigation management, Mali

Experiences from CoS 1

Emmanuel Dormon
P. O. Box MB 539, Accra, Ghana

Introduction

The livelihood of over 60% of Africans is derived from agriculture but productivity remains low on the continent whilst all other continents have experienced significant increases. Formal agricultural research in Africa has not been very successful in improving the livelihood of resource-poor farmers. A possible cause of the low impact of research on productivity in Africa could be the way research has been designed and undertaken on the continent.

Convergence of Science (CoS 1) aimed at analyzing participatory innovation processes to find more efficient and effective modes of agricultural research and technology development. CoS1 had three key principles: Convergence between 'formal' and 'informal' science and research; social and biological science; and between institutions and organizations.

The PhD students on the CoS1 project tackled many specific problems relating to soil fertility, incidence of pests and disease, genetic diversity of crops, weed infestation etc. In addition to the standard criteria for formal research, namely; reliability, objectivity, external and internal validity, CoS added criteria including the following: (i) that research has to benefit resource-poor farmers and (ii) research has to be relevant, by recommending practices that are affordable, desirable and applicable under the farmers' local conditions.

Research approach

The field research was preceded by technographic studies conducted by researchers in Ghana and Benin to identify broad priority areas and issues that warrant research intervention. This was followed by diagnostic studies to better understand farmers' views on the areas identified and narrow down on location specific needs. In all the field studies, an action research approach was followed to gather and analyse both quantitative and qualitative data with the objective of stimulating collective action in finding solutions to farmers' problems.

Initial results and challenges

Initial interventions focused on addressing various technology issues (soil fertility, pests and diseases, weeds, etc.) and results were quick in coming because without much new technology, many of the technical constraints were addressed. However, the challenge was how to sustain the continued adoption and adaption of the technologies to be relevant and applicable under the farmers' circumstances. Institutional issues such as markets, land tenure and cultural practices played such a major role in determining what practices were relevant and applicable in the farmers' local context. This greatly influenced the second half of all the PhD research studies by refocusing attention on experimenting with interventions in land tenure arrangements and building linkages among various institutions to address the non-technical constraints. In this regard, it was realised that addressing soil fertility issues in both Benin and Ghana using promising technology had to be accompanied by new socio-organizational arrangements with land tenure. For instance, using IPM techniques alone was not sufficient in overcoming the problem of low yields caused by pest and disease incidence; it required non-technical interventions. Also, adopting IPM practices on cocoa farms required socio-political interventions that addressed cheating by LBCs (who adjusted their weighing scales to read less than the actual weight). It also required the development and strengthening of marketing arrangements for niche cocoa markets in the case of organically produced beans. These challenges showed that for research to have an impact there is the need to expand the small windows of opportunities available to resource poor farmers by *creating space for innovation* (Dormon *et al*, 2007).

Main conclusions

The main conclusions drawn from CoS 1 were that it is not difficult to find technical or biological solutions to farmers' problems, however, a deficient interface of institutions and technology constrains adoption and/or adaption of these technologies thereby limiting the impact of research on especially smallholder farmers. Therefore, research targeted at resource poor farmers needs more than technical or biological solutions. What is needed are innovations that combine technical, institutional and organizational aspects that have been co-developed in a coherent manner to address constraints holistically. This will typically involve: (i) Combining natural and social sciences, (ii) clear policy support, and (iii) engaging with all relevant institutions. To successfully develop such innovations, it is necessary to operate above conducting research at farm level and build networks amongst all relevant institutions and stakeholders.

Reference

Dormon, E. N. A., Leeuwis, C., Fiadjoe, F. Y., Sakyi-Dawson, O. and van Huis, A. (2007) Creating Space for innovation: the case of cocoa production in the Suhum Kraboa-Coalter District of Ghana. *International Journal of Agricultural Sustainability* Vol. 5(2&3) pp 232-246.

The innovation systems approach proposed for CoS SIS

[1]D. Hounkonnou, [2]A. van Huis, N. Röling, [2]B. Sterk
[1]CoS-SIS Regional Office, 03 B P 3030,Cotonou Benin
[2]Wageningen University
P.O. Box 47, 6700 AA Wageningen,
The Netherlands

Introduction: key concerns for CoS-SIS

Some core issues discussed at the GFAR Conference in 2003 in Dakar were as follows:

(i) How to deal with the distrust vis-à-vis science, and with the inadequate impact of agricultural research on farmers? and (ii) How to ensure both *inclusiveness* and *efficiency*?

These questions are also the key concerns of the Convergence of Sciences Programme. Indeed, the programme started with the idea that science is too little used by the farmers, and that convergence is needed in technology development, not only between natural and social sciences, but also between societal stakeholders – mainly the farmers, and scientists. The need to change the research strategy in order to integrate the dynamism and the innovative capacity of farmers has been recognised in different arenas, including by FAO, the World Bank, the International Assessment of Agricultural Science and Technology for Development (IAASTD) and the Forum for Agricultural Research in Africa (FARA).

The concrete examples deriving from the implementation of the first phase of the Convergence of Sciences programme (CoS1) clearly paved the way for the second phase. Relevant technologies were generated, that farmers were able to use as these technologies actually worked in their conditions. Still, very limited windows of opportunity were left to smallholders. It became clear, therefore, that improving productivity at farm level has less to do, for example, with the performance of crop varieties than with alleviating constraints such as limited access to inputs, to credit and markets, poor infrastructure or cheap imports, etc. It was then decided that the focus of the second phase of the programme will be on strengthening *innovation systems* (SIS), in order to enlarge the socio-economic and institutional space for

small farmers to be more productive and efficient, and to be in the position to really improve their livelihoods. Based on the key lessons emerging from CoS1 (see table 1), the following presentation defines, among other concepts, innovation and innovation systems, before clarifying the purpose of CoS-SIS.

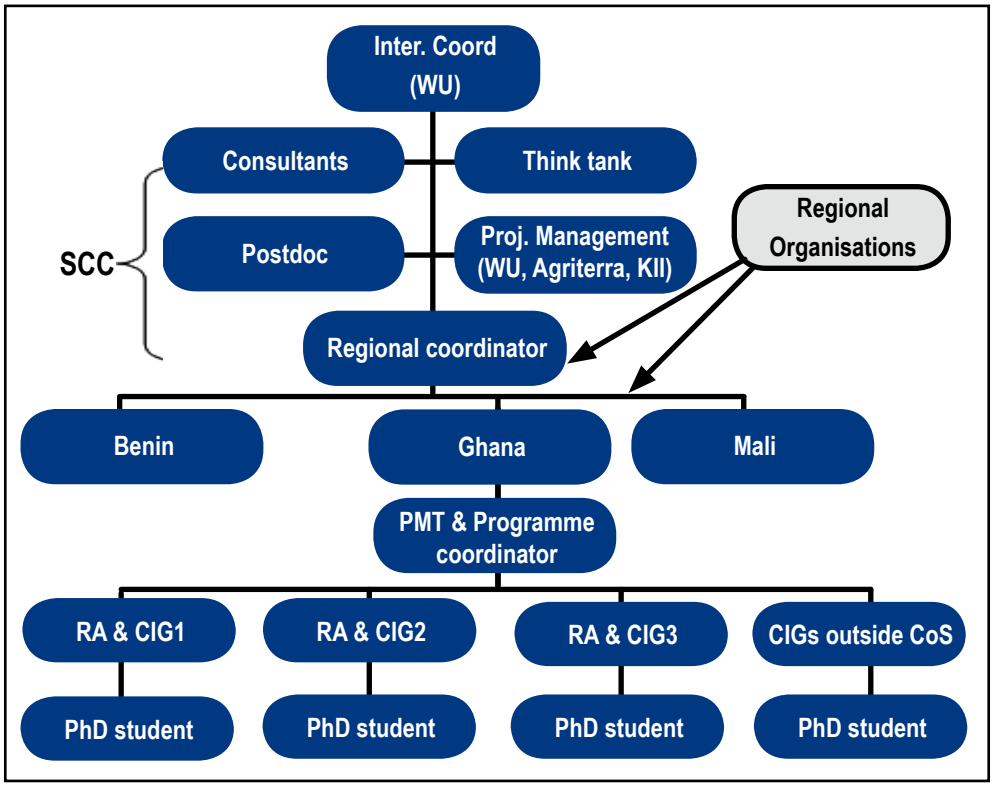
Table 1. Key lessons emerging from CoS1

Lesson 1	Doing research (effectively) with farmers generate technologies that do not need the usual *"packaging and pushing for adoption"!*
Lesson 2	Poverty reduction requires more than Participatory Technology Development
Lesson 3	Enlarging socio-economic and institutional space (e.g. through Innovation System Approach) is crucial (i) to allow technological improvements (ii) to allow them to work (for smallholders)!

The innovation systems approach

It is important to stress, however, that the innovation system approach is still subject to an on-going debate, even within the 'CoS circle', where the question has been raised as to whether we should not consider that we are dealing rather with *System Innovation*, which is understood as emerging interaction patterns in networks.

Innovation is seen as the emergent property of multi-stakeholder interaction; it works only when the actors involved realise that they are interdependent. Innovation systems are therefore the actors – whether individuals, enterprises or organisations, the interactions among them, the rules and framework conditions shaping their interactions, that together can generate the concerted action required to enhance control over material flows, livelihoods, clout and opportunities for the actors in the systems. Such innovation systems can be identified, facilitated, supported, and strengthened using the *innovation systems approach*.



Key to abbreviations: WU = Wageningen University / SCC = Scientific Coordination Committee

Figure 1. The Implementation Structure of CoS-SIS

An innovation system approach across local, national, and international levels can therefore be argued to be capable of generating the kind of institutional development that is required to deal with the impact problem identified.

CoS-SIS is conducting action research on how to strengthen innovation systems in Benin, Ghana and Mali. Each of the three countries has identified the domains where effective institutional interactions are expected to make a difference in smallholders' livelihoods. These will be the entry points or the research domains of the programme: cotton, oil palm and water for Benin, cocoa, oil palm and food security for Ghana, and, for Mali, water, shea butter and integrated crop/livestock production systems. These domains will be explored by nine research associates (three per country), and covered, after the diagnostic studies, by the PhD projects of the 11 students identified (originally nine from on the CoS-SIS, joined by two from the NPT programme).

The programme seeks to establish spaces for learning across multiple scales by building

Concertation and Innovation Groups (CIGs) with actors who have been identified as being able to play essential roles in strengthening innovation systems at regional, national and decentralised levels of decision making.

The implementation of the programme (see figure 1) will certainly face many challenges. Development actors are much better at technological innovation and transfer than at institutional innovation. There is also a political dimension due to "so many vested interests". It is therefore essential to build a strong methodology for the implementation of the programme.

CoS-SIS might be "a small fish in the river", but acting effectively together, the stakeholders involved could make it a "working model" to share with others.

Contributions from Panel Members

Judith Ann Francis
Senior Programme Coordinator, ST&I Strategies
CTA, Agro Business Park 2,
Wageningen, The Netherlands
e-mail: Francis@cta.int

Good morning – distinguished guests, fellow panelists, ladies and gentlemen, colleagues in innovation for development. Thanks to Professors Niels Röling and Arnold van Huis and the members of the organizing committee for inviting CTA to share our experiences on our work on innovation systems in Sub-Saharan Africa, the Caribbean and the Pacific (ACP).

The CTA experience

CTA experiences revolve around building capacity of scientists/researchers/academicians to understand innovation, innovation processes, the innovation system approach and their relevance for ACP agricultural and rural development. A multi-pronged approach was adopted which involved sensitization of key decision makers to obtain buy-in, training of scientists to improve understanding of key concepts. Support is provided for the conduct of case studies on analysing the agricultural science, technology and innovation systems by applying the innovation system approach to key sub-sectors that were important either for food security, agricultural diversification or under threat of loss of markets to reinforce training and provide information for decision-making. Based on the results of selected case studies, some approaches were integrated into capacity building for strengthening the system. These included farmer experimentation and innovation, demand-led research-priority setting and influencing policy processes. Multi-disciplinary teams participated in the seminars and training workshops and inter-disciplinary teams conducted the case studies.

The premise for embarking on the progamme was based on the assumptions that (i) there was under investments in S&T; (ii) little innovation was taking place and; (iii) there was a disconnect between the S&T community, policymakers and other stakeholders and all factors were contributing to underperformance in the agricultural sector. The goal was to mobilize the ACP scientific community to contribute to enhancing innovation and improving the performance of ACP agriculture. We framed

our approach to ST&I for agricultural and rural development within the context of economic development. Therefore ACP agricultural development required renewed focus on innovation and technological change within the institutional, economic and political context are important.

Questions are often raised as to whether innovation is a product or process**.** We have moved towards achieving some consensus on the following: (i) Innovation may take many forms – technological, social, political, financial, marketing; (ii) innovation process is interactive, evolutionary and cumulative; (iii) innovation is creating value from knowledge; all types of knowledge are sources of ideas for innovation; (iv) innovation takes place within an economic, institutional, social and political context and that continuous earning is important.

Innovation system comprises several actors. Farmers and farmer organizations are only one set of actors in the system and their key role as economic agents cannot be ignored. Yet there are other economic agents who also play a key role – those who add value to agricultural commodities (crops, livestock, fisheries and forestry) namely agro-processors; those who trade, market and distribute e.g. traders and supermarkets; those who provide inputs e.g. agrochemicals and consumers whose requirements – price, quality, and convenience are changing continuously and cannot be ignored. Additionally, an under-resourced scientific community cannot respond to the needs of the agricultural sector e.g. create new knowledge or assist in interpretation of existing knowledge. Neither can uninformed policymakers / decision-makers create the enabling environment for innovation in the sector.

Innovation systems perspective suggests that:

(i) Information and knowledge are available and can be accessed/exchanged and assimilated – linked to competencies of actors.
(ii) Interactions occur between and among actors at various levels and scales e.g between farmers and other actors -researchers, financiers; between national and international researchers/organizations thereby contributing to the flow of information, knowledge and investments/resources.
(iii) New knowledge is being generated through research – whether the farmer, agricultural scientist, engineer, market researcher, trade analyst / economist etc.
(iv) Institutions – Formal (policies, rules, regulations of the game) and informal – culture, belief system etc. exist and facilitate, stimulate or control innovation.
(v) Organizations exist and participate in and contribute to innovation processes.

Although the innovation system approach is considered relevant for studying and comparing innovation performance and constructing innovation systems, conceptual

differences exist and certain questions persist namely; (i) does the IS exist or not? (ii) can the boundaries of the system be clearly defined – local, national, regional, international? (iii) is the innovation system static or dynamic e.g. do new actors move in and others move out; what is the effect of new knowledge?

In applying the innovation systems approach various aspects can be studied:

i. Institutions and institutional learning – policies, rules and regulations e.g. IPR, cultural beliefs and behavioural practices;
ii. Key actors and their functions;
iii. Knowledge infrastructure (e.g. knowledge base and technologies including competencies of the actors);
iv. Interactions/linkages between and among actors / actor groups and by extension how they impact on the information, knowledge and investment flows.

The challenge of agricultural and rural development in ACP countries

What then is the relevance to agricultural and rural development in Africa, the Caribbean and the Pacific – and many more developing countries? If we accept that innovation and technological change are important for development and that knowledge and learning are critical, then we need to understand the social, political, economic and institutional context before making policy prescriptions and embarking on any interventions – well intentioned or not.

The challenges facing ACP agriculture, especially smallholder farmers are enormous and farmers will only take advantage of opportunities whether these are new technologies, markets or financing mechanisms that make sense to them. The enabling environment is important – not only markets, but the policies and programmes and the ability of actors to continuously generate or access information, knowledge, technologies and financing and interpret, evaluate and use them to their fullest potential. An important factor is how to develop the learning competence of actors so that they can create or take advantage of opportunities.

In 2008, CTA in collaboration with its partners embarked on the process of identifying indicators for monitoring and evaluating the performance of Agricultural Innovation Systems in ACP countries to respond to questions on how to demonstrate improvements in system performance. We recognize the relevance of the innovation systems approach to agricultural and rural development and advise CoS-SIS to work closely with partners to achieve consensus on key concepts and terminologies. We look forward to continued collaboration.

Janice Jiggins
Wageningen University
The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD)

What is the IAASTD?

The IAASTD was convened as an inter-governmental process. The Executive Summary was adopted line-by-line by 58 governments in Johannesburg, 2008, and the other IAASTD reports approved. China, Brazil, India and the bloc of African government representatives in particular strongly endorsed the main findings and suggested options for decision-makers.

The reports were developed over 4 years by over 400 authors, from all parts of the world, in consultation with many thousands of experts, against rigorous tests of the evidence and two rounds of public peer review.

The IAASTD was conceived as a follow up to the Millennium Ecosystem Assessment, that alerted the world to rapidly deteriorating trends in natural resources and ecosystem functioning, the Millennium Development Goals initiative, world-wide adoption of Agenda 21, a series of UN agency reports on food, nutrition and human health, and the successive reports of the International Panel on Climate Change that drew attention to the causes, trends and risks associated with the gaseous emissions implicated in climate change. Agriculture is both a large contributor to these gaseous emissions (carbon dioxide, but especially nitrous oxide and methane) and a potential contributor to significant mitigation. Unchecked global warming significantly threatens food security.

The IAASTD has two unique features.

- Governance was based on a board comprising a multi-stakeholder membership: governments, United Nations agencies, private sector interests, producer and civil society organisations, and NGOs.
- Knowledge, science and technology were assessed (back 50 years, to draw lessons from the past, forward 50 years to assess need and potential over the coming decades) through a 'screen' that brought together the goals of sustaining productivity, and natural resources and ecosystem functioning in agriculture, while increasing equity and improving the livelihoods of small scale farmers.

This proved a tough assignment, but generated a significantly different understanding of the 'space for innovation' to meet the combined goals, and the need for strong and rapid evolution of Knowledge, Science and Technology – *Business as Usual is Not an Option!*

Over the last year the IAASTD's findings and proposed options have been discussed in depth within the UN system, at G20 meetings, within various sections of the European Union concerned with agricultural research, food security, and development assistance, by the Global Forum on Agricultural Research, by NGOs and civil society meetings, and by national governments.[see further www.agassessment.org; bulk orders of printed versions of all reports (Summary, Synthesis, Global, and five regional reports, as well a sets of Policy Briefs) are available at discount prices from The Island Press www.islandpress.org/iaastd]

IAASTD findings support the orientation of CoS-SIS

The findings that apply in particular to CoS-SIS are the following:

- Agriculture and food security are back on the policy agenda. The belief that markets and private commercial actors could be left to 'meet the challenge' has not survived the test of history, although there is an abundance of food in the world and sufficient science and technological capacity to maintain productivity well into the decades ahead. In particular, the IAASTD notes that as commodity and food markets grow, they become entangled in financial circuits that increase vulnerability, as shown by the food price spikes consequent to the recent and ongoing global financial crisis, and by the links between fossil fuel prices and input prices. It also emphasises the systemic relationship between the evidence that today there are more obese people in the world than hungry, while the numbers who do not grow or have access to sufficient food or food of good quality, or who cannot afford to buy it, continues to increase.
- Small scale farmers are once again appreciated as key actors in relief of rural poverty – where the largest number of poor are to be found – and the resources they command offer significant potential for mitigation of global warming and for productivity increase. Further, the IAASTD notes that throughout the world examples exist of small scale systems that are both highly productive and natural resource conserving, in some cases creating sustainable agro-ecological landscapes over wide geographical areas, of high socio-cultural value. There is much that formal science can learn from

the underlying principles, traditions of knowledge generation, and practices that create and sustain such systems.

- All countries have much to gain from more open trade in agricultural and food products, but 'the playing field is not level', so *free trade* is not necessarily *fair trade*. There is a strong case for temporary, special measures to avoid or mitigate the negative effects of premature opening to global markets. And a strong case for giving more emphasis to development of local, national and regional market relations.
- In order to deal with the challenges of the present and the future, the organisation of small scale farmers and rural entrepreneurs, as well as among civil society actors and consumers, is essential.

But CoS-SIS also needs to note the following:

- What happens in agriculture is no longer driven by the simple relationship expressed as research-extension-farmers, and increasingly not even by the actors in the agricultural sector. The strongly emergent new drivers are:
  - Consumers who are demanding, even in developing countries, quality food, and changing food habits as people move into towns and cities
  - Private retail actors, in particular the five or six globally dominant retail chains but also a handful of strongly growing regional chains based in the South. They are the ones – even more than public regulators – who are setting and enforcing standards, making arrangements for procurement throughout the supply chain, and setting price relations along the value chain.
  - Policy actors concerned with natural resources, ecosystem functioning, zöotic disease, epidemics and human health.

This 'change of scene' offers many possibilities for CoS-SIS.

The IAASTD, looking ahead, also warns of a series of threats to future food security as rainfall and temperature become more volatile, and if pressure on natural resources is not ameliorated by a re-orientation of the agricultural technologies and management practices associated with the worsening trends. Of these, in many countries 'the water challenge' is likely to be the first encountered. But ahead lies the rising price and eventual exhaustion of phosphorous – for which, like water, there is also no known substitute – with supplies confined to a few countries; uncontrollable biological responses to 'global warming' (pests, diseases, etc); sea level rises; biodiversity loss; soil deterioration….Add in the shifts consequent to transition towards a low carbon economy, and the fact that beyond any rise over 2º in global temperature (a level that seems increasingly probable, by round about the middle of this century)

all the five major crops on which global food security depends will begin to lose productivity……..

> *…….and we can say with some certainty that the values, rules, organisational arrangements, actors, technologies and practices of future agriculture and food systems will not be those we know today!!*

A final reflection

Science – and the many new techniques that are emerging in different branches of science – and the knowledge and experience of a wide range of actors, are essential to meeting the challenges and developing the opportunities that lie ahead. But the task facing us all, as we learned through the IAASTD experience, importantly requires acts of courage: intellectual courage, and emotional courage, that builds relations of trust that allow us to imagine that a more dignified and satisfying future for all the world's people is possible and to overcome our fear of what lies ahead. CoS 1 has created a space of trust and courage to dream – and I very much expect and hope that CoS-SIS will continue to strengthen and widen our collaboration within this unique 'space for innovation'.

Theme 2 The innovation systems approach and its relevance

Palm oil in Benin

Why is the innovation systems approach important for African agriculture?

A. A Adekunle
Director NSF4, Partnerships and Strategic Alliances,
Forum for Agricultural Research in Africa, FARA,
2 Gowa Close Roman Ridge, Accra Ghana
e-mail: aadekunle@fara-africa.org

Agriculture is the dominant economic activity in sub Saharan Africa (SSA), employing about 62% of the inhabitants of the region (excluding South Africa). Agriculture also generates 27% of the GDP of these countries. The large gap between the shares of agriculture in employment and GDP suggests that (i) poverty is concentrated in the rural areas where most agricultural activities are carried out, and (ii) as the non-agriculture sectors experience growth, rural poverty also increases.

In spite of the fact that majority of the people of sub-Saharan Africa are engaged in agriculture, its productivity has stagnated for several years. The yield of cereal crops correlates highly with the trend of poverty in several regions. Between 1964 and 2002, the yield of cereals in South Asia increased steadily from about 1.5 tons per hectare to about 2.5 tons per hectare. During the same period, poverty incidence as described by the level of people in the region who lived below the poverty belt of one dollar a day declined from about 50% to 30%. In sub-Saharan Africa however, yield of cereals during this period remained stagnant at around 1ton per hectare and poverty incidence correspondingly remained stagnant at 50%. If the current stagnation of agricultural productivity is not reversed quickly enough, sub-Saharan Africa may end up being the only region that would not be able to achieve the Millennium Development Goal of halving poverty by 50% by the year 2015 (World Bank 2005).

So many reasons have been given for the stagnation of agricultural development in sub-Saharan Africa. In the first place, small farmers who constitute the bulk of the farming populace lack enough access to improved technologies and thus, have low human capacity for innovation to address ecological, market, institutional and policy challenges. There are also poor infrastructural facilities leading to high transaction costs and low competitiveness of products. Farm subsidies that are provided to farmers in industrialized countries also help in creating unfavorable external markets for African farmers. This, coupled with poverty-induced ineffective internal

demand for products has put the farmers at the wrong side of the poverty belt. In addition to these, service provisions at all stages of the commodity chain also suffer debilitating institutional weaknesses. Finally, countries in sub-Saharan Africa have very few policies and regulatory mechanisms that support the participation of local communities and the private sector in decisions on agricultural matters. These technological and institutional weaknesses hinder the chances of countries in sub-Saharan Africa to enter the path of rapid economic development required to bring the farming populace out of poverty.

This situation calls for a dramatic transformation of the agricultural sector through the innovation systems approach. Innovation systems approach holds promises to rapidly revitalize the agricultural sector with achievable impacts at a speed that is high enough to bring about a quick reversal of the poverty trend. An innovation is the capacity to apply new knowledge or to recombine existing knowledge in order to improve productivity and to create new products and processes. For this reason, innovations are considered the engine of productivity, competitiveness and employment growth for stakeholders and for the countries. Edquist (2001) defines innovation system as an interaction of different factors (economic, social, political, organizational, institutional, and other factors) that influence the development, diffusion, and use of innovations.

Traditionally, in SSA, agricultural research and development takes place in a linear version starting with the researcher who delivers the outputs or technologies that are supposed to be picked by the extension services who in turn expect farmers to adopt. In this process, the farmer sells products to the marketers who pass the products to the consumers. This approach presupposes that the researchers are the suppliers of knowledge which farmers must take. Intrinsically, there is a lag between the generation of technologies and their adoption.

Different efforts have been made in the past to improve this linear approach to research and development. But all of them have fallen short of what is required. For instance, with failing extension services in most of SSA, researchers had thought of improving the system by directly engaging with farmers. This modification and others like it including the introduction of gender in ARD and the use of participatory approaches failed to deliver the impact in substantial quantities thereby necessitating the use of more effective approaches.

Innovation systems approach is different. It looks at the value chain and employs an inclusive multi-stakeholder partnership approach to diagnose problems and design solutions that convert technologies and institutional changes to innovations. It brings researchers into partnerships with extension, agents, farmers, input dealers, policy

makers, private sector and end users to catalyze the innovation process. It shortens the traditional lag between the development of technologies and their adoption thereby improving the chances of increasing development impacts. Furthermore, it also holds promises for addressing emerging issues like desertification, land degradation, climate change, biodiversity degradation among others.

Recently, FARA developed the Integrated Agricultural Research for Development (IAR4D) as an example of the innovation systems approach for its partners. This was packaged for the CGIAR as the Sub-Saharan Africa Challenge Program (SSA CP). Following a request by the Science Council of the CGIAR, FARA is currently involved in a widespread experimentation of IAR4D concept in 8 different countries of SSA with the sole aim of proving whether the concept of IAR4D works in SSA or not. Research activities are geared towards answering three central questions aimed at the proof of the concept. These are as follows:

- Does the IAR4D concept work and can it generate deliverable international and regional public goods for the end users?
- Does the IAR4D framework deliver more benefits to end users than conventional approaches (had the conventional R & D and extension approach had access to the same resources)?
- How sustainable and useable is the IAR4D approach outside the test environment (i.e. issues of scaling out for broader impact)?

Research activities in SSA CP are being implemented in three Pilot Learning Sites located in West Africa, East and Central Africa, and Southern Africa. Each Pilot Learning Site has three Task Forces.

Southern Africa (ZMM) based on value chain

1. Expansion of horticulture value chains in irrigated and rainfed systems. [Biodiversity International]
2. Integration of sustainable soil fertility management innovations into staple food value chains in high and low potential systems [SOFECSA/ CIMMYT]
3. Integration of efficient water and high nutrients use innovations in high and low potential cereal grains systems [TSBF-CIAT]

East Africa (Lake Kivu) based on watersheds

4. More food product and better nutrition at reduced cost and minimal degradation of the natural resource base [ISAR]
5. Beneficial conservation and sustainable use of natural resources [Makerere/ ICRISAT]

6. Wealth creation through agro enterprise diversification and improved market access [CIAT]

West Africa (KKM) based on agro-ecology

7. Innovation platforms to improve livelihoods in the Northern Guinea Savanna [IFDC]
8. Sustainable agricultural intensification in the Sudan Savanna zone [IITA]
9. Improving rural livelihoods in the Sahel of Niger [INRAN]

Partners in the SSA CP

FARA has succeeded in mobilizing stakeholders including both the traditional and non-traditional research partners around the experiments going on under the Sub-Saharan Africa Challenge Program. Partners on this program come from the Advanced Research Institutions, National Agricultural Research Systems, Farmers and Traders organizations, The Private Sector including Banks, Non-Governmental and Community Based Organizations, and the International Agricultural Research Centers. Numerically, only about 55% of partners came from research-oriented institutions.

This array of partners are working together, learning together and sharing experiences towards the crystallization of innovation platforms for experiments leading to the proof of the IAR4D concept.

From the maize innovation platform

The levels of poverty and underdevelopment in Africa demands that outcomes and impacts are derived in much larger quantum from research efforts. These benefits must however be observed in different sectors of the commodity chain and by a wide range of actors for them to be sustained. Positive indications of this were obtained in a recent effort in Southwest Nigeria where an innovation platform was set up around the maize commodity chain. In this innovation platform, scientists from the International Institute of Tropical Agriculture and the Bowen University in Nigeria worked with other stakeholders including Adom Feeds Ltd which is a livestock feed-mill located in Ibadan as an example of output markets, Adedigba enterprises located in Ago Are selling inputs, Tractor Hiring Association of Ago Are, Union Bank Nigeria Ltd. (providing credit) and the State Extension Services. Farmers numbering about five thousand (5000) were part of this platform as producers. The research plan was centered on the development of optimal management practices for a new variety of maize which has demonstrated reasonable resistance to maize

streak and downy mildew diseases of maize. Three years after the platform had been established the adoption rate for the new variety of maize and the management practices were almost hundred percent resulting in doubling in yield per hectare and income to farmers. Similarly, other stakeholders including the Bank, Input dealers, Tractor Hiring Agents, also recorded significant increases in sales and income while the end user recorded savings from the lubricated supply chain.

