

# Renewing innovation systems in agriculture and food

How to go towards more sustainability?



edited by: E. Coudel, H. Devautour, C.T. Soulard, G. Faure and B. Hubert

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The Technical Centre for Agricultural and Rural Cooperation (CTA) is a joint international institution of the African, Caribbean and Pacific (ACP) Group of States and the European Union (EU). Its mission is to advance food and nutritional security, increase prosperity and encourage sound natural resource management in ACP countries. It provides access to information and knowledge, facilitates policy dialogue and strengthens the capacity of agricultural and rural development institutions and communities.

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*Wageningen Academic  
Publishers*

This book was also published in french by Quae under the title: 'Apprendre à innover dans un monde incertain: concevoir les futures de l'agriculture et de l'agroalimentaire'. Chapters 1, 5, 6, 8, 11, 12 were translated from French by Kim Agrawal.

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P.O. Box 220

6700 AE Wageningen

The Netherlands

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**ISBN 978-90-8686-214-6**

**e-ISBN: 978-90-8686-768-4**

**DOI: 10.3920/978-90-8686-768-4**

**First published, 2013**

**© Wageningen Academic Publishers**

**The Netherlands, 2013**

## Acknowledgement

This book is the culmination of a long process of coordination, debate and creativity. We wish to thank all the people who gave life to the ISDA 2010 symposium and capitalized on the many discussions that took place.

Thanks to the “Innovation” Research Unit from Montpellier for launching the idea of bringing together different communities working on innovation in agriculture and food and seeing this project through to its completion.

Thanks to the members of the Scientific Committee for bringing their vision, guidance and spirit of synthesis: B. Hubert (Agropolis International, France), F. Aggeri (Ensm, France), C. Almekinders (WUR, Netherlands), J. Berdegue (Rimisp, Chile), R. Buruchara (Ciat, Colombia), P. Caron (Cirad, France), B. Chevassus-au Louis (Ministry of Agriculture, France), O. Coomes (University of McGill, Canada), S. Dubuisson Quellier (Cnrs, France), M. Fonte (University of Napoli, Italy), A. Hall (Link limited. & CRT-RIU, UK), S. Hisano (University of Kyoto, Japan), K. Hussein (Ocde), P-B. Joly (Inra, France), J. Kirsten (University of Pretoria, South Africa), J-M. Meynard (Inra, France), D. Requier Desjardins (IEP Toulouse, France), P. A. Seck (Africa Rice, Bénin), R. Teulier (Cnrs, France)

Thanks to the Local Scientific Committee for bringing their enthusiasm throughout the process and for aggregating their networks to make this event a success: H. Devautour, E. Coudel, M. Antona, J-M. Barbier, D. Bazile, E. Biénabe, E. Chia, D. Desclaux, G. Faure, P. Gasselin, P. Maizi, M. Piraux, C. Poncet, B. Prevost, S. Ridaura, C. Soulard, L. Temple, L. Temri, J-M. Touzard, B. Triomphe, E. Valette.

Thanks to all those on the back stage who, with their best effectiveness, coordinated all the logistics, communication, travelling: M-F. Chazalette, B. Gillet, N. Kelemen, E. Grégoire, A. Rossard, C. Rollin, Denis Delebecque, T. Erwin, P. Radigon, C. Rawski, P. Lajous-Causse. A special thanks to K. Agrawal and A. Cockle for translating the chapters of this book.

Thanks to those who agreed to bring their energy to facilitate the sessions: C. Albaladejo, M. Barbier, P. Bonnal, M. Bonin, F. Bousquet, C. Bryant, E. Cheyins, N. Cialdella, Y. Chiffolleau, E. Doidy, M. Dosso, S. Dury, C. Ferraton, S. Fournier, C. Gary, F. Goulet, C. Harris, H. Hocde, H. Ilbert, F. Jarrige, G. Kamau, P-Y. Le Gal, V. Mathieu, A. Quinlan, R. Rajalahti, H. Rey-Valette, S. Ridaura, G. Ruivenkamp, D. Sautier, P. Tittonell, E. Torquebiau, A. Torre, S. de Tourdonnet, J. van den Berg, F. Wallet, A. Waters-Bayer.

