

Enhancing performance of agricultural innovation systems

by Jon Daane¹

1. The need for new approaches to innovation

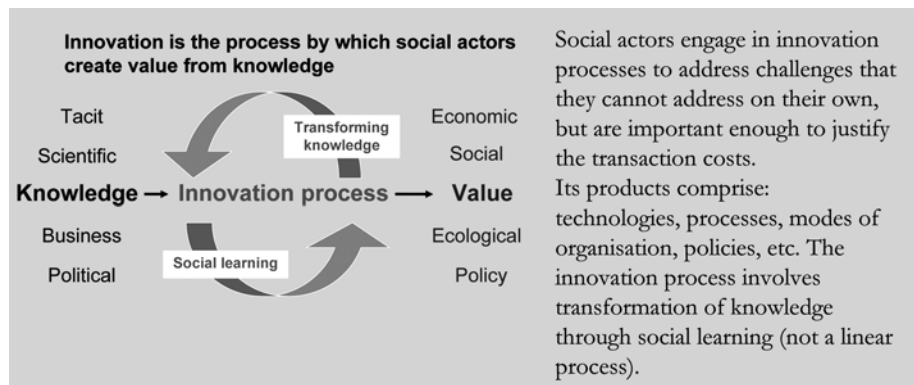
Like other economic sectors, agriculture today is evolving in an environment of rapid changes in technology, markets, policies, demography and natural environments (e.g. climate change, desertification). Although partly due to globalisation and world-wide trends, the challenges that these changes pose to national agricultural sectors or local communities are context-specific and complex. These challenges are putting new demands on all actors in and around the agricultural sector to innovate and develop new ways of collaborating to generate knowledge and put it into use at the required pace. This includes ‘co-innovation’ between different companies (e.g. between Philips and Sara Lee to develop the Senseo coffee machine and pads), between companies and users of their products, between private and public research, between farmers, agro-industries and retailers (e.g. to develop new convenience foods requiring new crop varieties), between farmers, policy makers and research (e.g. to develop ways of complying with new food safety or environmental regulations), etc. Making knowledge work and scaling up innovation also requires collaboration between actors who can promote that

markets, policies, financial and business support services are adequate and mutually reinforcing the large-scale use of knowledge for change.

2. Towards agricultural innovation systems

These observed new collaborative innovation processes and institutional arrangements differ sharply from the conventional concept of a ‘knowledge pipeline’ with clearly distinguished roles between creating, transferring and using knowledge and technologies. By contrast, in the new collaborative network arrangements that emerge here and there, the roles are much less sharply separated, as actors share their knowledge to jointly generate and use new knowledge (see Figure 1).

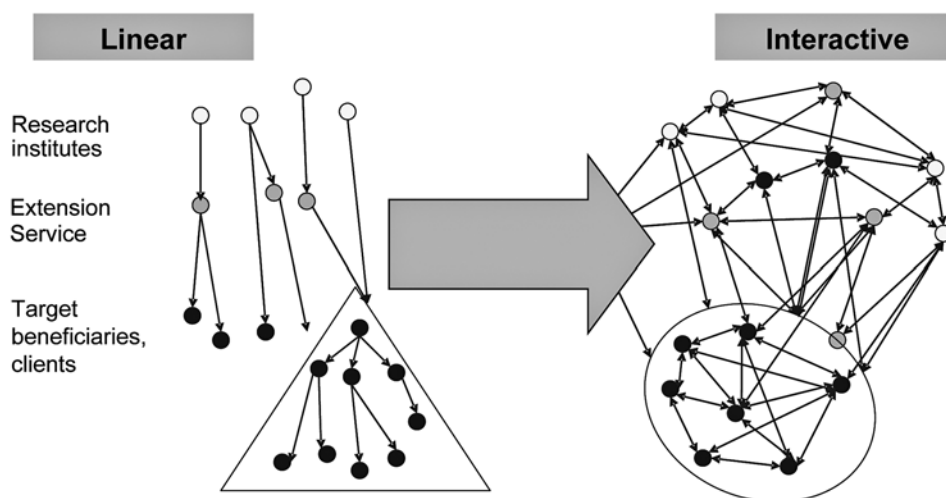
Box 1 – What is innovation?



The ‘innovation system’ concept (see Box 2) is used to analyse this observed evolution in innovation processes and institutional arrangements, as well as to inspire and guide policies that support the transformation of pipeline systems into interactive networks. The concept is also used to help actors themselves look at

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Figure 1 – From ‘pipeline’ to interactive networks



their own reality in new ways and discover new opportunities for joint action and synergy in new networks. The networks formed in agricultural innovation processes are context-specific and transient. They emerge around specific challenges and engage evolving configurations of actors in different tasks at particular points in time. They disband when the challenge has been addressed or take up new challenges in new compositions with new players. Policy should thus focus on creating enabling conditions for the spontaneous emergence of such networks rather than on blueprint designs.