Conclusion

The problems of African agriculture are enormous, with debilitating effects on the continent's wellbeing. The situation requires a holistic solution from the research sector which is traditionally responsible for generating innovations. Current research and development approach emphasizes a linear relationship between stakeholders. This does not show enough response to the problems and if this is not replaced by a more functional system, Africa stands the risk of becoming the only region of the world that will not meet the millennium development goal of halving hunger and poverty by 2015. The need for a replacement of this ineffective approach is more urgent now that the continent is being throbbed by other challenges like climate change, land degradation, etc. Innovation systems approach which is an inclusive multi stakeholder partnership approach shows promises in that it addresses both the technical and institutional challenges in one package. And through its inclusive partnership arrangement expands the input base for the design of agricultural research development agenda thereby promoting chances of adoption. As it promotes chances of adoption of new technologies for increased technical and institutional innovations, it also spins benefits to other stakeholders and to the country. Innovation systems approach has a high potential for the transformation of the agricultural sector in Africa and FARA is actively promoting it.

Reference

Edquist, C. (2001), The systems of innovation approach and innovation policy: an account of the state of the art

Paper presented at *DRUID Conference*, Aalborg, June 12-15.

The innovation systems approach

An international perspective – the Issue of boundaries and scale

Jim Woodhill
Programme Director,
Wageningen International

We live in a world with a higher average income per capita than ever before and we have the technical know how to produce enough food for all. Yet approximately one billion people have an income below 1 US$ per day and many of these are food insecure. At the same time we are confronted with issues of climate change, diminishing natural resources and biodiversity loss which affect rich and poor alike. Food systems have been increasingly globalised with critical implications for issues of quality, safety and sustainability. We are seeing a change in the economic order as countries like China, India and Brazil, which were historically poor, are now playing an increasingly significant role in the global economy and political arena. These countries are also very large producers of agricultural commodities.

It has been recognised that achieving of the Millennium Development Goals is intimately linked with agriculture and rural development. It has become clear that agriculture is key to more evenly distributed economic growth and poverty reduction and that developing economies depend on a sustainable growth of agricultural productivity and trade. Diversification in the rural economy and strengthening of institutions and markets are critical. Further, climate change, natural resources and biodiversity issues are highly connected with agriculture.

Consequently, after an extended period of declining attention, the importance of agriculture, agricultural markets and rural development for economic development and poverty alleviation has re-emerged. Recognition of the complexity of agricultural development along with the limitations of past government driven models of linear-technology transfer has also given rise to a new focus on innovation systems.

The above-mentioned development issues present knowledge institutions with significant challenges, responsibilities and opportunities. Society-wide learning and dialogue processes, informed and supported by rigorous scientific understanding

and analysis are key to the collective action, profound changes and management of conflict that will be required. Important is not just the knowledge researchers and experts have about issues but the shared understanding that exists across actors in government, business and civil society, since this creates willingness and capacity for change. It is also now widely acknowledged, that process of scientific research and technological development are also significantly enhanced by effective engagement with 'end users' throughout the research process.

An innovation system is a "network of individuals, organisations, and enterprises that brings new processes, products and organisational forms into economic use along with the institutions and policies that affect the systems' behaviour and performance..... The innovation systems concept embraces not only the science suppliers but the totality of the interactions of actors involved in innovation" (World Bank).

Innovation systems involve different actors working and learning together in various forms of multi-stakeholder, dialogue and learning alliance processes. To be effective, these processes require good knowledge and research support, effective brokering and facilitation and capacity development of the individuals and organisations involved. There also remains much to be learned about how to enable and support such processes in different contexts and around different thematic issues.

Particularly in countries with developing and transitional economies, where a reinvigoration of agricultural driven development is seen as critical, much of the traditional agriculture extension system has collapsed or become obsolete. At the same time they are faced with rapid changes in the structure and dynamics of agri-food systems at global and local levels. There are clear calls for rapid technological and institutional innovation to underpin a greater focus on agriculture for development. However, both multi-lateral agencies and national governments are struggling to develop research and innovation systems appropriate to challenges of pro-poor growth, food security, sustainable resources use and adaptation to climate change.

At the heart of many development issues, are institutional challenges such as the development and implementation of laws and regulations, the functioning of market mechanism, institutional arrangements between public and private entities, overcoming cultural divides and enhancing systems of public service delivery and governance. Responding to these challenges will require much scientific work and rapid technological innovation. However, the successful introduction and adaptation of these innovations, will largely depend on the extent to which technological and institutional innovation are accepted and can be integrated.

These issues imply the need for a closer 'learning relationship' between knowledge institutions, transition managers, and 'end-users'. The uncertainty and rapid pace of change around many issues demands new linkages and learning processes between research, policy and practice. For this to work, a better understanding of the functioning of innovation systems is required. Open 'innovation spaces' are needed where learning by doing 'experiments' can be developed to support adaptation and innovation. There is a need to focus on both the quality of the human and political processes and on the quality of scientific and technological content.

The innovation system concept also has important implications for the structuring and support of research activities. The global nature of many sustainable development issues requires strong linkages between Northern and Southern institutions and ensuring a strong Southern research capacity.

There is a great need for interdisciplinary research that responds directly to the needs of knowledge users. It is also essential to maintain an independent and critical role of academic research.

Capacity development is also an important aspect of developing effective innovation systems. The pace of change and complexity of issues demands that individuals and organisations need to be constantly and rapidly updating and improving their capacities. There is a vast need for focused, need driven and inter-disciplinary capacity development that complements traditional forms of graduate and post-graduate education. Such capacity development goes beyond 'training' to involve longer term processes of engagement, on-the-job facilitated learning and the support of various forms of cross-organisation and cross disciplinary learning alliances.

As illustrated in the diagram below (see figure 1), the innovation system perspective opens up the opportunity for knowledge institutions to strengthen and broaden a set of functions that lie beyond research. Alongside the traditional functions of research and education is the function of supporting learning and innovation processes amongst networks of stakeholders.

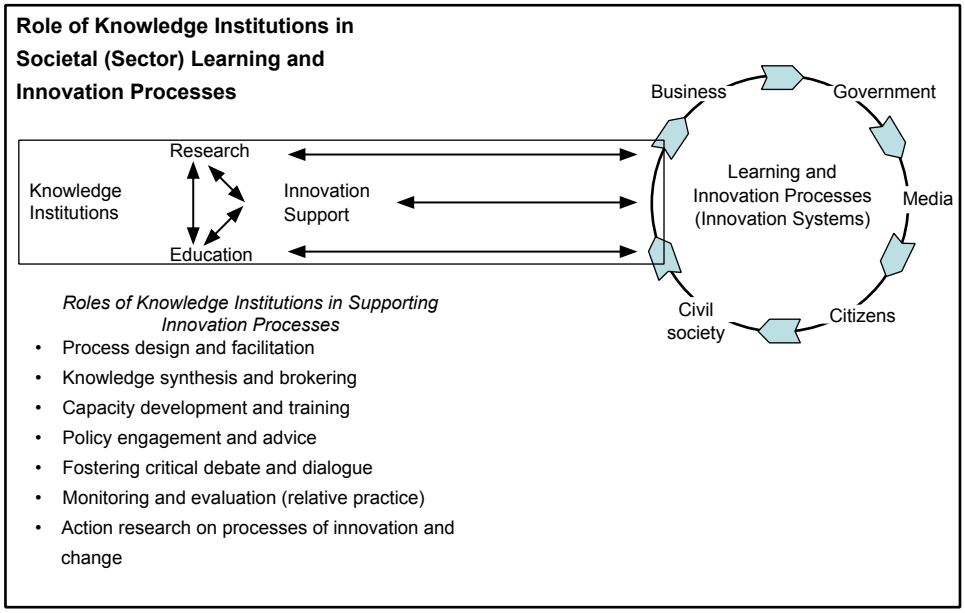


Figure 1. The role of knowledge systems in societal learning and innovation processes

Why are we investing in innovation systems through CoS-SIS innovating a niche in Dutch Development Cooperation?

Wenny Ho
Research and Communication Division (DCO/OC)
Ministry of Foreign Affairs
Amsterdam, The Netherlands

The Dutch Ministry of Foreign Affairs houses two Ministers[1] one of whom is the Minister for Development Cooperation. The current policy priorities for Development Cooperation are:

- Security and development
- (Economic) Growth and equity
- Rights & opportunities for women and girls (education, health care, violence)
- Sustainability, climate and energy

The Ministry consists of various departments one of which is the department of Cultural Cooperation, Education and Research. The Research and Communication Division (DCO/OC) is one of its two divisions, the other being Education (DCO/OO)[2]. Rather than being delimited by geography or theme, thanks to recently introduced changes, the realm of DCO/OC is defined by its goal of strengthening capacities to learn and innovate. It has at its heart the Research and Innovation programme.

Three main lessons underlie changes in orientation of the division. Firstly, there is a growing recognition within the Ministry (and in the wider development cooperation sector), that development is a knowledge-intensive sector: knowledge should be harnessed in order to enhance the impact and effectiveness of development interventions. This has been especially emphasized by the current Minister for Development Cooperation. Secondly, while donor agencies funding development research have generally engaged with academic researchers, there is a move away from thinking about knowledge generation in linear terms in which researchers play a central role towards multi-dimensional models in which researchers figure as one of the sources of knowledge creation. This relates to a third lesson regarding the

[1]And the secretary of state for European affairs
[2]This organisational set-up is to be restructured in the coming months. The two divisions are to be merged into the division of Education and Research within a newly to be established department of Social Development.

centrality of demand-articulation and user involvement, ensuing in a shift in attention from research to processes of innovation.

Concepts and principles derived from the stream of literature on Knowledge and Innovation Systems have guided the re-orientation of DCO/OC's work. To narrow down the rather broad and abstract concept of a knowledge and innovation system, certain criteria and delimitations were evolved for the programme, also to guide the priority-setting and grant-making processes. Briefly, these can be stated as:

- It is to focus on innovation as a capacity and agency, that is capacity building should not be a stand-alone approach;
- In the end, all efforts should contribute to poverty-alleviation;
- It is focused on knowledge and innovation systems in the South;
- It supports a user-driven approach in which processes of demand-articulation play a central role;
- Researchers are seen as one of various potentially strategic stakeholders and contributors to processes of knowledge generation and articulation. Hence, programmes supported have a multi-stakeholder set-up, strengthening capacities of individual persons or organisations being the area of the sister Education division (DCO/OO);
- In general, a multi-level approach is followed, with an emphasis on the macro- and meso-level.

Two further sets of delimitations concern the What and the How of Knowledge and innovation systems supported by DCO/OC. Regarding the first, within the policy priorities set for Development Cooperation, attention will be given specially to strengthening KIS in the areas of health, science and technology, agricultural research for development, and governance for development. Within the Ministry, maintaining an active and constant dialogue with the thematic and geographic divisions and relevant embassies is to enhance complementarities and synergy in policy-making. At the same time, DCO/OC's involvement in policy-making and agenda-setting platforms in the prioritised areas which can be considered strategic from a global perspective will be further strengthened.

Regarding the How of KIS, a three-prong approach is envisioned revolving around enhancing capacities to generate and articulate knowledge; building and strengthening flows, linkages and interactions between actors located at various levels; and the enhancement of an enabling environment for learning and innovation, among others, in terms of policy-frameworks such as intellectual property rights, access to genetic resources, and ethical and (bio) safety issues.

Ideally, supported initiatives and programmes not only address several levels simultaneously, but strengthen the linkages between levels as well. A programme can thus contribute to capacity building of stakeholders at national and regional levels to understand emerging trends and put in place mechanisms to articulate interests, facilitate and embed interactions between stakeholders in a national platform or regional steering committee to address related challenges in national, regional or international spaces.

At the same time, the hope is that supported initiatives also contribute to advancing understanding of DCO/OC and the Ministry in general regarding the functioning and performance of knowledge and innovation systems.

This is a genuine interest and concern: as Knowledge and Innovation Systems are messy, driven by complex emerging processes with intricate dynamics, in which a multitude of actors play not always well-understood roles, the BIG question is "Where do we invest?". The research fund is rather small and staff capacity of DCO/OC is very limited, so how to identify and judge effectiveness of leverages, who are potential catalysts?

CoS-SIS is one the programmes supported by DCO/OC. In a way, it is an example of how the different concepts, criteria and delimitations come together in one initiative. Nevertheless, some specific hopes have been vested in CoS-SIS, two of which are spelled out here:

- Firstly, and related to the interest to strengthen policy-making: that CoS-SIS provides convincing evidence beyond anecdotes regarding the usefulness of 'alternative' as against linear approaches. Linear is here taken both in terms of designing and evaluating development interventions (e.g. logframes) and as a way of perceiving development (more technology leads to more agricultural productivity);
- Secondly, and related to the need to broaden the body of knowledge on innovation systems: that CoS-SIS deepens understanding regarding performance and dynamics of KIS in an African context; and generates indicators, criteria or any other way of judging success and effectiveness of open-ended multi-stakeholder approaches.

Theme 3 Opportunities identified in domains by Research Associates

Women participation in field experimentation, Mali

Zooming in on opportunities for small-scale farmers: the exploratory approach to CoS-SIS

Arnold van Huis
Wageningen University,
Wageningen, The Netherlands
e-mail: arnold.vanhuis@wur.nl

Context

The Zambian lady economist Dambisa Moyo (2009) depicts a worrying situation for Africa. Half of the 700 million people live on less than one dollar a day. The average income is lower than in 1960. Fifty percent of the world's poor live in Africa. The life expectancy is 50 years and one in seven children die before they are five years old. Fifty percent of the countries in Africa have a non-democratic rule. The bad governance situation has also been mentioned by Collier (2007), Meredith (2005) and Calderisi (2006). The Ghanaian Ayiteh (2005) pointed to the absence of independent institutions (banks, judiciary system, free press), and mentions the possibilities for indigenous development. Moyo (2009), and also Calderisi (2006), point the ineffectiveness of development aid and Moyo even states that the 50 US$ trillion given by donors in the last 50 years only impoverished Africa and fuelled corruption.

So how best can frameworks be created to offer the required opportunities for rural development, especially for rural poor small holder farmers?

Farmers limited windows of opportunities

CoS works in countries where democracy wins from patrimonial networks. However, should the rural poor be strengthened or should we focus on the public sector in creating the necessary framework conditions and opportunities? Strengthening the countervailing power of farmers and women organizations is essential as they will be conditional to sustainable development. Farmers have little control over commodity prices, e.g. input providers in Benin refused to provide specific pesticides that would allow need-based spraying instead of calendar spraying. Marketing Boards in Ghana establish the percentage free on board price for farmers, however farmers' input is marginal. Imported subsidized feed stuff often undercuts local farmers' enterprises. Therefore, the Innovation System approach needs to go beyond the farm

enterprise and strengthen coalitions of institutional actors across multiple scales. That is different from approaches taken in the past, that either focused on transfer of technology, or providing appropriate inputs (Farming Systems Research) and on farmer participatory approaches (see table 1).

Table 1. Changing approaches in agricultural research and development.

	Transfer of Technology	**Farming Systems Research**	**Farmer Participatory Research**	**Innovation systems**
Scope	Productivity	Input-output	Farm-based	Beyond farm gate
Changes	Farmer behaviour	Scientist's knowledge	Scientist-farmer relationship	Opening space for innovation
Institutions and politics	Technology transfer independent	Ignored	Acknowledged	Central dimension of change
Innovators	Scientists	Scientists adapt packages	Farmers and scientists	Multiple actors

Source: Scoones and Thompson (2009).

Lessons from the first phase of the Convergence of Sciences programme, CoS1, are that farmers are innovative but constrained, and those constraints are very often beyond the farm gate. This requires systematic exploration of the context: which are the key actors (public and private sector), their attitudes and practices, their patterns of interactions, and the enabling environment (policies and infrastructure)? Examples of institutional innovation could be: meeting quality standards of international markets, collective bargaining of farmers' organizations, linking farmers and processors, food crop becoming industrial (cassava), or new crops such as flowers.

Some people indicate that our policy is doomed to fail as we are challenging mainstream science and policy, and vested interests. Would it be possible to change entrenched bureaucratic structures, educational systems, and political processes? Or can we create a learning environment such that there will be a win-win situation for everybody? This remains a major challenge for CoS-SIS.

Domains of CoS-SIS

CoS-SIS plans to study the nexus between institutional and technological development. For that reason we need to know whether institutions constrain technological development and which kind of technologies would fit institutional frameworks. This requires scoping the landscape to see where opportunities are for institutional experimentation. The first zooming in was done in 2006 by national commissions consisting of the most important people in the R&D organizations in the countries, using criteria such as national priorities (PRSPs), food security, geographic coverage, cash crops or food crops systems, potential for effective and dynamic partnerships, regional cooperation, possibilities of multi-stakeholder participation, etc. (Table 2).

Table 2. Domains chosen by responsible R&D officers in each country in 2006.

Country	Domains
Benin	1. Cotton 2. Oil palm production 3. Water management
Ghana	1. Cocoa 2. Food security (cowpea, millet/sorghum, livestock) 3. Oil palm production
Mali	1. Agricultural surface water management 2. Non-woody forest products: shea nut/karité 3. Integrated livestock/ fodder management

Exploratory studies

In the first half year of the CoS-SIS programme in 2009, exploratory studies were carried out in these domains and the potential for innovation was systematically appraised across multiple levels at different scales (local, district, regional, national and international). The Research Associates established a roadmap for those exploratory studies during workshops in Cotonou (October 2008), Bamako (February 2009) and Accra (April 2009) and the following roadmap for the exploratory studies was established:

1. Defining parameters/boundaries; pre-selection location
2. a. Poverty analysis as a context to identifying opportunities (food security)
   b. Identify relevant value chains (commodities)

3. Analysis of information generated
4. In depth studies
5. National workshops
6. Prepare manuscripts and PowerPoint presentation for the 1st international CoS-SIS conference in Elmina Ghana.

The results of those studies (Table 3) are reported in greater detail in the following section of these proceedings.

Table 3. The exploratory studies: domains covered by research associates

Domain	Country	Research Associate
Oil Palm	Benin	Dr Pierre VISSOH (UAC)
	Ghana	Dr Samuel ADJEI-NSIAH (UOG Research Institute
Livestock	Mali	Dr Bara OUOLOGUEM (IER)
Shea butter	Mali	Dr Fadiala DEMBELE (IPR/IFRA)
Food Security	Ghana	Dr Emmanuel DORMON and Dr Samuel ADJEI-NSIAH (taken over by Kofi DEBRAH, PLAN GHANA)
Water Management	Mali	Dr Soumano LASSINE (IPR/IFRA)
	Benin	Dr Aliou SAÏDOU (UAC)
Cotton	Benin	Dr. Elisabeth ZANNOU (UAC)
Cocoa	Ghana	Dr Emmanuel DORMON (Independent consultant)

References

Ayitteh, G.B.N., 2005. Africa unchained: the blueprint for Africa's future. *Palgrave MacMillan, New York.*

Calderisi, R., 2006. The trouble with Africa: Why Foreign Aid isn't Working.

Yale University Press New Haven and London pp249.

Collier, P. 2007. The bottom billion: why the poorest countries are failing and what can be done about it. *Oxford University Press*.

Meredith, M., 2005. The fate of Africa: history of fifty years of independence. *Public Affairs, New York.*

Moyo, D., 2009. Dead Aid: why aid is not working and how there is another way for Africa. *Penguin Books, London*.

Scoones, I and Thompson, J (2009) Farmer First Revisited: Innovation for Agricultural Research and Development. *ITDG Publishing, Oxford*.

World Bank, 2006. Enhancing Agricultural Innovation: How to Go Beyond the Strengthening of Research Systems. Agriculture and Rural Development. *The World Bank, Washington.*

Research reports by Research Associates

BENIN

Cotton in Benin

Identification of opportunities for action-research for more efficient management of the cotton sector in Benin

Elisabeth T. Zannou and Dansou Kossou
Département de Production Végétale; Faculté des Sciences Agronomiques, Université d'Abomey Calavi; 01 BP 526, Cotonou, Bénin
e-mail: ezannou2@yahoo.fr ; kossoudansou@yahoo.com

Introduced in Benin since 1946 by the French Company for Textile Development (CFDT), cotton is currently cultivated in 53 communities covering two cotton zones, one considered as marginal (Mono Department) and the other as intensive (Zou, Borgou and Alibori Departments).

For 50 years, this agricultural industry has remained the back bone of Beninese economy and a major labour source. Several actors are involved in the management of the cotton chain starting from the producer to the consumer. But negative fluctuations often recorded in the system led to liberalization of this sector. Nowadays it is being managed by an inter-professional network (AIC[1]). Despite all the measures taken to improve the cotton chain by the state and the AICs, drastic decreases of cotton productivity are recorded, although the industry is still the country's strategic tool for poverty reduction.

The CoS-SIS Programme, in its action research and development objective, conducted technographic studies with a view to identifying constraints and opportunities that may be factors to be tackled for a better improvement of the sector. The results of this investigation are described and elaborated on the value chain of cotton in Benin.

[1]Association Interprofessionnelle du Coton

Questions and Comments

Chris Gordon

a- Cotton is a very high water demanding crop which needs to be factored into analysis

b- Salination of soils can be a major issue

Emmanuel Owusu-Bennoah

Cotton cultivation is faced with several challenges such as expensive inputs and low cotton prices. Would it not be advisable to consider the cultivation of Bt cotton? This would reduce the human and environmental effect on cotton farmers and the environment.

Emmanuel A. Odame

Judging the fact that the cotton industry is plagued with numerous constraints, political, environmental degradation and contamination coupled with cooperation of farmers groups.

Would it not be possible to shift emphasis to another crop which will enhance the livelihoods of the people and bring the actors together?

Afia Appiah

Please reflect the child labour issue in your value chain to show what actors are doing what, when, where and how.

Anthony Youdeowei

I am pleased to see the component of indigenous knowledge and alternatives to the use of pesticides for cotton production. How would this opportunity intervention play in the context of the political influence of pesticides use in cotton production with the associated risks to human health and the environment?

What is the role/position/opportunities for organic cotton production, which is rapidly becoming important?

Gualbert Gbèhounou

One of the major problems of the value chain is that it is under the influence of price squeeze in the international markets while Benin and the other countries in the region export 98% of their production. That is why the producers would gain from investing in collective efforts to add value to the crop (and make their product competitive in the world market). CoS-SIS should therefore invest in research to support collective value adding of cotton.

Oil palm in Benin

Exploratory scoping phase of CoS-SIS: case of oil palm production systems, Benin

P. V. Vissoh and Dansou Kossou
Faculté des Sciences Agronomiques
d'Abomey-Calavi, Benin
Corresponding author (e-mail:pierrevissoh@yahoo.fr)

Introduction

Historically, the oil palm tree was first introduced into the kingdom of Daxomè during the pre-colonial era by King Ghézo (1818-1858). It produced palm oil, palm wine for alcohol and fodder for home consumption and trading. Oil palm provided 80% of Benin total exports, which contributed 10% of the world palm oil export and Benin is recorded as the first African palm oil exporter.

The colonial government established a research centre at Pobè (1922) to develop improved Tenera varieties to replace the wild groves (Dura variety). From the colonial era to the first decades after independence, the development plans devoted substantial funding for the expansion oil palm holdings through the establishment of various state societies.

Land was declared a public utility and farmers were organised in cooperatives. Processing factories were established close to the plantations, and soap factories were also installed in Porto-Novo and a multi-functional oil mill in Cotonou.

With the liberalization of the national economy, there was a drastic decline in crop yields and exports after devolution to the cooperatives squeezed Benin out the international oil palm market. The major reasons for the decline of the Benin oil palm sector include: climate change, price fluctuation, severe competition from other producing countries, lack of labour and indiscriminate felling of trees for alcohol production (Sodabi), low prices paid by the mills to farmers, dissatisfaction of expropriated land owners and lack of capacity of members to manage the cooperatives. Other reasons are the political and economic centralism of the Marxism Leninism of the 70s and 80s, traditional production and processing technologies and lack of financial resources.

The liberalization of the economy through Structural Adjustment and the devaluation of the CFA franc during the democratic era led to a new government initiative to revitalize the oil palm sector through an agricultural diversification programme declared by the national rural sector's Round Table to meet local demands and explore regional markets.

The CoS-SIS Programme

The CoS-SIS programme has identified oil palm production systems, as one of the domains to strengthen innovation to reduce rural poverty in Benin. The main objective of this study was to explore potential opportunities and the main constraints of oil palm production systems to innovation. Specific objectives include: better understanding of the past in order to identify opportunities for innovation; clarify broad constraints, as well as relevant actors and their interaction; analyse interaction in networks to make appropriate choices.

The exploratory study was carried out in the southern departments where the oil palm grows. The oil palm value chain was studied. Actors involved in production systems were identified and their relationships analysed. Opportunities were identified in the context of poverty reduction. Data were collected using a Participatory Rural Appraisal approach with a combination of methods comprising: archival research, literature review, collaboration with ongoing research group (SNV), structured, semi-structured, informal, individual and focus group discussions with key informants, farmers' organizations and cooperatives leaders, researchers, extensionists, national and international organizations, input dealers, processing equipment producers, individual woman and women processing groups and men group meetings. Field visits and SWOT analysis were conducted for triangulation and for better understanding of the multi-functionality of oil palm.

Findings

The findings revealed that oil palm contributes to poverty reduction. Different parts of a palm tree and the different by-products are useful. More than 80 products and by-products are marketed locally, providing employment and revenue to people in rural areas. There is a real political will from the state, the donors and farmers, to revitalize the oil palm industry.

There are three different types of production systems for oil palm production, namely: smallholder agro-forestry planting (Dura variety: the largest but unknown hectarage); private/smallholder, medium and larger plantings of improved Tenera

variety and Government cooperation plantations (11 000 ha). The conducive conditions comprise: demand for palm oil and palm kernel either in Benin or in the neighbouring countries is not being met**.** Research has developed high yielding, drought, disease and pest tolerant varieties for distribution to farms. Emphasis is now being placed on private holdings with processing equipment.

Solving the technical, administrative, financial, and management problems and the political crisis in the cooperatives could increase production. Farmers adapt their production systems to rainfall and land constraints by developing coping strategies. However, revitalization of oil palm cultivation is constrained by technical, socio-economic and organizational problems, such as low rainfall, which averages 1200 mm with a 5-months drought a year. Other constraints include: diseases such as vascular wilts caused by the fungus *Fusarium* and insect pests (e.g., leaf miners, unavailability of fertilizers, which are expensive, costly seedlings, lack of labour, low mechanization resulting in low productivity and low return. The organizational constraints include: insufficient political will to financially support the oil palm sector, and lack of integration of the value chain. The socioeconomic limiting factors are: piracy of oil palm seedlings and the stealing of oil palm fruit bunches.

The importation of foreign oils sometimes results in selling locally produced oil at a loss. There is acute land shortage in the South-West (Mono/Couffo department) and land insecurity in the state cooperatives, lack of financial support and chaotic management by councils of the cooperatives.

Questions and Comments

Chris Gordon
Why is palm oil produced in Africa not consumed in the US? Is oil palm produced for bio-fuel?

Dr. Babakar Ndao
1. Can price policy influence oil palm production?
2. What are the different government policies that are implemented to promote the oil palm sector since independence? There is a need to create wealth and struggle against poverty
3. Can technology bring price fluctuation under control?

Water management in Benin

Exploring opportunities for enhancing land productivity by smallholder farmers through water management

Saïdou Aliou and Kossou Dansou
University of Abomey-Calavi, 01 BP 526 RP
Cotonou, Benin
email: saidoualiou@gmail.com

Introduction

Despite the availability of a diversity of water resources, agriculture in Benin is mainly rainfed. About 3% of the cultivated land is irrigated. Water management ensures continuous production during the whole year; it generates local employment and contributes to the improvement of the livelihoods of the local population through the development of off-season agriculture.

Hydro-agricultural management did not achieve much success. For example, in order to enhance food security, from 1960s, the Benin government started developing large-scale water management projects with the assistance of Taiwan. The main objective was to develop and promote rice production in order to reduce imports from Asian countries. Most of these projects failed because of technical and organisational problems. Then, with the UNDP/FAO Project BEN/84/012, Benin experimented with small-scale water managements in the inland valleys for rice and vegetable production. This also did not succeed due to socio-economic, financial and organisational problems. There were also regional experiences by the West Africa Rice Development Association, WARDA, through the Inland Valley Consortium (IVC), which focused on the development of technologies to improve crop production in inland valleys.

Experiences in water management in Benin started with large-scale infrastructures developed in the different river basins with the assistance of foreign technical cooperation (especially from the Chinese). These were based on gravitational pull irrigation system. Small-scale water management systems in the inland valleys (*bas-fonds*) started with the UNDP/FAO project during the period of 1980-1987 after the failure of the larger scale water management systems. From 2007 to date, the

government invests large sums in water management programmes, which aim to ensure food security through development of off-season production.