Thanks to the various donors for their financial support which enabled so many participants from the South to come: CTA (Centre Technique Agricole), IFAD (International Fund for Agricultural Development), Agropolis Fondation, the french Ministry of culture and communication (General Delegation of the french language and languages of France),

Languedoc-Roussillon Region, Agglomeration of Montpellier. Thanks to the sponsorship of the Ministry of Agriculture and Fisheries, Ministry of Foreign and European Affairs, and the Ministry of Ecology, Energy, Sustainable Development and the Sea. Thanks to the World Bank and OECD (Organization of Economic Cooperation and Development) for their participation.

Finally, thanks to the more than 500 participants for having brought their enthusiasm, their ideas, and their willingness to share into ISDA 2010.

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## Acronyms

AARINENA	Association of Agricultural Research Institutions in the Near East and North Africa
AFD	French Development Agency
AIS	Agricultural Innovation System
AKIS	Agricultural Knowledge and Information Systems
ANT	Actor-Network Theory
ASARECA	Association of Strengthening Agricultural Research in Eastern and Central Africa
BRAC	Bangladesh Rural Advancement Committee
CBD	Convention on Biological Diversity
CGDA	General Council for Agricultural Development, Morocco.
CIRAD	Centre for International Cooperation in Agronomic Research for Development
CMNR	Collaborative Management of Natural Resources
CPERA	Commissions for Planning and Evaluating Agricultural Research
DFID	Department for International Development, UK
ENA	National Administration School of Rabat, Morocco
ENFI	National School of Forestry Engineers, Morocco
FAO	Food and Agriculture Organization of the United Nations
FAP	Fodder Adoption Project
FARA	Forum for Agricultural Research in Africa
FIPS	Farm Input Promotion Services
FRP	Federated Research Projects
GAPs	Good Agricultural Practices
GCARD	Global Conference on Agricultural Research for Development
GCRAI	Consultative Group on International Agricultural Research ( <i>French acronym</i> )
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIAHs	Globally Important Agricultural Heritage Systems
GMO	Genetically Modified Organisms
GREMI	Group for European Research on Innovative Environments
HDI	Human Development Indicator
IAV	Hassan II Agronomy and Veterinary Institute, Morocco
ICAR	Indian Council for Agricultural Research
ICCROM	International Center for the Study of the Preservation and Restoration of Cultural Property
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IFOAM	International Federation of Organic Agriculture Movements
ILRI	International Livestock Research Institute

IFT	Index of Frequency of Application ( <i>French: Indicateur de Fréquence de Traitements</i> )
INGC	National Institute of Cereal Crops
IP	Intellectual Property
INRA	National Institute of Agronomic Research, France
IPHAN	National Institute of Historic and Artistic Heritage, Brazil ( <i>Portuguese: Instituto do Patrimônio Histórico e Artístico Nacional</i> )
IRD	Institute of Development Research, France
IRESA	Institute of Agricultural Research and Higher Education
IS	Innovation Systems
ISDA	Symposium on Innovation and Sustainable Development in Agriculture and Food
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature
LAS	Localized Agrifood Systems
LINK	Learning Innovation Knowledge
NAIP	National Agricultural Innovation Project
NEG	New Economic Geography
NGO	Non-Governmental Organization
OECD	Organization for Economic Cooperation and Development
PGRFA	Plant Genetic Resources for Food and Agriculture
PMCA	Participatory Market Chain Approach
PPPs	Public-Private Partnerships
PSDR	Programme 'On and For Regional Development' ( <i>French: Pour et Sur le Développement Régional</i> )
RAI	Rural Agro-Industries
RIU	Research Into Use
SACCAR	Southern African Centre for Cooperation in Agricultural Research and Training
SRI	System of Rice Intensification
SSA-CP	Sub-Saharan Africa Challenge Programme
TRIPS	Trade-Related Aspects of Intellectual Property Rights
TTOs	Technology Transfer Offices
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
VCC	Village Coordination Committee
WECARD	West and Central African council for Agricultural Research and Development (CORAF)

# Preface

*Patrick Caron*

There is no doubt that the issue of innovation and its processes and impacts is fundamentally important for research institutions, policymakers and society as a whole.

