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**The origins and implications of using innovation systems
perspectives in the design and implementation of agricultural
research projects: Some personal observations.**

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Abstract

In recent years there has been an increasing recognition of the potential of the innovation systems concept to provide new ways of making more effective use of agricultural research and improve its impact on socially desirable outcomes. This paper documents the experiences of a group of researchers in India who experimented with this framework and tried to operationalise its principles in project design. The paper comments on some of the implications of using this approach and the challenges it presents for implementers of agricultural research projects in developing countries.

Key words: Innovation systems; agricultural research; development practice; poverty reduction; lessons and principles, research project design

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The origins and implications of using innovation systems perspectives in the design and implementation of agricultural research projects: Some personal observations.¹

Andy Hall

1. Introduction

In recent years there has been an increasing recognition of the potential of the innovation systems concept to provide new ways of making more effective use of agricultural research and improve its impact on socially desirable outcomes. However, currently there is only limited [international] experience in how this concept can be operationalised in agricultural research design and implementation. One of the challenges of using this concept is that not only is there no well recognised innovation systems “approach”, but also that there shouldn’t be one either! Blueprints, best practices and tool kits are all an anathema to this perspective. Instead the innovation systems concept presents a set of principles that researchers, planners and entrepreneurs need to operationalise in their own contexts and in ways suited to their own goals.

So what can so called innovation systems “experts” offer to those who are interested in pursuing this approach? The answer is probably closer to innovation systems counselling and mentoring rather than innovation systems training. However what can be provided is examples of initiatives that have followed principles that are broadly in line with the innovation systems concept; present the concept and its principles and discuss what the implications of these might be; and share some of the limited experience of trying to purposefully use these principles in the design of an agricultural research projects. This short paper addresses the last two points.

2. The conundrum of agricultural research, innovation and poverty reduction.

A useful way to introduce the innovation systems concept is to give a short personal history of how we started to use this idea to think about agricultural R&D.

In 1998 a small group of researchers in India (including the author) started to experiment with the innovation system concept as an analytical aid to help understand why otherwise promising research and development projects failed to bring about desired social and economic changes. This was by no means a new problem. Academics such as Stephen Biggs and Robert Chambers had for many years been pointing out that the organisation of agricultural research and extension was a major reason why science was failing to improve the livelihoods of poor people.

By 1998 thinking on this subject had established a very strong critique of what was then (and in many instances continues to be) the conventional organisation of agricultural R&D. This critique pointed out that if research develops and transfers technology in a linear fashion to farmers, very often these technologies are found to be inappropriate to

¹ This paper was originally prepared as part of a training workshop held at the International Potato Centre (CIP), Lima Peru in collaboration with CONDESAN, June 2006.

the social, physical and economic setting in which farmers have to operate. At the very least such technologies needed complementary organisational, policy and other changes to enable them to be put into productive use. To remedy this problem feedback loops were suggested as a way of informing technology developers about technology users needs. This was a major change in thinking for the agricultural R&D community. In fact it was only possible to start and challenge the primacy of agricultural science in this way because a number of researchers had established convincing evidence that indigenous knowledge held by rural people had value and could play a role in technology development. The work of Robert Rhodes and Bob Booth on farmer-developed diffused light storage methods for potatoes in the Andean region published in 1982 helped established this position, but also Paul Richard's book *Indigenous Agricultural Revolution* (1985), Stephen Biggs and Ed Clay seminal paper on sources of agricultural innovation (1981) and the numerous writings of Robert Chambers².

These ideas came together in the early 1990's with the participatory research movement variously named, participatory technology development, farmer-first approach and so forth. While these approaches and the whole debate about participatory methods that was stimulated by Robert Chambers and his colleagues certainly advanced development practice, in terms of agricultural research approaches it hit a number of serious obstacles.

The first problem was that of established working practices and power relations. While many of the participatory approaches assumed the reputation as magic bullet tools, on their own they were not sufficient to change deeply held views among agricultural scientists and planners about what was the right way of working and the correct role of researchers, extension agents and farmers. "Obviously scientists knew better than farmers"!!!! These are the so called institutional factors that pattern behaviour and create the routines that lock people into certain ways of working. This was of course reinforced by the power relations that surround an urban based scientific elite and a rural based peasant agriculture³.