The CoS-SIS study

The recent food crisis with the consequence of food shortage has affected Benin smallholder farmers' sources of income. Efforts are now being put into the management of both river basins and inland valleys in order to enhance off-season cropping with a new vision taking into account past experiences. In this context, how could such a political initiative become sustainable in order to enhance food security and ensure improved livelihoods for smallholder farmers? What are the various institutional constraints that need to be tackled to ensure that farmers have faith in the opportunities created?

The CoS-SIS study aims to identify opportunities for sustainable land production through integrated water management in Benin. Specifically, it aims to: (i) identify opportunities offered to smallholder farmers by different water management programs, (ii) analyse the durability of political initiatives regarding the opportunities offered to smallholder farmers, (iii) suggest types of farmer-based organizations (FBO) needed to capture markets, and (iv) study the institutional constraints that may hinder smallholder farmers from taking advantage of available opportunities.

The study was carried out in two phases: an exploratory survey (from January to March 2009) and an in-depth survey (from April to June 2009). Six regions where some water management programs are going on were selected: Malanville (Niger and Sota rivers basins), N'dali (inland valley), Covè and Zagnanado (Ouémé and Zou river basins and inland valleys), Dogbo and Aplahoué (Mono and Couffo river basins and inland valleys). These areas were selected in close collaboration with the various actors who are active in water management. Field and participant observations, focused group discussions, non-standardized and largely unstructured interviews with individual farmers, farmer organizations and key informants were used in data collection. Type of data collected concern the history (main events) of water management, types of water management and actors involved, constraints faced in crop production and local solutions and potential opportunities.

Results

Four types of water management systems were observed in the areas studied, (i) the indigenous practices consisting of building high and large mounds for planting yams and rice between them, (ii) a second indigenous system with partial water control used by gardeners working in the inland valleys for off-season vegetable production, (iii) full water control systems by farmers in the river basins, (iv) stationary micro tube well systems locally called "*puits tubés*", used only in the Niger river valley area.

Two full water control systems exist: (i) large-scale water management system with barrage (on the river), irrigation canals distributing water to individual rice plots through gravitational flow, and (ii) a system entirely based on gravitational pull using water flow. A by-pass is constructed at the arrival of the perimeter, then water is distributed to the main canals serving production zones. Irrigation organisation, land access, purchasing of the fuel, and even marketing of the rice are organized by the farmer organizations. The sites of the large-scale water management systems faced several technical problems especially irrigation canals crumbling and lowering of the water level in the barrage (Mono river) due to inter-annual climate variability (climate change effect). The partial water control systems occurred mostly in the inland valleys where they are known as micro irrigation systems. Two types were observed, a well-managed one and a traditional one. The well-managed system consisted of wells constructed with cement, equipped with motor-pumps and tower stocking water pumped from the well which is used to water the fields through PVC hosepipes. Such infrastructures are provided to farmers by some international NGOs. The second type of partial water control system consists of traditional wells built by farmers in their field. These wells are frequently crumbled and face water shortage in the dry season. Both systems are used only for vegetable production.

The most important stakeholders playing roles in water management systems are: smallholder farmers, groups of farmers, unions of farmers' organizations, the Chinese cooperation mission, the national extension service CeCPA (*Centre Communal pour la Promotion Agricole*), mechanics and tractor drivers, PUASA (*Programme d'Urgence d'Appui à la Sécurité Alimentaire*) project and NGOs. Meanwhile processors, private entrepreneurs (traders, local input sellers and spare parts suppliers), local authorities (involved in conflict management), research institution and WARDA (West Africa Rice Development Association), SONAPRA (*Société Nationale pour la Promotion des Produits Agricoles*), ONASA (*Office National d'Appui à la Sécurité Alimentaire*) have indirect roles.

Three categories of constraints were mentioned: (i) constraints related to the production system (lack of input, pest attack, weed infestation, lack of agricultural equipment, and crop destruction by herders' animals), (ii) constraints related to water management (degradation of the irrigation canals, uncertain irrigation water quality and inter-annual climate variability), and (iii) constraints related to market outlets and working capital (credit).

Opportunities that exist in relation to the constraints identified include the following:

1. Presence of dynamic and functional farmer organizations,
2. The interdependence of the smallholder farmers working in the different sites (as they use the same natural resource) leading to a moral obligation of maintaining the sub-canals serving their plots,
3. The existence of private entrepreneurs involved in the trading of the inputs, the existence of agricultural mechanization project,
4. Quality of the local rice well appreciated by consumers, the development of micro-finance institutions,
5. The existence of integrated crop management technological packages developed by research,
6. Local and traditional authorities solving conflicts and production diversification through the development of fish culture in ponds.

Developing collective action and facilitating learning processes with stakeholders are needed to empower existing farmer organizations to capture these opportunities.

Questions and Comments

David Perce

Irrigated land is usually only available to some of the farmers in a community. In this situation of evident injustice, how can a multi-actor platforms work?

Chris Gordon

Has the extraction of water from shallow wells impacted on ecosystem function downstream?

There is a need to include the Volta Basin Authority as part of the key institutions

Amadou Sidibé

In our countries, the accent is placed on management of (subterranean or surface) water sources that already exist. Why not involve local actors in developing reservoirs to collect rainwater, that is normally lost, for use in the dry season?

Thom Kuyper

There is a large role for Chinese cooperation, also in the rice value chain. To what extent is improved irrigation promoting China's food security rather than that in Benin? Do all exports go to China?

Rock Mongbo

1) The low rate of repayment of credit that has been provided to producers is not the fault of the producers but also of the way the credit is provided. The solutions is therefore not only to engage producers in credit management training

2) Political will can not be elicited on the basis of some research. It is necessary to see how that political will can effectively be made to work.

3) In the large hydro-agricultural schemes, the equipment is of Chinese origin and spare parts difficult to get. Do Beninese organisations for technical training invest in mastery of that equipment so that spare parts can be produced locally?

MALI

Integrated livestock/fodder production systems in Mali

Integration of agriculture and livestock farming in Mali: a need to reduce poverty in rural areas

Bara Ouologuem[1] and Mamoudou Traoré[2]
[1]Institut d'Economie Rurale (IER),
Station de Recherche Agronomique de Sotuba, BP 262
e-mail: ouologuembara@yahoo.fr
[2]Institut Polytechnique Rural de Formation et de Recherche Appliquée (IPR/IFRA) de Katibougou, Mali

Introduction

Crop and livestock farming are the main sub-sectors of the Malian rural sector, employing more than 80% of the population. These two sub-sectors, which should naturally be complementary, are at the moment highly competitive in terms of space. When there is successful complementarity, a harmonious and sustainable development of the whole sector will be assured.

Pioneers of this search for complementarity have defined their integration: contributions from livestock farming to crop production comprise organic fertilizer, and power for transport and traction, while those from crop to livestock production comprise fodder production. Despite long years of research and popularization, this approach has not fully been implemented in the agricultural development programmes in the country.

This is why the new concept called "Innovation system" deserves to be tested. It involves several actors (private sector, producers, traders, administrators, technical services, research, etc.) who are interested in innovation and permanent growth of the field of activity by stressing the results of the technology, the generation and the adoption of knowledge, rather than strengthening the research system and its results. The present work, which is to take place in several stages, is conducted within this framework.

Background

Sub-sectors of crop and livestock farming in Mali have evolved differently, depending on whether one considers the South or the drier Sahelian parts of the country. In the South, these activities were well separated and products. But during their evolution they started to converge. This evolution, first observed in the fifties (Curasson, 1948a 1948b), has now generated considerable interest as shown by many studies (Kébé 1993, Landais and Lhoste 1990, Bosma 1996, Djouara and al. 2006, etc.).

We increasingly observe a strengthening of interrelations. Actually, from the Sahel to the Sudano-Guinean zone, agricultural and livestock areas increasingly overlap caused by rapid colonization of the northern areas by crop farmers, the continuous advance of migrant herds in the South, and the increase in livestock due to the acquisition of animals by arable farmers. The effects of these developments are accelerated by ongoing changes in socio-economic and environmental conditions in most agro-pastoral systems, characterized by high population growth (3.1% /year), reduction in cultivated areas per inhabitant, and environmental degradation (Kanté 2001, Doumbia 2006, Djouara *et al.* 2006). This growth results in various forms of increasingly strong pressure on land: 1) spatial expansion of towns and villages, 2) increased expansion of crop areas to meet vital needs in basic food, particularly cereals, and 3) reduction in soil fertility and therefore of crop yields. That is why research and development are challenged to find a new development system adapted to the present situation of these sub-sectors. The integration planned must generate livestock income through sale of milk and/or meat and arable income (cereals, by-products, fodder crops) so as to ensure sustainability of the system.

Methodology

The study started with a literature review, which made it possible to know the extent to which the subject has been dealt with by investigators. Based on information obtained, the study area of the new project was selected by using selection criteria with a coefficient and a five-point rating. The score obtained was then multiplied by coefficients. The area with the highest total scores multiplied by the coefficient was selected as the study area.

In the selected area, eleven criteria, including accessibility, presence of population strata with very low income, and the need for integration, were used to select sites for project introduction. Later, value chains, actors, and main constraints and opportunities were successively identified.

Results

Since the 1950s, scientists and development partners have appreciated the need to integrate crop and livestock farming. The subject was tackled from the angle of the introduction of animal-drawn cultivation in agriculture. However, in the last few years very little attention was paid to herd productivity in the country's cotton growing areas.

The *Office du Niger* zone was selected as an area where the relevance of the question under study was more visible and clearer than in the cotton area. Following the CoS–SIS national workshop held at Ségou, 6 communes in that area of the *Office du Niger* were selected, including three in the *cercle of Niono* (Kalasigida and Mariko Yeredon Sagnona) and three in Macina (Macina, Kokry and Bokiwèrè).

Five value chains were identified in the selected communes; fattening, raw milk, cereal, fish, and livestock feed. However, the first three, which are interdependent, are the most important. The major or direct actors of these chains are: input providers, producers, the traders' guild, processors and consumers. The indirect actors are decision-makers (administration and local councilors, professional organizations, non-governmental organizations, extension and research services).

The chain constraints are many and very varied but can be classified into two groups: those, which are specific to the direct actors and those which relate to the indirect actors and described as institutional. The most important constraints of the direct actors are their poor organization, the lack of training, the inadequate adoption of technologies generated by research and lack of consultation among direct and indirect actors. Inadequate management, difficult access to credit, lack of developed land per farm are the institutional constraints for the indirect actors. The three important chains (meat, milk and cereals) can all be entry points for the CoS-SIS programme, but the milk chain has more opportunities for crop–livestock integration because of its existing favourable conditions. In the milk chain, the entry point is food and farm manure production. The main favourable conditions are the government's political support, funding of the national strategy to promote local raw milk production, creation of a Ministry responsible for the integrated development of the Office du Niger area, high demand for milk and existence of a dairy for the conservation and processing of local milk.

Questions and Comments

Akke van der Zijpp

1. Intensification: more product per animal or more animal per ha?
2. Environmental impact: water use (crops for feed), water quality for human and animal consumption
3. Breed conservation?
4. Who was responsible for the identification of the three problem areas: farmers' organizations, low product, technical packages?
5. Dairy cow compete with cheap imported milk powder?
6. You missed the feed factory in the value chain.
7. Diversity of value chain: around Bamako (urban market), export and local markets
8. Herder – sedentary farming interactions?
9. Increase in small ruminants more than beef.

Annemarie van Paassen

1. I am interested in having a better knowledge of the specific roles of male and female farmers and breeders to identify the advantages and constraints they derive from the crop-livestock farming integration, especially since it targets milk for various actors.
2. Is improving and expanding fattening not more advisable than the strategy to increase milk production?
3. What is the situation of the privatization of the extension system and what support can farmers expect from it?

Idrissa Diallo

My intervention is rather a contribution. I represent the Permanent Assembly of the Chambers of Agriculture of Mali, which brings together farmers, breeders, fishermen and forest operators. The question Mr. Ouologuem dealt with is one of the concerns of our citizens, knowing that the annual meeting between producers and the President of the Republic in Mali had as theme "promoting local raw milk". This shows that the theme dealt with, crop and livestock integration, is very important.

Aliou Saïdou

The water supply aspect was overlooked in your presentation. What connection can you establish with the field of water management?

Tod Crane

How does/could this integrate the systems of herding: farms that are separately managed by different actors? What is common in Mali?

Djakaridja Gnambele

1. Why was the Office du Niger selected instead of Sikasso, which is supposed to receive more herds now?
2. There are still large spaces for livestock farming at Niono, whereas there is no real need to produce pasture in the 3rd region.

Nathalie Kpera

The two main factors for animal production are feed (grass and water) and animal health. Your presentation didn't mention anything about animal health. Please take this into account in future work.

Dawo Simplice Vodouhé

1. Breeders and livestock traders' organizations seem to be covered in the work.
2. What are the conflicts between farmers – breeders for the use of land and water in the context of intensification?
3. How is cow dung used: collected and spread or through stay of livestock in the fields?

Simon Oosting

Cattle represents a high livelihood investment; sheep and goats a relatively small livelihood one. The numbers of sheep and goats has increased at a higher rate than those of cattle. Dairy cattle will benefit relatively rich households. Is there competition for feed between the two types of livestock? Is there competition between beef and sheep and goat meat?

Shea butter/karité production in Mali

Identifying the driving factors and constraints related to the value chain of Shea butter/Karité products in Mali

Fadiala Dembélé et Mamoudou Traoré
IPR/IFRA de Katibougou
BP 12 Koulikoro Ba, Mali

Introduction

The Shea tree is a wild and naturally growing tree in the Soudano-Guinean area of Mali. Exploited as a non-woody forest product, for example, Shea butter is used in the preparation of cosmetics and traditional medicine. Shea butter and all the derived products provide an important source of income for all the stakeholders. Shea tree products are also objects of trade in the domestic market as well as in the West Africa regional and in international markets.

The current study aims to identify the driving factors and the constraints for better promotion of the Shea tree products value chain.

Methodology

The methodology used for the study consisted of surveys of the different actors involved in the value chain of Karité. Those actors are as follows:

- Rural Women's Associations
- Production and Processing Cooperatives
- Traders
- Extension Officers and
- NGOs as support services.

After the survey, a national workshop was organised at Ségou, by the National Coordinator of CoS-SIS Programme. Held from June 15-17 the workshop was intended to summarize and validate the constraints identified during the survey, and the driving forces for the creation and promotion of an effective Shea tree products value chain.

Output of the national workshop

During the workshop, the criteria to identify the intervening sites of the project were determined. The constraints and favourable conditions related to the production, processing and trade were compiled and prioritised.

The availability of resources, access to the site, the existence of the women's organisations and their poverty level are the most important criteria that guided the choice of sites. In this regard, the following constituencies were selected in the four regions located in the distribution area of Karité: (i) Kita, (ii) Bancoumana, (iii) Siby, (iv) Diola, (v) Zantiebougou and (vi) Ségou.

The environmental conditions favourable for Shea butter production include the following: the distribution of the natural population of Shea tree, the existence of many interested women's associations and cooperatives including the availability of market potential.

The main constraints are the shortage of drying equipment of the kernel, the storage facilities, and the uneven productivity of the Shea tree from one year to another as well as the *Laurantacea* pests which invade and damage the trees.

The availability of raw materials and the small equipment for processing as well as the local skills and know-how are the main positive factors for the production of Shea butter and related products. The main constraints for processing are the shortage of water, small-scale improved equipment and the difficult access to inputs for processing the derived products. Furthermore, the lack of storage facilities for the Shea butter has also been identified as one of the constraints facing the Shea products trade activities.

Factors positively influencing the Shea products trade identified include the following:

1. Periodic organisation of framework for displaying the Shea product,
2. Existence of a potential market,
3. The number of Shea products' traders and
4. The prospect for the biological production of Shea butter.

Factors constraining the Shea products trade are

1. The poor quality of the Shea butter,
2. Inefficient marketing strategies
3. Lack of a Malian label for locally produced Shea products and
4. Lack of laboratory to assess the quality of butter

Questions and Comments

Todd Crane
The export market is small compared to the total production. We should explore the domestic market/value chain in greater depth, because it is more accessible to a greater number of actors.

David Reece
Karité production and the value chain are done by women. What practical problems does this pose for the research process?

Kofi Adade Debrah
Is bush fire a problem in Mali? I ask this question because in northern Ghana it is a problem and I believe that this leads to smothering of younger Shea trees. If this is so, how is the tree sustaining its population in the wild?

Anthony Youdeowei
Do you plan to include an investigation of the indigenous knowledge system in the exploitation of the Shea tree? Such information would be very useful in developing innovations to promote the production of the tree.

Thom Kuyper:
How does the Karité in intensive agriculture compete with other crops?

Daniel Abeng-Ofori
How many people rely on the product in terms of economic impact?

Annemarie van Paassen
How are the trees located in the collective areas managed? How are the Shea products traded? What is the proportion of organised women in relation to those who are not organised?

Note: We could not jot down all the questions in this abstract, they will be taken in account in the research activities. Despite the different constraints, the Karité value chain is promising with regard to the high demand on the internal market. This value chain can contribute in the alleviation of the abject poverty faced by rural women.

Water management in Mali

Exploring opportunities for integrated management of water resources in Mali

Lassine Soumano
Chercheur Associé IPR/IFRA de Katibougou
BP 12 Koulikoro Ba, Mali
e-mail: lsno2002@yahoo.fr

Introduction

Agriculture, is a major water consumer, and represents the main component of the economy of Mali. Since the 70s, agriculture is confronted with a relative shortage of fresh water, despite the importance of hydrographic network in the country. The water shortage has been characterized by a decrease in rainfall and available water resources. This decrease has been caused not only by the increase of the induced needs resulting from the demographic pressure on water use for different human activities, but also by water pollution. This means less fresh water for the different uses of the population, in particular for agriculture because of inefficient distribution, and its non-availability during the critical phases of the growing stage of annual crops in some places in the country.

The CoS-SIS study

The present study, conducted within the framework of the CoS-SIS programme, covers the study of different types of hydro-agriculture facilities existing in the country, through the identification of constraints and opportunities for small farmers, actors in integrated water management in Mali.

To reach our objectives, we have limited our study to the Office du Niger zone because of the fact that according to many Malians it constitutes the hope for achieving food security and poverty reduction. During the 2006/2007 season, the Office du Niger produced 52% of Mali's needs in rice; and the scheme is one of the oldest development programmes in Mali. The Office du Niger constitutes a school for learning in terms of addressing the difficulties in management and maintenance of hydro-agricultural system through the gravity system.

Methodology

For this reason, the methodology used consisted first of literature review in order to delineate the domain, to define the site choice criteria and to pre-select the study zones. An exploratory phase focused on group discussion, individual interviews, direct observations and finally an in-depth study with a national workshop held in Ségou for the identification of the constraints, opportunities, values chain and possible actions to be undertaken. Discussions were conducted with all the stakeholders involved in the value chain of irrigated agriculture on the ways to improve smallholder farmers' incomes.

The analysis of the data showed that the hydro-agricultural facilities in Mali are of different types. The typology of the infrastructures can be defined according to several classification criteria among which the size of the perimeter constitutes an essential element. Thus, we classified hydro-agricultural facilities into large schemes, intermediary schemes, village irrigated perimeters (PIV), controlled submersion (SMC), private irrigated perimeters (PIP), small market gardens (PPM) and inland valley development. From the analysis, the following emerge as the main constraints:

1. The insufficiency of the irrigators' training
2. The discrepancy between the acreage allocated and the number of working men on the exploitation
3. The insufficiency of farm equipment
4. The insufficient maintenance of the intakes and deterioration of some
5. The deterioration of the sanitation network
6. Difficult access to water for the herdsmen
7. The enormous waste of water
8. Access to credit

These results show that water is permanently available, there is political will to support development, smallholders are involved in the management of the water network, the rice chain is one of the best integrated in the country and contributes significantly to food security. There is an increasing urban demand for off-season fresh vegetables, and a rapid growth of the national rice market. There is a research center working in close collaboration with the producers, credible farmers' organizations exist and farmers have gained mastery of technical packages of rice and onion production.

Suggestions made for entry points of CoS-SIS activity were: improving the value chains of rice and onions, with a special focus on the benefits for smallholders; farmers' organizations around the tertiary canals (OERT); the role of private input and equipment suppliers, extension services and joint committees responsible for the secondary units.

Questions and Comments

Fassassi Ramanou

1. How can your exploratory study take into account the principle of subsidiarity in the water management as stated in the introduction?
2. The conclusion does not reflect the principles of water management strategy in Mali
3. Role played at the local level by smallholders to influence national water management policies. The Cos-SIS approach could help us in that case

Todd Crane

1. National level output is not the same as improving smallholder livelihoods.
2. Large-scale production systems are often incompatible with smallholder systems, as has happened in the US. This is not a healthy vision for rural development in Mali.

Nuertey B.N.

Watershed Management, what are the interventions put in place to protect watersheds in Mali?

Auhe

1. What about the livestock-crop interaction? Are residues being used for livestock feed?
2. Does livestock intensification cause water pollution?
3. Water quality issues for human use?

Thom Kuyper

1. It was mentioned as an opportunity that Mali rice was preferred over imported rice. To what extent is that due to price differences or to food preferences?
2. Would the opportunity for indigenous rice remain if farmers would get better paid for their produce?

Frans Huibers

1. Inland-valley production plays a more direct role in food security for poor farmers than large-scale irrigation. Decisions about the process of development of the Office du Niger are taken by higher government, not so much by farmers.
2. Polluter pays principle: how is this applied in practice? (domestic and agriculture pollution).

GHANA

Oil palm production in Ghana

Exploring opportunities for enhancing innovation in agriculture: the case of oil palm production in Ghana

S. Adjei-Nsiah
Institute of Agricultural Research, College of Agriculture and Consumer Sciences, P.O. Box 38, Legon, Ghana
e-mail: y_nsiah@yahoo.co.uk;

O. Sakyi-Dawson
Agricultural Extension Department, School of Agriculture, College of Agriculture and Consumer Sciences, P.O. Box 68, Legon, Ghana
e-mail: osakyid@gmail.com

Background

Raising productivity at farm or crop level is not sufficient to enable innovation in agriculture in a rapidly changing global context. Evidence from previous studies has shown that increasing productivity of smallholder farmers in West Africa often is not sufficient to improve livelihoods. We carried out a study using key informant interviews, focus group discussions and individual interviews to explore opportunities to enhance innovation within the oil palm sector in Ghana.

Oil palm was selected for the study for three main reasons: (1) it is considered as a national priority crop because of its potential for reducing poverty, (2) it has a wide geographical coverage as it can be cultivated in six out of the ten administrative regions of Ghana and (3) oil palm is considered as both food and a cash crop.

The CoS-SIS study

The study revealed that oil palm has evolved from a wild to an industrial crop, and in the past 40 years from a public sector to a private sector crop. The sector is dominated by small private farms, which produce about 80% of the crop; large scale industrial estates with their network of smallholder and out-grower farmers who produce to supply their large scale mechanized processing mills; small-scale semi-mechanised processing mills dotted around the large industrial estates and secondary processors which process the crude palm oil into vegetable oils, margarines, laundry and toilet soap and other products. Although Ghana requires about 240,000 metric tons of crude palm oil to meet its domestic needs, it is only able to produce about 100,000 metric tons from its existing plantations thus, offering farmers the opportunity to produce to meet the ever-growing needs of the industry.

Between 47% and 73% of farmers in the oil palm producing areas derive their major source of livelihood from oil palm cultivation. Yields of fresh fruit bunches obtained by small private farmers are generally low, ranging from 3 tons/ha on farms in the Ahanta West District in the Western Region to about 6-14 tons/ha on farms in the Kwaebibrim District in the Eastern Region of Ghana. The low yields in the Ahanta West District could be partly attributed to the use of volunteer seedlings and poor crop management practices. The use of external inputs in the small private farms is generally low, thus offering an opportunity for farmers to enter into the organic/Fair Trade market, which is rapidly expanding.

The rate of innovation in the sector is low due to weak interaction among actors, although some examples exist of changing interactions among actors, such as the use of agents to purchase the fruits by some estates to ensure prompt payment for farmers. The sector faces many challenges, including (1) poor access to extension services; (2) poor access to credit; (3) price fluctuations in farmers' produce; (4) absence of a coordinating body to regulate the activities of actors in the sector; (5) weak interaction among actors and (6) poorly organized farmers.

To remain competitive in the international market and for the country to derive the maximum benefit from the industry, the oil palm sector needs to be organized to adjust to the rapidly changing context and to innovate at all levels of the commercial value chain (production, processing, quality, marketing and use of by-products). Achieving these objectives requires collaboration among the various actors in the sector, including the government, research, farmers, the large estates and the small-scale millers.

Questions and Comments

Kofi Adade Debrah
I know that around 1995 to 2000, TechnoServe/Ghana was involved in organising small-scale processors and farmers. I believe this will advance the research into your hypothesis. A lot of their work was done in the Eastern and Ashanti Regions

Emmanuel A. Odame
1. The environment in which small-scale processors work is not good enough. What are the necessary measures to be factored in to solve or manage waste from oil palm processing, e.g., effluent from contaminating the water bodies and the environment as a whole?
2. From the schematic diagram, there were no arrows pointing from OPRI seed supply to out-growers and smallholders

Daniel Obeng Ofori
What important technologies have been developed by the Oil Palm Research Institute of Ghana for farmers?

Anthony Youdeowei
1. Do smallholder oil palm farmers also keep ruminant livestock (sheep and goats)? And if so, how does this mixed farming system influence livelihoods?
2. We talk about export market. Does this encompass the West African regional market?
3. To what extent does the production of oil palm satisfy the domestic market?

Afiah Appiah
1. Between 47% and 73% of farmers derive their livelihood from oil palm. Is this an alternative to crop production?
2. What are the derivatives of palm and their level of importance in the Ghanaian household to give indication of policy direction and financial priorities?

Neurtey, B.N
Your presentation showed that smallholders attached to GOPDC and who benefit from inputs and pre-financing adopted good agronomic practices such as planting of leguminous cover crops and fertilizer application. Can we deduce that lack of finance is a barrier to the adoption of technologies?

Kofi Debrah
According to your presentation, smallholder oil palm producers are not supported to produce but we also know that the Presidential Initiative on Oil Palm has been

running since 2003. What has the PSI done to improve smallholder conditions and how do you see the initiative *vis-à-vis* small holders?

Francis Kofi Oppong

1. What could be the entry point for the PhD student in line with the use of innovation system approach as aimed by CoS SIS programme?
2. Farmers located around OPRI appear not to be using cover cropping for weed control and were not applying fertilizers, as compared to farmers in other communities which are far from the Research Institute. Did you find out the reasons for non-adoption of some of the technologies by the farmers close to the Research Institute?

Tjeerd-Jan Stomph

1. Is there a potential role for farmers to produce seedlings from improved seeds in the Region where volunteer seedlings are used?
2. Which part of the oil palm income is from the palm oil?

Chris Gordon

1. The Oil Palm Research Institute has been chronically underfunded for several decades. This has led to a shortage of research to develop the crop.
2. Why do farmers at Kusi not adopt improved technologies given that they are so close to OPRI?
3. There is a big difference between the two areas, which cannot be explained by price levels but more by local issues. We have to explore the role of oil palm production and/or processing in the livelihood strategies of the different actors. Explore also the gender differences. This allows insight into the issue of poverty and its alleviation. Get an idea of the structure of the value chain within the two areas to compare them and get ideas of the opportunity of change in these value chains.

Kwadwo Amankwah

I refer to your map of the oil palm value chain. It has three components: Actors, Supporters and Functions. I missed the formal and informal institutions (i.e. institutions as defined as rule-guided interaction). How do you make these visible for study and analysis? (Ref: Scoones, 1998)

David Reece

Gulf between findings and conclusions: the data show that communities using improved planting materials, etc. gain higher yields, yet this evidence that some small changes work was not reflected in the conclusions.

Cocoa in Ghana

Exploring opportunities for enhancing the profitability and sustainability of cocoa production in Ghana

Emmanuel Dormon[1] and O. Sakyi-Dawson[2]
[1]P. O. Box MB 539, Accra, Ghana; [2]College of Agriculture and Consumer Science, University of Ghana, Legon

The study objective & methodology

Worldwide, 95% of annual cocoa production comes from smallholdings of 1-3 ha. In W. Africa, 90% of the cocoa is produced by 2 million households with holdings of 2 ha or less. Cocoa is a major foreign exchange earner for the West African producing countries and in Ghana, it contributes between 22% and 33% of the foreign exchange. However, the cocoa sector is characterized by price volatility, a declining trend in real prices and low productivity.

The objective of this study was to explore potential institutional and technical innovations that can improve the efficiency and competitiveness of the cocoa sector, improve profitability for smallholder producers and also enhance the sustainability of cocoa production in Ghana. The methodology used for the study focused on literature review, key informant interviews and value chain mapping and analysis. The three main components of the cocoa value chain (production and marketing by the main direct actors; the business enabling environment; and essential services) were analysed.

Results

Production and marketing

Productivity remains low at 400kg/ha. However, farmers can increase their productivity substantially with the right research and extension approach. Increases in production in the last decade are attributed mainly to area expansion rather than increased productivity and this has negative environmental consequences.

Business Enabling Environment (BEE)

Under the BEE, issues relating to pricing and taxation, quality control and land tenure were considered as important. Real prices rose by 73% in 2001/2002 and 43% in 2002/2003 but started declining by 9% in 2003/2004 and 13% in 2005/2006. The present single pricing system for all grades of cocoa in Ghana limits opportunities for entering niche markets (organic and fair trade) whilst the weak nature of farmers' organisation does not make them effective in pursuing farmers' interest.