As far back as 1993, at the initiative of CIRAD's Rural Economics and Sociology Mission, three French research institutions, CIRAD, INRA and ORSTOM (now IRD) organized an international seminar in Montpellier, France, on the topic of 'Innovation and Societies: What kinds of agriculture? What kinds of innovation?'. The 1990s were, in general, marked by a mobilization of the human and social sciences within agriculture research institutions. This was done in order to better understand and overcome what was perceived as social and cultural resistance to change and thus to facilitate and accelerate the dissemination of research outcomes. At the same time, representatives of these disciplines experienced firsthand the uncomfortable asymmetry of thoughts and actions between the dominant life sciences and the social sciences. Therefore this seminar was a welcome opportunity to take stock of innovation processes hiding behind these resistances and to encourage dialogue between disciplines.

Since then, in a context where environmental and poverty issues have gained importance, international agricultural research has shifted its focus to contributing to sustainable development and the Millennium Development Goals. This is reason enough to revisit once again the debates of the past. How best to position ourselves in a perspective of change and disruption?

What were our reasons to revive the debate, 17 years on, through another international conference? Our initiative was based on a four-fold motivation. First of all, we thought it important to base ourselves within a perspective of international thinking by broadening participation beyond only French institutions. Secondly, we recognized the real challenge of reaching beyond the conceptual framework of the human and social sciences and of seeking useful interdisciplinary fertilizations. Thirdly, we understood the challenge of looking beyond local dimensions – while recognizing the irreducibility of some local aspects – to address the interplay between different organizational levels, a challenge which echoes the global aspects of issues of development. Finally, meeting the actors of development and training, outside the confines of research, could help us better position ourselves in relation to changes that are taking place in society.

Research and education find themselves disrupted by technical, economic and social changes and the rise of uncertainties highlighted daily by the media. Environmental, economic, financial, social and political crises have become, in many cases, the basis for discussion and action. Such crises stress the urgent need for processes of adaptation and regulation based on collective



action and call into question existing knowledge and challenge the omnipotence of scientific expertise. Innovation has always been perceived as a process where the solutions of tomorrow will be born. But the proven tendency of innovation in some cases to lead to situations of exclusion does not conform to the rhetoric and raises the question of the relationship between innovation and equity, highlighted in the IAASTD Report or the World Bank report (2008).

Current changes challenge in a very fundamental way the development models we consciously or unconsciously espouse and our unshakeable belief in the virtues of differentiation and innovation. Are we not systematically confusing innovation for development? Aren't our programmes still oriented towards change as a paradigm of social progress? Isn't innovation, as approached through the invention-innovation pairing, the very basis of action-oriented research? We can ill ignore these questions when we decide to focus on innovation.

It thus seemed appropriate to us to revisit our development models through a reflection on the link between Innovation and Sustainable Development, and this via an analysis of the effects of innovation processes in terms of 'development'. The scientist cannot let himself be trapped by an irrational belief in the virtues of innovation. Already in 1993, Chauveau and Yung<sup>1</sup>, drawing on Hirshman, had counterposed two visions of these processes. On the one hand, a rhetoric, often called progressive or even scientific, supported by a diffusionist conception of innovation, defines innovation as a factor of technical and social progress. On the other, a rhetoric, called reactionary, critical of innovation, denounces the capturing of its benefits by dominant forces and challenges its idealized effects on traditional societies. This latter viewpoint is still very relevant and useful.

Thus, the objective and challenge of the ISDA conference on Innovation and Sustainable Development, organized jointly by CIRAD, INRA and Montpellier SupAgro, was to develop renewed, combined and cross-disciplinary perspectives on innovation. The intent was to understand the relationship between knowledge production, learning and innovation in terms of that ultimate of goals: development. The conference invited us to approach innovation itself as a research subject and to provide an update on scientific advances in this domain. It helped stimulate the reflexivity of our R&D activities and generate new ways of thinking about innovation. And, last but not the least, it encouraged innovation within the scientific world itself.

The conference was indeed an occasion for several fruitful discussions between the various communities working on innovation. With over 500 participants from 65 countries, it was a significant step forward in understanding innovation and its effects. I am convinced that the outcome of the conference will help shape our institutions' activities and programmes for some time to come. This book bears witness to the richness of debates and opens up new frontiers for our research institutions in the design of development policies.

