Innovation Systems Concepts and Principles and their application to Integrated Agricultural Research for Development (IAR4D: Personal views and perspectives.

Kwaku Agyemang

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1. Preamble

The term "agricultural innovation" has been around for decades. In more recent times the term has been used mostly in connection with the Green Revolution that occurred in Asia that averted a feared catastrophe of famine in that region. The technologies that were transferred to farmers, mainly on the use of improved varieties of cereals and the application of recommended doses of chemical fertilizers are credited to be the forces behind the success of the Green Revolution. Therefore, agricultural technologies and innovations and the research and institutions that pioneered their creation remain in the minds of many as something that have shown success and should be supported. Indeed the CGIAR, the global group that emerged from the few founding research institutions and their promoters, identify themselves closely with the term "agricultural innovation" and attests to its reliability for producing positive results (see "Who We Are" section of the CGIAR Home Page on the WWW).

While there is no doubt about the huge success of the Green Revolution and the appreciation of the technologies that drove the phenomenon, there are questions about whether the manner of the development and application of those technologies are appropriate in more complex situations as faced by farmers in other parts of the developing world. According to Pimpert the transfer of technology model (TOT) of agricultural research typical of both national and international agricultural research systems and where all the key research decisions are made by scientists who experiment on research stations or under controlled, simplified conditions in farmers' fields and technologies thereof are then handed over to the extension services for transfer to farmers may have served the industrial and green revolution agricultures well but the TOT model of agricultural research has had limited successes in the context of complex, risk-prone, diverse environments where the majority of the world's rural people are dependent on this type of traditional agriculture which is mainly rainfed, on undulating lands and found in mountains, hills, wetlands and the semi-arid and people live today. The physical and economic conditions on research stations have, after all, been very different to those of resource poor environments.

The application of the old Research and Development (R&D) approach to tackle farmers' needs is being challenged as well (Spielman et al.) By the close of the last decade 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, then very often these technologies are found to be inappropriate to 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 (Hall,2007). A typical complex situation where the traditional R&D approach of 'one bullet shot" has failed to

work effectively and in some cases has not been appropriate is what has been described for the Sub-Saharan land use and farming situation whereby the situation is described as " widespread land degradation, manifested by soil erosion, nutrient depletion, desertification, deforestation or overgrazing" (SSA CP, Programme Proposal).

In recognition of this situation of the "TOT" failing to solve farmers' complex problems in a sustainable way and in an attempt to remedy the problem, feedback loops were suggested as a way of informing technology developers about technology users needs. As a result there have been several "innovative" R&D approaches introduced since the 1970s, starting with the Farming Systems Approach (FSR) developed from the disappointing adoption by resource-poor small farmers of crop and livestock technology developed in research stations; Farmer Participatory Research (FPR), which further stressed the need for researchers and farmers to work in a more equal partnership, recognising that this could not happen without the "empowerment" of farmers; Rapid Appraisal of Agricultural Knowledge Systems (RAAKS) which recognises that rural innovation systems are more complex than the simple, linear "research-extension-farm" model implicitly assumed by many professionals; The Sustainable Livelihoods Approach, which focuses on the concept of "livelihood" as the capabilities, assets (including both material and social resources) and activities required for a means of living; Integrated Natural Resources Management (INRM) developed by The International Agricultural Research Centres of the CGIAR, as it became clear that solving the complex problems of agricultural communities required strategies that enhance natural and social resources to gain the benefits of improved germplasm, Integrated Agricultural Research for Development (IAR4D), developed by FARA in the context of their Sub-Saharan Africa Challenge Programme, the Territorial Approach to Rural Agro-Enterprise Development developed by CIAT "to link small farmers to expanding markets so they can develop sustainable livelihoods in the rural sector", an approach that places "fresh emphasis on the issues of social organisation and the policies affecting market access and trade opportunities for developing countries" through identifying markets, analysis and improvement of marketing chains, and strengthening of business support services.