Services

Three important essential services required to ensure effectiveness and efficiency in the cocoa sector are research, extension and financial services. For the cocoa sector in Ghana, there are weak linkages between research and extension whilst producers have little access to financial services.

Opportunities identified for further research

Three broad opportunities were identified for possible in-depth studies. These are:

1. Examine opportunities for producing for niche markets like organic and fair trade: Exploring such niche markets has the potential to reduce environmental impact of cocoa production, and possibility to improve profitability by selling at premium prices.
2. Study the extent to which land tenure impacts on productivity and profitability of cocoa and recommend some best practices
3. Support the strengthening of Farmer Based Organisations (FBOs): The broad objective that has to be pursued in strengthening FBOs will be to enable them to effectively engage COCOBOD and other industry players to ensure their interests with regard to the producer pricing and taxation are protected.

Food security in Ghana

Identifying opportunities for enhancing food security in the Upper West Region of Ghana

[1]***Emmanuel Dormon, Samuel Adjei-Nsiah,***
[2]***O. Sakyi-Dawson, and Kofi Adade Debrah***
[1]*P. O. Box MB 539, Accra, Ghana*
[2]*Agricultural Extension Department, School of Agriculture, College of Agriculture and Consumer Sciences, P.O. Box 68, Legon*

Food security situation

Food security is defined as access by people at all times to food for an effective and healthy life. Forms of food insecurity include chronic food insecurity (inadequate resources, etc.) and transitory food insecurity (temporary). In the decade of 1995 to 2005, food production increased in the world but the number of hungry people in Sub-Saharan Africa increased by 19%. Hungry people are characterised as those who consume less than 2,100 calories/day.

Food security and poverty

Poverty reduced in Ghana from 51.7% in 1991/92 to 39.5% in 1998/99 and further down to 28.5% in 2005/06. In 1999, all regions in Ghana, except Accra city and the Upper West Region (UWR), experienced a decline in poverty. High incidence of poverty in Northern Ghana is attributed to exclusion from trade.

Scoping dtudy – research problem and objective

Although Ghana has made large strides in reducing poverty, a large number of people remain hungry and food insecure especially in the UWR. This is an indication that poverty reduction and food security strategies have not been successful across board. Therefore the objective was to explore opportunities for pursuing innovative interventions required to accelerate poverty reduction and improve food security in the UWR.

Methodology

This included desk studies, selection of research locations, data collection and analyses using the DFID sustainable livelihood framework (SLF). The data collection involved the use of key informants, focus group discussions, community meetings and observation. In defining the parameters for selection of locations, the criteria established were poverty levels, other food insecurity factors (irregular climatic conditions, poor/degraded soils, bushfires, poor farm to market roads and storage facilities), enabling environment (absence of ethnic conflict) and opportunities. After attaching weights to the various criteria, out of a maximum of 10 scores, Northern Region had 6.8, Upper East Region had 7.2, while the UWR had 8.8 scores. Two communities, Daffiama in the Nadowli District and Kupulima in the Sissala West District, were selected for the scoping study as some development interventions and original studies have been done by two NGOs (Action Aid Ghana and Plan Ghana, respectively) and therefore formed a basis for case studies.

Results

In terms of assets, while Daffiama had access to good roads, 3 mobile communications networks, electricity and adequate water and sanitation services, the situation in Kupulima was the direct opposite apart from access to boreholes for drinking water. For social services, both of locations have basic schools and while Daffiama has 2 secondary education schools, Kupulima has none. In addition, Daffiama has a functioning health centre while Kupulima has no access to rural health facilities. For tools and technology, both locations mainly use hoes and cutlasses and have access to small scale irrigation schemes. Also about 25% of both population rely on tractors and bullock ploughs. Fertilizer is used only by a few rich farmers, while in Kupulima farmers talked about diversion of some of the fertilizer provided by cotton companies for farming cotton to their maize fields. For natural assets, soil fertility is low with scattered Shea and Dawadawa trees growing in the wild. While the water body in Kupulima is already developed into an irrigation facility; that of Daffiama is under construction.

For social assets, both communities involve themselves in self-help groups as part of their coping strategies involving specifically income generation and reciprocal labour. Environmental degradation problems are being curbed by traditional authority action. There is a microfinance scheme at Kupulima facilitated by Plan Ghana. Remittances from relatives in Southern Ghana are common in both communities while access to a microfinance scheme and some credit from a bank is available in Kupulima only.

Their vulnerability context was identified in terms of drought and heavy winds, annual bushfires, inappropriate farming practices, indiscriminate tree felling for fuel and charcoal, which culminated in loss of vegetative cover and consequently in erosion and decline in soil fertility.

Looking at policies, institutions and processes, their land tenure system has resulted in fragmented family lands limiting large-scale farming and less access by women. Interventions by NGOs include that of Plan Ghana in the area of irrigation, microfinance, school feeding, etc., while World Vision is working in education.

Livelihood objectives vary between men and women and different wealth classes. The wealthy produce to generate income and meet food needs of the family while the poor produce only to meet their immediate food needs. The in-between group produce to meet family needs and sell the surplus. Women work with husbands but have their own farms to meet their personal needs and supplement the family livelihood.

The major livelihood activity is crop farming with groundnuts being the cash crop. Maize, sorghum, millet and cowpea are also cultivated in both communities. However, communities in Kupulima grow cotton and yam in addition while for religious reasons, they do not allow pito (local sorghum beer) brewing and pig rearing which are lucrative ventures at Daffiama. Trading in maize and livestock by the wealthy occurs at Kupulima but it is only petty trading that happens at Daffiama. In both communities, livestock rearing is not just for cash and food security but also used for ploughing, marriage, funerals and religious purposes.

In terms of occupation and wealth status, whereas crop farming is undertaken by all, livestock and poultry rearing is the preserve of the wealthy and the in-between group. Charcoal burning and selling of firewood, which are the main environmental degradation activities are being undertaken by the poor.

With regard to food availability and coping strategies, in a normal rainfall year, food lasts for 10 to 12 months for the wealthy and average income household while poor households only have 2 to 3 months. In drought years, most households have coping resources for 5 to 6 months while the poor have less and depend on payments from the rich after working on their farms. Most female-headed households are the poorest. The female-headed households have more diverse coping strategies than the male-headed ones. Sale of livestock and reliance on petty trading are the major coping strategies for the rich while the poor depend on remittances, crediting of food, sale of firewood and out-migration. In terms of gender, the sale of livestock and dry season gardening are male activities, while collection of wild fruits and vegetables, sale of firewood, charcoal production, Shea butter processing and pito brewing are female preserves.

Conclusion

In the UWR, food security still remains a major concern especially in drought years with climatic factors, annual bush burning and indiscriminate tree felling increasing vulnerability. The poorest are the female-headed households. The basis for food security of everyone remains crop farming (especially maize, sorghum and groundnuts) while livestock has limited food security significance for the poor (cattle mainly for the wealthy and sheep/goats for the in=between group). Different groups of persons (wealthy, poor, men, women) adopt different livelihood coping strategies.

What innovative interventions can be pursued? What can we learn from past experiences? We need further exploration.

Questions and Comments

Francis Kofi Oppong
The presenter stated that there are local laws against indiscriminate felling of trees for charcoal production. However annual bush burning continue to be one of the major constraints to food security in the area. Certainly bush burning contributes to reduction in soil fertility and retards the growth of Shea and other trees. Why is it that nothing is being done about bush burning in the two communities to help reduce food insecurity in them?

Felix A. Asante
Food security and livelihood strategies in Northern Ghana cannot be discussed without addressing water issues in the household. Most of the livelihood strategies in Northern Ghana depend on the availability of water. I suggest that the Ghana team add water issues (household water use) in its research or study.

Emmanuel Dormon
Have market chains of sheep and goats been identified? Diversity between Christian and Moslem communities? Poultry offers opportunities for very poor farmers. Why was this not recognized?

Afia Appiah
Why is it that projects do not work in the UWR? What other social factors are we overlooking in the poverty reduction race in the UWR? Central Region as a focus for poverty reduction?

Anonymous
FAO, NEPAD, CAADP and FARA documents provide more reliable information on the food security situation in Africa than USDA data. Ghana Poverty Reduction Strategy Documents. Your earlier slides show data reference from USDA. I will feel more comfortable and be more confident of data from FARA, FAO, NEPAD, CAADP, etc.

Adegbidi Anselme
How do we speak of food insecurity if we do take into account the structure of property rights in the society?

Idrissa Diallo
Is it possible to put in place cereal banks in communities to solve food security problems during lean seasons?

Fassassi Ramanou
As one listens to the diagnosis done in the two villages under study, one gets the impression that food security is only limited to agricultural products and not linked to local development. That is, food security should be linked to local development, so that CoS-SIS will be able to be interested in how grassroots stakeholders in these chosen villages (socio-professional groups) can influence decision-making in the drawing up of local development plans.

Anonymous
How can we link food security to community development? Food security affects everything i.e. local development.

Anonymous
Is food security linked to religion?

Anonymous
How is food security linked to aid?

Theme 4 From opportunity to institutional and technical change

Fruits of the shea butter tree, Mali

The case of Yiriwa SA, Mali – An opportunity-based Innovation

Rhiannon Pyburn and Bart de Steenhuijsen Piters
KIT, The Netherlands

Introduction

Research in Sub-Saharan Africa aiming to change farmer practices through the dissemination of tested and proven results has generally not been very successful. Yiriwa, a trade house for Organic Cotton, Sesame and Soy in Mali that had its first harvest season in 2008, has managed to introduce new cropping practices amongst a group of 640 producers within one season. In addition, a new way of doing business has emerged through market linkages in the organic value chain. The company supported the shift to organic production through skilled extension workers, but farmers' responses have been more than adequate and compliance with the organic standards has been 100%. This reflects a remarkable innovation dynamic, one, which facilitates rapid changes in practices. The objective of this contribution is to draw lessons from this opportunity-based innovation.

Background

Mali is the second largest cotton producing country in Sub-Saharan Africa with more than 25% of the population depending on this commodity for their livelihoods. The national cotton company – *Compagnie Malienne pour le Développement des Textiles (CMDT)* has had a monopoly on cotton trade since its establishment in 1974. The combination of a national marketing board with a development agenda and the high priority placed on research and extension allowed Mali to develop one of the best cotton sectors in Sub-Saharan Africa. Mechanization, input use and farmer knowledge about cotton production have resulted in Mali boasting the highest cotton yields and acreage across the African continent. Cotton was referred to as "the engine of rural development" because it provided rural households with income and farm inputs that could not be provided by other commodities. However, the 2006 drop in world prices, coupled with a poorly coordinated national market, has left the sector in crisis. By 2008 the Malian government had effectively withdrawn from the sector through the extended process of privatization of the *CMDT* and a refusal to subsidize the inputs required for conventional production. This has shaken the confidence of

cotton producers and has left them seeking out other possible sources of income. The context was ripe for change and new opportunities to take root.

Yiriwa is a cutting edge example of public-private partnership in the development sector involving multiple actors: KIT through *Anona*[1], ICCO, and AKO are the investors. AKO is a company specializing in large-scale organic projects; their sales represent more than 50% of the world trade in organic cotton. KIT's is involved both as an investor and as a knowledge provider on technical issues and on the business model for the trade house. ICCO is also an investor and has extensive experience with organic cotton production in West Africa. The Dutch development organisation (SNV), while not an investor, is involved at the field level in capacity development and producer support. In March 2008, the Trade House was set up with the mission of developing sustainable trade in organic products thus reducing rural poverty and enhancing rural livelihoods in Mali. The aim is that the shareholder profile will eventually be comprised of: KIT (28% minimum); ICCO (24%); AKO (24%) and producers (24%). ICCO and KIT do not plan to be shareholders indefinitely; exit strategies for ICCO and KIT are already prepared.

The farmers

By the end of 2008, Yiriwa was working with 640 organic cotton producers. All were audited both through internal inspection conducted by the Yiriwa team, and private third party verification through the international certification body, *Control Union.* Farmers are dispersed over two zones – Fana and Sikasso – which involved 93 villages in Fana and 66 in Sikasso: a total of 159 villages. These numbers indicate that only a few farmers from each village participated in the 2008 production cycle. However, many more showed interest and engaged actively in discussions *vis-à-vis* organic production and sales. Neighbours watched with curiosity and often surprise at the organic experiment. Even the sceptics now acknowledge the technical and economic success of this first year: the cotton grew with reasonable yields and producers were paid in a timely manner. A fair conclusion is that the participating farmers in 2008 tested the ground for biological production for the entire village community.

Small farmers are well-known for being risk adverse and the farmers growing for Yiriwa are no exception. Technically, the changes were not dramatic: bio-pesticides replaced chemical pesticides; and compost use, no longer widely practised, increased significantly and was prioritised, which required better wagons and the use of mules

[1]Anona is KIT's sustainable investment fund that aims to find market-based solutions in cooperation with the private sector.

or oxen to transport the compost to the fields. That the farmers recognised the 'new methods' meant that organic was not seen as entirely foreign or unfamiliar. They entered slowly into this new production system, most allotting half a hectare to test the viability. To spread risk further, farmers continued with conventional cotton in parallel production, generally at the same level (approximately 0.5 ha). In addition they grew crops such as millet, which can be sold on local markets if the cotton is not paid on time, or used for family consumption. Interestingly, when piloting organic cotton production, producers underwent a process strikingly in line with (scientific) experiments: they saw an opportunity or idea, tried it out, observed what happened, analysed the outcome, drew conclusions and have made a plan for next steps or follow-up actions. This is an 'organic' process of action-research.

It is quite remarkable that farmers who had practised intensive cotton production involving high applications of chemical pesticides for over thirty years adopted different practices so quickly. This abrupt change of practice reflects a high degree of farmer flexibility and their responsiveness to new opportunities. The case demonstrates that an opportunity, as seen by farmers, is an effective starting point for innovation. In this case opportunity translated as: a context that was constrained – there was a felt need for change; low costs associated with the innovation; the potential for improved income (through premium prices); security through the regular and timely payment for product; and technological changes that were not unfamiliar (e.g. *more* compost use; move from chemical pesticides to bio-pesticides). Of the multiple drivers behind farmers' response to the new market opportunity offered by Yiriwa but the most important was reliability or security. During the early stages of the organic campaign farmers placed a very high importance on the assurance of payment. The CEO of Yiriwa paid for the sales of produce on time. This has resulted about 4000 farmers enlisting in biological production with Yiriwa for 2009 covering an area of approximately *2100 hectares.*

Recommendations for CoS-SIS *vis-à-vis* opportunity-based innovation

1. Understand farmer perceptions of opportunity; let their concerns/priorities drive the change.
2. Allow for and encourage small-scale testing and community learning in an exploratory phase.
3. Support the community in analysing the impact of the experimental or exploratory phase.
4. Analyse and understand the dimensions of innovation beyond just technical (e.g. markets, relationships, trust, community dynamics, power)

5. Include poor(-er) households in the innovation process through inclusion in the learning process. Even if the most marginalised do not engage in year one, they can be part of community-wide evaluation. This allows them to integrate the experience into their decision-making in the next production cycle.
6. Draw lessons by evaluating the impact on different household and farmer categories (wealth, land ownership, position in the community, age, gender) to allow conclusions as to the scope for up scaling and potential impact on different community sub-groups.

IFDC's experiences in institutional innovations development

Kofi Debrah
IFDC Representative in Ghana
PMB CT 284, Cantonments, Accra, Ghana
email: kdebrah@ifdc.org

Introduction

The International Fertilizer Development Centre (IFDC) was created by US Presidential Executive Order in 1974 as a public international non-profit organization to respond to the World Food Crisis by working on fertilizers and crop-productivity enhancing technologies. Over the years, IFDC changed its focus to respond to the needs of actors in the agricultural value chain ranging from access to inputs, through production and marketing to policy analysis.

IFDC's collaborative initiatives

In line with strengthening innovation systems within the framework of the CoS-SIS programme, IFDC works with multiple stakeholders to improve institutional conditions in order to enlarge the opportunity sets of farmers beyond the farm level and ensures that each actor is motivated to do more and better. Our experience in doing this is anchored in building capacities of people and organizations, investing in networks and building social capital so that together the actors involved work together for their mutual benefits. This paper briefly summarizes our experiences in such key areas as research and development, agricultural inputs, production, value addition, marketing and policy.

Research and development work in fertilizer and crop productivity-enhancing technology is driven by market forces such as the recent increases in fertilizer prices where IFDC has responded by creating and testing new generation fertilizers in its pilot plant in Muscle Shoals, Alabama. One such fertilizer is the Urea Deep Placement (UDP) fertilizer, which is a slow release fertilizer developed in pellet forms and placed directly at the root of the plant, preventing losses incurred in the traditional top dressing manner of application. A related innovation is the creation of the AISSA (Agricultural Intensification in Sub-Saharan Africa) network where practitioners and other stakeholders share methodologies, exchange ideas and build

capacities around agricultural intensification in their respective countries using the blog as the communication channel for now.

With funding from AGRA (Alliance for a Green Revolution in Africa), IFDC is implementing a 3-year Ghana Agro-Dealer Development (GADD) project where the major component is to develop the capacity of the Ghana Agricultural Associations Business Information Centre (GAABIC) which IFDC itself had helped create in 2004 under the MISTOWA project to provide technical assistance to the organizations and associations under its umbrella. GAABIC is made up of the association of agricultural input dealers (GAIDA), the association of agricultural input importers (CropLife) and a national association of crop and seed farmers (APFOG) with the day-to-day affairs of the three associations managed by a full time Executive Secretary. A major activity currently being undertaken is a survey that will lead to the development of a comprehensive database complete with cell phone contact and GPS locations of all input dealers in Ghana. The GPS mapping of dealers on the Ghana map will provide visual information of where dealers are currently located vis-à-vis farmer organizations and will help businessmen make decisions as to where to locate new dealerships. IFDC has also developed an agro-dealer training syllabus for basic and intermediate training in the areas of management, record keeping, finance as well as technical knowledge.

In collaboration with the Plant Protection and regulatory Services Department (PPRSD) of MOFA and the Environmental Protection Agency (EPA), the project has institutionalized agro-input dealer training by requiring that prospective dealers are trained using the approved syllabus and are certified by PPRSD and EPA, the two regulatory bodies. In future, anyone who has not received the training will not be licensed to sell agro-inputs. To make the training sustainable we have agreed with GAIDA to require trainees to pay GHC30 per person for the basic training. In April 2009, we trained 560 dealers and collected GHC17,000 which will be re-cycled into the training programme by making the materials available on video and in local languages. It is our hope that such training activities will be self-sustaining to permit GAABIC to continue training as key activity at the end of the project.

In the area of agricultural production activities, IFDC essentially builds capacities of the farmers themselves as well as their organizations. For example we have been training farmers to access market information through the use of their cell phones and are currently working with the national farmer organizations to form a common platform for the purpose of speaking with one voice and for representation, while maintaining the individual identities. Apart from the traditional support to seed and food crop producing farmer organizations, IFDC has recently entered into a private-

public sector partnership involving Wienco (fertilizer importer), Technoserve, CRIG and the Cocoa Abrabopa Association to build the cocoa association's capacity to manage the fertility of the soil and to use the appropriate inputs.

In the area of value addition, the two main projects in which IFDC has experience in innovation systems development are the 1000+ project and the MiDA projects. In the 1000+ project, IFDC collaborates with local training and development institutions and support services to develop commodity clusters in which actors are encouraged to network among themselves in given geographic areas to produce and market their products. The MiDA project, which IFDC implements in the Northern Intervention Zone, involves farmers' organizational capacity building, value chain thinking, business and technical training as well as irrigation and post harvest supports to farmers. The MiDA project has also produced a new cadre of training and technical services providers (TTSPs) who are contracted to do the training and provide services, and could become private extension agents at the project's end. The project has also developed a new cadre of farmers who now have the value chain thinking mentality and have been linked with input dealers, financial institutions and buying companies thereby addressing the perennial problem of lack of access to inputs and to product markets.

One area in which IFDC has excelled is in the area of marketing and market information through the MISTOWA project funded by USAID West Africa and by AGRITERRA in the Netherlands. The project was a West Africa regional project with the objective of helping increase intra-regional trade in agricultural and livestock products within West Africa. The components included the strengthening of producer and traders organizations, increasing their access to market information and thirdly to advocate for the implementation of the policy of free movement of goods and people in the region. In order to bring information to the doorsteps of farmers and traders, IFDC developed a partnership with a private software developing company (BusyLab, Accra) to take advantage of the most rapidly adopted technologies in Africa (the cell telephony) to create a platform called "TradeNet". Through the platform, accessible by website or cell phones, market information is collected and disseminated in real time and facilitates price discovery, supply chain management and direct/indirect marketing. Users have provided testimonies indicating that their use has increased their negotiating power, decreased their transaction costs and increased their incomes (Debrah, 2009; IFDC 2008a and b).

The most frequently mentioned constraint to the adoption of improved technologies in agriculture is the lack of marketing outlets where farmers can sell at remunerative prices. The ICT-based TradeNet platform has been useful in helping farmers find

buyers and make business deals without having to physically move to spot markets. To complement that, IFDC is about to get funding from AGRA to implement a marketing project aimed at linking farmers to markets by helping them to establish long-term business relationships with assured buyers.

IFDC's success is derived from its decision to address complex and difficult but real problems that the different stakeholders face. Although not always easy, IFDC makes concerted efforts to involve the multiple stakeholders in the conception, planning, execution, monitoring and control of the projects and has developed strategic partnerships in the process.

The one thing IFDC has not done well is its ability to capitalize on lessons learned. Ideally at the end of every project, there must be a formal closure where lessons learned are documented, databases created and project data archived for future retrieval and use. If all projects did this we would have contributed largely to the body of knowledge in Innovation Systems Development.

References

Debrah, S. Kofi (2009). Importance of ICT-based MIS for Enhancing Agricultural Incomes. In "towards Priority Actions for Market Development for Africa Farmers" *Proceedings of an International Conference organized by AGRA (Alliance for a Green Revolution in Africa), Nairobi, Kenya, May 13-15, 2009*

IFDC 2008a. End-of-Project MISOWA Project Report submitted to USAID. *IFDC Ghana, Accra*

IFDC 2008b. Compiled Testimonies of Users of TradeNet. *IFDC Ghana*

Technology as opportunity

Thomas W. Kuyper
Department of Soil Quality, Wageningen University,
P.O. Box 47, 6700 AA Wageningen, The Netherlands

The word *Opportunity* has been a buzzword during the CoS-SIS conference. During CoS-1 the word opportunity was also a buzzword. (For instance the word opportunity occurs 11 times in the CoS paper by Hounkonnou *et al.* published in NJAS in 2005.) Almost always the word opportunity was used in the context of 'the small windows of opportunity for resource-poor farmers'. Therefore the main question of this presentation revolves around the issue whether and what role technology can play in enlarging these small windows of opportunity. Intuitively, the answer would be an unambiguous yes – it is impossible to stretch the windows of opportunity without new technology. But at the same time, the large number of projects where the impact of technology did not last (that is after the artificial conditions that were introduced with the project disappeared) or where the technology was vetoed by farmers through non-adoption, demonstrate that this intuition is incomplete at best.

Such failures can often be explained by the fact that technological opportunities were disconnected from the wider institutional (socio-economic, political) context. Innovation results from the interplay of technical and institutional development and if one of these developments stagnates further development along the other axis will have no impact. The relationship also implies that technological and institutional development may have their own temporal scale(s) and that these scales do not always match. In cases where institutional development has a slow rate of change, the pace of successful technological change is similarly limited. Another important question that this relationship raises is whether technological developments affect institutional development and vice versa, or whether both change over time and are only correlated. If there is mutual causation, we could try to use new technology as an entry point for generating or achieving institutional change.

An example from CoS-1 could illustrate my point. Both Samuel Adjei-Nsiah and Aliou Saïdou worked on issues of soil fertility management in relation to land tenure. In both Ghana and Benin technologies were available that could maintain or improve the fertility of the land, but these were not used by all farmers. Especially, some groups of migrant farmers did not use them. Those migrants claimed that they did

not have the possibility to use them due to the prevailing system of land tenure. But landowners claimed that they had no choice except imposing those land tenure rules because alternative arrangements would rapidly deplete soil fertility. In such a situation of deadlock, technology by itself would unlikely directly contribute to improved soil fertility management – otherwise these technologies would already have been picked up. Instead both CoS researchers proposed to introduce technological alternatives as a way to change the tenure system. Such a system would only be successful if the technology could change the zero-sum game (a better arrangement for migrants brings less profit for landowners and vice versa; the cause of the deadlock) into a win-win situation for both landowners and migrants. In order to achieve that the role for science and technology was twofold:

- Use technology to increase the productivity of the land
- Provide instruments that assess or help farmers assessing the effectiveness of these technologies

Scientists therefore took the role of honest brokers rather than that of outside experts with a solution.

The long-term success of that role that scientists played has not been assessed – that will take part when CoS-1 will be evaluated. However, preliminary experience from Ghana indicated unexpected problems related to ambiguous social dynamics. (In retrospect, it would have been better to describe the ambiguity as due to as ambiguous institutions – some African institutions do not reduce uncertainties in interaction, but allow a certain degree of ambiguity and space for maneuvering.) Informal rules (and tenure rules are not very formalized) also turn over very slowly, more so than the formal and written rules of tenure that were part of the agreement. That large temporal scale is probably hampering the successful introduction of new technologies for soil fertility management. (Similarly, the large temporal scale may also have a negative impact on more formal tenure rules with a shorter turn over time.)

Further instances where technologies for improvement of soil and crop management practices exist but are underutilized unless the technology affects the social and institutional dynamics can be easily found. An example is the System of Rice Intensification (SRI). As a technology it can be described as a set of practices (including age at which seedlings are replanted, seeding quantity, planting density, water management). But the successful implementation of the technology depends on the context – different forms of water management necessitate collective action; and the new forms of collective action make better and more self-confident farmers, which already leads to agronomic improvements. Therefore SRI combines better

technologies with the formation of better farmers. Farmer Field Schools (FFS) would provide a further example.

Mutual causation is also visible from the other perspective, when institutional dynamics prevent certain technological changes. As an example I refer to Conservation Agriculture (CA), another set of practices that could maintain soil quality and crop productivity with less external input. But here organization of labour (division of labour, labour alternatives outside agriculture, options for child labour versus schooling, etc.) hampers the technology. Only farmers who could overcome these labour constraints, can use the technology – the opportunity is then partisan. Richer farmers (who can solve labour constraints for additional weed management by buying herbicides [which then makes CA potentially less sustainable] or by buying equipment for weed management) can grab the opportunity, but for the resource-poor farmers the technology is beyond their opportunity and they will then remain non-adopters.

I therefore propose that we should not look at opportunity as being somehow a property of a technology, but rather look at opportunity as the fit between the technology and the wider (institutional) context. Because of that latter, many technologies do indeed not stretch the windows of opportunity for resource-poor farmers. Especially technologies that neglect labour constraints run a risk of rather diminishing these windows.

References

A. Saïdou, R. Tossou, D. Kossou, S. Sambieni, P. Richards & Th.W. Kuyper 2007. Land tenure and sustainable soil fertility management in central Benin: towards the establishment of a cooperation space among stakeholders. *Int. J. agric. Sustain. 5: 195-212.*

S. Adjei-Nsiah, C. Leeuwis, K.E. Giller & Th.W. Kuyper 2008. Action research on alternative tenure arrangements in Wenchi, Ghana: learning from ambiguous social dynamics and self-organized institutional innovation. *Agricult. Human Val. 25: 389-403.*

N. Röling 2009. Pathways for impact: scientists' different perspectives on agricultural innovation. *Int. J. agric. Sustain. 7: 83-94*

International trade and markets: Opportunities and constraints

What kind of innovation systems?

Niek Koning
Wageningen University Department of Social Sciences,
P.O. Box 47, 6700 AA Wageningen,
The Netherlands
email: niek.koning@wur.nl

CoS-SIS focuses on stakeholder networks for participatory innovation. This approach was used in countries that successfully developed their agriculture. However, in these countries, it was part of a larger package, in which government support played a key role. Governments invested in roads, irrigation and rural electrification; supported family farms through land reform, tenant protection and consolidation; sponsored research, extension and education; and systematically intervened in markets to stabilize and support agricultural prices. In spite of free trade theory, nearly all countries that successfully developed their agriculture have protected their farmers. Most West European countries and Japan have been doing so from around 1900, all other developed countries from the interwar period, and other Asian Green Revolution countries from the 1960s or '70s. Countries that failed to protect their farmers often saw their agriculture stagnate. In Britain between 1880 and 1930, the lack of protection entailed near total stagnation of productivity growth in agriculture. In Asian colonies of European countries, it entailed a downward spiral of resource degradation and poverty. And a similar involutionary spiral is seen in many places in Africa today (Koning 2007).