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<sup>1</sup> Chauveau, J.P. and Yung, J.M. (eds.), 1995. Innovation et Sociétés – V2 Les diversités de l'Innovation. Actes du XIV<sup>ème</sup> séminaire d'économie rurale. INRA-CIRAD-ORSTOM, 13-16 September 1993, CIRAD, Montpellier, France.

# Chapter 1. Reconsidering innovation to address sustainable development

*Guy Faure, Emilie Coudel, Christophe T. Soulard and Hubert Devautour*

## 1.1 Introduction

The world is being confronted by a multi-faceted systemic crisis. In addition to structural and ongoing changes such as climate change, increased pressure on renewable resources and population growth (still strong in Africa), the world must now contend with a severe economic crisis of unpredictable consequences, deepening poverty, shrinking export markets, tighter credit and cutbacks in development funding. In such a context, agriculture faces an uncertain future, particularly in some of the world's regions, with the emergence of differentiated development models that have led to an increasingly fragile family agriculture and the simultaneous rise of a capitalist agriculture. Nevertheless, this systemic crisis may also provide new opportunities over the long term. It is leading to a break from the past and calling into question paradigms until now taken for granted. It has brought to the fore the vulnerability of agricultural and agrifood systems and highlighted the need for innovation to take advantage of new development models. At a time of great uncertainty, with shifting values and standards, our societies should show themselves to be creative by reinventing modes of production, processing and distribution of agricultural products with a long-term perspective that takes into account the territories and their peoples, putting the concept of sustainability at centre stage.

Several agricultural and agrifood systems have already proven their ability to promote sustainable development by basing themselves on principles of agroecological production (De Schutter, 2011) or by encouraging local food systems (Muchnik and De Sainte-Marie, 2010). These innovative systems are still not very common and currently exist either in competition or in complement to the dominant productivist systems, some of them also claiming adherence to principles of environmental sustainability. These innovative agricultural systems take different forms depending on whether they are located in countries where agriculture is highly capital-intensive with high consumption of inputs and fossil fuels or in countries where agriculture has little access to these resources, resulting in low labour productivity.

While it is necessary to report on, share and capitalize on these innovative experiments, it is more urgent to create a new paradigm to consider differently the contributions of the agricultural sector to development. A renewal of agricultural and agrifood systems is not accomplished by simply designing new technical and/or organizational solutions. It has to examine the very status of knowledge necessary for sustainable development and call into question the monopoly of scientific knowledge over other forms of knowledge. It requires

transforming the innovation processes by creating new links between research, economic stakeholders, civil society actors and policymakers. Agricultural research should reorient itself in its involvement with innovation, given that agriculture is no longer assessed by its sole function of production but rather by how this production interfaces with the environment and society as a whole. The issues to address today are 'agriculture and health', 'agriculture and environment', 'agriculture and energy', 'agriculture and rural activities', etc. To understand these changes and their implications for research, we must engage in collective thinking.

Various recent works have proposed new directions for encouraging innovation. Thus, the books 'Innovation Africa' (Sanginga *et al.*, 2009) and 'Farmer First Revisited' (Scoones and Thompson, 2009) stress the need to promote collaboration between farmers, researchers, advisory services and the private sector to create useful practical knowledge and to improve technologies by adapting them to farmer requirements. The role of the market as a driver of innovations is becoming increasingly accepted. Emphasis is laid on capacity building of actors and thus on training and advice, on strengthening social capital and thus networks, on the establishment of new institutional arrangements including the promotion of multi-actor platforms and on drawing up of suitable public policies. The book 'Action Research in Partnership' by Faure *et al.* (2010) focuses on new ways of conducting research by according greater importance to interactions between stakeholders.

These different options are part of a lively debate with contrasting positions being espoused on the type of innovation necessary for sustainable development. That is why we wanted to initiate a clash of ideas and sharing of thoughts on this topic through an international symposium, 'Innovation and Sustainable Development in Agriculture and Food' (ISDA), which was held in June 2010, in Montpellier, France. Participants included researchers from various disciplines, development actors and policy makers from countries of the North and the South. This book presents an account of these reflections, which analyzed experiences undertaken to promote innovation, drew lessons from their successes and failures, with the hope that they will lead to the emergence of new scientific and political perspectives for innovation systems that could contribute to sustainable development.

