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Agricultural Knowledge and Innovation Systems in Transition – a reflection paper

Standing Committee on Agricultural Research (SCAR)

Collaborative Working Group AKIS

Research and Innovation

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AGRICULTURAL KNOWLEDGE AND INNOVATION SYSTEMS IN TRANSITION - a reflection paper

Standing Committee on Agricultural Research (SCAR)

Collaborative Working Group on Agricultural Knowledge and Innovation Systems (CWG AKIS)

Brussels

March 2012

AGRICULTURAL KNOWLEDGE AND INNOVATION SYSTEMS IN TRANSITION – a reflection paper
SCAR-Collaborative Working Group AKIS
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The European Union's Standing Committee on Agricultural Research (SCAR) is mandated by the Council to play a major role in the coordination of agricultural research efforts across the European Research Area (currently composed of 37 countries). This includes questions of advisory services, education, training and innovation. The SCAR installed a Collaborative Working Group of civil servants from the European Commission and the member states to reflect on Agricultural Knowledge and Innovation Systems.
Innovation is an important challenge for European agriculture, but little is known about the performance of the Agricultural Knowledge and Innovation Systems (AKIS). This report gathers experiences from different countries and regions. These systems are very different between countries, regions and sectors. Although they are changing, there is no guarantee that they are fit to answer the challenges posed by the need to increase productivity and sustainability in agriculture and food production.

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Preface

Innovation is much talked about these days, and the European Commission as well as member states in the European Research Area are designing and implementing policies to promote innovation as a method to improve labour productivity and the competitive position in a rapidly changing world. This also involves the agricultural sector and food production.

Seen the resource constraints and the need to globally feed 9 billion people in 2050 foresights have argued that more food should be produced but that at the same time production should become more sustainable regarding people, planet and profit. This calls for more investments, system innovation and a transition.

These developments raise the question whether the current Agricultural Knowledge and Innovation System (AKIS) is in optimal shape to meet those challenges. Answering that question is not easy. The European Agricultural Knowledge and Innovation Systems and their recent changes are not well documented or monitored.

This caused the Standing Committee on Agricultural Research (SCAR) to set up a Collaborative Working Group (CWG) with a mandate to review links between knowledge and agricultural innovation in Europe. The mandate included three expectations: a] that the work would provide a starting point to establishing a European monitoring device of the AKIS structures and their evolution, a crucially necessary tool for designing and evaluating AKIS policy formation and implementation, in the perspective of the challenges ahead; b] that the findings of the working group could be interesting to the European Commission, in particular in view of its report on the Farm Advisory System, since advisory and extension services are likely to play a significant role in the development of any future European agricultural knowledge system and c] that the process would provide an incentive for member states to reflect on the organisation of their own AKIS and to benchmark with other countries.

Over the last two years the Collaborative Working Group had an interesting and pleasant innovation journey which has resulted in the reflection offered in this report. The content is the responsibility of the Collaborative Working Group. We think it is important to share these results with a broader audience. However we also consider it to be work in progress. SCAR has agreed to our recommendation to follow up this Collaborative Working Group with a new one with an updated mandate.

We would like to take the opportunity to thank SCAR for their confidence in our work. We thank the experts for their input and the European Commission for financing them. We thank the members of the Collaborative Working Group for their active participation, and especially those acting as work-package leaders, writing parts of this report, organising stimulating meetings and organising the conference in March 2012 where this report is presented. More details are given in Annex 1.

May this report be useful as a small building block in meeting the challenges that our European agricultural and food system faces.

Pascal Bergeret
Krijn J. Poppe
Co-chairs of the CWG

Executive summary

S.1 Key message

Innovation is an important challenge for European agriculture, but little is known about the performance of the Agricultural Knowledge and Innovation Systems (AKIS). This report contributes towards this knowledge, as it reports on experiences from different countries and regions. The systems are very different between countries, regions and sectors. Although they are changing and diversity is useful in innovation and transitions, there is no guarantee that they are fit to answer the challenges posed by the need to increase productivity and sustainability in agriculture and food production.

Different parts of AKIS, such as education, extension and research face different challenges. They are also governed by different incentives, which can be problematic for synergy and cooperation within an AKIS. Education is often weakly connected to research, extension and business. Applied research is often reviewed on scientific output, much less on practical relevance. Networking and cooperation between research and extension or farmers groups is crucial and to be promoted. Agenda setting by farmers and food business is more important than just more research dissemination. We therefore advocate a distinction between *science-driven research* and *innovation-driven research* in the motivation of research. Programming, farmer/business involvement and the role of the EU are quite different in both types (Table S1). By taking this difference in motivation into account, research policy and management could be improved.