The second problem with the participatory methods was what became known as the "tyranny of participation/ indigenous knowledge". This alluded to the backlash against organised science that accompanied these developments and which was at times so severe that peoples' action and indigenous knowledge was viewed as the panacea to all rural problems. Stephen Biggs⁴ referred to this as "throwing the baby out with the bathwater", meaning that in the rush to give rural people centre stage, these approaches marginalised the power of science to solve problems and stimulate innovation and change. As Martin Bell (2006) recently pointed out, the whole point of recognising the importance of indigenous knowledge was to find ways of better integrating it with scientific knowledge in an interactive process of innovation. After more than 20 years since this idea first

² Robert Chambers had been putting forward ideas about people centred development since the early 1980. An example of his work in relation to agricultural research and innovation is Chambers, R. and Ghildyal, B 1985.

³ The authors personal experience of this from working in the National Agricultural Research programme can be found in Hall and Nhady 2000.

⁴ Personal communication

emerged, development practice has largely failed to achieve the desired degree of integration.

To make this recent history complete, two other perspectives on this topic need to be mentioned. The first is the ideas of Neil Roling on agricultural knowledge systems. In a recent retrospective commentary on this approach⁵ Roling himself explains that his original thinking on this was based on the idea of knowledge production and use as a systemic process involving a wide range of different actors and interaction. Unfortunately history will perhaps remember Roling's work for the Agricultural Knowledge and Information System (AKIS) model taken up by the World Bank and FAO. Here the originally well conceived idea was distorted, over emphasising the strengthening of agricultural education processes. It did recognise that many different sources of information exist, but was still fixated on methods of passing this information to farmers.

The second of these perspectives is the work of Paul Engel published in 1996 as a book under the title of *The Social Organisation of Innovation*. This set out an explanation of the nature of rural knowledge systems. It explained that innovation as a social process of integrating different pieces of information held by different people, is subject to the whole range of social and institutional factors that pattern people's behaviour and interactions. In a companion publication (1997), Paul and his colleague Monique Salmon presents a framework for exploring these knowledge systems and identifying ways that these can be strengthened to solve rural problems. This is known as the RAAKS approach – Rapid Appraisal of Agricultural Knowledge Systems. Both Paul's book and the RAAKS approach are, as will be explained below, very similar in perspective to the innovation systems approach, but for some reason did not get as widely used as they deserved.

There were others too working on similar ideas, notably in Wageningen in the Netherlands, see for example the recent and cryptically titled book "Wheelbarrows Full of Frogs". But again these good ideas didn't seem to spread much beyond Dutch development assistance. I suspect that there is also a large volume of Spanish language literature on similar ideas and perspectives and a participatory research tradition that has evolved in similar ways in the Latin American region over the last 15 years or so. Being a linguistically challenged Englishman I am ignorant of these parallel developments.

3. New directions.

Meanwhile, back in 1998, our research group had experimented with participatory methods and was increasingly coming to the conclusion that research projects need to start and include more partners if they were to be successful in a social and economic sense (see Hall et al 1998). In other words rather than just looking further down the production chain at farmers and rural household, we started to also look up the chain at the private sector and NGOs. These organisations were viewed as necessary partners in a much bigger process of change involving linking rural communities to emerging markets

⁵ This can be found in the introduction to Leeuwis and Pyburn's 2002 book *Wheelbarrows full of frogs: social learning in rural resource management*

and relevant information and resources needed to engage in more productive/ competitive practices.

This was a special time in India as the urban markets were starting to look for high value products and the export markets had recently been opened up by the economic liberalisation process started in 1991. But this approach was also built on earlier experiences of the team on post-harvest issues in Uganda. In that case research projects routinely worked on the development and marketing of new processed products without involving local entrepreneurs – the rationale being that processing and market development created new markets for a crop produced by the poor, in the Ugandan case sweet potatoes. Perhaps not surprisingly such research made limited headway. In contrast to India, the Ugandan entrepreneurs were often very small scale, but, with the benefit of hindsight, it was obvious that they were important players that needed to get involved early on if research was going to be part of a whole series of both technical and organisational innovations needed to produce and market a new product.

Box 1 Interaction among multiple agencies in the horticultural supply chain in India

Between 1996 and 2001 CPHP supported the development of mango exports by Vijaya, a Fruit Growers Association and the Agricultural Processed Products Export Development Authority (APEDA). The main focus was on the development controlled atmosphere (CA) container sea-shipment protocols. APEDA set up a series of contract arrangements with relevant organizations from both the Indian Council of Agricultural Research (ICAR) and from the Council for Scientific and Industrial Research (CSIR) as well as with the Horticultural Department of the local State Agricultural University. These organizations then worked with Vijaya to develop and test the CA protocol. The ICAR institute dealt mainly with pre-harvest pest management issues; the CSIR institute undertook experimentation on CA storage regimes; and the University department advised on packhouse management.