Apparently, government support is a sine qua non for getting agriculture moving. Why is this so? Before the Industrial Revolution, agricultural development mostly proceeded without state intervention. When populations increased, the supply of farm products had difficulty to follow the increase in demand, so that agricultural prices rose and labour became cheaper. It made investing in agriculture profitable for landlords or larger farmers, who took the lead in agricultural intensification and innovation. From the later 19th century, however, industrialization removed the traditional shackles on the global supply of farm products. The effect was a regime change in international markets (Schultz 1945). Agricultural prices became subject to

Figure 1. Real wheat prices (1901-05 = 100)

a long-term decline. Also, they became more instable because the increased room for supply growth enhanced the effect of investment booms and slumps on the market situation (Figure 1). It is often thought that agriculture should have adjusted by a shake-out of small farmers and a shift of labour to other sectors. However, economies of scale in farming were too small to enforce this response. Rather than leaving their farms, in modernizing areas, smallholders tightened their belts and defended their incomes using new technical and market opportunities for increasing production. It led to a treadmill that generated recurrent oversupply. This made primary agriculture unprofitable for larger entrepreneurs, who therefore no longer fulfilled a leading role in intensification and innovation. As a consequence, agricultural development had to be based on smallholdings. This was only possible if governments intervened to smooth the transition from large to small farms, mitigate the drawbacks of small farms for innovation, and support and stabilize prices so that frugal smallholders had some margins left for investment.

Such government support first evolved in differentiated market economies with not-too-dominated peasantries and constitutional states that were not colonized by European countries. In such a configuration, landowners and tillers mobilized on the basis of sector and class, agronomists and officials highlighted the need for supporting agriculture in the national interest, and many industrialists endorsed supportive farm policies because these could stimulate the domestic market for manufactures. In other

types of societies, supportive farm policies evolved less easily. In many colonies, the disconnection between indigenous farmers and colonial officials prevented the introduction of protection. Where large landowners were dominant, like in Latin America, rather than leading the sectoral demand for support, they evicted millions of labourers and small tenants to pave the way for cost-cutting mechanization. In societies where kin was more important than class and the state was a kind of property of the ruling group, farmers clustered into clientelist factions rather than on a sectoral or class basis. This situation, which existed in much of Africa, was not conducive to the emergence of Asian-type developmental states that supported their farmers. Nevertheless, things are changing. Today, one sees the emergence of African farmers' organizations that develop capacities at national and regional levels and which are negotiating with their governments for more supportive policies.

A complication is that these organizations also have to cope with international powers that are pressuring their governments to not protect their agriculture. This has to do with the evolution of international trade policies. To avoid distortions of international markets, the original General Agreement on Tariffs and Trade prehibited countries from coupling agricultural protection to production and export controls. The EU and the US have not conformed to this condition and allowed their protection to entail rampant dumping. To whitewash this violation of the GATT, in the Uruguay Round, they enforced their own kind of 'liberalization'. According to it, price supports had to be reduced, but direct payments were exempted from any condition. By shifting to direct payments, the US and the EU can now continue to export farm products below their own cost of production without violating official trade rules. At the same time, they use 'liberalization' to justify their refusal to cooperate at international arrangements for stabilizing tropical export crop prices, and to pressure poor countries to reduce their own tariff defenses – like in the case of the European Partnership Agreements (Koning 2008).

What are the consequences of all this for a programme like CoS-SIS? The import is that participatory innovation and stakeholder networks are not enough to get agriculture moving. They should be combined with *enabling policies at higher levels*. The possibilities for researchers to influence policies are limited. Nevertheless, we could do a few things:

- We could acknowledge that farmers' organizations have developed capacities at national and regional levels and become a negotiating partner of governments. When we formulate a program, we could ask national and regional organizations about their research needs – *before* the main decisions about domains, disciplines and personnel have been taken.

- We could highlight the policy conditions that should be fulfilled to make our solutions work. For example, we could clearly state that our solutions for irrigation can only work if irrigation crops such as rice are protected against cheap imports with which African farmers cannot compete.
- Finally, we could be aware of possibilities that our activities offer for farmer mobilization. In the cocoa group, for example, we have been talking about grading and price differentiation. This is important for increasing the quality of cocoa, but it would also offer opportunities for the self-organization of farmers in groups that engage in bulking and grading.

References

Koning, N. (2007). What can be learned from the history of developed countries? In N. Koning & P. Pinstrup-Andersen, *Agricultural trade liberalization and the least developed countries* (pp. 197-215). *Dordrecht.*

Koning, N. (2008). *The evolution of farm policies: a long-term global perspective*. Paper for the CoST workshop on "State agricultural policies: causes, implementation and consequences", 3-5 June 2008, *Möschberg/Grosshöchstetten.*

Schultz, Th.W. (1945). *Agriculture in an Unstable Society*. MacGraw Hill, New York & London.

The international trade perspective

Protection measures needed for the development of the agricultural sector in West Africa

Babacar Ndao
Technical Advisor, ROPPA

Introduction

As far back as 2005, ROPPA, has been aware of the importance of supplying ECOWAS negotiators with tools on APE and WTO during a regional workshop held from 17 and 18 November, at the conference hall of ECOWAS Bank for Investment and Development (EBID) in Lomé (Togo), to validate studies on agricultural issues in the CET /APE/WTO process. This workshop should also serve as a reference for remarks on the Common External Tariff because it is consistent with the recommendation of ECOWAS Heads of State on the urgency to implement ECOWAP and involve socio-professional actors. ROPPA assumes the responsibility of this issue together with many other actors who are our partners since main topic of this workshop was the validation of studies on agricultural issues in the CET/APE/WTO process.

The contribution of ROPPA

ROPPA was also involved in the presentation of the Memorandum on issues in the agricultural sector in ECOWAS external trade policy. It is as part of its contribution to the debates that ROPPA, together with its partners and resource-persons, began a series of studies and reflections on "protection measures needed for the development of the agricultural sector in Africa" while ensuring food sovereignty.

The main objective was to identify trade policy tools to apply at ECOWAS level to meet the objectives the region has set itself in its common agricultural policy (ECOWAP). In a food sovereignty approach, ECOWAP aims to satisfy food needs, contribute to the region's economic and social development and promote a reduction in poverty and inequalities by primarily increasing the availability of local products and promoting regional trade. To achieve this, ROPPA wishes to act by influencing

and lobbying all policy instruments. These instruments can be organised into three interdependent groups:

1. Policy instruments that influence markets;
2. Policy instruments that influence resources; and
3. Policy instruments that influence institutions.

Instruments in the first group can be:

- Subsidy and tax policies of products and inputs in the local market;
- External trade policies (taxes, subsidies, quota);
- Policies on the use of food aid (quantities, methods of distribution and how to put it on the market, price, etc.; public buying (Brazil);
- Agricultural products and inputs storage policies (for instance: subsidy on farm storage facility);
- Intervention policies on agricultural products markets (guaranteed minimum price, strategic reserves, packages, etc.);
- Exchange rate policy (which determines prices of products traded with the rest of the world).

For instance, during the adoption of CAP basic instruments, the Council of the European Union (Cabinet) established two instruments through the European Agricultural Guidance and Guarantee Fund (EAGGF): the Guarantee section and Market support funding. This section was replaced by the European Agricultural Guarantee Fund (EAGF).

In the second group of policy instruments, we mostly find resource management rules. They may be fiscal instruments or incentive measures influencing the behaviour of economic agents. Example is the multi-functionality in agriculture – payment for work linked to protection.

For the third group of policy instruments, which influence institutions, it could be

- Restore the State's regulatory roles (education, health, security, arbitration, etc.);
- Ensure the responsible participation of all actors;

As an example CAP derives its success from two things: first, farmers' participation (COPA) in all decision processes (Studies) and secondly, state political commitment for 40% of the EU budget is devoted to CAP. It includes above all regulation and protection aspects. These are probably the most efficient tools to also influence the market if we want a people's ECOWAS we should work towards that.

For example, as far as the European Common Agricultural Policy is concerned, article 34 (previously article 39) of the Treaty made provision for the implementation of a common organisation of agricultural markets that could take three forms:

- Common rules on competition;
- Compulsory coordination of the various national market organisations;
- European market organisation.

The Stresa conference defined the main principles of CAP:

- Market uniqueness corollary to the free movement of goods;
- Community preference, which protects the European market from cheap imports and world market fluctuations;
- Financial solidarity, expenses imposed by CAP are catered for by the community;
- Guaranted minimum producer prices.

It is clear that besides the choice of individual instruments, what is important in a policy formulation is its coherence and the use of the synergies and complementarities of the various instruments selected. For instance, community preference would make it possible to shelter European agriculture from fluctuations by granting it advantages in terms of prices compared to imported products and farmers could enjoy indirect aid that is "regulated prices".

ROPPA's work contributes to the finalization of the ECOWAS Common External Tariff (CET), which aims at creating a common customs union. In this case it is therefore about defining what trade policy tools linked to ECOWAS could be more appropriate to:

1. Stimulate food production in each of the countries,
2. Promote regional trade.

The international context

In an international context where the economic system works in such a way that food sovereignty can be destabilized at any moment by speculative behaviours where the international community cannot establish rules beneficial to all and stop carelessness. Every country or group of countries should have the right to find by itself the resources needed to avoid the dreadful effects of such behaviours. Development of production and its protection are necessary.

Yet our countries have not invested in agriculture. During the last three decades of liberalization and structural adjustment, African governments have given agriculture less than 10% of budgets even though it accounts for more than 30% of ECOWAS

GDP and employs more than 60% of active people. In Europe however it is 2% of active people, 2% of GDP and almost 50% of the Union budget, which is allocated to agriculture.

In 2025, the population of Sub-Saharan Africa is estimated to exceed one billion people as a result of a high demographic growth rate. There are now more than 15 million young people who will be looking for employment every year. The demographic transition is not complete and is therefore one of the region's big challenges. It therefore becomes a major political, economic and social issue.

Agricultural as well as the land, its natural support, are means to anticipate these trends and should therefore receive a special treatment. Yet we have great potentials for example.

- The region has about 236,036,000 ha of land suitable for cultivation. Only about 55,454,000 are actually farmed.
- Out of the 10 billion ha of irrigable land in West Africa, the region managed to develop less than 10% of this potential.
- These 10 million hectares of irrigable land could feed more than the 420 million inhabitants the region will have in the year 2020. In addition, the region has 170,397,000 ha of pastoral lands, which are not very much cultivated as well as important forest, wildlife fishery resources reserves.

Furthermore, the continent devotes more than 30 billion dollars a year to import food (twice higher than aid received). With the increase in prices, the bill has more than quadrupled and has become unbearable for our countries. The sub-region has a huge deficit.

Reflection on the application of strengthened protection measures, whether limited or structural, to stimulate agriculture and develop regional trade is justified for several reasons. In Ouagadougou, ROPPA carried out the restoration of its controversial study on CET with ECOWAS in the beginning of February 2009; shortly before the sixth meeting of the said committee which was held from 10 to 14 February in the same city in Burkina Faso; the meeting allowed experts to make progress on the identification of products to classify in the fifth band. OPs without any doubt also hoped toconbsidering make progress on the re-classification of products in all the 5 bands or make progress on the other protection measures and mechanisms of ECOWAS CET.

ECOWAS should be able to negotiate to increase its protection at importation, considering the consolidated and applied customs duties of some developed countries. PED on some sensitive ECOWAS products show that ECOWAS has to

increase the margins of its consolidated and applied customs duties and its choice of customs duties terms as long as the Doha round is not finalized and does not prohibit specific and complex customs duties. At least this should be done at the same time ECOWAS negotiates at WTO the consolidation of an agricultural DD common to all its member States at a high level, of 150% preference for example.

Reflections on system innovation, innovation systems, opportunities and change

Cees Leeuwis
Professor of Communication and Innovation Studies,
Wageningen University

The CoS-SIS ambition: working towards 'system innovation'

In the first phase of CoS we started with the ambition to make science relevant to farmers, and develop innovative solutions that could work under farmer conditions. However, we concluded eventually that 'appropriate technology' alone is not likely to result in meaningful change, and that it is important also to alter the boundaries and conditions that affect the space for change. In CoS-SIS, therefore, we strive for more radical forms of innovation, that include a re-organisation of social relationships and institutions, whereby the term 'institutions' refers to the formal and informal rules, organizational forms and policies through which society is ordered. Examples of possibly relevant institutions that we may want to work on in CoS include land tenure arrangement, trade policies, mechanisms for benefit distribution in production chains, regulations for water distribution, etc. The kind of profound socio-technical innovations that we are striving for in CoS-SIS are called 'system innovations' (Geels, 2002) in modern innovation literature, i.e. innovations that involve a simultaneous re-configuration of social and technical systems. Using a computer analogy, we can define a system innovation as a successful combination of 'hardware' (i.e. new technical devices and practices), 'software' (i.e. new knowledge and modes of thinking) and 'orgware' (i.e. new social institutions and forms of organisation) (adapted from Smits, 2002).

Relating 'system innovation' to 'innovation systems'

Another term that is often used in innovation studies and by organisations such as the World Bank is that of *'innovation systems'*. This term is often used to refer to the innovation support infrastructures (such as research and extension) that are in place to catalyse and induce innovation (including possible radical system innovation) in society. In this context, some people speak of 'national innovation systems' and/or 'sectoral innovation systems' (Lundvall, 1992) such as the agricultural innovation system. In CoS-SIS we do not use the term 'innovation systems' in order to refer to a fixed set of organizations with clear boundaries, because we feel that one cannot

realistically know in advance which organisation or stakeholder may (have to) become involved in working towards system innovation. Also, we feel it is not very appropriate to assume that there is already somehow 'a system' in place to realise innovation. The word 'system' carries connotations of synergy and collaboration towards a common goal, which in reality are often lacking. Moreover, the set of actors that is relevant any particular innovation process is likely to change over time as a result of newly emerging insights and experiences in an ever-changing context. Thus, we decided in CoS-SIS to speak of *(transient) networks of actors who may (or may not) become effective over time in realising a system innovation*. More precisely, we can say that current practices in agricultural chains are shaped by networks of interactions among stakeholders (farmers, traders, processors, consumers, governments, etc.), and tend to be reproduced (i.e. they have a degree of stability) because actors draw upon existing institutions (formal and informal rules) when interacting with each other. Our ambition to realise system innovation means that we are interested in changing dominant social institutions and interaction patterns. To achieve this, we must somehow contribute to the formation of new networks, and to establishing a process of learning and negotiation towards new 'hardware', 'software' and 'orgware'. It is only when the network becomes effective in realising a 'system innovation' that we could speak of an emerging 'innovation system'. Thus, the two terms are closely related, and in fact even pre-suppose each other. The term 'system innovation' points essentially to an ambitious outcome that is strived for, while the term 'innovation system' refers mainly to the process through which the former is effectively achieved. The idea of 'Strengthening Innovation Systems' (the SIS in CoS-SIS) is reflected in the programme's emphasis on organising and designing a **process** through which scientists and societal stakeholders become effective in altering the framework conditions in which farmers operate.

The CoS-SIS hypotheses in essence

The above elaborations essentially mean that we have the following hypotheses in CoS-SIS:

Part 1: The CoS-SIS **process approach** is effective in realizing meaningful techno-institutional change (i.e. 'system innovation' or 'changing interaction patterns in networks').

What the CoS-SIS process approach exactly *is*, is yet to be defined and described more clearly. But it includes elements like diagnosis of institutional constraints and opportunities, working with (or event establishing) nested platforms, tailoring research agenda's, engaging in collaborative research, etc.

Part 2: The techno-institutional changes realized contribute to improvement of farmer livelihoods and to reduction of poverty.

Conceptualizing the process

Building on different strands of literature, we argue that three (simultaneous) processes deserve particular attention and support in order to contribute to this. The first process is that of *network building*. We have seen that innovation inherently implies a re-configuration of relationships within and between networks, and possibly the formation of new networks and/or the demise of existing ones (Engel, 1995; Callon *et al.*, 1986). A second key process is *supporting social learning and experimentation.* In different strands of thinking about innovation, learning is considered a critical process for developing a conducive fit between innovations and their environment (Geels, 2002; Rotmans et al., 2001; Smits & Kuhlmann, 2004). System innovation requires that the parties involved slowly develop overlapping – or at least complementary – perspectives on relevant models of reality, problems, goals and boundaries as a basis for identifying desirable, feasible and acceptable options for change. Dialectical debate and joint learning are proposed as the main route towards achieving this (Checkland, 1988); several scholars have labelled this process 'social learning' (Friedmann, 1984; Röling, 2002, Woodhill, 2002; Leeuwis, 2002). The third key process that can be supported is *dealing with dynamics of power and conflict*. Efforts to change the status quo are likely to lead to tensions and conflicts of various kinds. Moreover, the realisation of change in one way or another involves the mobilisation of power resources to overcome resistance. Our point here is not that dynamics and power and conflict must be prevented; instead we argue that they are always at play, but that there are more and less productive ways of dealing with them (see Leeuwis, 2000).

Some relevant process considerations for CoS-SIS

From literature and experience many specific guidelines can be formulated that may be relevant for CoS-SIS (see e.g., chapter 14 in Leeuwis, 2004). At this point I will highlight some that may be of particular relevance at this early stage:

a. *Involving **all** stakeholders is a recipe for disaster* – The idea that conflict cannot be avoided when the aim is system innovation has serious implications for the selection of stakeholders. It often happens that one actor (e.g., a farmer community in West Africa) feels interdependent on another (e.g., the European agro-industry) in solving what they perceive to be a problem (e.g., market distortion), while the other party does not recognise that problem as something that is its concern, and thus feels no pressure to talk seriously -let alone negotiate- about this issue. Similarly, especially resource-rich stakeholders may be feel that they can defend their interests best through other means than negotiation, for example by litigation, lobbying, violence, etc. Here it is important to recognise that conflicts are dynamic, and often evolve along a particular pattern. In the early stages of conflicts stakeholders usually tend to explore and follow their opportunities to 'win' the battle with the means they have available. During such an exploration of 'Best Alternatives To Negotiated Agreement' (BATNA: Fisher & Ury, 1981) conflicts tend to reach a climax, whereby the relations among the opposing parties usually deteriorate. In cases where both parties have considerable resources at their disposal, however, stakeholders tend to eventually find out that fighting each other does not lead to a satisfactory solution to either of the stakeholders, and start to realise that the only way forward is to restore relations, and negotiate a solution. An important lesson that can be derived from this is that an inclusive participatory approach (i.e. one that brings all relevant stakeholders together) only makes sense during the 'final' stages in a conflict cycle. In cases where the key stakeholders do not (yet) feel inter-dependent, interventions may more usefully focus on enhancing feelings/ perceptions of mutual inter-dependence. This may be achieved, for example, by strengthening the position of particular (coalitions of) actors vis-à-vis other stakeholders, or with the help of conventional policy instruments such as new regulations, 'carrots' and 'sticks' and/or strategic campaigns and advocacy.

b. *Working with the existing system, or bypassing it* – Closely related to the issue of stakeholder selection, is the strategic choice of whether CoS-SIS efforts will be directed at working with the dominant actors in the system (e.g., an existing production chain), or bypassing it (e.g., by establishing an alternative chain). What is the most conducive option needs to be assessed contextually. As is indicated in the previous section, establishing a bypass may well be a temporary strategy to enlarge the pressure on actors in the existing system, and work towards greater interdependence.

c. *Ensuring legitimate process leadership* – It is not self-evident that CoS-SIS staff and students will be regarded as credible and legitimate facilitators of learning and negotiation in innovation processes and platforms. Thus, it is important to pay considerable attention to exploring and identifying what people might be better positioned to do so. In this context it is certainly worthwhile to explore already existing initiatives, networks, platforms and leadership arrangements, and investigate whether and how they can be enrolled in the CoS-SIS endeavour, respectively how we can become enrolled in their existing ambitions and work.

d. *Making exploration of opportunities and constraints a permanent process* – Innovation processes are dynamic and must be seen as a discovery process in which new challenges, obstacles and opportunities emerge as a result of learning, negotiation and/or changes in the wider context. Thus, exploration and diagnosis cannot usefully be a 'once only' effort at an early stage in the process. We must somehow ensure that exploration becomes a continuous process and prevent that we become blinded by earlier formulated goals and assumptions. To this end we may regularly invite relative outsiders to critically monitor our efforts and act as sparring partners.

Possible strategies for further exploration of constraints and opportunities

In view of the CoS-SIS ambition, several strategies for collaborative exploration maybe of use:

a. *Get inspired elsewhere and mobilise outside expertise* – It can be very stimulating to look how others (nearby or far away) have dealt with similar problem situations. Face-to-face exchange of experiences can be extremely valuable, but if this is impossible mediated exchange (e.g., a video) may also be of use.

b. *Visualising the invisible* – Relevant phenomena are not always visible and transparent to stakeholders. This holds for e.g., the movement of minerals in the soil, but also for something like the distribution of benefits in an agricultural production chain. Visual models of varying complexity (e.g., a simulation, animation, or a simple flowchart) may aid in enhancing insight (e.g., of where profits in a production chain go) and lead to new ways of thinking. Similarly, visions about the future may well become more tangible if they are somehow visualised, e.g., in an artist's impression.

c. *Analysis of coinciding trends and windows of opportunity* – At any point in time we can see various trends occurring over time. It can be inspiring to identify such trends, and discuss whether or not coinciding trends provide new opportunities for change. In the beginning of the 21st century, for example, we witness a number of relatively independent developments: (1) rapid population growth in China; (2) increased presence of China in the African continent; (3) improved access to Internet in both China and Africa; and (4) the recent signing by China of WTO treaties. In view of these coinciding circumstances, it is not unthinkable that African smallholders might be able to gain access to the Chinese food market. Of course, it would require a network of people to see the opportunity, gain insight in the Chinese food preferences, introduce e.g., soybean production in Africa, find reliable business partners in China, organise transport and permits, etc. It may never happen, or it may happen in such a way that smallholders do not benefit, but the least one can say is that the 'window of opportunity' for accessing the Chinese market is probably enlarged in view of current trends. Clearly, such 'windows of opportunity' can help to orient action in CoS-SIS.

d. *Visioning* – In order to facilitate that different actors and stakeholders develop some common ground, it can be useful to abstract -at least temporarily- from current problems, concerns and issues, and instead focus on a point in the relatively distant future. There are several participatory (large) group methodologies and approaches, which make use of this principle; well known examples are Future Search (Weisbord & Janoff, 1995) and Search Conferences (Emery & Purser, 1996). As can be derived from Box 1, both Future Search and Search Conferences try to encourage that people think about the relations between past, present and future. Looking at the past helps stakeholders to analyse how the present has been shaped, which phenomena are persistent, and which larger trends can be identified. When combined with an assessment of what different stakeholders find positive and negative about the present, looking at trends may help to speculate (!) about more and less desirable characteristics of what is likely to happen in the future, if no significant changes in action patterns and modes of coordination take place. Often, this helps to foster a general sense that 'something must be done', even if stakeholders still disagree about what that might entail. From there, the focus shifts towards generating creative ideas on how the future could -ideally speaking- look like in 5 to 20 years from now, in contrast to the scenario that is deemed likely. When different stakeholders can identify sufficient commonly attractive elements in such ideal scenarios, they can start to reason back to the present ('backtracking') by asking: 'what is it

we can/must do now in order to improve the chances of arriving at a more desirable future?' This is where issues of (coordinated) action planning become significant. In all, the basic idea is that going through an intensive process of joint analysis improves the chances of arriving at an -at least partly- shared understanding about a desirable (and possibly realistic) future, as well as agreement on what action the various stakeholders must take 'today' in order to contribute to arriving there.

Box 1: Basic steps/tasks in Future Search and Search Conferences (based on Weisbord & Janoff, 1995; Emery & Purser, 1996)

Tasks in Future Search	**Steps in Search Conference**
○ review the past ○ explore the present and current trends ○ discuss 'prouds and sorries' (+ and -) of stakeholders ○ create ideal future scenarios ○ identify common ground ○ make action plans	• discussion of our turbulent environment • our system's history • analysis of our current system • the most desirable system in 5 to 20 years • action planning • implementation

e. Simple scenario analysis – When talking about the future, it is not only relevant to discuss current trends, but also uncertainties (Aarts & Van Woerkum, 2002). After all, we do not usually know whether trends will continue. A possibly helpful technique for making uncertainties relevant to innovation is to use them in a 'what if' scenario analysis. This can be done through complex means (e.g., computer modelling), but also by using a simple matrix. One may discuss with stakeholders, for example, what they find the most important uncertainties. These uncertainties can be represented as axis in a figure, and the cells in the matrix can then be used to discuss the likely result of a given combination of conditions, as well as an appropriate response (see Figure 1 for a fictitious example).

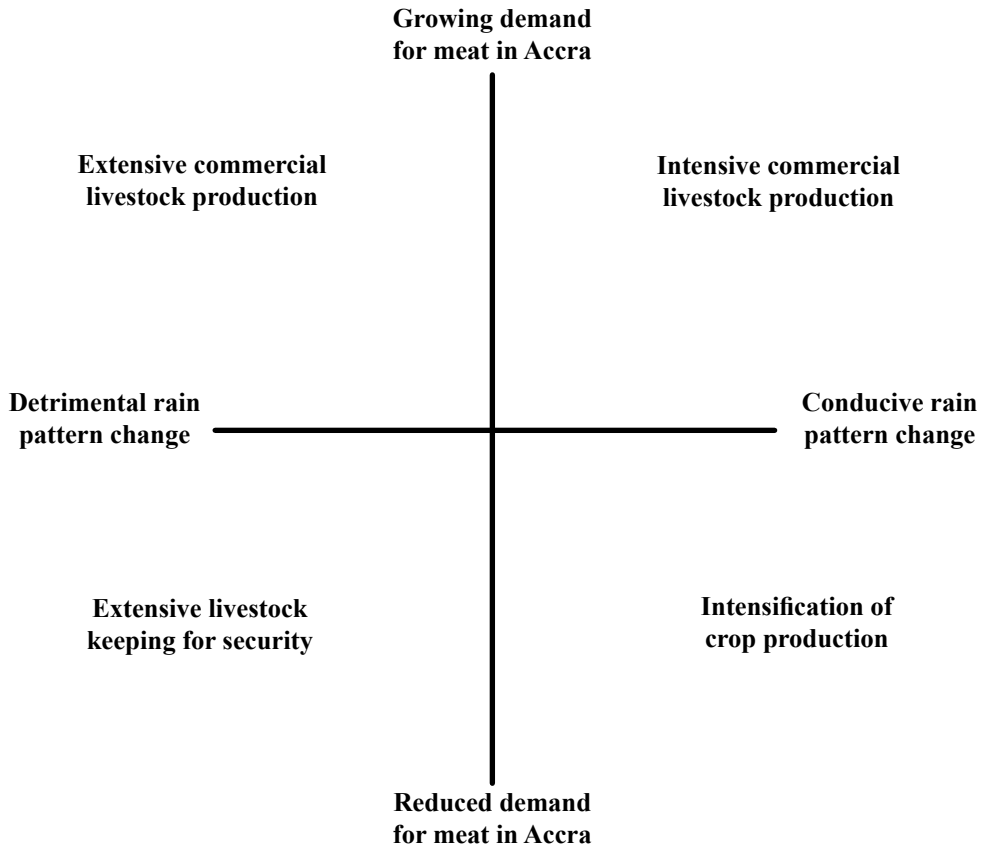


Figure 1. Fictitious scenario analysis, Northern Ghana

Ideas for assessing change from a process and communication perspective

As CoS-SIS is in many ways a process approach, we cannot and should not assess the effectiveness of CoS-SIS only in terms of measures about outcomes and impact. We also need to develop and use a set of process indicators (about e.g., network building, learning and negotiation) to monitor and evaluate our progress. Relevant questions to ask ourselves in connection with this could include:

- How have network configurations changed during the process?
- What kinds of agreements have been reached in (or between) different networks of actors?

- What experiments have been conducted, and what has been learned from these?
- What mistakes have been corrected over time?
- Did the way in which stakeholders talk about problems, solutions, friends, enemies and responsibilities change over time?
- What events have been influential in fostering such changes?
- What was the role of CoS-SIS in critical events defined by stakeholders?

References

Aarts, M.N.C. & C.M.J. Van Woerkum (2002) Dealing with uncertainty in solving complex problems. *In: Leeuwis, C. & R. Pyburn (Eds) (2002), pp. 421-435.*

Callon, M., J. Law & A. Rip (Eds) (1986) Mapping the dynamic of science and technology: Sociology of science in the Real World. *Macmillan, London*.

Checkland, P.B. (1981) Systems thinking, systems practice. *J. Wiley & Sons, Chichester.*

Emery, M. & R.E. Purser (1996) The search conference. A powerful method for planning organizational change and community action. *Jossey-Bass Publishers, San Francisco.*

Engel, P.G.H. (1995)Facilitating innovation. An action-oriented and participatory methodology to improve innovative social practice in agriculture. *Published doctoral dissertation. Wageningen Agricultural University, Wageningen.*

Fisher, R. & W. Ury (1981). Getting to yes: Negotiating agreement without giving in. *Penguin Books Ltd, Harmondsworth.*

Friedmann, J. (1984) Planning as social learning. In: D.C. Korton & R. Klaus (Eds) (1984) People centered development: Contributions towards theory and planning frameworks. pp. 189-194. *Kumarian Press, West Hartford.*

Geels, F. (2002), Understanding the dynamics of technological transitions. A co-evolutionary and socio-technical analysis. *Twente University Press, Enschede*.

Leeuwis, C. (2000) Re-conceptualizing participation for sustainable rural development. Towards a negotiation approach. *Development and Change.* 31**,** 931-959.

Leeuwis, C.(with contributions by A. Van den Ban) (2004), Communication for rural innovation. Rethinking agricultural extension. *Blackwell Science, Oxford*.

Leeuwis, C. & R. Pyburn (Eds) (2002*)* Wheelbarrows full of frogs. Social learning in rural resource management. *Royal Van Gorcum, Assen*.