Table S.1 Two types of motivation for research

Aspect	Science driven research	Innovation driven research
Incentive to program a topic	Emerging science that can contribute to solving a societal issue (or a scientific question)	An issue / problem in society that can be solved by new research, or a new idea to solve an existing issue
Participation of users	In demonstration phase / via research dissemination	In agenda setting, defining the problem and during the research process
Quality criteria	Scientific quality	Relevance (for the sector or a region)
Focus	Research organisations	Networks of producers and users of knowledge
Diffusion model	Linear model	System (network) approach
Type of government policy	Science / Research Policy	Innovation Policy
Economic line of thinking (see table 2.1)	Macro-economics	Systems of innovation
Finance	To a large extent public money: more speculative and large spill over effects	Public-private partnerships very possible / advantageous

The role of the EU	Efficiency of scale (member states often too small), smart specialisation between member states, create European research market with harmonisation of hard- and soft infrastructures	Stimulate interaction and learning in Europe between national/regional AKIS. Enable in CAP innovation by networks with farmers
Typical EU examples	Horizon 2020, FP7, ERC, some ERAnets, Joint Programming Initiatives	CAP: European Innovation Partnership, LEADER, European Technology Platforms, EIPs, some ERAnets
Type of research	Interdisciplinary with absorption capacity in AKIS (to work with material science, ICT, chemistry etc.).	Transdisciplinary and translational with close inertactions.

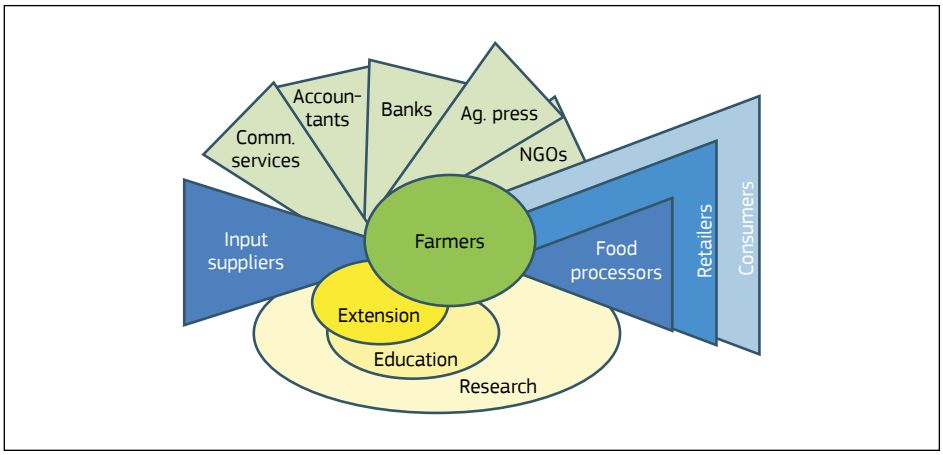
Coherent policies regarding AKIS are scarce, monitoring of innovation and innovation systems is nearly absent and conceptually challenging. This suggests there is room for improved, coherent policy making in member states and in the European Union / Research Area. There are elements in the European Innovation Scoreboard, the Community Innovation Survey and the Farm Accountancy Data Network that could be a starting point. It also implies possibilities for learning between member states (regions) at a European scale – a process that could be facilitated by the EU.

The Common Agricultural Policy (CAP) should use parts of its budgets to encourage *innovation-driven research* with empowerment of (groups of) farmers and could play a role in exchange of knowhow in Europe. As the bulk of innovation-driven research is regional, the EU's Horizon2020 could focus on *science-driven agricultural research* and organise smart specialisation (related to social challenges): there are huge challenges that call for more investment in agriculture where at the same time government budgets are becoming very tight. *Science driven agricultural research* is not only science for science (as carried out by the European Research Council) but also science for competitiveness and for society, linked to social issues (Table S1). The linkage of Horizon2020 and the CAP should guarantee the collaboration between *science-driven* and *innovation-driven* research.

S.2 Complementary findings

AKIS is a useful concept to describe a system of innovation, with emphasis on the organisations involved, the links and interactions between them, the institutional infrastructure with its incentives and the budget mechanisms. Although the components Extension (Farm Advisory) system, Education and Research are often stressed, it is important to realise that there are many more actors in the food chain that directly influence the decision making of farmers and their innovations (figure S.1).