Trial shipments took place over a period of 3 years. However, consistent problems with the quality of fruit exported led to an evaluation of the export protocol and technical backstopping provided. Individually the quality management recommendations were technically robust. However it was observed that there was limited interaction with farmers in the development of recommendations and this was part of a broader concern over the client focus of the contracted agencies. Typical of their organizations, the scientists involved had little experience in working with farmers or in a commercial environment, and were usually not encouraged to do so. It was also observed that quality management measures were not devised and implemented in an integrated way across the supply chain. This resulted from relevant technical expertise being located in organizations governed by two different research councils, with scientists contracted independently to work on components of the quality management problem. Vijaya was then left (unsuccessfully) to ensure that these component technologies and practices operated effectively together. This was particularly apparent with attempts to deal with anthracnose, a quality-related disease that needs to be tackled with an integrated pre and post-harvest approach.

The notable feature of the Vijaya case is that even where interactions with the public sector can be developed through contracting arrangements, the ability of individual research institutes to assist is limited by current institutional arrangements. Not only is there strong disciplinary segregation within ICAR, but different research council affiliation also tends to make integration difficult. The nature and rigidity of organizational culture – a key institutional arena – also makes the development of more integrated and responsive working practices amongst scientists difficult.

But if innovation in a general sense was restricted, what were the prospects for pro-poor innovation? In this case even though mango growers were (rather euphemistically) referred to as poor farmers, the reality was that those involved in the export shipment trails were inevitably large-scale, non-poor producers. It was this group that dominated the farmers' association involved, even though the majority of members were genuinely poor households whose livelihoods depended on mango production. The key stakeholders in this intervention were willing to continue the rhetoric of pro-poor focus, as this was a stipulation of the donor supporting the work. Dominant (and perfectly legitimate) stakeholder agendas included: mango export promotion; accessing high-value export markets; accessing technical expertise; developing (and having ownership) of new post-harvest technology and other research products. Stakeholder agendas were not investigated until much later in the research process, by which time it was probably too late to make any difference. By ignoring this important institutional context, not only was innovation in a general sense impeded (different agendas and roles were never negotiated and resolved), but more importantly it was almost a forgone conclusion that pro-poor innovation would not take place. (Hall et al 2003).

These experiences were telling us that partnerships were an essential ingredient in research projects. And this wasn't partnerships between different research organisations (although that was often required) but more importantly partnerships between dissimilar partners – public sector / private sector / NGO sector, research / non-research. What we found, however, was that partnerships on their own weren't enough. Some of the old problems faced by participatory research started to emerge – particularly problems associated with institutional factors, i.e. the ways of working that in some organisations were so strong that these prevented them being able to engage effectively in this different more partnership-based way of working.

The classic example of this was a project on mango export quality (see box 1). In many senses it was a well conceived project. It involved a number of different types of research organisation working on the whole set of issues relating to mango production, processing and storage and transportation. It involved a private growers association and a network of village producers cooperatives. It had good support from the government. Yet it failed totally because established ways of working prevented the different organisations working together in a coherent fashion. It was our work on this project that made us realise that we needed to find a different conceptual framework to help us understand the interplay between the linkages required for innovation and the institutional setting needed to make those linkages work.

Probably if we had been sufficiently well read we would have turned to AKIS or RAAKS to help us make sense out of these problems. Instead we turned to the more general, developed country-focused innovation literature where at the time the latest big idea was National Systems of Innovation. Based on empirical research trying to answer the question of why some economies perform better than others, National Systems of Innovation was telling a story very similar to the one we were observing. This was a story about successful economies being those where a social process of interactive learning was nurtured by fluid knowledge flows in dense networks of partnerships and other forms of linkage between different sorts of research and non-research actors in an economy. Furthermore the most successful cases where one where for historical and cultural reasons, national economies had been able to learn and improve upon this way of working as a cohesive whole.