Lundvall, B. A. (1992) National systems of innovation: towards a theory of innovation and interactive learning. *Pinter, London.*

Röling, N.G. (2002) Beyond the aggregation of individual preferences. Moving from multiple to distributed cognition in resource dilemmas. *In: Leeuwis, C. & R. Pyburn (Eds) (2002), pp. 25-47.*

Rotmans, J., Kemp, R. & Van Asselt, M.B.A. (2001), More Evolution than Revolution: transition management in public policy. In: *Foresight,* 3 (1) 15-31.

Smits, R. (2002), Innovation studies in the 21st century. Questions from a users perspective. *Technological Forecasting and Social Change,* **69**, 861-883.

Smits, R. & S. Kuhlmann (2004) The rise of systemic instruments in innovation policy. *The International Journal of Foresight and Innovation Policy*, **1**, 4-32.

Weisbord, M.R. & S. Janoff (1995) Future search. An action guide to finding common ground in organizations and communities. *Berrett-Koehler Publishers Inc, San Francisco.*

Woodhill, J. (2002) Sustainability, social learning and the democratic imperative. Lessons from the Australian Landcare movement. In: *Leeuwis, C. & R. Pyburn (Eds) (2002), pp. 317-331.*

3. IMPLEMENTATION OF CoS-SIS AND RESEARCH PLANS

Using natural experiments, the viewpoint of institutional economics: Field experiments and institutional change

Erwin Bulte
Development Economics Group
Wageningen University,
P.O. Box 47, 6700 AA Wageningen,
The Netherlands

Introduction

Development workers are increasingly challenged to demonstrate the "impact" of their work. A few years ago this was relatively simple, and it was sufficient to demonstrate a "difference in the means" of the variable of interest between two groups, or to demonstrate a simple correlation between intervention and this target variable. However, times have changed, and the standards of rigor have moved up considerably. After working with multivariate regression models, panel models and instrumental variables models, the economics profession has now embraced experimental methods to evaluate impact.

The use of randomized evaluations has been aggressively promoted as the new "gold standard" of empirical work by so-called "randomistas." Prominent proponents can be found at respected universities such as MIT and Harvard, and institutions like the World Bank have proven to be sensitive to the call for financing field experiments. As a result, the economic discipline seems to be transforming rapidly. However, the new standards of rigor come at a cost. They imply a shift from "why interventions work" to "whether interventions work," and might invite a shift from theory to numbers. Moreover, certain questions cannot be tackled via randomized experiments (think of changing macroeconomic policy). Yet if randomization becomes the standard, then such important topics may become unfashionable from an academic perspective, and will be ignored.

Nevertheless, given the focus of the CoS-SIS framework, it is sensible to explore whether experiments can have a role to play in the methodology portfolio.

The missing counterfactual

The challenge of demonstrating impact is constructing the counterfactual – what would have happened had the intervention not taken place? An object is treated or not, and never both simultaneously, so we cannot simply compare the means of the same object. Of course we can do a before-after comparison, but this introduces the risk of confounding impact with many other factors. Prices or policies may have changed in the meantime. We also cannot simply compare the object to another one that has not been subject to the intervention. This would introduce the risk that these two objects were different from the start (possibly explaining why one got treated, and the other not—a selection effect). Propensity score matching has been developed to attenuate such concerns, but only allows matching based on observables. The cleanest way to create a counterfactual is simply by randomly assigning objects to either a "treated group" or a "control group." Random assignment implies that, in expectation terms, the treated and control group are the same *ex ante*. By considering the difference in the mean of the variable of interest we have obtained an estimate of the average treatment effect. Often, but not always, this is what policy makers are interested in.

Challenges: validity

There are many challenges to a proper design and implementation of field experiments. Here we will only highlight two of them: external and internal validity. External validity refers to the question whether we can generalize the results from the field experiment to a broader set of actors—to what extent are the findings specific and context-dependent, and to what extent may policy makers expect that the average treatment effect applies to the wider community. One factor that compromises external validity is general equilibrium effects. For example, consider the case of an intervention that raises cocoa yields. While at the experimental stage this may raise incomes of treated farmers, it is not obvious that the same benefits apply when countries like Ghana or the Ivory Coast upscale the program to the national level. Even if we ignore the many technical and practical issues that may prevent upscaling, it is evident that expanding the program would raise cocoa supply, likely lowering cocoa prices. If so, the favorable income effects for cocoa farmers found at the pilot (experimental) stage may not eventuate at the national level.

Internal validity is about the question whether we indeed measure what we want to measure (do we really measure trust in a trust game experiment, or something else?), and whether the sample is indeed random. Randomly assigning households to the treated or control group does not guarantee that the eventual samples will be randomly composed. For example, some people randomly assigned to the treated group may prefer not to be treated. If the subset of people opting out is different from

the ones who remain and volunteer to be subjected to the intervention, then biased estimates eventuate—unless properly corrected for by, for example, an instrumental variables approach. Internal validity may also be compromised by spillover effects (or diffusion). If the intervention is a specific "change of behavior," then it may easily be copied by farmers outside the treated group, spreading and contaminating the control group. This would again bias estimates of the pure average treatment effect. The bottom line is that field experiments are not a panacea and should be carefully implemented.

Institutions and experiments

What is the scope for using natural field experiments to analyze the performance of innovation systems within Cos-SIS? I believe there is considerable potential to explore this option. Two issues are important: (i) what is the unit of analysis, and (ii) what is the proper intervention? The treatment could be the institutional innovation of introducing a multi-stakeholder deliberation process. In this case, the question is whether the innovation systems approach arrives at proper identification of bottlenecks and formulation of follow up activities. Since the intervention amounts to introducing discussion, negotiation and bargaining of stakeholders, the unit of analysis should be the community.

Alternatively, the treatment could be a specific (pre-described) intervention, sometimes amounting to a certain change in the governance context. Examples include linking up a random subset of farmers to a specific commodity chain, or enhancing the quality of information available to farmers (improving their bargaining position *vis-à-vis* traders). We may also explore the potential to introduce a grading system for a random subset of farmers. For example, in collaboration with a cocoa buying entity we can adjust the payments system so that higher prices are paid for better quality cocoa. We can then analyze how such monetary incentives impact on farmer investments in improving the quality of output. In this case, the proper unit of analysis may be the individual cocoa producer.

Conclusions

Natural field experiments are transforming the discipline of (development) economics. While there are risks and shortcomings of the experimental approach, it also embodies potential for interesting and policy relevant work. We could explore how to make it part of the CoS-SIS methodology.

Further reading

Deaton, A., 2009. Instruments of development: Randomization in the tropics, and the search for the elusive keys to economic development. *NBER Working Paper # 14690.*

Causal process tracing: Overview and application

Todd Crane and Paul Richards
Wageningen University
P.O. Box 47, 6700 AA Wageningen,
The Netherlands
email: todd.crane@wur.nl

The Convergence of Science meeting in Elmina has given rise to a number of challenges regarding the design and feasibility of the individual PhD research projects and the overall CoS-SIS program. These challenges include, among others:

1. Measuring change in a system whether biophysical and/or social, without using predetermined indicators
2. Balancing between context specificity and generalizable lessons, within and between individual research projects (getting "beyond anecdotes")
3. Identifying and describing mechanisms of change in complex and non-linear systems ("emergent interaction patterns in networks") in scientifically robust ways

This presentation proposes "causal process tracing" (CPT) as a method which addresses these concerns. As a method for systematic of analysis of change in complex systems, CPT is capable of integrating biophysical and social science data, qualitative and quantitative data, and can operate across scales. It is oriented toward testing hypotheses of causality, not simply describing processes.

Causal process tracing methodology seeks to describe a set of contextualised relationships between a range of hypothesised (or candidate) causal process mechanisms. Relationships between elements in the process description may be expressed in informal terms (e.g. as sets of linked elements) or in formal terms (e.g. as a system of Boolean "gates"). The description will embody theory-driven assumptions, but elements in the process and their inter-relationships require justifying or modifying on empirical grounds (by weight of evidence marshalled). The approach is case-study oriented, and is applicable both to within-case analysis and between-case comparison.

CPT is a systematic approach to causation in complex systems. It allows:

- incorporation of theory-driven expectations
- assessment of competing candidate mechanisms, in relation to empirical data concerning context, mechanisms themselves, and outcomes (CMO)
- assumptions to be challenged through new and unexpected findings

CPT differentiates situations in which different causal pathways lead to similar outcomes (equifinality) and in which comparable pathways lead to different outcomes (multifinality), possibilities often masked in standard quantitative studies. CPT also offers an antidote to subjective regression (the piling up of explanatory factors in a subjectively-chosen causal chain reflecting the analyst's initial assumptions or loyalties). According to Perri 6 (2008), CPT involves six basic steps (italicised text below). A 7th step is added for the purposes of CoS-SIS need for cross-case comparisons. A brief outline of the suggested application for CPT methodology is described, using Comfort Kudadje-Freeman's (2008) case study on reformulation of northern Ghana sorghum contract farming as a point of reference.

1. *Select cases. This selection should be theory-driven. Negative cases (where the theory is not confirmed) are especially valuable*.

   Three broad "theories" – contract farming exploits farmers because capitalist relations of production are exploitative (Marxist), contract farming benefits farmers through linking them to the market (neo-liberalism), "convergence" theory (resolving institutional and technical bottleneck issues will benefit farmers). These theoretical framings are intentionally simplistic for the purposes of illustration.

   Northern Ghana *kapaala* sorghum contract farming case for brewery, involving Technoserve. The "test" envisaged would be to implement a "stage two" of the intervention analysed to see if institutional and technical adjustments led to favourable outcomes for farmers;

2. *Develop a background narrative. This is the basic data set against which the hypothesis is assessed.* As per account given in Kudadjie-Freeman et al. (2008);

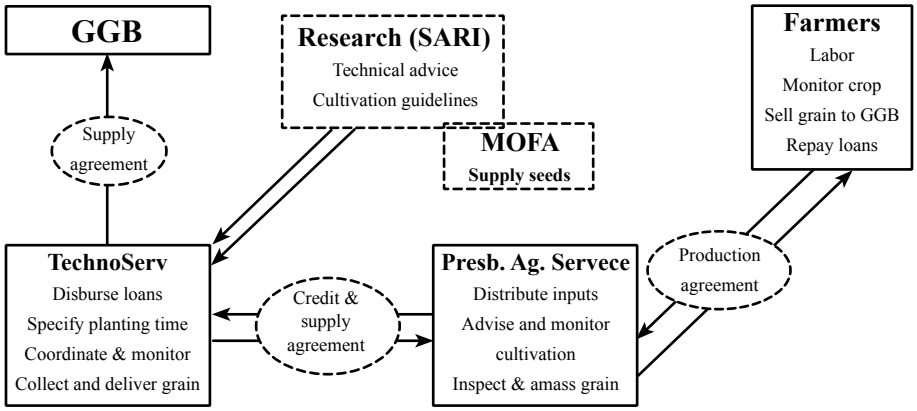
3. *Develop alternative hypotheses to explain the case, reflecting theoretical assumptions.*

   a. Marxist – locate and demonstrate mechanism for exploitation (e.g. that farmers are locked in dependent/exploitative relationship with credit organizations, to benefit of latter)

   b. Neo-liberal – there will be teething troubles, but these should (in some way) show evidence that their resolution is driven by market competition

Causal Process Tracing: Overview and Application

• 2. Develop background narrative



c. CoS – evident difficulties in contract arrangements can be overcome by paying attention to institutional and technical adjustments

4. Operationalize explanatory concepts.
   a. operationalize concept of exploitation – how did credit operate, did farmers have to pay back after poor harvests, did this lead to permanent damage (e.g. loss of land?)
   b. operationalize concept that market competition "resolves" technical and institutional bottlenecks (did a small group of farmers emerge to seize opportunities and develop technology?)
   c. operationalize concept of convergence, e.g. describe steps taken to diagnose and resolve technical and/or institutional constraints.

5. *Deduce inferences from expected observations*.
   a. that many farmers will be locked into a debt cycle
   b. that at least some farmers will see through "teething troubles" to recognise longer-term market opportunities
   c. that stakeholders will actively engage in institutional and technical modification, seeing a way forward through convergence

6. *Test hypotheses against case-study data and offer counter-hypothetical reasoning for each candidate for causal inference*.

   Step 1 – assemble and assess evidence for items 5a. to 5c. above.

   Step 2 – counter-hypothetical reasoning

   a. indebtedness is not recurrent, farmers are able to avoid exploitation e.g. by using subsistence strategies, inflation, etc., as ways of avoiding debt
   b. that further activity "peters out" despite continuing market signals – e.g. even though brewery continues to offer favourable prices for malting sorghum
   c. that despite institutional and technical diagnosis, and efforts to rekindle interest in contract farming farmers show no interest in further experimentation

7. *The abstraction of mechanisms and processes of change for cross-case comparison.*

   Each case study will develop and test its own explanatory model for change within the systems. The abstraction of the mechanisms and patterns of interaction between factors in each case study will enable meta-analysis across the cases studies, leading to more robust generalizations relationship between variables and the nature of system change.

CPT has so far been used mainly by political scientists (although similarly structured approaches can also be found in other social sciences), often to trace and explain "one-off" policy choices or political judgements. Most importantly, CPT has been used as a *retrospective* analytical approach, looking back on events and outcomes that are already known and delimited. Our usage envisages very a different context – analysis of development interventions in ethnographic real time, where some degree of controlled experimentation is possible, but where outcomes are not known until the end of the research.

A remaining challenge in the application of CPT is to address how (in logic, and theory) is it possible to compare experimental (experimentable?) and non-experimental approaches to explanation?

Reference

Kudadjie-Freeman, Comfort, Paul Richards, and Paul C. Struik (2008) Unlocking the potential of contract farming: Lessons from Ghana. In *Gatekeeper Series. Pp. 20, Vol. 139: IIED.*

Proposed CoS-SIS Research Design

Niels Röling
Wageningen University, The Netherlands

IAASTD's main conclusion: "Business as usual is not an option". (Quoted by Janice Jiggins). CoS-SIS seeks to experiment with new pathways of science that are beyond business as usual. "Only by putting such theories into practice will we find out if such schemes can provide a future for African agriculture" (Guardian Weekly May 1 2009).

CoS-SIS is ACTION RESEARCH:

- ACTION: Enhance innovative performance of smallholder agriculture (strengthening capacity and patterns of interaction, technology development, enabling environment);
- RESEARCH: Provide evidence of such system innovation.

This talk is about the second point: how do we make sure our knowledge claims are credible. Why?

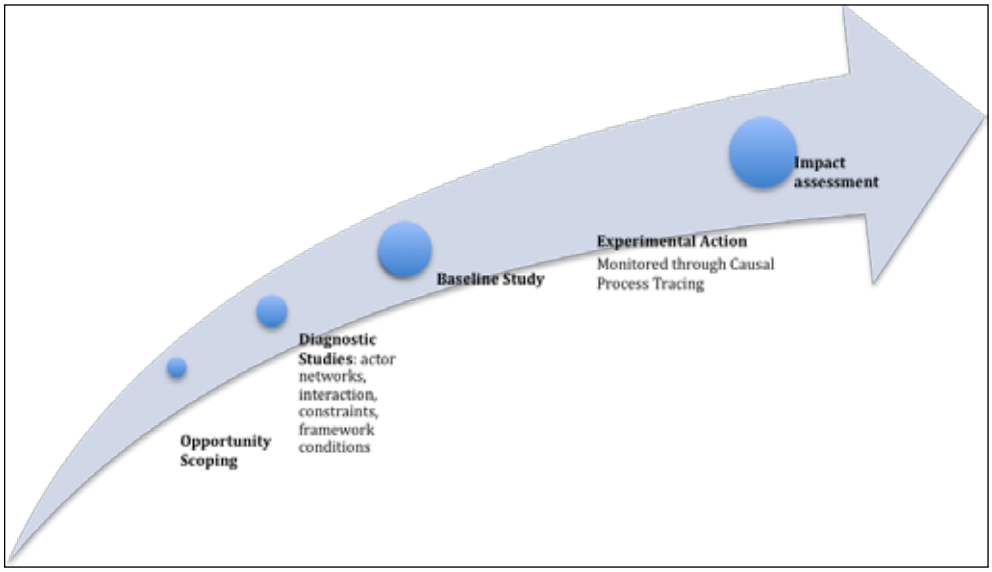
- Contract with donor: 'CoS-SIS must provide evidence of a broader framework than the linear approach … How does KIS apply in African context?' (Wendy Ho);
- Convince development community: 'Has CoS1 been sufficiently evaluated?' (Emmanuel Owusu Bennoah);
- Stand up to sceptics: 'We had to provide proof of concept to the Science Council' (Wale Adekunle);
- 'We want to show impact' (Erwin Bulte).

CoS-SIS is a research *programme* with nine research *projects* (RA and PhD work in the domains). How do we ensure that the *programme* leads to coherent results? (i.e. more than a stack of dissertations and publications). It requires a common design that the partners accept and adhere to.

The design must fit CoS-SIS' open-ended nature so as to fit the complex contexts in which we work. That means:

- Avoid pre-analytic choices (preconceived ideas or indicators that lead to *cul-de-sac* path dependencies);

- Participatory exploration (probing) that allows us to zoom in on what matters: opportunity scoping, diagnostic studies, participatory experimentation;
- Joint learning by moving forward in a multi-stakeholder process.



We now focus on the experiment (box in the figure above). Types of information that CoS-SIS can produce (Hursh-César, G. 1986).

	Extrapolate	***Generalise***
Describe	(a) What behaviour exists in a sub-group.	(b) What behaviour exists in the population?
Explain	(c) What causes behaviour in a sub-group?	(d) What causes behaviour in the population?

- *Describe*: tell what exists;
- *Explain*: tell why something happens and how it is caused;
- *Extrapolate*: make an inference about a population based on evidence from a sub-group that does not necessarily represent the population;
- *Generalise*: make an inference about all situations based on a study of some of them.

In CoS-SIS we want to:

- *Explain*: *What* is impact of using an IS approach*? How* was it brought about?
- *Extrapolate*: We will usually work in situations without knowing how representative they are. We analyse the impact in the situation. CoS-SIS mostly in cell C: *extrapolate an explanation;*
- *Generalise*: In some cases, we can randomly assign situations to treatments: cell D (Erwin Bulte).

Apart from the few cases where we can apply real field experiments with randomly allocation of situations to treatment, the main methodologies for extrapolation that are available for CoS-SIS are:

- *Case studies*: one in each domain;
- *Pilots or demonstrations:* apply IS approach in each domain;
- *Quasi-experimental (QE) design*: no random assignment to treatment, but interrupted time-series (before/after); non-equivalent groups (with/without); comparability across 9 domains: 'Triple Delta design'

For each CoS-SIS Domain:	**TIME 1 (BEFORE)**	**TIME 2 (USE IS APPROACH)**	**TIME 3 (AFTER)**
Experimental Situation (WITH)	***Baseline Study***	***Causal Process Tracing***	***Impact Assessment***
Control Situation (WITHOUT)	***Baseline Study***		***Impact Assessment***

Causal Process Tracing

- Delivers plausible narratives about HOW an IS approach leads to the outcome;
- Traces the process that explains the observed outcome from what happened during the intervention;
- Is a procedure that uses theory to establish a causal pathway of 'mechanisms' that you 'trace' by using observable proxies for the mechanism;
- Is to be carried out by PhD students.

How PhD *Projects* contribute to *Programme*? We propose that PhD dissertations have two chapters in common:

1. Diagnostic and baseline study
2. Causal Process Tracing and impact assessment

These will be published as special issues of international journals. We need to develop common methodology and protocols for these two chapters.

Reference

Hursh-César, G. (1986). The context for using rapid low-cost methods for monitoring and evaluating health care delivery.

Washington: International Communication Inc. for USAID Centre for Development Information

Reflections on Design: Convergence of Sciences and research mechanism to support innovation - Some conceptual and methodological challenges

Roch L. Mongbo
Faculty of Agronomic Science
Faculté des Sciences Agronomiques, Université d'Abomey Calavi
&
Plateforme Nationale pour l'Innovation dans le Secteur Agricole, Benin

Introduction

Convergence of Sciences to build capacity for institutional innovation in agriculture has many conceptual and methodological challenges right from the beginning of the process when it comes to the need to set up a dialogue between the actors and the institutional knowledge involved. Actually, it cannot be easy to build a coherent dialogue in which PhD students could take part and which combines academic requirements, practical application of development indicators, donor expectations and modus operandi of various levels of coordination. A critical aspect of the construction of a convergent dialogue is that of the whole research mechanism. For that purpose one should also take note of the diversity of the innovation system approaches involved and then keep the most realistic research mechanism and reach an optimal consensus on the roles of the actors. This is what I plan to discuss in this text.

Systemic metaphor applied to innovation

The notion of systems, borrowed from ecology and life and earth science by sociology, has since thrived. Nevertheless, it remains an abstract mental perception. In everyday innovation phenomenon, it corresponds to an ideal rather than a reality. The semantic shift from 'innovation system' to 'system innovation' (Leuwis, 2009) makes it possible to avoid conceptual pitfalls but keeps us in the normative ideal of innovation as a social consensual phenomenon.

Innovation or the process through which social actors in opportunistic or strategic alliances create an increase in economic and social value from knowledge and improve a situation is bound to be a contextual process and phenomenon (linked through place and time). Even if a specific innovation involves a lot of actors and interest groups, it cannot be totally contextual since there will be winners and losers. By its contextual and questionable nature it can only be difficult to manage. Indeed, the economic, social and political environment that generates it evolves and therefore there will always be the need for new innovations. In addition, since it is very likely that losers are going to react; the phenomenon has to deal with various forms of disputes including the development of competitive innovations. Finally, technology requires organizational arrangements and strategic coalitions to protect some interests; in short, innovations demand permanent needs.

Conceptual framework of a CoS research to support innovation

Such a theoretical point of view of the innovation phenomenon requires that the basic paradigms to structure this research programme be built around sociological thesis of control or social conflict rather than around social consensus thesis.

Therefore, a prerequisite and some key principles will be considered here. For the prerequisite, we should convince ourselves that those at the heart of the research (professionals in the agricultural sector) are the ***actors*** and therefore not passive agents faced with the problems they encounter in their daily activities. Within the limits of their capacities, they are therefore in permanent innovation. Furthermore, as actors, they have a memory and carry life projects affected by their life dynamic environment. Such a prerequisite has implications for methodological principles and directions. Indeed at local, regional and national levels there is a need to:

- Restore the endogenous engineering and geopolitics (non traditional) of innovation and change by highlighting incorporated local and external ingredients, internal and external contributory alliances as well as opposition faced, the proportion of interventions, past and present projects;
- Develop case studies with theoretical foundation/paradigms and specific hypothesis;
- Monitor past and long-term itineraries of the actors, their rationalities, conflicting trends and interest groups, life project cost and social benefits, their cost and environmental benefits;
- Propose and try out technical, organizational and political structures of alternative rationality and efficiency.

Such prerequisites and principles applied to current concentration themes that are water, oil palm, cocoa, food security, cotton and shea suggest that the following should be investigated and well documented:

- The daily efforts of actors to improve on their profit at the various levels of the value chains;
- More or less successful and conflicting arrangements to control inputs, markets and value addition;
- Understanding that these actors have of the situation and issues. This understanding is often partial due to their partial and selective access to information.

Such documentation will provide researchers opportunities to support innovation within the framework of CoS-SIS, in test (almost) systems that PhD candidates could run with the help of Research Associates and other members of the research groups by combining three operational thrusts, namely:

- ***Technological*** to improve productivity (soil fertility, seeds, alternative or improved techniques or technical systems for processing, preservation, storage, packaging, etc.);
- ***Organizational and informational*** through the formation and/or activation of links and information and knowledge sharing;
- ***Strategic*** by mobilizing interest groups or strategic groups to get and preserve value addition as well as governance.

Research system (experimental) and measurement parameters

The experimental systems are set-ups that make it possible to document changes at their fair value and assess their causes with limited margins of error. They often require ***with/without*** and ***before/after*** type of arrangements (see Daane, Mongbo and Schamhart 1992). In the present case, classic experimental systems with experimental groups or control groups under the control of research seem obviously inopportune. Virtual experimental systems with groups with known socio-economic and innovative differential characteristics exposed to various levels of the initiatives are possible. Such a system of the type "***with various levels of exposition"*** is a credible alternative to the classic "***with/without"***, which is hard to envisage in a social, dynamic and open situation as this one. For the "***before/after"***, there is of course a "***before"***, which would restore the story of the innovation endogenous individual and collective engineering. But instead of the "***after"*** there will be an "***ongoing"***. Actually an appraisal could be done at any time but the on-going processes will continue.

Variables or parameters indicating changes to be measured are of various types:

- Productivity of biological and physical-technical parameters;
- Intrinsic (professional) capacities of actors and structures to access information on techniques, input and product markets;
- Levels of well-being of the households of professionals in the agriculture sector involved or affected;
- Strategic alliances and links at local, regional and national levels (including strategic alliances and links with decision authorities) to produce and exchange knowledge (innovation governance) and to mobilize and keep a substantial part of the value addition.

As we can realize, such a conceptual and methodological view of research requires a combination of disciplines and methodologies, a methodological pluralism which in order to be built around doctorate theses requires a good clarification of roles of the actors involved.

The actors and their roles

PhD candidates while backing up this process to support innovation and change will also care about concluding a doctorate thesis with a disciplinary profiling recognized on the current job market. Indeed while working on the theoretical improvements required in the affected disciplinary field, they will also be real scientific mediators (or *brokers*), intermediaries who throw the bridges required between the sciences to be converged. The supervisors will be responsible for the scientific back up of this exercise in the conceptual logic of the Convergence of Sciences.

Associate Researchers are strategic actors in this set-up since they will enable the programme to really meet the "practical" expectations for processes to begin. Actually the academic calendar of PhD candidates cannot always coincide with that of the dynamics that these processes will cause. Therefore the thematic focus that the PhDs will require will leave whole sections of research fields, themes on which working groups could be formed apart from PhD candidates and where the associate researchers will be very much involved.

National coordinators will play a major role in the coordination of the actors of the centre and especially in alliances to be established with national partner institutions (associations of agricultural professionals, agricultural training and research institutions, other actors and institutions involved in the agricultural sector (see Mongbo, 2008).

For innovation and changes within the framework of this programme to be effective, sub-regional (with associations of professionals and ECOWAS specialized institutions) and international (with chancelleries whose countries are involved in the ongoing debate on opening of markets and play crucial roles in the access of African products on western markets) strategic alliances will be needed. National, sub-regional and international representative committees are primarily concerned here. If this programme aims to produce sustainable impacts on poverty and the abilities of professionals in the agricultural sector to generate wealth, the experimental research system should also bring innovations in giving a sense of responsibility to actors and institutions at all levels.

References

Daane, J., R.L. Mongbo et R. Schamhart, 1992. "Socio-economic research methodology in Africa's rural areas". National University of Benin, Calavi, Benin

Mongbo, R.L., 2008. National platform for innovation in the agricultural sector in Benin: justification and challenges. UAC, Abomey-Calavi, Benin

REPORTS FROM WORKING GROUPS

Cocoa production, Ghana

BENIN

Working group – Cotton in Benin

Participants

Name	Function	Country
Bakiri Tamou	Farmer	Benin
Diakité Ibrahima	Farmer	Mali
Euloge C Togbé	PhD student	Benin
Dr Gualbert Gbéhounou	National PMT member	Benin
Dr Simplice Vodouhè	National PMT member	Benin
Prof Dansou Kossou	National CoS SIS Coordinator	Benin
Prof Arnold Van Huis	International CoS SIS Coordinator	Wageningen
Prof Anthony Youdeowei	International Consultant - CoS SIS	Cote d'Ivoire & Ghana
Prof Emmanuel Owusu-Bennoah	University of Ghana	Ghana
Dr Elisabeth T. Zannou	CoS SIS RAs	Benin

Reporter : Dr Zannou Elisabeth T.

Facilitators : Dr Gualbert Gbèhounou & Dr Vodouhè Simplice

Summary of discussions

During three days, the working group on Cotton in Benin worked on cotton sector to address the Terms of Reference which included promising opportunities and technical entry points for the CoS-SIS programme. Discussion focused on five essentials points, namely:

1 Entry point
2 Assumptions
3 Information to be collected
4 Methods
5 Task division

REPORT OF DAY 1

1: Entry point

Question 1: Discuss/identify potential promising opportunities for CoS-SIS

Question 2: Think about possible institutional/technical entry points for CoS-SIS

- Those with possible leverage to other constraints
- Within the reach of CoS-SIS programme
- Availability of a willing coalition/network of motivated stakeholders
- Availability of process leadership
- Added value of CoS-SIS need for research

Synthesis of the group discussion

- A strong institutional setting is required to implement CoS-SIS through building on the achievements of CoS 1. (example the Case of Dali)
- Soil fertility and crop protection
- The high inputs cost appears as an opportunity to be used as major objective leading to IPCM implementation towards the LEC as entry point with local product extension.
- A diagnostic survey will yield the set of components required to set up a viable system for the sector

REPORT OF DAY 2

The producers expressed the idea that when institutional / organizational conditions are well set up, cotton production could be easily improved.

Question asked by Anthony Youdeowei: Where and how can CoS-SIS use cotton production environment to promote the innovation system?

Synthesis of the group discussion

- Pests to be viewed as a technical problem/constraint to successful cotton production; need to build IPM capacities to address this problem
- IPM/FFS as concept for building up institutional and organisation set up including different actors :
  - researchers
  - extensionist
  - Farmer organizations
  - Input suppliers

- Financial institutions
- Processors
- Marketing
- Transporters
- NGOs, etc.