The chapters of this book express various positions on innovation processes and contain reflections of different experts in the dynamics of innovation, of institutional representatives involved in guiding and managing innovation, and of researchers who have analyzed and participated in innovations on the ground. The authors have relied on the many presentations and discussions held during the ISDA symposium; some of them will illustrate their points in the text with case studies<sup>2</sup>.

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<sup>2</sup> The symposium proceedings are available online: <http://hal.archives-ouvertes.fr/ISDA2010>.

## 1.2 Innovation for what kind of development?

### 1.2.1 Development, a constant questioning

To understand innovation and its contributions to development, it is important to consider the meaning given to the notion of development by various actors. Indeed, the definition of development is not self-evident. A first definition, widely disputed but which still surfaces in current debates, argues that *'development is economic growth'*, as measured primarily by a nation's gross domestic product. Further refinements are possible by incorporating other criteria such as social justice: *'development is evenly distributed economic growth'*. Economic thinking on development has been marked by the necessary evolution of societies due to growth. For example, Rostow (1979) identifies five stages of growth through which societies must pass to get closer to 'developed' Western societies: (1) the traditional agricultural society, (2) expansion of trade with the first changes in techniques and attitudes, (3) the 'take-off' powered by cumulative growth, (4) the 'drive towards maturity' with progress extending to all activities and (5) the advent of a mass consumer society. Such a definition of development is marked by the notion of progress with a clearly defined target, shared by a large section of society and towards which society proceeds step by step. Its adoption implies a period of major planning of technical interventions and a belief in the overall positive effects of these techniques.

As far back as the 1970s, 'The Club of Rome' warned of the danger of unfettered economic and population growth leading to the depletion of natural resources. The development model based on the accumulation of wealth was then contested. François Perroux (1963) proposed a more social definition: *'development is a combination of a population's mental and social changes which makes it ready for cumulative and durable growth of its real global product.'* One of the proposed alternatives to economic development was that of Maurice Strong, secretary general of the 1972 Stockholm conference. He spoke of *'eco-development'*, in the sense of a prudent use of resources and a valorisation of Third-World knowledge. This concept, which was also taken up by Ignacy Sachs (1980), became central to the policies of the United Nations programmes of the 1980s. At the same time, the future Nobel laureate in economics, Amartya Sen (1989, 1999), proposed a relook at poverty through the prism of basic needs and capabilities of individuals and freedoms enjoyed by them. He introduced the concept of human development (later formalized as the HDI, the human development indicator). During the Rio conference in 1992, these ideas all converged together in the notion of sustainable development as enunciated by the famous definition by Brundtland: *'sustainable development is development that meets present needs without compromising the ability of future generations to meet their own needs'* ('Our Common Future' report of the World Commission on Environment and Development, 1987). This new paradigm emphasized the multiplicities of the dimensions of development with the ones most often mentioned being economic, social and environmental. Cultural and governance-related dimensions, are also widely cited.

Thus development becomes the implementation of a social project. The nature of the project is not defined *a priori* in reference to one or other external models. Its objectives can differ from one society to the next and there are several paths to reach them. What counts is the flexibility, the resilience and the reversibility of economic and social systems put in place to avoid compromising the ability of societies to ensure their futures.

### 1.2.2 Development in agriculture

The agriculture sector is, of course, impacted by this thinking on development. For decades, agriculture has been driven by the goal of increasing production by, on the one hand, promoting an increase in cultivated area per unit of labour or capital and, on the other, by raising crop and livestock yields. This model was called the 'green revolution' in countries of the South and intensive agriculture in those of the North. It was only gradually that other dimensions relating to territories, sectors, value chains or food systems were taken into account, at more or less the same time that limitations of positivist and productivist models were becoming apparent. The concept of multifunctionality of agriculture that emerged in the 1990s is one example. It recognizes that agriculture, beyond its function of production, plays an important role in building a territory, participates in the management of renewable resources, generates jobs and helps build a local culture. Thus, gradually, other agricultural models emerged, based on novel principles such as agroecology (Altieri, 2002) or seeking to promote new short supply chains or new forms of equity in the markets (Colonna *et al.*, 2011).