This provided us with a framework:

- That viewed innovation as a process of both creating, sharing and putting knowledge into productive use.
- That recognised research as an important part of a wider network of actors and linkages
- Where special types of relationship enable interaction, promoting knowledge sharing and learning
- Where technical and institutional innovations often operated in combination and where new ways of working represented a new type of innovation important for researchers.

- Where the institutional setting – routines and ways of working, as well as policies – are an important element of the ability of a system to innovate and its tendency to skew innovation towards the interest of different social groups and agendas.
- Where patterns of linkage and the roles of different organisations and individual changes in response to the changing situation they find themselves in
- Where innovation capacity concerns the systemic coherence all the different organisations, processes and policies related to the production, diffusion, adaptation and use of knowledge and the ability to respond dynamically to changing threats and opportunities.

To put things more simply this provided us with a framework that revealed the true complexity of the innovation process and the location of research within that process. Having found this framework and adapted this for our own purposes, the real challenge was to know how to use this in the design and implementation of agricultural R&D projects. As a research team we were fortunate to be able to experiment with applying this perspective in one of DFID's natural research programmes – the crop post-harvest programme.⁶ Some of the experiences of adopting this approach as shared at the end of this paper.

4. Implications for design and implementation of agricultural R&D projects.

The specialist literature on innovation systems and more on recently agricultural innovation systems can be very dense and prone to meandering conceptual musing. For example, recent attempts to use game theory (Spielman 2005) as a way of operationalising this idea provide few obvious practical insights. Innovation is certainly a highly nuanced process. The trick that one needs to master, however, is to try and glean from all of this thinking on the subject some basic principles that can be used to help design and implement projects. The following principles would appear to be important.

Selecting who to work with. The first principle concerns the range of different organisations that are required for innovation and the selection of which ones need to be involved in research projects and in what roles. A fine balance needs to be reached here. There can potentially be very many actors that need to be involved in a research project – farmers, NGO's, private companies, government departments and policy makers. Brining in too few will not will miss the point of the innovation systems concept. Brining in too many can end up being unmanageable and even ritualistic. Similarly not all partners need to be involved in all activities all the time.

Managing roles. Some thought needs to be given to the roles different partners in a project are going to play. Researchers are often best placed to do scientific research, but not always. In some cases a more productive role will be for them to coordinate the research and development activities of others. There might be a role for research at the

⁶ We fortunate enough to be able to publish extensively based on our experiences with DFID programme, for example Clarke et al 2003, Hall et al 2001, 2003, 2004

beginning of a project but towards the end it might be a case where the main activity is piloting schemes and here other organisations might play a more useful role. The innovation systems concept recognises that as the innovation process unfolds the importance of different organisations, pieces of knowledge and skills changes. Projects need flexibility to embrace this evolution. Not only does the importance of roles change but also the roles 'played' by distinct actors also may change.

Providing incentives. A key incentive for researchers is publishing papers. Private companies and NGO respond to other incentives and it is important to recognise this in project design as these non-research partners need to see some point in being part of a project. In one of our research project the project manager explained that his main task was managing relationship of a diverse set of partners and this mainly involved making sure these partners recognised what they would get out of it. It is also important to be transparent about what the partners will get from project and what is its objective (see below discussion on new research questions and old partners). In the same vein partners expectations from innovation-mode projects need to be carefully managed.

Organising interaction. In my opinion, organising effective patterns of interaction between diverse knowledge sources (and the individuals and organisations that hold this knowledge) is the central principle from innovation systems. Its also the most difficult to organise effectively in projects. It is important because interaction is the process through which different pieces of information and ideas are brought together. This is how we learn. This is how innovation comes about. It difficult because it involves personal interaction and we all bring so much baggage with us – egos, power relations, personal and professional hierarchies, and mistrust -- that this process is fraught with difficulties.

Investigating interactions. Projects have to deal with the problem of getting people to work effectively together. And they have to do so without resorting to the rhetoric of participation and partnership (having token farmers at all meetings, for example, meets presentational concerns rather than operational concerns.) A big part of this problem stems from the way individuals are conditioned to work i.e. institutional factors. One aspect of this is that implicit in many of these ways of working is the tendency to exclude the poor – they are invisible, inarticulate, politically and socially disempowered. The innovation systems concept encourages researchers to reveal these aspects of projects and both address patterns and quality of interaction as part of the project process. Tools such as an actor linkage matrix can help map interaction. Understanding the quality of these interactions can be more difficult. The typology of attitudes and practices in table 1 provides some guidance on trouble shooting problem relationships.