Promoting this spontaneous emergence is not simple, however. Multi-actor co-innovation and collaboration in scaling up the use of innovation products are complex processes. Although motivated by the jointly felt need to address a common challenge, the actors

involved have different perspectives of this challenge and different interests in the innovation process. Not surprisingly, a recent study by the World Bank (2006, cited by Klerkx *et al.*, 2009), found that, even when there were strong market incentives for actors to collaborate for innovation, linkage formation was still extremely limited.

Innovation brokers

In a recent paper, Klerkx *et al.* (2009) discuss the experience with innovation brokers in the Dutch agricultural innovation system and its relevance for the development of effective multi-actor innovation systems in developing countries. In the Netherlands, a variety of new types of specialised brokers are trying to fulfil new roles in the gap that was left when the public extension agency was privatised and virtually disappeared.

The authors point out that, ideally, neutral intermediary organisations are formed to (i) articulate innovation needs; (ii) bring actors together and bridge and ‘translate’ between their different logics; and (iii) facilitate the innovation process. In developing countries, this neutrality may be compromised because these functions are often a side-activity of ‘traditional’ knowledge-intensive service providers like research & extension, or of farmer organisations

Box 2 – What is an innovation system?

Innovation systems are complex, open and dynamic human activity systems in which actors (individuals, groups, organisations) apply their minds, energies and resources to innovation in a particular domain of human activity. Like all human activity systems, innovation systems do not exist ‘out there’ as objective entities or realities – they only exist ‘in the minds of those who define them’, i.e. as social construct, or as a heuristic device for analytical purposes.

An implication of this definition is that innovation systems are defined in relation to a particular domain of human activity. Thus, one can e.g. define a system for innovation in a specific commodity, value chain or business cluster, or in specific (agro) eco- or farming systems. (Daane *et al.*, 2009a)

and the private sector. The authors point out the difficulties of funding such common good services in a market (i.e. on a fee-for-service basis) and the reluctance of public funders to support such services for long because their indirect impact on the performance of the system makes their contribution invisible and difficult to evaluate with hard indicators (Klerkx *et al.*, 2009).

Governance and management of innovation systems: filling an institutional vacuum

Enhancing the performance of innovation systems is also complicated by the fact that within these evolving networks there is often no formal relation between the actors involved. While this informality allows creativity and new combinations, the need for some form of coordination and formal agreement is quickly felt when it comes to negotiating and implementing mutually agreed action plans. It requires new ways of working together, new rules and regulations, new decision-making procedures, codes of conduct and modes of conflict resolution, etc. Establishing and institutionalising these processes and procedures requires leadership and champions determined to make the innovation system work, external facilitation by innovation brokers and an enabling environment (Daane *et al.*, 2009b).

The role of public R&D organisations in innovation systems

Moving from the formal, linear agricultural innovation model towards transient interactive networks has very considerable implications for the role of public R&D organisations in the innovation process. They need to move from R&D to Agricultural Research **for** Development, i.e. to integrate research much more into transforming the agricultural sector (Daane *et al.*, 2009b). Public R&D organisations need to accept that science is by no means the only driver of innovation and that innovation can, and more often does, result from new social, economic and environmental challenges and opportunities that provoke new combinations of entrepreneurship, policy change and applications of knowledge. For this reason, the public R&D system should not see itself as the core of the innovation system. This also means that the normative systems that R&D organisations use to appreciate

knowledge should not dominate the innovation system to the exclusion of the appreciative culture of other actors.

The role of education institutes in innovation systems

The education system needs to adapt in two ways to meet the needs of the enhanced dynamics of agricultural innovation. One of these is that education institutes, both higher and vocational, have to offer more relevant subject matter for agricultural innovation, including biotechnology, ICTs, agri-business administration, market and policy analysis, international trade, law and intellectual property rights.

Offering new course content is not enough, however. Co-innovation means working in inter-organisational and multi-actor teams. Effective co-innovation teams require individuals with competence, not only in their profession's subject matter, but also in solving complex problems jointly with people from complementary professions and with non-professionals by exchanging knowledge and mutual learning. Professionals in co-innovation teams need to possess good teamwork, communication, leadership, facilitation, negotiation and conflict-management skills, including the ability to give, receive and use feedback. Next to these 'soft skills', competencies that enhance team members' performance also include abilities in systems thinking and soft system methodology (Checkland *et al.*, 1990; Engel *et al.*, 1997), planning and management of multi-actor processes (including participatory M&E and joint reflection aimed at improving performance), gender analysis, as well as basic knowledge of epistemology and adult learning theory.