Figure S.1 Actors in the AKIS directly relevant for agricultural innovation in the food chain



Source: This project
Note: Commercial services include laboratories, veterinarians, management software, notaries, land brokers etc. Accountants have been mentioned separately as being in some countries very influential on strategic decisions

Innovation starts with mobilising existing knowledge. Innovation is a social process, more bottom-up or interactive than top-down from science to implementation. Even pure technical innovations are socially embedded in a process with clients, advisors etc. Very often partners are needed to implement an innovation.

Innovation is first of all the responsibility of businesses. But it is a government responsibility too. Innovation has not only benefits for those who innovate, but also others gain: future innovators as well as the clusters of business and the economy at large with a better competitive position and in the long run more jobs and higher incomes. These are so-called positive externalities (spill-over effects) that an investor in innovation does not take into account and can lead to underinvestment in innovation. A second reason for governments to promote innovation is that this is one of the policy instruments to mitigate negative external effects such as environmental pollution in agriculture and food production (see table 3.1).

As innovation is a risky business and benefits from the exchange of ideas, learning and innovation networks have proven to be an adequate vehicle for empowering groups of farmers to investigate new options to make their business more viable or sustainable. It also seems to be an efficient form for information brokers such as farm advisors. This implies policy instruments that finance collectives in networks, including food chain partners, non-governmental organisations (as advocates of sustainability), extension and research. It should be noted that innovation policies have recourse to many more instruments than research: for instance labour market policies, regulation (with standards or mandates) or de-regulation and access to risk bearing capital can be as important as research or could strengthen its impact.

Social innovation refers not only to the social aspects of the innovation process, nor only the objective that innovations should also be sustainable in the corporate social responsibility sense, but to also the fact that social problems need innovative approaches. These include rural development in regions with aging or declining populations, decreasing (governmental) service levels and (sometimes) uncompetitive agriculture. But social innovation with urban farming and food projects can contribute to improved quality of life in poor neighbourhoods

of big cities with high levels of unemployment and high rates of obesity. Social innovation can go along with the desire to strengthen the link between urban life on one hand and food and the rural area on the other hand.

S.3 Background

The European Union's Standing Committee on Agricultural Research (SCAR) is mandated by the Council to play a major role in the coordination of agricultural research efforts across the European Research Area (currently composed of 37 countries).This includes questions of advisory services, education, training and innovation. The SCAR set up a Collaborative Working Group (CWG) with participants from the European Commission and the member states (both civil servants and researchers or extension workers) to reflect on Agricultural Knowledge and Innovation Systems. The CWG asked experts to provide a paper on the concepts used in science (summarised in chapter 3 of this report) and a paper on social innovation (summarised in chapter 4). The members collected and presented material from their own countries in workshops (chapter 5) and discussed trends and future scenarios. The reflection was for the participants very useful and of direct use for current policy development. Seeing the challenges in this area and the focus in policy on innovation, we recommend SCAR to follow up this group up with a new group with an updated mandate to continue the work on outstanding questions and emerging issues.

1 INTRODUCTION

Text by Krijn J. Poppe

1.1 Innovation by tradition

The familiar image of agriculture is more conservative than innovative. This is wrong. Agriculture and innovation go hand in hand. Ever since agriculture was invented some 10.000 years ago, somewhere in the fertile crescent of the Middle East (and simultaneously in some other places in the world), farmers have innovated. In working with nature they knew that mutating weeds and pests would win the battle when innovation faltered. Some of our food products still resemble those of a few hundred years ago, and are not so much associated with innovation as new products in ICT are; nevertheless innovation has happened and on balance has contributed to social welfare.

In the last century agricultural innovation has been professionalised in outsourcing these activities to universities and state activities in applied research and extension (advice) and to professional companies (such as breeders and equipment suppliers). The social return of these activities has been enormous, and often far above market rates for investments [Alston,2010]. As a result our food, at least in countries such as the EU member states, has become cheap and plentiful.

Notwithstanding these successes, in the recent years discussions on the effectiveness of the innovation system have taken place. With plenty of cheap food available and raising awareness of negative externalities (such as environmental and food safety issues) the future of the food system became an issue for broad political debate. Read a newspaper or walk into a bookshop and the information on food issues is as plentiful as our supermarkets are. This public debate has its effect on agricultural policy (in issues such as rural development and cross compliance) and food legislation. Of course this also affected the orientation and sometimes the structure of the agricultural knowledge and innovation system but also led to complaints that the old production oriented innovation system was not fit to deliver new farming systems [SCAR 2nd foresight – Brunori et al. 2008, IAASTD, 2009].