Timing interactions. One of the practical issues that this perspective implies is that relationships and interactions need to be built in to and be part of the design phase of projects. It's no good researchers designing projects and getting them approved and then inviting "partners" to help implement projects. This is the worst kind of patronising behaviour. Yet all too often donor norms mean that there are no resources available for a project development phase that would allow this sort of consultative process of project design to happen properly. In the same way, these sorts of interaction need to take place

thought the project. Consultation with project partners can't be accomplished in the inception workshop and then conveniently forgotten. This has to be an on going process.

Table 1. Typology of attitudes and practices affecting key innovation processes and relationships

Innovation processes and relationships	Restrictive attitudes and practices	Supportive attitudes and practices
Interacting, knowledge flows, learning	<ul style="list-style-type: none"> • Mistrust of other organizations • Closed to others ideas • Secretiveness • Lack of confidence • Professional hierarchies between organizations and disciples • Internal hierarchies • Top-down cultures and approaches • Failures are covered up • Limited scope and intensity of interaction in sector networks 	<ul style="list-style-type: none"> • Trust • Openness • Transparency • Confidence • Mutual respect • Flat management structure • Reflection and learning from successes and failures • Proactive networking
Inclusiveness of poor stakeholders and the demand side	<ul style="list-style-type: none"> • Hierarchies • Top-down cultures and approaches 	<ul style="list-style-type: none"> • Consultative and participatory attitudes
Risk-taking and investing	<ul style="list-style-type: none"> • Conservative 	<ul style="list-style-type: none"> • Confidence • Professional incentives

Source: Hall et al 2006

The nature of the research question. The principles discussed so far suggest that issues associated with “who to work” with, “in what role” and “how to organise the interactions necessary for innovation”, all need to be brought into the design of projects. But the innovation systems concept goes one step further. It tells us that the different elements and the organisation of the innovation process are very context specific and that this context is itself evolving. The implication is that there simply isn't a blueprint for how to do this. In practice what this means is that research projects framed in this way not only have to address technical question, but they also have to address organisational and institutional and policy issues about how the innovation process in a particular context is best stimulated, organised and promoted. To make the same point more simply, projects actually have to investigate the whole landscape of different players related to an innovation task. And the projects then need to investigate how to organise things so that those players interact in ways that allows new ideas – including those from research -- to be brought into use in ways that address the needs of poor people. To borrow the analogy from the computer world, projects need to work on both hardware questions (technology) as well as software questions about patterns of organisation, linkages, governance and ways of working. One way of capturing this software knowledge about

ways of doing things is to include the documentation of institutional histories in the project design. A separate briefing note is provided on this tool.

Shift to understanding innovation capacity as a transferable generic. What this actually means is that projects are actually investigating questions about innovation capacity. That is capacity in the sense of the nature and patterns of linkages and interaction and the ways of working, mechanisms of governance and even the policy environment needed to bring about pro-poor innovation. Take the example of a recent project that we have been designing with ILRI on livestock fodder. ILRI has spent millions of dollars and 20 years trying to get farmers to adopt new fodder varieties, but with limited success. The innovation systems perspective is helping them approach this same question from the perspective of investigating the networks of relationships, practices and policies in which fodder technology needs to be embedded to bring about changes in livestock production systems that benefit livestock dependent poor people. The knowledge that can be transferred from this research is not about the fodder technologies per se, but about how to organise locally relevant arrangement that allow innovation in fodder production to take place and how these capacities can be made responsive to changing opportunities and threats in the livestock sector.

Transparency about the research objective. The more one works through the implications of using the innovation systems perspective in project design, the more one comes to realise that it calls for a fundamentally different type of research project. This brings its own set of problem that need to be managed. For instance many research organisations have settled into comfortable relationships with NGO's whereby scientist do their research by providing inputs for NGO's to hand out in villages for "testing". Everybody is happy. Researchers do their thing. NGO's keep their village constituencies happy with free inputs. And technology testing in villages is convenient for donors visits and provides good photo opportunities to illustrate annual reports. An innovation systems project is actually about investigating how different organisations can work together more effectively. Of course there may well be a technological element to this. But the main deliverable is about how to work better. If this is not agreed with partners from the beginning of the project, problems are likely to arise. Investigating ways of working are sensitive issues. Organisations usually don't feel comfortable having this explored. And unless partners buy into the fact that what is in it for them is ways of improving their performance as part of a wider system, they are unlikely to agree to some of the research methods needed to work in this sort of project. This is why transparency at the design stage is so important.