Reactions to these efforts to get farmers to be involved in the design of technologies that would be more relevant to their circumstances, production environments, etc have not received a resounding acceptance by all, including farmers themselves. Participatory approaches are sometimes deemed as lip service from researchers, who in some cases are also accused of being rigid in their ideas and approaches to development. Their institutions are also thought to be reluctant to accept indigenous knowledge and institutions as important players in contributing to generating technologies and innovations. According to Hall (2007), 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. On the other hand some canvassed for indigenous knowledge in the development of technologies to the point that science would have been locked out of the process. Bell (2006) commenting on the extreme opposite view said 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, and according to Hall (2007) after more than 20 years since this idea first emerged, development practice has largely failed to achieve the desired degree of integration.

In the late 1990s and early 2000s evaluation of several Research Projects showed that some of the Projects which otherwise had good science behind them still failed to make impact or lacked adoption. The major emerging reasons were associated with poor analysis of the demand for the products, who were the major actors and what were their roles and how the actors related with each other. It was also becoming clear that research projects needed to start to include more partners if they were to be successful in a social and economic sense (Hall, 2007). It was suggested that rather just looking further down the production chain at farmers and rural households, a closer look at the chain at the private sector and NGO was necessary, as these organizations are necessary partners in a much big process of change involving linking rural communities to emerging markets (Hall, 2007). It was concluded from these studies that perhaps some framework was needed to handle what had emerged in terms of the complexities of the innovation process. Out of this body of work and analyses emerged the notion of "Innovation systems" that provides new ways of looking at the whole question of how best to develop technologies that work and are sustainable. Innovation system as a concept studies how societies generate, exchange and use of knowledge (Spielman et al., 2007). At the heart of innovation then would be a process of both creating, sharing, and putting knowledge into productive use, and which recognize research as an important part of a wider network of linkages. Thus, innovation and production as considered to be processes that involve systematic interactions among a wide variety of actors for the generation and exchange of knowledge, and affected itself by knowledge and technologies, actors and networks and institutions (norms, routines, common habits, rules, laws, etc, (Malerba, 2007)) must by definition be a dynamic process better placed to deal with sectors that are changing in context, such as agricultural development. Within a sector, a sectoral system of innovation (innovation system) is said to be composed of a set of agents (organizations or individuals (e.g. consumers, researchers, etc) carrying out interactions (market and non-markets) for the creation, production and sale of products. These agents interact through the process of communication, exchanges, cooperation and competition. According to Heemskerk (2006) agricultural innovation is a product of social negotiation, as an intrinsic characteristic of farmers is that they innovate to sustain and improve their production systems. Heemskerk noted that although farmer participation has improved and getting institutionalized as evidenced by the number farmer organizations and formal mechanisms such as Memoranda of Understandings signed. However, questions have also been raised about the effectiveness of farmer participation alone, i.e., without multi-stakeholder participation or demand of society (Gladwin et al, 2002). Heemskerk includes in his suggestions for the future of agricultural innovations that consideration should be given to ensuring increased *on demand* research and extension by empowered farmers (and/or their organisations) and the private sector (Sagustume et al, 2003) and to consider the fact that for improvements in the dissemination of agricultural changes, institutional innovations may be needed, with respect to enhanced communication and transparency (Mundy and Sultan, 2001).

A casual look at the analyses often made on sectors from industry and manufacturing such as pharmaceuticals, biotechnology and lately in the agriculture sector, shows that certain common principles emerge that may have implications for the design and implementation of agricultural R & D or agricultural research for development (AR4 D). Whereas these concepts and principles are fairly established, it is said that there are no universally applicable blueprints for interventions (Hall, 2007). Hall (2007) states that there are no well recognized innovation systems "approach" and blueprints, best practices an toolkits are all anathema to the emerging perspectives on the topics and at best only the concepts and principles can be operationalized in agricultural research and

implementation. Hall (2007) provides an innovative systems checklist for assessing existing capacity when designing research projects which is reproduced below to facilitate discussion:

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 collaborationacross 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?