LEC will be used as pesticide cost reduction factors in cotton production

Favourable Policy environment for implementation of LEC strategy toward ICPM

- Policy makers as actors (special workshop to educate the policy makers)
- Need of political support around IPCM problems implementation mechanism
- PMT members to enhance the information dissemination between the different decision makers.

Question about strategy of implementation

- The involvement of the policy makers right from the beginning of implementation of the system
- The use of CoS-SIS strategy through a CIG for this implementation

REPORT OF DAY 3

1. Location of CoS-SIS activity: criteria for site selection

1. LEC villages
2. Village with PARFCB (Projet d'Assainissement de la filière Coton)
3. Production
4. Financial debts
5. CoS-SIS villages
6. Gender (WFO=Women Farmers Organizations)
7. Complementarities (FAO project)

Based on these criteria the list of villages will be drawn and prioritized. Decision should be made depending on the amount allocated to the research and its objectives.

2. Uncertainties and assumptions

Hypothesis: (Objectives-Outcome)

It is feasible to achieve sustainable livelihood in rural communities in cotton production system using ICPM/FFS concepts for promoting innovation system approach.

Assumptions

1. There is a network of producers using ICPM
2. Producers have ICPM Knowledge and implementation skills
3. ICPM inputs are available and accessible
4. Farmers to farmer training skills are available in the villages
5. Conducive policy environment for promoting the ICPM concept and approach
6. There is a added value to the produce

3. Information to be collected

1. Characterization of the communities and sites (gender included)
2. Information on work already done in the area or related works
3. Similar work done elsewhere
4. Information on government plan (development) for cotton
5. Information on institutions
6. Information on stakeholders
7. Information on cotton market including transportation, transformation

4. Methods to be used

FFS, Stakeholders analysis: Need to be developed by RA/PhD students with their academic supervisors.

5. Task division

The **Research Associate** will focus on the following tasks:

- Deep actors and stakeholders analysis
- Constraints and opportunities identification
- Operationalization and problem solving (Intervention)

The **PhD student** will focus only on the scientific issues that might appear during the whole process.

Question: How to influence Input supply for cotton?

Answer: Various projects working on cotton: CMA (GAP, LEC, IPM), African Development (Good Agricultural Practice, GAP)

6. Planning for the two upcoming months

Activities

- Analysis of criteria
- Selection of the sites
- Update knowledge about cotton system in Benin (CRA-CF, SODECO, AIC, FO, ginners) and visit in two communities

Data to be collected

- General information about what happen in cotton sector
- Find out the constraints and the opportunities (social, technical, institutional), also about IPM and LEC

The PhD student suggested a plan of activities for the two upcoming months (July and august 2009).

Working group - Oil palm in Benin

Participants

Akpo Essègbèmon, PhD student ; Yèmadjè Roland, PhD student ; Fassassi Ramanou, Extension officer (MAEP, Benin) ; Adégbidi Anselme, FSA, UAC ; Vissoh V. Pierre FSA, UAC ; Crane Todd, WU ; Stomph Tjeerdjan, WU ; Niels Röling, WU

Reporter of the group: Pierre V. Vissoh

Summary of discussions

After a brainstorming session, the group identified opportunities emerging from the exploratory study presented by the RA. It was assumed that these opportunities could guide PhD students to undertake their diagnostic studies:

Opportunities identified

- Genetic variability
- Indigenous knowledge of water management
- Oil palm system fallows
- Conflict in the cooperatives
- Oil palm cropping system comparison
- Processing system
- Influence of new oil palm cropping systems on food crop yields

These opportunities are not exhaustive; students can identify more during their diagnostic studies.

More details were needed from the RA as complementary data collection on identified opportunities, including:

- Processing rate
- Palm oil quality
- Palm prices

Methodology

The group discussed the methodology to be adopted by the PhD students for a two months field data collection. Student's attention was drawn to the importance of a detailed Literature review, which is essential for any field work, especially in the oil palm domain.

Study area

Criteria were set for study area selection including Provinces, districts and villages

- Selection criteria
  Criteria could be the rainfall patterns which decrease from South to North and from East to West, the cropping and/or the farming systems, palm oil production versus palm wine production, the importance of oil palm production (high, low production), and population density. The students were asked to set relevant criteria to select representative study areas.
- Number of villages to be explored (8 villages)
  Students were asked to select a manageable number of villages within two months field data collection. They decided each to select 8 villages within the oil palm production area; because collecting data from two selected villages in a week is doable.

Data collection

The type of data to be collected as well as methods and tools for data collection were discussed

- Type of data to be collected
  Qualitative data on farming, cropping, processing, marketing systems, land tenure arrangement, soil fertility, institutional issues in the oil palm value chain, socioeconomic issues
  - Method and tools for data collection
  - Informal
  - Semi-structured interviews (checklist)
  - Participant observation

Time schedule

- Two villages/week
- Data analysis (one week)
- Report write up (one week)

Working group - Water management in Benin

Participants

Dr A. Saïdou Research Associate (RA), B. Onikotan CoS-SIS PhD student, N. Kpera NUFFIC PhD student, Prof. L. Cees Dutch suppervisor, Prof. J. Jiggins Potential supervisor, Prof. C. Gordon from University of Ghana Legon, Prof. R. Mongbo potential Benin supervisor, and Dr. David from WARDA.

Summary of discussions

The objective of the assignment was to discuss the opportunities identified by the RA and to identify potential linkages with the PhD fieldwork.

The discussions started with exploring the opportunities identified by the RA and options analysis in relation with technologies (functions), governance (institution) and interaction processes in relation to innovation systems.

These issues could be better addressed using an ecosystem approach taking into account human (people), environment and the ability to deliver. Potential examples were discussed with regard to water management and crocodiles, integrated agricultural intensification in relation to water quality and rice cropping system in the wetlands, commercial exploitation of rice biodiversity techniques and institutional innovations.

Water and crocodiles

N. Kpera presented an overview of the work on water and crocodiles. She is a crocodile specialist and member of the International Nature Conservation Union. She did her DEA (MSc) on the topic. The overview covered 180 pastoral dams built in the northern Benin (Borgou and Atacora departments) with the initial objective of developing livestock, fish cultivation and vegetable production. These dams are now invaded by crocodiles. Such invasion sometimes becomes a source of conflict between farmers and crocodiles, herders and crocodiles and the other water users with crocodiles. Although crocodiles are protected species, illegal hunting often occurs for traditional uses. There is considerable potential in Benin for crocodiles farming for tourism, and for trophy hunting. A study option for this PhD student could be to investigate the involvement of stakeholders or decision makers in the management of these dams, changes in attitudes and rules with regards to crocodiles in the local communities where the dams were constructed and innovation space offered. This crocodile issue was not part of the study on opportunities carried out by

the RA. The main question was how to link this study with that carried out by the RA. However none of the dams was visited during the exploratory and in-depth studies carried out by the RA. Working Group participants agreed that it could be part of the multifunction of the integrated water management as fish cultivation was identified amongst the opportunities by the RA in order to diversify farmers' activities.

Water quality

Water quality was identified as a constraint by the RA. In the study area, unsustainable farming practices were observed with regards to intensification of irrigated rice production. However, inputs not recommended are used for inland rice; furthermore, water used to irrigate the rice fields belongs to different communities and in the upstream of the river, cotton is cultivated consequently, the irrigation water may be polluted by pesticides and chemical fertilizers.

This topic was of interest as an opportunity because the PhD student graduated in water sanitation and she has expertise in the development of techniques to improve water quality.

Options to be studied could be to investigate the relationships between water quality and food quality, people's health; multiple use of water regarding innovation space and institutions developed; potential technical options to improve water quality by implementing some participatory on-farm experiments.

Multiple uses of water and institutional innovations development

This will be the domain of study by the RA through the establishment of the Concertation and Innovation groups (CIGs). Different learning techniques will be developed in order to empower farmer based organizations to exploit opportunities. Commercial exploitation of rice, off-season crops (maize and vegetable), diversification of crop by developing fish cultivation and conflict over natural resource management between herders and farmers are of interest.

Collaboration between CoS-SIS with the WARDA's RAP program

The group also discussed possible collaboration between CoS-SIS Programme and a similar WARDA's RAP programme on agricultural productivity in Benin and Mali. The RAP project is the following up of the Inland Valley Consortium Project.

Potential areas of collaboration identified by the group include exchange of students, assistance of WARDA to the PhD student, provision working facilities to CoS-SIS, and CoS-SIS team assistance to the RAP project in the multi stakeholder platform management.

MALI

Working group - Water management in Mali

Summary of discussions

i. Production constraints at the *Office du Niger*

- inadequate supervision
- inadequacy between areas allocated and the number of active people
- inadequate training of producers
- deterioration of irrigation channels
- poor drainage
- drop of the water in man-made lakes
- high cost of inputs
- low level of income
- difficult access to credit
- difficult access to some plots
- delay in the supply of inputs
- inadequacy of farm machinery
- invasion of aquatic plants
- inadequate maintenance of sprinkler drains
- excessive debt of producers
- importance of hydrous diseases

ii. Opportunities identified for CoS

- permanent availability of water
- regrouping small producers into associations
- transfer of responsibilities to small producers
- existence of a contract between the Office du Niger and these associations
- booming rice farming
- existence of a sub-regional market
- high urban demand for market garden produce
- existence of banks and microfinance networks
- presence of NGOs
- existence of an operational training centre
- existence of areas that can be developed
- existence of agronomic research station
- commitment of producers to grow rice
- availability of rice processing facilities

- multifunctionality of water
- facility for the preservation of onions
- unit for the drying of onions
- existence of important local markets
- existence of a sub-regional market

iii. Entry points
Improvement in water management

iv. How to extend opportunities for a favourable change to the small producer
Creation of an actor platform

v. Criteria for selection of sites
- diversity of crops and actors
- sites located upstream and downstream of tertiary channels
- site accessibility

Sites selected: Molodo, Niono and Macina areas

vi. Information to be collected
- production constraints
- availability of actors to cooperate

Working group – Livestock/fodder integration in Mali

Participants

Prof Akke van den Zijpp, Dr. Annemarie V Paassen, Dr. Bara Ouologuem (Research Associate), Dr. Adama Traoré, Dr. Koniba Traoré, Mr. Issiaka Guindo, Mrs. Coulibaly Fatoumata Sylla, Mr. Ibrahima Diakité, Mr. Idrissa Diallo, Mr. Drissa Doumbia (PhD student)

Summary of Discussions

Issues discussed

1. Research on an entry point for the study of identified potential value chains
2. Selection of villages in the identified areas
3. Selection of a sample of farms in the selected villages
4. Types of data to be collected
5. Schedule of implementation of the survey.

The discussions aimed at a thorough examination of the diagnosis made by the Research Associates to keep the PhD student busy during his two-month stay in Mali.

Research on an entry point for the study of identified potential value chains

This point was widely discussed and the potential value chains selected are:

- Milk
- Meat
- Subsistence crops (rice, market garden produce)

Opportunities identified for these chains are:

- High demand for rice
- High demand for milk
- Existence of a dairy

It was decided that the entry points for these chains should be animal feeds (agricultural by-products, fodder crops).

Location of study sites

Locations were selected according to the following criteria:

- Access to the milk unit
- Existence of resources (herds and farmers)
- Availability of a pasture area

Based on these criteria, three villages are to be identified for the in-depth survey. This is to be done after returning to the area and discussing with partners.

During this in-depth diagnosis, some points would need to be clarified, especially:

- Criteria used to categorize farms
- Specify the characteristics of the value chains actors

Selection of a sample of farms in the selected village

For the diagnosis, it was agreed on a sample of 4 farms per village, that is, 12 for the three villages that will be selected.

Types of data to be collected

Data to be collected will be primarily of a socio-economic type, for example:

- General data for the sites (population, working population (men and women), equipment, categorization, number of animals, etc.)
- Specific data from the selected villages (farms, farm size, working population, etc.)

Actors from whom information is to be collected:

- DRPIA, DRA, OF, SLPIA, local drainage services, veterinary sector, agricultural sector, LCV, SLCP, CRRA
- Political decision-makers (administration and regions with a measure of autonomy)
- Danaya dairy, OP, producers' unions, Microcredit, producers' representatives
- NGOs (Alphalog, Nieta Conseil, VSF Belgique, Switzerland)

The data will be collected by using a structured interview guide.

Implementation Schedule

This survey will be carried out by the Research Associate and the PhD student. Therefore, they are to work together on the methodology and the interview form but in the field, they will move separately while constantly meeting in sessions to summarize their findings.

The survey is to be carried out in July and August during the student's stay in Mali.

GHANA

Working group – Oil palm in Ghana

Participants

Dr. Adjei-Nsiah
Dr. Tjeerd Jan Stomph
Dr. Ben Nuertey
Mrs. Charity Osei-Amponsah
Mr. George Essegbey
Mr. Joseph Inkumsah
Mr. Emmanuel Odame

Summary of Discussions

The group discussed the presentation by the Research Associate on Oil Palm and made the following suggestions for the PhD's Scoping study.

Location

The scoping study will be done in possibly 3 Districts in Ghana:

(a) Kwaebibirim in the Eastern Region e.g. Otumi
(b) Juaben in the Ashanti Region e.g. Ejisu Juaben
(c) Ahanta West (to be decided later, work could be done by an M.Sc. Student within the 6 weeks for the scoping Study or by a PhD in March 2010).

Cases to be studied

Basically, to study the structure/organization of the various production systems of oil palm. These are the nucleus estates in the plantation, smallholder out-growers (landowner, estate land), independent small scale (land owner, landless).

a. farm sizes, yields, planting materials, methods of farming, types of crops if there is intercropping, types of pests and diseases, how do farmers' system impact on the environment, livestock integration, issues of volunteer/rejected seeds, land tenure arrangements, acquisition of inputs, accessing credit.

Uncertainties/Assumptions

a. Farmers shifting from oil palm to rubber cultivation because of incentives e.g. credit, better prices in some parts of the Western Region.

b. Cheating by women processors who buy oil palm fruits without weighing and diversion of fruits to industrial estates.
c. Waste from the small scale processing pollutes the environment.

Information to be collected

a. Existing national policies, interventions e.g. PSI, existing Farmer based organizations, livelihood strategies, constraints in production, coping strategies, Non-farm incomes for farmers, study the marketing chain of the fresh oil palm fruit, issues of prices, quantity produced and quality, actors involved and their interactions, harvesting, transportation, middlemen, point of sale, uses of the fresh fruit, why are technologies not adopted by some farmers within the district.
b. Types of processors, actors involved and interactions, description of processing machines, yields of palm oil, efficiency of processors, capacity, quality and quantity of oil produced, challenges in the processing industry, coping strategies, institutional issues.

Methods to be used

a. Discussions with farmer groups, input providers, managers of plantations, processors, researchers, NGOs/FBOs, middlemen/women.
b. Key informants, focused groups, open-ended structured questionnaires, observation, use of RA's exploratory study results and networks.
c. Organized workshop for all stakeholders, let each group meet to come out with ideas and then bring them together according to the issues.

Roles of PhD students and Research Associates (RA)

PhD students will visit the study communities and conduct the various interviews. RA will facilitate the Stakeholders platform. He will also share with the PhD his networks.

Working group – Cocoa in Ghana

Summary of discussions

The task of each CoS-SIS domain group during the conference was to identify potential promising opportunities for CoS-SIS. The domain groups were to further think about possible institutional and or technical entry points for the CoS-SIS research programme and then work towards a plan for PhD scoping studies and further RA research in the coming months.

Following presentations by the Research Associate on cocoa (Dr. Emmanuel Dormon), the cocoa working group discussed a number of potential or promising opportunities for CoS-SIS.

Some of the opportunities discussed include:

(i) Production for niche markets (organic cocoa);
(ii) Assessment of the impacts of land tenure arrangements on productivity and profitability of cocoa production;
(iii) Strengthening farmer based organizations for better pricing and improvement in quality and
(iv) Studying the actual economic benefits of the government mass spraying policy.

Point of entry

As a point of entry for CoS-SIS, the cocoa team discussed two main issues – of strengthening farmer based organizations and the improvement of quality. The group also discussed the possibility of testing the effect of cocoa price differentiation on productivity, profitability and quality improvement.

Plan for PhD scoping study

The plan for the PhD scoping survey is to begin with key informant interviews at the Quality Control Division of the COCOBO, various LBCs and other private sector organizations that work with cocoa farmer based organizations.

The PhD student is also to visit cocoa farmers to explore the issues of quality and pricing.

The group agreed that the RA will provide the needed support for the PhD student to collect as much information on quality and pricing at all level of the cocoa system.

Working group – Food security in Ghana

Participants

There were five regular members of the group.

Dr. Simon Oosting (Wageningen University)
Dr. Kofi Debrah, (IFDC, Accra)
Madam Victoria Adongo (Peasant Farmers, Ghana)
Mr. Kofi Debrah (RA/Plan Ghana)
Mr. Kwadwo Amankwah (PhD Student).

A number of other workshop participants spent a couple of hours with the group on different occasions. These include Dr. Sakyi-Dawson (University of Ghana), Prof. Cees Leeuwis (Wageningen University), and Prof. Ben Ahunu (University of Ghana).

Summary of discussions

Four items were discussed: definitions of food security, exploration of windows of opportunity based on the RA's presentation on food security, possible focus for a further study, and probable topic for further study.

The first item discussed was conceptualizations of food security. Three aspects were mentioned, namely, availability, accessibility, and utilisation. One person said there is a fourth aspect but did not recall the concept.

The group then discussed the RA's presentation on Food Security and explored if there were any windows of opportunity for a further study to be undertaken by the PhD student. The suggested entry points were as follows:

- Integration of crop, livestock and markets in smallholder households in Northern Ghana.
- Increased coordination of individuals, groups and organizations engaged in crop and livestock integration in N. Ghana.
- Increased participation in the livestock supply by smallholders in Northern Ghana.

It was suggested that further study should focus on access or entitlement to food in order to build upon one of the major strategies of smallholders in coping with food insecurity, which is the sale of small ruminants and poultry.

A discussion followed on the following question; what do smallholders do or what are their coping strategies? The background information discussed in response to the question was as follows:

- 81.9% of smallholders sell livestock i.e. second only to reduction in number and size of meals (Quaye, 2008)
- Northern Ghana account for bulk livestock production in Ghana
- Livestock supply in Ghana currently supplemented from Burkina Faso

Concluding the discussions, the group suggested the following probable topic: "Institutional constraints in the value chain: livestock feeding and health to improve food accessibility in northern Ghana"

4. CoS-SIS: THE WAY FORWARD

The Scientific Coordination Committee
Arnold van Huis, International Coordinator
Dominique Hounkonnou, Regional Coordinator
Niels Röling, Consultant
Barbara Sterk, Postdoc.

During the first phase (CoS1) of the Convergence of Sciences (CoS) programme, it became apparent that not only technology but also institutions form a major impediment to family farm development in West Africa. Institutions are usually defined as the way we collectively do things, expressions of agreement that have become 'institutionalised' in rules, e.g., gender relations, markets, systems of governance, corruption, etc. The new phase of the CoS programme, "Strengthening Innovation Systems (CoS-SIS), will explicitly investigate how institutions and technology in various combinations can create opportunities for smallholder development. New technologies can, by themselves, create opportunities (e.g., tissue culture multiplication of a new sweet variety of pineapple that allowed Ghana to exploit the world market), but opportunities can also open up as a result of institutional change (e.g., integrated chain development creating a market for organic cotton, the removal of extractive practices that make smallholder farming un-remunerative and non-profitable, or farmer organisation leading to better protection against cheap imports). In most cases, new technologies will require institutional change, while opportunities that open up as a result of institutional change will only give their full potential benefit with the use of new technologies. This nexus of institutional and technological innovation will be addressed by the CoS-SIS PhD students and the Research Associates.

The CoS-SIS Programme thus has a clear research focus that will create a better understanding of what it takes to enlist West Africa's smallholders in strengthening global food security and national food sovereignty. With this objective, CoS-SIS seeks to operationalize the finding of IAASTD that smallholders and their vast productive but presently under-utilised resources provide the best route to enhancing global food security. That security is threatened by climate change and the volatility of food markets in which fewer and fewer global players monopolize the systems and call the shots. In this context, the growing dependence of many West African countries on food imports needs to be diagnosed, and experiments with business models to add value to local farming are called for.

CoS-SIS is particularly relevant and topical because it starts with the current state of farm development in West Africa, explores an understanding of the opportunities and constraints that smallholders face *from their point of view*, and then experimenting with techno-institutional change to realise the opportunities and remove the constraints. But an essential condition for impact of such a research programme is that it provides a *forum for learning and involvement for a wide range of stakeholders* within each of the participating countries (including the Netherlands), and within international networks.

Therefore, CoS-SIS has not only been designed as a research programme but also as an *action-learning programme*. It not only seeks to produce credible and robust information about family farm development in West Africa, but also to create institutional leverage at higher than farm levels to create conducive conditions for family farm development.

These Proceedings contain the reports of the first scoping of opportunities for innovation by the Research Associates. An Innovation System (IS) approach implies that innovation is the emergent property of concerted action among relevant complementary actors to realise an opportunity. Development action using the IS philosophy therefore relies on deliberate facilitation of multi-stakeholder processes to generate innovation as emerging from synergic interaction. For that reason the opportunities identified through the scoping by the Research Associates will be taken up and experimented on by Concertation and Innovation Groups (CIGs) in each domain. Research Associates will be responsible for facilitating one or more CIGs around each of the three domains in each country under the auspices of the country's Programme Management Team. One PhD student and his/her team of academic supervisors are assigned to each domain/CIG, and are responsible for baselines, diagnostic studies, and intervention monitoring and impact assessment. These research projects will be supervised by teams of inter-disciplinary researchers constituted into Domain Advisory Groups.

An important design feature of CoS-SIS is the methodology for describing the experimental treatments (i.e. the actual deployment of the IS approach) in such a manner that they can be compared, that impacts can be attributed and that conclusions can be drawn about the usefulness of the IS approach. Therefore the description and analysis of the intervention, which will hopefully lead to attribution of impact, need to be carried out carefully.

The *interventions* using an IS approach might cover a considerable period and will be composed of four elements:

(1) Identifying opportunities and constraints for smallholder development;
(2) Identifying technological and institutional 'impact points' for realising opportunities and removing constraints;
(3) Identifying and facilitating relevant development actors for concerted action;
(4) Concrete development activities by these actors assembled in CIGs; and
(5) Impact assessment and analysis of how that impact came about.

Establishing robust *evidence of impact and attribution to interventions* will require rigorous research as well as participatory assessment. However, the methodologies for institutional analysis and monitoring still have to be developed, and several papers were presented at this conference on this issue. For answering the question of how to identify, measure and analyse impact on smallholder opportunities, the methodologies need, at least, to deliver the following:

- Baseline information against which any impact of the IS approach can be credibly assessed;
- Diagnostic frameworks that allow identification and analysis of institutional 'impact points' for effective action by CIGs;
- 'Variables' that can distinguish between 'experimental treatments' and 'controls'. Such variables can be monitored by PhD students as CIGs engage in action;
- Some tracing of the process during the intervention to understand what happened.

In addition to delivering robust research outcomes, CoS-SIS is an exercise in *action learning* across a wide range of actors at the higher than farm level. Widespread participation and institutional learning across decentralised, national and international levels will hopefully occur so that the IS approach becomes embedded into policies, poverty reduction strategies and development action.

The first CoS-SIS International Conference reported in these proceedings provided an exciting opportunity for an international group of researchers and development actors to work and learn together what IS thinking can accomplish in terms of achieving development and sustainability goals.

PRINCIPAL ACRONYMS AND ABBREVIATIONS

AGRA	Alliance for a Green Revolution in Africa
APCAM	Assemblée Permanente des Chambres d'Agriculture du Mali
BATNA	Best Alternatives to Negotiated Agreements
BEE	Business Enabling Environment
CAADP	Comprehensive African Agricultural Development Programme of NEPAD
CET	Common External Tariffs
CFDT	French Company for Textiles Development, Benin
CGIAR	Consultative Group for International Agricultural Research
CIGs	Concertation and Innovation Groups
CMDT	Compagnie Malienne pour le Développement des Textiles
CNRA	Comité National de la Recherche Agricole, Mali
CoS-SIS	Convergence of Sciences – Strengthening Innovation Systems
CPT	Causal Process Tracing
CRIG	Cocoa Research Institute of Ghana
CSIR/STEPRI	Council for Scientific and Industrial Research/Science & Technology Policy Research Institute, Ghana
CTA	Technical Centre for Agricultural and Rural Cooperation, Wageningen, The Netherlands
DGs	Directors General
EAGF	European Agricultural Guarantee Fund
ECOWAS	Economic Community of West African States
ECOWAP	ECOWAS Common Agricultural Policy
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FBOs	Farmer-Based Organizations
GDP	Gross Domestic Product
IAASTD	International Assessment of Agricultural Knowledge, Science and Technology for Development
IAR4D	Integrated Agricultural Research for Development

ICPM	Integrated Crop and Pest Management
ICT	Information and Communications Technology
IER	Institut d'Economie Rurale, Mali
IFDC	International Fertiliser Development Centre
IITA	International Institute for Tropical Agriculture
INRAB	Institut National des Recherches Agricoles du Bénin
IPR/IFRA	Institut Polytechnique Rural de Formation et de Recherche Appliquée, Katibougou, Mali
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
NPC	National Programme Coordinator
PNISA	Plateforme Nationale pour l'Innovation dans le Secteur Agricole au Bénin
PPRSD	Plant Protection and Regulatory Services, Ministry of Food and Agriculture, Ghana
RA	Research Associate of the CoS-SIS Programme
RC	Regional Coordinator of the CoS-SIS Programme
SCC	Scientific Coordination Committee of the CoS-SIS Programme
SLF	Sustainable Livelihoods Framework
SSA CP	Sub-Saharan Challenge Programme, FARA
SWOT	Strengths, Weaknesses, Opportunities and Threats
UAC	University of Abomey-Calavi, Benin
UG	University of Ghana, Legon
USDA	United States Department of Agriculture
USAID	United States Agency for International Development
WARDA	West Africa Rice Development Association – The Africa Rice Centre
WTO	World Trade Organization
WUR	Wageningen University Research Centre, The Netherlands

5. ANNEXES

Annex 1. List of Conference Participants

ID. NO	NAME	ORGANISATION	ADDRESS	TELEPHONE NO.	E-MAIL ADDRESS
1	ACKAH-NYAMIKE E.	University of Ghana	Legon	244028959	eackah@ug.edu.gh
2	ADEGBIDI Anselme	FSA-DESAC-UAC	04BP 0887, Cotonou, Benin	(299)21049063	ansadegbidi@yahoo.fr
3	ADEKUNLE Adewale	FARA	2 Gowa Close, Roman Ridge, Accra, Ghana	(233)261437045	aadekunle@fara-africa.org
4	ADJEI-NSIAH Samuel	University of Ghana	P.O. BOX 38 LEGON	245395251	y_nsiah@yahoo.co.uk
5	ADONGO Victoria	Peasant Farmers, Ghana	PMB 56 KIA Accra, Ghana	244657451	vicadongo@yahoo.com peasantfarmers Ghana@yahoo. com
6	AKPO Essegbemon	PhD Candidate, CoS-SIS	BP 840 Calavi, Benin	(229)97481778	e.akpo@yahoo.fr
7	SAIDOU Aliou	FSA/UAC Benin	04 BP 1510 Cadjehoun, Cotonou, Benin	(229)97494480	saidoualiou@gmail.com
8	AMANKWAH Kwadwo	CoS-SIS & AHP College	BOX TL 300 Tamale, Ghana	209171789	kojo116@yahoo.com
9	APPIAH Afia	Hedge, Ghana	7 Oyarifa street, East Legon, Ghana	243903452	aappiah@hedgeghana.org
10	ASANTE Felix	ISSER, UG	Legon, Chana	2446435190	fasante@ug.edu.gh
11	BAKARI Tamou Bio	Producteur, Benin	NIDALI. BP 32	(229) 96-06-15-36	ezannou2@yahoo.fr
12	BELT John	KIT	P.O. Box g5001, logo HA Amsterdam, The Netherlands	(31)20 5688332	j.belt@kit.nl
13	BULTE Erwin	WUR			erwin.bulte@wur.nl
14	CODJIA Jean T. Claude	FSA/UAC Benin	01B526 Cotonou, Benin	(229) 95958769	jtccodjia@yahoo.fr
15	COULIBALY Fatoumata	DNPIA	(223) 20222020, Bamako, Mali	(223)76037392	fatoumacoulh@yahoo.fr