Recent worries about scarcities and the functioning of the food system have led to new questions on the effectiveness of the Agricultural Knowledge and Innovation systems (AKIS). Is productivity increase levelling off, have the investments been too low and the old productivist objectives wrongly been neglected, have the reorganisations that several countries have orchestrated not yet been beneficial enough? - these are just some of the questions that pop up in discussion in several countries [OECD, 2011 and 2012; House of Lords, 2011, Sundell et al., 2011].

This report reflects on the state of the AKIS from the point of view of the research and innovation policies in the EU and in its member states. It has been commissioned by and written to inform the EU's Standing Committee on Agricultural Research (SCAR) on the current state of the AKIS and their fitness to contribute to the EU's innovation agenda 2020 (for smart, sustainable and inclusive growth).

1.2 Introduction to the Standing Committee on Agricultural Research (SCAR)

The Standing Committee on Agricultural Research (SCAR) was established in 1974 by a Regulation of the Council of the EU. It is formed by representatives of member states (and presided over by

a representative of the Commission), and has a mandate to advise the European Commission and the member states on the coordination of agricultural research in Europe.

The SCAR committee was given a renewed mandate in 2005 by the Council to play a major role in the coordination of agricultural research efforts across the European Research Area. The "new" SCAR is made up of the 27 EU member states, with representatives from candidate and associated countries as observers. The SCAR members currently represent 37 countries.

On the occasion of an informal Council of the ministers of agriculture in Krems, 28th–30th May, 2006, under the Austrian Presidency, the Ministers recommended "that, in the framework of the Lisbon Strategy, the Standing Committee on Agricultural Research (SCAR) should invite EU member states to include questions of advisory services, education, training and innovation in their discussions."

On 6-7th October, 2008, the French Presidency of the EU organised for SCAR a workshop in Angers entitled "Strengthening the links between knowledge and agricultural innovation in Europe". The workshop conclusions pointed out that European farming and agro-industry need knowledge from many different sources to compete with quality products in a globalised world. Climate change mitigation and adaptation and recent fears related to food security are new challenges. Compliance with standards concerning the environment, food safety, animal health and welfare need integrated approaches for optimised farm management.

Farming is much more diverse than in the past and is often combined with other activities. New knowledge is generated by farmers, researchers (basic and applied) and private companies. The old linear model of technology transfer (from scientists to the users) is therefore outdated and should be replaced by an interactive model of networking systems, which integrate knowledge production, adaptation, advice and education. The Angers workshop provided an opportunity to identify the key features of a European Agricultural Knowledge and Innovation System and to analyse how shared experience from important reforms in several European countries can lead to potential "best practices". It highlighted the stakes linked to the need of proper AKIS for Europe:

- How to maintain a sufficient technical and scientific level among actors in order for them to respond to global and local changes and to enhance their entrepreneurial skills?
- How to orient development work and to link it to continuous education of the actors?
- How to conceive a new Common Agricultural Policy (CAP) that is supported by strong innovation systems in agriculture?

The conference on "The Knowledge Triangle: Shaping the Future of Europe", organised by the Swedish Presidency of the EU on 31st August – 2nd September, 2009 in Gothenburg dwelt on the importance of a well-functioning knowledge triangle (education-research-innovation) for Europe, in a situation where the EU's research and higher education system is perceived as fragmented and calls for intensified interaction between policy areas, notably higher education, research and innovation. A European modernisation agenda is presently stimulating universities to develop their diverse missions and new models for the way they operate. Innovation and entrepreneurship must be integrated while maintaining education and research as core activities. The need to develop further the knowledge based European society creates a strong pressure on universities as central actors of the knowledge triangle. Problems as complex as those presently facing agriculture need broad approaches looking beyond the traditional agricultural boundaries. There is a need for inter- and even trans-disciplinary approaches.

1.3 The SCAR and Agricultural Knowledge and Innovation Systems (AKIS)

In line with the renewed and extended SCAR mandate, the 2008 Communication from the European Commission to the Council, the European Parliament, the European Economic and Social Committee and the Committee of the Regions entitled "Towards a coherent strategy for a European Agriculture Research Agenda" indicates that "the Commission intends to make use of SCAR to identify agricultural knowledge structures in each Member State, with a view to eventually creating a corresponding CWG".

Subsequently, the SCAR plenary meeting of December 2008 endorsed the proposal that "the SCAR-Working Group will look into the possibility to set up a CWG on this issue (i.e. on the links between knowledge and agriculture innovation in Europe)". The same idea was expressed during the SCAR plenary meeting of June 2009, during which France and the Netherlands expressed their commitment to explore a possible follow up of the Angers workshop in the form of an ad hoc Collaborative Working Group.