Given the crucial importance of actors, agents and how their interactions can impact on the whole innovation system, Hall (2007) goes further to provide some principles that can aid in the design and implementation of research projects, namely,

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 place 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 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.

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 form 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 agreeded 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 identity 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 changed need to promote innovation capacity. Remember, adopting an innovation systems approach to research means that technical, institutional and policy questions are not longer tacked 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 (End of checklist).

From the above discourse multi-stakeholders, actors and agents and their institutions and organizations, and how these actors relate and partner with each other stand out as essential ingredients in the design and implementation of research projects and generation of technologies. Therefore, any new paradigm of research on natural resources management or agriculture that does not incorporate these elements are not likely to achieve a true integration and would have

missed the importance of these actors in the value chain. An analysis on a in India(Anonymous, 2005) on capacity development on applying innovation systems concepts to agricultural research revealed that a common practice in agricultural organizations is to look at only one aspect of the value chain, for instance, production, whereas what is important is to look at the entire value chain and decide what kind of research (and also how it has to be done) and expertise sharing that needs to be undertaken to promote the entire value chain. The analyses further showed that participants mostly agreed that the key differences between a research system and an Innovation System were related to range of actors; role of scientists, policy and farmers; accountability; intended outcomes, key processes, patterns of interaction, key changes sought, indicators of success etc.

Value chains, their concepts, principles design and their analyses, as they have come to be understood as approaches and practices "that encompass the full range of activities and services of market actors required to bring a product or service from its conception to its end use and beyond" would seem then to be relevant for the whole process of attempts to reach for new research and development (R & D) approaches that truly contribute to broader objectives beyond the production of a product. The similarity in concepts, principles and approaches become even more striking when it is considered the "market actors" referred to in the concept of value chains includes producers, processors, input suppliers, exporters, retailers linking their activities in both vertical and horizontal manner.

The key steps followed in designing programmes in the context of Value Chain Approach, i.e. the selection of the value chain for consideration (embodying criteria for selection that address competitiveness, targeting, enabling environments; the listing of possible value chain candidates, using secondary and primary information to inform short listing; short listing using formal methods like Matrix choice; and selection based on raking), the actual value chain analysis (with objective of identifying the primary actors in the chain, their roles and relationships; identify unmet demand, sale markets and competitors; identify supply chains and trends; identify constraints and opportunities that inhibit value chain growth and competitiveness) and to have a "governance structures (dealing with organization, decision making, rules, and nature of relationships among participants, etc) and the clear linkages to market developments for small and medium enterprises lend themselves for easy translation to the improvement in the traditional approaches in R & D. Indeed the concept of following a "product" from its inception to the "end use" and "'beyond" and engaging all actors along each step represents a major paradigm shift akin to the selection of relevant research among several options with inputs from stakeholders, implementing with stakeholders, generating products that have immediate appeal for bettering the livelihoods of producers and for satisfying unmet market demand, thus causing research to lead to development, in a sense " a research for development" or an R4D. Although value chain based program designs typically consider one or a few products at a time, the number of stakeholders involved, their interactions and linkages would qualify the description of an "integrated" approach. The critical mass created by the multi-stakeholders in a value chain, each contributing at crucial steps along the chain in itself presents a "platform" from which new opportunities can emerge.

In the context of R & D, innovation platforms are new ways to position stakeholders closer to generate more innovative solutions. By bringing together stakeholders focused on "societal challenges" an innovation platform enables the integration of a range of technologies and better coordination. Key features of innovative platforms include the research community engaging with

civil society including business and linking research to markets. For agriculture R & D this further adds another layer of integration of the R&D process and nudges it towards a true agricultural research for development AR4D.

The new ways of looking at things and doing things in the light of innovation systems concepts and principles in comparison with traditional R& D approaches are illustrated in Appendices 1, 2, 3 and 4 culled from Hall (2007).

Appendix 1. Comparisons between traditional Research and Development Systems Approaches and Innovation Systems Approach.