16	CRANE Todd	WUR	MarkT2e. Wageningen, The Netherlands	(31)317483190	Todd.crane@wur.nl
17	CRENTSIL Ishmaelia	UNIVERSITY OF GHANA	Dept of Agric. Extension, University of Ghana, Legon	244847675	ishmaeliacrentsil@yahoo.com
18	DEBRAH Kofi Adade	Plan International, Ghana	P. Box 427, Wa, Ghana	244331951	kofi.debrah@plan-international.org
19	DEBRAH Kofi	IFDC	PMB CT 284, Cantonments, Accra, Ghana	244214489	kofidebrah@usa.net
20	DEMBELE Fadiala	IPR/IFRA	IPR/IFRA Katibougou, Mali	(223)76152369	faddembele@yahoo.fr
21	DIAKITE Ibrahima	CRU-Sotuba	BP 262 Bamako, Mali	22376387925	imadiakite@yahoo.fr
22	DIALLO Idrissa	APCAM, Mali	BP 2499 Square. Patrice Lumumba, Bamako, Mali	(223) 66710035	apcam@apcam.org
23	DORMON Emmanuel	ACDI-VOCA, Accra	P.0. Box MB 539, Accra, Ghana	244374926	edormon@hotmail.com
24	DOUMBIA Drissa	Nature Conservation Off	P.O. Box 275. Bamako, Mali	(233) 76218898	iddriassa_idy@yahoo.fr
25	EFFAH Douglas	University of Ghana	Dept of Agric. Extension, University of Ghana, Legon	243425253	effahgyamfi2001@yahoo.com
26	ESSEGBEY George Owusu	CSIR-STEPRI	BOX CT 519 Accra, Ghana	243753314	george_essegbey@yahoo.co.uk
27	FRANCIS Judith	CTA	AGRO BUSINESS PARK 2 NETHERLANDS 6708 PW Wageningen, The Netherlands	(31)317467190	Francis@cta.int
28	GBEHOUNOU Gualbert	INRAB, Benin	01 BP 215, Porto-Novo, Benin	(229)21388396	gbehounougualbert@yahoo.fr
29	GNAMBELE Djakaridja	CoS-SIS PhD	Bamako, Mali	(233)66898782	gnambjack@yahoo.fr
30	GORDON Chris	UG	Legon, Ghana	208117200	Cgordon @ug.edu.gh
31	GUINDO Issaka	D.N.A	B.P. 1092, Bamako, Mali	(233)66895261	guindoissaka@yahoo.fr
32	HO Wenny	Ministry of Foreign Affairs	P. O. Box 200612500 EB	(31)703484380	wenny@minbuza.nl
33	HOUNKONNOU Dominique	CoS-SIS	03 BP 3030. Cotonou, Benin	22921335901	dhounk2@intnet.bj

34	HUIBERS Frans	WUR	P.O. Box 47. Wageningen, The Netherlands	(31)317484267	Frans.Huibers@wur.nl
35	INKUMSAH J.C. E Joseph	GOPDC	P.O. Box M428 Accra, Ghana	244330102	jc.inkumsah@gopdc.com
36	JIGGINS Janice	WUR	Wageningnen, The Netherlands	(31) 488 451016	Janice.jiggins@inter.nl.net
37	KIEPE Paul	Africa Rice Center	Obr 2031, Cotonou, Benin	_	p.kiepe@cgiar.org
38	KONING Niek	WU	Wageningen, The Netherlands	(31)317484667	niek.koning@wur.nl
39	KOSSOU Dansou	FSA-UAC. COS-SIS Coordinator	06 BP 258. PK6 Cotonou, Benin	(229)21331395	kossoudansou@yahoo.com
40	KPERA Nathalie	CoS-SIS	Benin	(233)90939445	Nathalie.kpera@wur.nl
41	KUYPER Thom	WUR	P.O. Box 47. Wageningen	(31)317482352	thom.kuyper@wur.nl
42	LEEUWIS Cees	WUR			cees.leeuwis@wur.nl
43	MONGBO Roch L.	UAC & PNISA	02 BP778, Cotonou, Benin	(229)95966446	rochl_mongbo@yahoo.fr
44	NANEMA Jacques	University of Ouagadougou/Agrinovia	11 BP 45 Ouagadougou 11, Burkina Faso	78203121	jacquesnanema@yahoo.fr
45	NUERTEY NARH Bernard	CSIR, OPRI	Box 74, Kade	244513466	bennuert@yahoo.com
46	NDAO Babacar	ROPPA	BP 671 Thies, Senegal	(221)776186768	ndao_babacar@yahoo.fr
47	OBENG-OFORI Dan	University of Ghana	Department of Crop Science, Box LG 44 Legon, Ghana	0242877113; 0277601861	Dobenge@ug.edu.gh
48	ODAME Emmanuel A.	MOFA-DAES	P.O. Box MB 37, Accra, Ghana	246852415	berachah3000@yahoo.com
49	ODONKOR NARH Ezekiel	CoS-SIS, Ghana	Box LG 68, Legon	0244531808	Ezenarh2001@yahoo.com
50	OOSTING Simon	COS-SIS/WUR	P.O. Box 338 6700 AH Wageningen, The Netherlands	(31)317484599	simon.oosting@wur.nl
51	OPPONG Kofi Francis	CRIG	P.O. Box 8 Tafo E/R	+233 20 8113596	foppong2003@yahoo.com

52	OSEI-AMPONSAH Charity	CoS-SIS	Ghana	022-402089	cdosie1672@yahoo.co.uk
53	OUIKOTAN Blandine	PhD Candidate	06BP1281, Cotonou, Benin	(299) 90031820	arougba@yahoo.fr
54	OUOLOGUEM Bara	IER- Mali	SRA/SOTUBA 0022320297853 BP 262, Bamako, Mali	(223)76461530	ouologuembara@yahoo.fr
55	OWUSU-BENNOAH E.	University of Ghana	Department of Soil Science, University of Ghana, Legon	772257	eobennoah@ucomgh.com
56	QUARMINE William	CoS-SIS	University of Ghana	(223)20875123	qandq2002@hotmail.com
57	RAMILWAAL Lidi	Netherlands Ambassador	Embassy	(0)244322075	
58	REECE David	WARDA	Benin		j.d.reece@cgiar.org
59	ROLING Niels	CoS-SIS	De Dellen 4, 6673 MD Andelst NL	(31)488 451016	n.roling@inter.nl.net
60	SAMAKE Fafre	IPR/IFRA de Katibougou, Mali	BP 06 Koulikoro, Mali	(223)21262012	samfafre@yahoo.fr
61	Sakyi-Dawson Owuraku	University of Ghana	Box LG 68, Legon, Ghana	(233) 24090460	osakyid@gmail.com
62	SIDIBE Amadou	PhD Student	Koulikoro, Mali	(223)76120945	sidibeama@yahoo.fr
63	SOUMANO Lassine	COS-SIS	IPR-Katibougou, Mali	(233) 66875988	lsno2002@yahoo.fr
64	STERK Barbara	WUR	Wageningen, The Netherlands		Barbara.sterk.wur.nl
65	STOMPH Tjeerd Jan	WUR	BP 430 6700AH Wageningen, The Netherlands	(31)317433079	tjeerdjan.stomph@wur.nl
66	TOGBE Codjo Euloge	FSA-UAC. COS-SIS	07 BP 1049. Cotonou, Benin	(229)95716760	togbe74@yahoo.fr
67	TON van der Zon	Netherlands Embassy, Accra		248894652	ton-vander.zon@minbuza.nl
68	TRAORE Adama	CNRA	Bamako CNRA	(223)76462664	adama.traore@cnra-mali.org
69	TRAORE Koniba	Laboratoire Central Vétérinaire	BP.2295. Bamako, Mali	(223)79036588	traorekoniba@yahoo.fr

70	TRAORE Mamoudou	IFPR/FRA de Katibougou-Mali	BP06 Koulikoro, Mali	(233) 21262012	mamoudoutraore@yahoo.fr
71	VAN DER ZIJPP Akke	WUR	P. O. Box 8031 6700 EH Wageningen, The Netherlands	(31)318504003	Akke.van der zijpp@wur.nl
72	VAN HUIS Arnold	WUR	P.O. Box 8031 6700 EH Wageningin, The Netherlands	(31)1611354084	arnold.vanhuis@wur.nl
73	VAN PAASSEN A.	WUR	Wageningen, The Netherlands	(31)0102135037	Annemarie.vanpaassen@wur.nl
74	VISSOH V. Piere	FSA-UAC/COS-SIS RA. Cotonou, Benin	03BP 2115 Cotonou, Benin	(229)90929276	pierevissoh@yahoo.fr
75	VODOUHE D. Simplice	FSA-DESAC-UAC	02 BP 8033, Cotonou, Benin	(229)21301975	dsvodouhe@yahoo.com
76	WOODHILL Jim	WUR	Wageningen, The Netherlands	(31)0612906809	Jim.woodhill@wur.nl
77	YEMADJE Roland	WUR	Kwikstaarts- Weide 24. Wageningen, The Netherlands		rolandyemadje@yahoo.fr
78	YOUDEOWEI Anthony	CoS-SIS Consultant	Villa 126, Palmeraie, Abidjan, Côte d'Ivoire	(225)22479176; (225)06275514	ayoudeowei@yahoo.co.uk
79	ZANNOU Elisabeth T.	FSA-UAC, CoS-SIS RA	BP 526 Cotonou, Benin	(229) 90010613	ezannou2@yahoo.fr

Annex 2. Conference programme

Conference Objectives

- *To provide a forum at which PhD students, RAs, CoS Coordinators, scientific supervisors, domain experts, and chair persons of CoS-SIS Programme Management Teams can meet and discuss*
- *To create an opportunity for all the CoS-SIS actors to get a broad view and a common understanding of the CoS-SIS research programme and its background*
- *To begin to create a common perspective on institutional change, the Innovation Systems Approach, Multi-Stakeholder Processes and other key concepts*
- *To present, discuss and agree on the overall 'quasi-experimental' research design of CoS-SIS and its use of Causal Process Tracing (CPT)*
- *For the Research Associates (RAs) to present the results of the opportunity scoping in each of the CoS-SIS domains and for these results to be critically discussed and decided upon by the CoS-SIS actors*
- *For the CoS-SIS partners to discuss and guide the next steps of the CoS-SIS process defining the work of both PhDs and RAs.*

Final conference programme

DAY 1 - MONDAY JUNE 22

Chairperson Morning Session: Professor Chris Gordon (University of Ghana)

09h00-10h00: Preliminaries

- Registration of the participants
- Presentation of the programme and general information

10h00-10h45: Opening Ceremony

- Welcome address by Prof. Dr Nii-Noi Dowuona, Acting Provost College of Agriculture and Consumer Sciences, University of Ghana at Legon
- Her Excellency Mrs Lidy Remmelzwaal (Netherlands Ambassador, Accra)
- His Excellency the Vice-President of Ghana John Mahama: Keynote Address

10h45-11h15: Coffee break

11h15-13h00: From CoS1 to CoS-SIS

11h15-11h45: **Dr Emmanuel Dormon (CoS-SIS Research Associate):**

Lessons from CoS1

11h45-12h15: **Dr Dominique Hounkonnou (CoS-SIS Regional Coordinator): The Innovation System Approach proposed for CoS-SIS**

12h15-13h00: **Comments by panel and the floor:**

- Dr Judith Francis (CTA, Wageningen)
- Mr. Bio Bakiri Tamou, cotton farmer, Benin
- Dr Janice Jiggins (IAASTD, International Assessment of Agric. Knowledge, Science and Technology for Development)

13h00-14h00: Lunch

Chairperson Afternoon Session: Prof. Emmanuel Owusu-Bennoah (Ghana)

14h00-17h30: THE Innovation Systems Approach and its relevance

14h00-14h30: **Dr. Wale Adekunle (FARA /** to be confirmed**): Why is the Innovation Systems approach important for Africa?**

14h30-15h00: **Dr Jim Woodhill (Wageningen International): The Innovation Systems approach: an international perspective**

15h00-15h30: **Dr Wenny Ho (DGIS/DCO/OC): Why we are investing in Innovation Systems through CoS-SIS?**

15h30-16h00: Coffee break

16h00-17h00: **Small groups** discuss and formulate questions

17h00-17h30: **Panel of speakers:** answer questions from randomly chosen groups

17h30-18h30: Welcome drinks

DAY 2 - TUESDAY JUNE 23

Chairperson Morning Session: Dr. Chuks Ogbonnaya (CORAF)

Whole day: The Opportunities identified by RAs in each of the domains

8h30-9h00: Summary of the previous day

9h00-9h30: **Dr Arnold van Huis (CoS-SIS International Coordinator):**

Zooming in on opportunities for small-scale farmers: the exploratory approach of CoS-SIS

9h30-10h30: **Presentation by 2 RAs (on Oil Palm)**

10h30-11h00: Coffee break

11h00-12h30: **Presentation by 3 RAs (on Livestock, *Karité* and Food security)**

12h30-14h00: Lunch

Chairperson Afternoon Session: Dr Adama Traoré (Mali)

14h00-15h30: **Presentation by 3 RAs (2 on Water, 1 on Cotton)**

15h30-16h00: Coffee break

16h00-16h30: **Presentation by 1 RA (on Cocoa)**

16h30-18h00: Discussion in small groups around domains of opportunities presented: suitability, feasibility, relevance, appropriateness for testing IS approach.

DAY 3 - WEDNESDAY JUNE 24

Facilitator: Prof. Cees Leeuwis (WUR)

Morning Session: Zooming in on way forward

8h30-8h45: Summary of the previous day

8h45-12h30: **Plenary participatory exercise: emerging issues are identified, clustered and systematised with focus on risks, unknowns, methodological pitfalls, opportunities for making a difference, etc.**

12h30-14h00: Lunch

14h30 to 17h30: Excursion

- Integrated plantation of Oil Palm and Food Security
  (Interest: Observation and analysis of 3 systems: industrial plantation, out growers' plantation and small scale plantation)
- Elmina Castle and Market
  (Interest: How history affected the way market operates)
- Canopy Walk
  (Tourism … but also biological and ecological interests)

CONFERENCE Dinner

DAY 4 - THURSDAY JUNE 25

Chairperson Morning Session: Prof Jean Claude Codjia (Benin)

Morning: From opportunity to institutional and technical change

8h30-8h45: Summary of the previous day

8h45-09h45: Discussions in small groups around the domains (follow-up Day 2)

09h45-10h15**: Mr John Belt (KIT): What we can learn from Value Chain Development?**

10h15-10h45**: Dr Kofi Debrah (IFDC): The Experience of IFDC with Institutional Development**

10h45-11h15: Coffee break

11h15-11h45: P**rof. Thom Kuyper (WUR): Technology as opportunity**

11h45-12h15: **Dr Niek Koning: International Trade and Markets: Opportunities and Constraints**

12:15-12:45**: Dr Babacar Ndao (ROPPA): The international trade perspective**

12h45-14h00: Lunch

Chairperson Afternoon Session: Dr Adewale Adekunle, Director, Partnership and Strategic Alliances (FARA)

14h00-14:30: **Prof. Cees Leeuwis: Opportunities and Change**

14h30-15h00: **Prof. Erwin Bulte (WUR): Using natural experiments, the viewpoint of institutional economics**

15h00-15h30: Coffee break

15h30-18h00: **Facilitators: Prof. Cees Leeuwis, Dr Dominique Hounkonnou and Dr Jim Woodhill: Working groups** organised around domains discuss research designs for the respective domains. Prepare reports for Friday morning

DAY 5 - FRIDAY JUNE 26

IMPLEMENTATION AND RESEARCH PLANS

Chairman: Prof Fafré Samaké (Mali)

8h30-8h45: Summary of Day 4
8h45- 9h15: **Dr. Todd Crane (WUR): Causal Process Tracing (CPT)**
9h15-9h35: **Prof. Niels Röling (CoS-SIS): Proposed CoS-SIS Research Design**
9h35-10h00: **Dr Roch Mongbo (UAC): Reflections on Design**
10h00-10h30: **Discussions on Research Design**
10h30-11h00: Coffee break

11h00-12h30: **Short Reports from the Working Group**

FINAL SESSION
Chairman: Prof. Ben Ahunu (Ghana)

12h30-13h00:
The way Forward: Prof. Arnold van Huis
Closing remarks: Prof. Ben Ahunu

13h00-14h00: **Lunch**
14h30: Departure

Annex 3. Conference Organising Committees

International Organising Committee

The Scientific Coordination Committee

- Arnold van Huis, International CoS-SIS Coordinator
- Dominique Hounkonnou, Regional CoS-SIS Coordinator
- Niels Röling, Consultant
- Barbara Sterk, Postdoc.

Local Organising Committee - Ghana

- Owuraku Sakyi-Dawson, National CoS-SIS Coordinator
- B. K. Ahunu, Provost, College of Agriculture and Consumer Sciences, Technical Advisor
- Ezekiel Narh Odonkor, Conference/Programme Manager
- Douglas Effah, Conference/Programme Assistant
- Ishmaelia Crenstil, Conference/Programme Assistant

Annex 4. Conference addresses

Chairpersons opening remarks

Professor Chris Gordon,
Department of Zoology/VBRP,
University of Ghana, Legon

Your Excellency the Vice President of Ghana
Your Excellency the Ambassador of the Royal Embassy of the Netherlands
The Provost College of Agriculture and Consumer Sciences, University of Ghana
Distinguished Participants, Ladies and Gentlemen

It is a great honour for me to be asked to Chair the Opening Session of this landmark international conference "*Convergence of Sciences: strengthening Agricultural Innovation Systems".* I would like to start the ball rolling with a few observations.

Ever since I became involved in the project, I realised that it was something special. The main reason for this was that over the years, as a scientist I realised that there was a disconnect between the knowledge produced by scientists and end users whether they be farmers and fishermen or policy and decision makers.

There is a statistic often quoted by World Bank economists that the GDP of Ghana, Malaysia and South Korea were about the same in 1957. They then go on to say that at least 50% of the current gap between those countries and Ghana can be attributed to how they have managed knowledge – the so call "knowledge economy".

The first phase of the CoS project addressed the above twin issues of knowledge accessibility and availability. CoS I established a pathway for the development and adoption of new and improved technologies by farmers in Ghana and Benin. The project also facilitated institutional changes that created an enabling environment for innovation. This is apart from the capacity that was built in both Ghana and Benin in the form of completed PhDs.

Now one may ask, if the first CoS was so successful, why is there a need for a second project? Well for one thing the new project responds to the issue that developing the techniques alone is not enough due to the limited opportunities that farmers have to adopt innovation.

What we expect from this new project is that it will move from data collection to information synthesis, from information to accumulation of knowledge, and from knowledge to wisdom. At the same time we expect that the wisdom that is gained by this project will be translated to policy and that policy will be put into practice.

The project is designed based on fuzzy logic systems making it open ended in its approach. This enables rapid response to emerging issues and allows change when needed. This first international meeting is part of the process of moving the programme forward. The main donors to project, DGIS of the Netherlands, must be commended for being flexible enough in their operations to grant this bold and exciting project the needed funding.

Your Excellencies, Ladies and Gentlemen, these are my Chairman's remarks and I anticipate being uplifted and inspired by your contributions and deliberations of the CoS-SIS programme.

Thank you

Welcome address

Professor Nii-Noi Dowuona
The Acting Provost,
College of Agriculture and Consumer Sciences,
University of Ghana

His Excellency the Vice-President of the Republic of Ghana
Honourable Regional Minister,
Mr Chairperson,
Vice Chancellors,
Representatives of DGIS
Representatives of KIT
Her Excellency the Netherlands Ambassador to Ghana
Representatives of the International Agricultural Development Agencies
Farmer Representatives from the ECOWAS countries
Experts,
Distinguished Guests,
Ladies and Gentlemen,

First of all, I will like to welcome all workshop participants, especially those from outside to Ghana. I hope that your stay in Ghana will be both memorable and fruitful. I invite you all to join in the effort to evolve a framework for enhancing innovation in the agricultural sector of African countries. The University of Ghana is particularly proud and honoured to once again host an International Convergence of Sciences Conference.

His Excellency the Vice-President of the Republic of Ghana,

Honourable Minister, Mr. Chairperson, Distinguished Ladies and Gentlemen, from early 2001 the Wageningen University in collaboration with Université d'Abomey-Calavi, Benin and University of Ghana, Legon began exploring an alternative framework for undertaking agricultural research which is based on convergence of knowledge of stakeholders. We called it "Convergence of Sciences" Project. We are happy that this collaboration has grown to include IPR/IFRA of Mali.

The Convergence of Sciences Project has had far-reaching academic and development impact. Nine students from the sub-region have been involved in the research activities and all successfully defended their PhD thesis. Most of these, I believe continue to work in the sub-region and share their knowledge and experiences with the research and academic community. The College of Agriculture and Consumer Sciences of the University of Ghana, and indeed the University of Ghana as a whole has benefited tremendously from the CoS project. Some of the PhD products are now staff of the University.

Further, several faculty members now welcome the CoS approach to solving problematic situations in agriculture. This new outlook has led the College of Agriculture and Consumer Sciences of University of Ghana to propose a new Multi-Disciplinary Post-Graduate programme. This is necessary for educating the present and future scientists for the agricultural development through leadership in the use of Science and Technology to enhance the livelihood of the vast numbers of our population engaged in farming and related activities.

His Excellency the Vice-President of Ghana, Honourable Minister, Mr. Chairman, Distinguished Ladies and Gentlemen, I am informed that deliberations of this conference will focus on among others:

- Provide an opportunity for all the CoS-SIS actors to get a broad and common understanding of the CoS-SIS research programme
- For the CoS-SIS partners to discuss and guide the next steps of the process.

His Excellency the Vice-President, Honourable Minister, Mr. Chairman, Distinguished Guests, Ladies and Gentlemen, on behalf of the University of Ghana, I once again welcome all of you to Ghana and to this International Conference of the Convergence of Sciences.

Thank you.

Speech of Her Excellency Mrs Lidi Remmelzwaal

HE Netherlands Ambassador to Ghana

His Excellency the Vice-President
Hon Regional Minister
Vice-Chancellor
Professors, ladies and gentlemen

I am very pleased to be here today at the first International Conference of the second phase of the Convergence of Sciences programme, called 'Strengthening Innovation Systems'. This is also an occasion for me to refresh the good memories of the successful first phase of CoS programme. That first phase ended in October 2006 with a big bang in Accra and Cotonou, when all the PhD students successfully defended their thesis.

For me personally that was a very special occasion that I will never forget. It was my first speech as ambassador to Ghana, and – being a graduate of Wageningen University myself – it was great to be part of that event and meet some of my former professors and fellow students, who are now professors!

As an Embassy we have been supportive of CoS from the start, and the Directorate General for Development Cooperation of the Dutch Ministry of Foreign Affairs has committed to generously fund the second phase of the Programme.

Why do we support CoS, in spite of the fact that Agriculture is not one of the priority sectors of our development programme in Ghana? The reason why we have a keen interest in this programme is, because it addresses a much broader development agenda than just the agricultural sector.

And I will give you 2 reasons why I think this programme is very special:

1) In the *first* place, the focus of the programme is on improving the livelihoods of *smallholder farmers*. It is those farmers who bear the brunt of rural poverty. They will be the ones who suffer most from climate change, who most need access to better education, drinking water and sanitation. It is those farmers who manage the natural resources and biodiversity of Ghana. And, they are the ones who can assure Ghana's food security over the long-term. So the Programme contributes directly to the achievement of several of the Millennium Development Goals, which are a high priority for my Government.
2) S*econd, and* maybe even more important: the Programme is a unique form of *capacity building*. And I am – of course – not only referring to the 11 PhD students

and 9 post-docs involved in the second phase of CoS. The programme has been conceived as a multi-stakeholder learning effort, based on action research **with and for** smallholder farmers. That learning involves scientists of national universities, farmers, employees of ministries and civil society organisations, and local government. The Programme provides opportunities – such as this international conference – for a wide diversity of national and international experts and authorities to come together and learn from experience in the field. And this learning experience then will hopefully feed into effective policies and programmes for addressing Ghana's small holder agric sector.

Given the uncertainties of climate change, the volatility of global food and energy markets, the development of Ghana's smallholder farming seems an inescapable condition for achieving the kind of inclusive and broad-based development that the Government of Ghana is pursuing and that the Netherlands wholeheartedly supports.

Mr Chairman, it is therefore that it is a great pleasure for me to be present here and I would like to pass on my best wishes for the success of this first International conference of the CoS Programme as a milestone in the achievement of the goals of the Programme.

I wish you a fruitful conference!

Thank you.

Keynote Address

His Excellency Honourable John Dramani Mahama
Vice-President of the Republic of Ghana

Honourable Regional Minister,
Mr Chairperson,
Vice-Chancellors,
Representative of DGIS,
Representative of KIT,
Her Excellency the Netherlands Ambassador in Ghana,
Representatives of the International Agricultural Development Agencies,
Farmer Representatives from the ECOWAS countries,
Experts,
Friends from the Media,
Distinguished Ladies and Gentlemen,

I am particularly pleased to give the keynote address for the opening ceremony of the Convergence of Sciences – 'Strengthening Innovation Systems' First International Conference.

Allow me to first of all, on behalf of the President and the people of the Republic of Ghana, to once again welcome all the participants from abroad who are here to attend this important meeting. I believe you are here to share your experience and join in the effort to reflect on an integrated approach to innovate the rural livelihoods of our dear continent through science and technology. Ghana is particularly proud and honoured to host this meeting which I believe is a reflection of the recognition of the efforts of the Government and People of Ghana to improve the livelihoods of farmers through Science and Technology.

Mr Chairman, Distinguished Ladies and Gentlemen, the Government of Ghana through the Ministry of Food and Agriculture together with the Universities, the Council for Scientific and Industrial Research (CSIR), and other MDAs has been in the forefront of efforts to enhance agricultural development and thereby reduce rural poverty. However, even though there is some evidence that the living standards of Ghanaians improved over the last two decades, about 15% of the population are described as living in absolute poverty, and that poverty in Ghana is largely a rural phenomenon.

Mr Chairman, the Government of Ghana recognizes the need to improve economic performance and the welfare of its people. As a result, economic empowerment and poverty reduction have become the major thrust of the Government of Ghana as enshrined in the Growth and

Poverty Reduction Strategy (GPRS). In order to achieve these objectives agriculture, being the largest sector of the economy, has been targeted and a number of interventions proposed under the GPRS.

In line with this, the Food and Agricultural Sector Development Policy (FASDEP) was formulated as a sector wide approach/programme to provide a holistic framework for food and agriculture that took cognisance of all on-going efforts and individual projects in the agricultural sector.

In August 2007, the policy was revised. FASDEP II emphasizes the sustainable utilization of all resources and commercialisation of activities in the sector with market-driven growth in mind. It targets commodities for food security and income diversification, especially of resource poor farmers. Enhancement of productivity of the commodity value chain, through the application of science and technology, with environmental sustainability is emphasized. Greater engagement of the private sector and collaboration with other partners is to be pursued to facilitate implementation of policies.

It is hoped that through effective cooperation with MoFA and the commitment of all stakeholders (other MDAs working in the sector, private sector, including farmers, processors, traders, NGOs and civil society in general) in the implementation of the proposed strategies, the country can overcome most of the challenges facing the food and agriculture sector and achieve national food security.

Mr Chairman, Distinguished Ladies and Gentlemen, indeed, for a nation to properly cope with its economic and social development, it needs to institute an effective scientific and technological research system. This is perfectly understood by the government of Ghana. Therefore polices to improve agricultural development has included one on Technology Development. The focus is to improve appropriate technology generation, transfer and dissemination by both private and public sectors at all levels and ensuring the sustainable use and management of the nation's natural resources. Emphasis has also been placed on training more extension staff to improve extension delivery and support for farmer based organizations (FBO) to facilitate access to input, credit and markets.

Mr Chairman, Distinguished Ladies and Gentlemen it is increasingly clear that in the developed countries when scientists develop technologies, private firms, farmers and the public sector seek and utilise the information and technologies. However in the developing countries, the private sector is weak. So also are the public extension services, farmers and the markets. We therefore need to compensate for this institutional underdevelopment to ensure the system works. How to compensate for these institutional weaknesses is indeed a critical question.

Mr Chairman, Distinguished Ladies and Gentlemen, recent poverty and social impact analysis of the agricultural technology development policy has revealed that Research and Extension Polices have much to do to extensively impact the poor and women farmers. I believe the situation applies to most of the countries in Sub-Sahara Africa. Therefore another

question is how can agricultural research and development be undertaken for it to benefit the different strata where help is most needed. I want to belief that the Convergence of Sciences – Strengthening Innovation Systems research programme can provide us with some insights on how to enhance the distributional impact of agricultural research. It is my hope that CoS-SIS will identify and provide solution to some of the rungs on the ladder to sustainable agricultural development using science and technology.

Mr Chairman, it is my belief that the five days of discussions, will enable you to meet the goals set for this conference. It is clear that emphasis would be laid on a more active and more practical conception of research, based on institutional innovation.

We will be very attentive to the implementation of the programme that emerges from this meeting. I urge you to encapsulate a realistic vision of the programme and ensure that they are swiftly translated into action.

Let us not forget that the leaders of our countries and partners of the international community that are attending this conference are listening to your interventions. They will thus appreciate the propriety of your proposals.

Mr Chairman, Distinguished Ladies and Gentlemen, I cannot conclude without expressing my satisfaction and gratitude to especially the University of Ghana, Université d'Abomey Calavi, Wageningen University, IPR/IFRA Mali, and the Netherlands Government for their commitment to the CoS-SIS programme.

I wish you success in your deliberations. On this note I declare open, the 1st International Convergence of Sciences Workshop.

Thank your for your attention.

The Purpose of the CoS-SIS Programme

The purpose of CoS-SIS is to carry out inter-disciplinary experiments with a view to elaborate, apply and assess a development approach to sustainable rural poverty reduction and food security, based on Innovation System (IS) thinking. A key issue for CoS-SIS is to operationalize institutional change.

Given the widespread assumption that raising productivity per hectare is sufficient for agricultural development, the research issue that has been surprisingly left unattended is the relationship between institutional and technological development.

We now realize that much can be gained by making the relationship between institutional and technological development an explicit research concern for CoS-SIS. In the CoS-SIS Programme, it is required to scope the innovation landscape to identify opportunities that could be mobilized, focusing on institutional and technical constraints in the three domains in each of the implementing countries, namely Benin, Ghana and Mali.