What strikes the observer is how these new agricultural models, although well thought out in theory and gradually being implemented on the ground, are unable to displace the old models. Instead, different models coexist on the same territory. In Brazil, for example, family farming, State-supported for the past several decades, coexists with a capitalist agriculture where the role of finance is gradually gaining importance. In Europe, the model based on the family farm can no longer form the basis of agricultural policy given the appearance of private investment in the farming sector and the growing importance of diversification of activities of rural and agricultural households. In Africa, the phenomenon of land-grabbing is the brutal materialization of these rapid changes, with large private enterprises taking priority over traditional communities in matters of land ownership. While the coexistence of these models in a territory may be observable, it is far from easy to assess their dynamics and respective contributions. Are there conflicts between the models, especially for access to resources? What synergies exist, for example, in the creation of new markets? This coexistence can also be found even within organizations, for example, with a farmer association selling some of its products in a niche market and others through the mass-distribution route. It is also evident at the level of consumers who can purchase a product labelled 'fair trade' at a farmers' market or cooperative shop and another cheap product the same day at a discount supermarket.

The diversity of models calls into question the place of farmers in agricultural development. In a meaning close to Sen's (1999) 'capability', development can correspond to the capacity building of farmers so that they can, on the one hand, define their own targets and, on the other, acquire and implement the means of achieving them. Capacity building also helps them increase their independence and makes them more self-reliant. However, as stated, this concept is not completely unambiguous. Indeed, if farmer collectives can shape and be part of such a process, there is no guarantee that they will contribute to the building of assets or benefits considered as commons by the rest of society. We find here a 'negotiated' idea of development where the definition of what agriculture should be involves diverse agricultural and non-agricultural stakeholders with differing requirements (Compagnone *et al.*, 2009).

### 1.2.3 The place of innovation in development

Innovation is at the core of reflections on development, most often simply seen as the engine of development. Schumpeter (1934) was the first to propose that innovation allowed an entrepreneur to acquire a comparative advantage over his competitors and thus to generate profits. According to him, innovation is a new combination of production factors which can be expressed by the making of a new product, the devising of a new production method, the building of new outlets and markets or access to new resources. Innovation is an invention that has found its market and has thus become part of a system of production. Subsequently, numerous studies have attempted to characterize innovation which, for example, can be incremental or radical, technical or process-oriented, driven by the market (pull innovation) or by technological advances (push innovation). It is traditional to say that innovation can take various forms: technical, economic, organizational, social, etc. More specifically, innovation is usually composite: a technical innovation is most often paired with an organizational innovation in which we could say it is embedded. This observation leads to the concept of the socio-technical innovation<sup>3</sup>, with the technical object being understood through the uses it is put to and the social ties that its use generates, modifies or destroys (Flichy, 1995). Innovation can be grafted onto older systems or constitute a break from the past, it can be exogenous in origin and be driven by the technicians or endogenous with the farming world as its source. It can emerge in very varied contexts and can only be understood by an analysis of the overall society and the context in which it develops. Every innovation has a history: it is born, it develops and then it dies. Innovations are thus strategic instruments to achieve the objectives of certain actors or bolster their positions. They can be used as tools of power and negotiation by certain sectors of society to press for their preferred development agendas.

At another scale and in modern times, Europe claims to see its development solely in a knowledge and innovation society in order to maintain the competitiveness of countries and thus their societies' prosperity. Innovation can be found on the agenda of several

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<sup>3</sup> The socio-technical analysis considers an object in its social milieu and places itself at the exact point where the innovation is located (Akrich *et al.*, 1988).

stakeholders (policymakers, business leaders, research institutions, etc.) because it fits well in a context of production that is evermore complex and uncertain, where the combination of physical, social, intellectual dimensions of change enable continuous adaptation to an unstable environment which is in turn being constantly modified by this combination. But if innovation is not just technological but refers usually to complex processes, it does not mean that every change within an organization, or even a society, is an innovation. Innovation is a process that intentionally promotes the emergence of the new and of its adoption by society. Innovation requires a project of change and an interaction between the actors promoting this change and those appropriating it. Olivier de Sardan (1993) illustrates the complexity of the phenomenon through his definition of innovation: *'a novel graft, between two indistinct groups, in an arena, via brokers.'*