Activity/Characteristics Area	Traditional Research System/Approach	Innovation System influenced-AR4D System/Approach
Selecting Who to Work With	Range of organizations involved usually small, most likely organizations with same research focus	Wider range of organizations, including those connected with aspects of the value chain, step or two below or above level research is targeting. For example, research attempting to improving dairy production might include organizations associated with inputs, such as AI or animal feed producers or suppliers. Processors and Sellers organizations should be included as legitimate value chain participants. Within reasonable limit include organizations with different knowledge systems approach to the problem under investigation.
Managing the roles of various Actors	Rigid practices. E.g. Scientist doing "scientist job" year after year in Project life. Roles usually firmly attached to individuals, and not subject to change.	Maintain some flexibility. Roles may be changed to capitalize on accumulated knowledge and experience (e.g. a researcher assigned a coordination role). Evaluate if an existing role is still relevant, and if the "assigned" actor is still the best as the context changes.
Providing Incentives to Actors	Usually lead organization actors are aware of their incentives to be on Project. For examples scientists are motivated by reward from publications and associated "bonus" for publications.	All partners should be considered for incentives, in whatever form, and for be aware for what the objective is for the incentive. The timeliness of being aware of incentives and when due are also important.

Appendix 2. Comparisons between traditional Research and Development Systems Approaches and Innovation Systems Approach

Activity/Characteristics Area	Traditional Research System/Approach	Innovation System influence AR4D System/Approach
Organising Interactions	Usually based on "like minded" organizations, or famous personalities from certain organizational platforms. Organizations deemed critical ignored no matter rich its knowledge base.	Institutions and organizations diverse knowledge and experi encouraged.
Investigating interactions	Norm is to get people or associations on board out of representational concerns rather than operational. Relationships gone sour such as mistrust, secretiveness, internal and professional hierarchies, systematic non-performance are not investigated.	Encourages investigations tha may lead to identification of systematic problems excludin g vulnerable groups, women a the poor
Timing of Interactions.	Tendency to include persons and institutions as "after thought", sometimes brought in at mid-stream of Project life. Interactions sometimes last only up to conclusion of inception workshops.	Encourages planned timely interactions, sustained over ti beyond completion of specific project. Progress made on dissemination and outcomes etc.

Appendix 3. Comparisons between traditional Research and Development Systems Approaches and Innovation Systems Approach

Activity/Characteristics Area	**Traditional Research System/Approach**	**Innovation System influenced-AR4D System/Approach**
Nature of the research question	Usually the research question is framed around more or less a technical issue	Research questions must be extended to include addressing organizational, institutional and policy issues.
Nature of the research approach.	Much of the practice is on process of validating technologies and course of action. Mostly staying the course of action during Project life.	Encourages focusing on learning how to bring about the multitude of technical, institutional and organizational issues needed to bring about new ideas. Encourages the assumptions, a) Nature of problem addressed subject to review in response to changing local context, b) Project outcomes used to revisit project assumption, objectives and approach. Some kind of "Action research".
Transparency about the research objectives	Usually focuses on the "technology component" as the MAIN deliverable, and may be how can be transmitted to end users through Extension, NGOS, etc. Partners' development may not be obvious.	Emphasizes on how different organizations can work together more effectively. Partners' development in a wider system forms part of the objective.

Appendix 4. Comparisons between traditional Research and Development Systems Approaches and Innovation Systems Approach

Activity/Characteristics Area	**Traditional Research System/Approach**	**Innovation System influenced-AR4D System/Approach**
Investing questions about innovation capacity.	Technology and related issues usually dominate the enquiry to the exclusion of investigating the networks of relationships, practices and policies in which the technological discovery is embedded.	Encourages investigations of the capacity ----the nature and patterns of linkages and interactions and was of working, mechanisms of governance, and policy environment to bring about gender-sensitive and pro-poor innovation.
Ways of exploring innovation capacity.	Strengthening of innovation capacity and promoting institutional changes per se is rarely included in capacity building programs..	Encourages a simultaneous and integrated investigations of technical, institutional and policy change.