The nature of the research approach. What starts to emerge from the above points is that much of what needs to be found out can only really be explored through a process of trail and error. Who can really say at the out set who will make a good partner or what is the best way of organising interaction? This is not a process of validating different technologies or courses of action. Instead it is about learning how to bring about the multitude of technical, organisational and institutional changes needed to bring new ideas into use in different operational socio-economic setting. Our experience with these sort of projects is that these problems are like the layer of an onion – peel away one problem

and another emerges that has to be dealt with. Often assumptions about the nature of the problem that is being addressed need to be constantly revised as the nature of local realities reveals themselves through the research. Local reality is also dynamic and an important aspect of innovation capacity is the ability to respond dynamically to changing contexts. There is a well established methodology for dealing with this -- its called action research. This doesn't mean development projects that pretend to do research. It means a process driven, systematic research approach where research outcomes are used to continually revisits project assumption, objectives, approaches, partners and their roles and ways of working. Monitoring these parameters becomes a major task of the project and a key management tool.

Ways of exploring innovation capacity. Since the innovation systems perspective is giving such great emphasis to finding ways of strengthening innovation capacity and promoting institutional changes and lessons from this more widely, it is probably useful that research projects systematically explore this capacity at the outset. Such an investigation will help highlight patterns of interaction and institutional factors that the research project may need to deal with directly. It may also identify wider policy and institutional issues that will need to be addressed if the project is both to achieve its immediate objective as well as its wider objectives of influencing sector and national level institutional and policy changes need to promote innovation capacity. Remember, adopting an innovation systems approach to research means that technical, institutional and policy questions are not longer tackled in separate projects. Instead it means investigating these in an integrated fashion. As a result much greater efforts are needed to understand the contours of current capacities. Box 3 gives a check list to guide this sort of diagnostic process.

Box 3 An innovation systems checklist for conducting diagnostic assessments of innovation capacity.

When designing research projects it is useful to have some understanding the existing capacity of the innovation systems in which one is working. The following is a checklist to guide this type of diagnostic assessment. It is designed to address a central idea from the innovation systems concept: partnerships and linkages are central to innovative performance and must be analyzed in their historical and contemporary context to understand their strengths and weaknesses.

The historical context explains why organizations do things the way they do—for example, why industry associations in some sectors are active only in political lobbying and not in technological upgrading for the sector. In other words, it gives an explanation of the origins and limitations of the attitudes and practices that determine the capacity of companies, countries and sectors to innovate.

The context includes policy, market, and trade conditions and the challenges and opportunities they present, as well as other contextual factors, such as the sociopolitical environment and the natural resource base. The extent to which attitudes and practices interact with the new demands also defines actors' ability to innovate in a responsive way. So, for example, if international patterns of competition demand that national companies interact and collaborate to develop new marketing strategies (an innovation), the attitudes and practices of companies with regard to such collaboration will determine their ability to innovate in response to the new demands within the sector.

A description of the changing context is therefore a key diagnostic element for revealing any divergence between organizations/other actors and their practices (on the one hand) and the changing demands imposed by the context (on the other). An exploration of these issues is the unique contribution of the innovation systems concept.

Actors, roles they play, and activities in which they are involved:

- Is a sufficiently diverse set of organizations from the public and private sector actively engaged in a sector?
- Is the range of actors appropriate to the nature of the sector, the stage of development of the market, and the institutional setting of the particular country?

Attitudes and practices of the main actors:

- What attitudes enable or restrict collaboration between organizations?
- What ineffective or conservative behavior can be identified?
- Do patterns of trust and reciprocity exist to serve as foundations for evolving and future collaboration across the innovation system?
- Does a culture of innovation exist? For example, is there a demand for research in the private sector? Is there an emphasis on capacity building for future eventualities? Or do organizations simply deal reactively with their present problems and opportunities? Is the use of collaborative arrangements for knowledge-based activities common? Is there an emphasis on both technological learning (mastering new technology) and institutional learning (accessing and using knowledge more effectively)?

Patterns of interaction:

- Are there networks and partnerships between private companies, farmer organizations, NGOs, and research and policy organizations?
- Are the concerns of the poor integrated in the activities of the innovations system, and are there mechanisms to promote their agenda?
- Are sector-coordinating bodies present or absent? If present, are they effective?
 - Are stakeholder bodies, such as farmer and industry associations, present or absent? If they are present, what is the scope of their knowledge-based activities (research, training, technology acquisition, market and technology forecasting)?