Innovation thus directly questions the development models that we promote, consciously or unconsciously. Yung and Chauveau (1993) distinguish a progressive and scientific rhetoric of innovation as a source of technical and social progress in a diffusionist view from a reactionary rhetoric critical of innovation which denounces the annexation of benefits by dominant players to the detriment of traditional social structures. The central issue is not the improvements in performance of actors involved in innovation but rather the consequences of innovation on the other actors in terms of their inclusion or exclusion. Aimed at improving land and labour productivity, technical progress promoted in the agricultural sector has undermined the future of small farmers everywhere (Röling, 2009).

### **1.3 Research on innovation changes to progressively take into account complexity**

Research has always played an important role in understanding and promoting innovation. Is it not the very foundation of its activities? Nevertheless, research practices have evolved to better address the increasingly complex problems confronting societies. This evolution is based on research gradually (and partially) calling into question its ways of producing knowledge and of taking into account the 'social' requirements (which actors, what goals, what consequences?), leading to a different way of perceiving innovation. Innovation has thus been successively characterized by the behaviour of individuals, by interactions between individuals (networks) and, later, by interactions between organizations. We track here this evolution, in particular for the agricultural and agrifood domains.

#### **1.3.1 The farmer's role in the innovation process**

Until the 1980s, research focused on the producer and his environment for analyzing innovation. Rogers (1983) showed the different attitudes and behaviours of producers when confronted by change and drew up a typology of innovators (venturesome innovators, early adopters and social leaders, early majority, traditional late majority, wait-and-see laggards). He showed that the dissemination of innovation is non-linear, following an S-curve with time

on the x-axis and the number of adopters on the y-axis. But this diffusionist model does not take into account the fact that the conditions relating to the farm or its environment, which can either encourage or discourage the innovation under consideration, are not the same for all. As emphasized by Olivier de Sardan (1993), the diffusion of innovation, especially in the early stages, depends also on its proponents and on their ability to promote it based on their social position and the interests they perceive. For their part, Mendras and Forsé (1983) proposed five factors to evaluate the 'adoptability' of innovations, namely: the relative advantage accorded by the innovation compared to the initial situation, its compatibility with the system already in place, its greater or lesser complexity, its 'trialability' in the context of the actor concerned, and the observability its results with others. These factors incorporate the innovation's degree of complexity and the level of risk that the producer is being asked to take. But the question doesn't really have to do with the compatibility with the existing production system or if the producer can adapt to the proposed innovation. The real issue is to understand the dual relationship that is being established: how does the innovation change the farm and how does the farmer incorporate the innovation by adapting it?

Chauveau *et al.* (1999) relativizes this way of characterizing innovation, which puts the focus on the individual by emphasizing the interactions between him and his environment. Thus, they specify that (1) the supply and demand of innovation are built during interactions between the actors on technical issues, (2) innovations propagate through composite networks taking the heterogeneity of socio-economic units into account and (3) the relationships between innovation and the economic, social and political environment are not linear processes.

### 1.3.2 The diffusionist model called into question

Based this body of work, the ability of the dominant linear model of knowledge and technology transfer, called the diffusionist model, to provide answers to complex problems is being called into question. Nevertheless, it is still very much alive; it is not rare for researchers of the natural sciences to seek support from the human or social sciences to disseminate technologies developed in the laboratory or at the field station. However, debate on the changes necessary in the positioning of research in innovation processes remains lively. The story of research in developing countries is illustrative of the changes observed. From the 1980s, the research-development approaches to improving farm performance while taking rural realities into account have resulted in extensive literature.

Jouve and Mercoiret (1987) define research-development as '*full-scale experimentation in close consultation with the farmers for the technical, economic and social improvement of their production systems within their environment*'. It seeks to create a reciprocal triangular relationship between research, extension services and the farmers at every stage of the process of transforming production conditions. French research-development approaches and Anglo-Saxon ones of 'farming system research' converge on the basics (Jouve, 1994): willingness to consider the actual production conditions, a systemic approach to complex