3. What is the performance of an innovation system?

The performance of an innovation system can be defined in terms of the results that it achieves, as well as in terms of how well it performs essential functions for the innovation process (see Box 3). Put in soccer terms: the performance of a team can be measured by its score (did it win?), as well as by how well it played. Obviously, both are relevant. On average and in the long run, teams that play better also win more games.

But in the short run and incidentally, better playing teams could lose games simply because their competitors have a temporary advantage or just more luck. For public policy and management purposes, it is thus important to be able to link results to the functioning of the system and to monitor both.

Defined in terms of results, the performance of an innovation system is the extent to which it meets specified targets (outputs) by mobilising, processing and transforming resources (inputs) and the extent to which these outputs contribute to desired outcomes and impact. The use of such a linear model, based on simple cause-effect relationships between inputs-process-outputs-outcomes-impact is problematic. Depending on how narrowly or broadly one defines innovation systems and innovation – e.g. as just the production of new knowledge-products or as also including the scaling up of their use – it becomes more and more difficult to prove to what extent results are attributable to the innovation system. Many would also agree that enhanced capacity, empowerment of actors and resource availability are not just inputs, but also important results of successful innovation systems. Finally, results of innovation systems are never static. The lifespan of innovations is getting shorter and shorter as the pace of change in markets, policies, climates, etc. increases. A result like ‘competitiveness’ is thus a moving target that is never achieved or, putting it differently, that needs to be achieved again everyday.

If performance is defined in terms of how well an innovation system fulfils essential functions in the innovation process, the focus changes from results to process. Box 3 shows an attempt to list the major functions that an innovation system should perform in order to be effective.

A list of performance indicators for innovation systems, which combines both result and process-oriented indicators can be obtained from the publisher:

Box 3 – Functions determining the performance of innovation systems

Identification of needs and opportunities for innovation

1. Network formation and management
2. Developing, testing and adapting of opportunities
3. Knowledge and information exchange
4. Provision of an enabling environment for innovation
5. Market formation
6. Resource mobilisation
7. Creation of legitimacy / counteract resistance to change.

(Adapted from Hekkert *et al.*, 2007)

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Performance in terms of IAR4D principles

Another way of looking at performance of innovation systems is offered by the four ‘defining principles’ of Integrated Agricultural Research for Development (IAR4D) as proposed in a recent concept paper (Hawkins *et al.*, 2009). The degrees to which innovation systems meet each of these principles provide an alternative process-oriented assessment of their performance. The four principles comprise:

1. IAR4D integrates the perspectives, knowledge and actions of different actors around a common theme (i.e. an innovation challenge that serves as ‘entry point’ for network formation and collaboration).
2. IAR4D integrates the learning that actors achieve through working together. It is a social learning process, with actors learning from the experience of working together at the individual, organisational and institutional levels.
3. IAR4D integrates analysis, action and change across the different (people, planet, profit) ‘dimensions’ of development.
4. IAR4D integrates analysis, action and change at different levels of spatial, economic and social organisation. It recognises that e.g. local innovation may require simultaneous action and change at the local, national and international level (*ibid.*).

4. How can the performance of innovation systems be enhanced?

Creating an enabling (policy, institutional, resources ...) environment

This includes taking down barriers and enhancing coordination between different domains of public policy that are the responsibility of different ministries, e.g. agriculture & rural development, education, land use, justice, economic affairs, science & technology, finance, planning, etc. Achieving such coordination requires strong leadership, often at the level of the Prime Minister, and effective M&E through good interaction between policy makers and implementers on the ground. Special attention should be given to measures that stimulate collaboration between different actors in agricultural innovation. These include fiscal and financial instruments (e.g. new funding mechanisms for R&D that stimulate such collaboration), providing space and resources for experimentation with different new types of innovation brokers, and facilitating collaboration between the public and private support services that are essential to scale up innovation. In all these actions, special attention is needed to promote the integration and participation of the poor and vulnerable groups, as well as both genders in the innovation process.

Experimenting with emergence of new types of innovation brokers

In many developing countries the gap left by the demise of public extension agencies and the space opened for new intermediary services often have not led to the expected spontaneous emergence of new types of intermediaries. Sometimes existing players such as public R&D organisations or donor agencies have added this function to their 'traditional' role. Many doubt that public R&D organisations are the best option to fulfil a brokerage role. Public policy should take an interest in experimenting with the emergence of new types of – specialised and neutral – brokers and in improving its understanding of the effectiveness of different forms of brokerage. These experiments should be closely monitored and experiences documented and exchanged nationally and internationally to quickly build up a stronger knowledge base on these issues.