Enabling environment (policies and infrastructure):

- Are there science and technology policies to promote collaboration (such as competitive grant funds for partnerships), scale up innovations (such as incubators or venture capital), or encourage private research

investments (such as matching grants)?

- Do fiscal policies promote research and development?
- Are farmer and other organizations involved in defining research and innovation challenges?
- Do legal frameworks exist to facilitate the application of new knowledge from within or outside the country?
- World Bank 2006.

5. The Crop Post-harvest experience of applying the innovation systems concept.

The innovation systems concept is still relatively new in the design and implementation of agricultural research projects. One of the few examples of an explicit effort to try out this approach is the case of DFID's Crop Post-Harvest programme. There maybe other similar experiences, but this was an example of a donor research programme explicitly adopting the innovation systems approach as a way of restructuring its research in an effort to improve its impact. This case has been studied extensively and has been the subject of an independent evaluation by Andrew Barnett (2006) -- this is provided in full separately. Andrew Barnett's review suggested that there was prima facia evidence that innovation and therefore poverty impact were enhanced by adopting a innovation systems approach to research. He also pointed about a number of cautionary points and weaknesses. Our own list would include the following

Old partners and old habits and relationships. Considerable effort is required to introduce research partners to the innovation systems perspectives. Sometimes research groups are locked into well established partnerships and ways of working and these actually make it all the more difficult make a significant departure from established ways of working. Powerful partners, particularly research organisations seem to be very good as adopting the language and rhetoric of a new approach such as innovation systems. Yet they are merely camouflaging old ways of working. Since power relations make it difficult for former subservient partners to complain about this, business as usual tends to be persistent. This can be particularly acute where North-South partnerships are involved

Skill shortages, particularly soft skills. As already alluded to innovation systems perspectives can't be picked up over night. Training helps, but is no substitute for trying these ideas out. Good innovation systems-mode researchers have an instinctive systems perspective. No amount of tools and cookbooks can substitute for developing this outlook through experience. Our limited experience of trying to instil these ideas in people suggests that the best approach is an inductive one whereby people are exposed to different ways of working and helped to assess why some lead to success and others fail. In the research communities where soft skills such as process monitoring, facilitation, reflection and learning are generally not well develop, creating a systems perspective in research can be difficult. mentoring

Weak social science inputs. Social science inputs into project are usually only a small component and generally the social scientists represent the smallest property of scientific

strength. Yet what is clear from the innovation systems approach is that these sort of research skills are import in innovation systems-mode projects. And this is made all the more difficult because many social scientists have been subjected to economics training in the neo-classical tradition and as a result their ability to adopt a system perspective on innovation is usually permanently impaired – although rare cases of recovery have been recorded.

Difficulties of developing institutional knowledge. One of the cornerstones of the innovation systems approach is the research projects are delivery both technical and institutional knowledge. That is to say that information about new ways of working that will promote innovation and impact are often the transferable element that has relevance beyond the scale of the individual project. Yet capturing this knowledge is very difficult. Conventional skills sets in research projects usually can not manage this. Approaches such as using facilitated writeshops to develop institutional histories of projects is one approach. More realistically, specialist expertise will probably need to be brought in to synthesise lessons on ways that give them generic relevance and make them accessible to policy and other audience responsible for institutional and policy change.

Poverty relevance. A huge danger of adopting the innovation systems approach is one can easily assume that it is a magic bullet for making research more poverty relevant. It can be. This requires careful attention, however, to the extent to which the agendas of the poor are integrated into the innovation process. This in turn depends on patterns of interaction, the stakes of different interest groups and the effectiveness of governance mechanisms put in place. And maybe this is the moment to remind ourselves that we are not trying to promote farmer invention here. We are trying to promote innovations in the agriculture sector that will create new opportunities for agriculture dependent poor people -- not just farmers, but all poor people who's livelihood is derived from and are improved by a dynamic, continuously evolving agriculture-based economy.

Conclusions.

These are some personal experiences on how to use innovation systems perspective. But there is one large and very important caveat. Take all “how to manuals” on applying innovation systems perspective to the design and implementation of agricultural research project with a huge pinch of salt. Lets just say that there are no, and never will be any ‘how to’ manuals....

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