Developing new inter-organisational governance and management institutions

Innovation networks comprise actors as different as farmer organisations, private sector companies, policy makers, public and private support services, R&D and higher education institutes. Even if the potential collective gains are high relative to the costs, actors also perceive risks of failure, unequal distribution of costs and benefits, opportunism and free riders. Within each actor organisation there is thus a constant competition between time invested in its immediate individual interests (which lie outside the network activities) and time invested in the expected future benefits of the innovation network. Building trust, managing power differences, empowering actors and creating joint 'ownership' are essential to tip the balance in favour of the collective interest. Strong leadership and facilitation by innovation brokers play an important role to achieve these conditions. The more so, because the actors are either independent bodies in themselves or belong to different public bodies, so that there are either no institutional arrangements to govern and manage their joint action or the existing ones are inadequate for such new dynamic and transient multi-actor networks.

Public policy thus has an interest in stimulating and monitoring experimentation with new inter-organisational institutions and, where possible legalising new institutional arrangements (e.g. new legal provisions and new forms of legal entity to govern the collaboration of public and private organisations and natural persons; arrangements to protect the intellectual property rights of individuals and organisations as well as the collective interests in 'knowledge commons', etc.), so that they can be used by others who then do not have to reinvent the wheel.

Changing towards high-performance organisations

Organisations, be it within the public or private sector, are created to implement a mandate, which usually falls within one domain, not to solve transversal problems of society. Both the industrialised and the developing world are struggling with the mismatch between the increasing complexities of problems on the one hand and the domain-specificity and

compartmentalisation of organisations on the other. These new demands on organisations require that they develop all the characteristics of high-performance organisations, i.e. organisations that consistently perform better than their peers over a period of 5-10 years. The five main characteristics are: (i) high quality, coaching leadership, (ii) a culture of open internal and external communication and dialogue aimed at improving organisational performance, (iii) continuity of the organisation strategy and personnel, (iv) a clear vision of the organisation's competitive niche, and (v) high quality and diverse staff with complementary competencies and a strong capacity to work in co-innovation teams (De Waal, 2008). Such organisations are prepared to experiment with new ways of working, learn from successes and mistakes and share and apply the lessons internally and with other actors. The effective involvement of R&D and higher education organisations in innovation systems, will require changes in their staff performance assessment criteria to include not only single-author publications in peer-reviewed journals, but also contributions to multi-actor agricultural innovation.

Strengthening innovation competence

Working effectively in co-innovation teams requires both new subject matter and new transversal 'innovation' competence. This transversal competence cannot be taught as a subject matter or developed through conventional teaching or distance education aimed at individuals. Developing this competence requires learning-by-doing (action-learning) on-the-job or through internships, where learners (professionals, non-professionals, students) engage in multi-actor innovation teams, jointly reflect on their experience, draw lessons from this and integrate these into their cognitions and behaviour to increase team performance. What is needed to promote this learning are not so much courses, as tailor-made facilitation and coaching services. To date, few organisations provide such services. In some situations innovation brokers fill this gap.

Public policy should take a strong interest in promoting the emergence of such service providers, the training of people with these new (and currently rare) facilitation and coaching skills, the establishment of

quality control and certification, etc. Special attention also needs to be given to the question of funding these service providers, especially in the context of pro-poor innovation processes in developing countries.

If universities are to integrate this embedded learning-by-doing into the education of students, this has far bigger implications than the introduction of new subject matter. Universities are not experienced in developing transversal competence that cannot be taught but needs to be learned in action, and their traditional instruments to test students are completely inappropriate to measure the acquisition of this competence. Also, universities are not used to work with teams of learners with complementary backgrounds and roles, and few offer their students opportunities for internships to learn in real-world conditions (Daane, 2009a).

5. And finally ...

The foregoing clearly shows that enhancing agricultural innovation capacity requires a broad range of actions in the public, private and civil society sectors and across many different domains. These actions are needed at the national level, within and between organisations and at the level of teams and individuals. Also, these actions are highly interdependent for their success. Without actions to create an enabling environment, actions at the level of local innovation teams will be less effective than desired, for instance. And without organisational changes in schools and universities, it will not be possible to strengthen innovation competencies at the required scale. While this agenda may seem too broad to tackle, there is no other answer to the challenges of today than by engaging in co-innovation, and developments are driving societies in that direction. What will finally count is that many individual initiatives of groups and organisations at different levels and in different domains come together and find ways to complement each other to jointly create and sustain the conditions for success. It is evolution rather than a grand design that will bring about the needed change.

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