This new SCAR-CWG on agriculture knowledge and innovation systems in Europe intends to contribute to the fulfilment of SCAR mandate as described in the precedent section. It could provide a starting point to establishing a European monitoring device of the AKIS structures and their evolution, a crucially necessary tool for designing and evaluating AKIS policy formation and implementation, in the perspective of the challenges ahead: to feed the world population in the long term, in a sustainable way.

Furthermore, since advisory and extension services are likely to play a significant role in the development of any future European agricultural knowledge and innovation system, the findings of the CWG could be interesting to the European Commission, in particular in view of the Farm Advisory System, a policy instrument in the Common Agricultural Policy and in view of proposals to reform the CAP with more emphasis on innovation and a European Innovation Partnership (EIP) on productive and sustainable agriculture.

1.4 Background of the issue regarding AKIS

One key message of the first SCAR foresight exercise, which was widely disseminated by a June 2007 Conference in Brussels indicated that the mounting challenges facing the agri-food and rural sectors in Europe call for a review of the links between knowledge production and its use to foster innovation. Research could play a stronger role if different actors (farmers, advisory services, consumers, private sector, civil society, policy makers) were better integrated into actual agenda setting and became part of the research process through acting together as innovative networks.

The second SCAR foresight exercise has shed a rather crude light on the current state of Agricultural Knowledge Systems in Europe, described as *"currently unable to absorb and internalise the fundamental structural and systemic shifts that have occurred. The remaining publicly funded AKIS appear to be locked into old paradigms based on linear approaches and conventional assumptions."* The report stressed the need for renewed political attention to the effectiveness, relevance and scale of Europe's AKIS and for a redefinition of AKIS. Although many share this feeling, more evidence-based analysis is needed to develop adequate policy actions.

Since the start of the CWG in 2009, the issue has become even more relevant. The European economy has seen a changing policy context: the financial and food crises, the EU 2020 strategy

for a smart, sustainable and inclusive growth, the European Innovation Partnership initiative and the discussions on the CAP post-2013 (including the role of innovation) have influenced the discussions in the CWG.

1.5 Working methods of the Collaborative Working Group (CWG)

The Collaborative Working Group is a network of civil servants (and some counter parts from research organisations) from the member states and the European Commission. The European Commission made a small budget available for three experts to write a methodological state of the art paper. A reflection paper has been written on the AKIS concept [Dockès et al., 2011]. In addition a briefing paper on the significance of social innovation in the context of agriculture and rural development has been written (Bock, 2011). The CWG has made an inventory of national issues and structures and spent time on reflection on the present situation and options for the future. More details on the CWG, its composition and the way it carried out its work are given in Annex 1 "The Making Of".

1.6 Introduction to the report

This report starts from theory on (general) innovation policy in Chapter 2, where also current EU initiatives on innovation are discussed. We then describe the theoretical notions and experiences with AKIS (Chapter 3) and describe the topic of social innovation (Chapter 4). With these concepts the Collaborative Working Group has investigated and discussed experiences in the member states. As the CWG is run on a voluntary basis, this is not a representative picture for the EU or European Research Area as a whole. However we think Chapter 5 reports many important trends and gives interesting examples. We hope it shows what monitoring, in the sense of joint learning in a transition, can contribute. Chapter 6 tries to analyse the situation the economy and agriculture is in and to see what this could mean for the future. Chapter 7 offers our reflection and makes some recommendations.

This report is in English and the technical language that the CWG adopted is as much explained as we thought useful. But we warn the reader that practices and terminology (e.g. on types of research) differ between languages and countries.

2 INNOVATION POLICY: THEORY AND EU INITIATIVES

Text by Krijn J. Poppe

2.1 Some theoretical notions on innovation policy[1]

The thinking on AKIS is based in the so called Systems of Innovation thinking concerning innovation policy. Smits *et al.* (2010) distinguish two views on innovation policy: the systems of innovation approach versus the macro-economic approach (Table 2.1).

Table 2.1 Two views on innovation policy

	Mainstream macro-economics	Institutional and evolutionary economics: systems of innovation
Main assumptions	Equilibrium Perfect information	Dis-equilibrium Asymetric information
Focus	Allocation of resources for invention Individuals	Interaction in innovation processes Networks and frame conditions
Main policy	Science / Research policy	Innovation policy
Main rationale	Market failure	Systemic problems
Government intervenes to	- provide public good - mitigate externalities - reduce barriers to entry - eliminate inefficient market structures	- solve problems in the system - facilitate creation new systems - facilitate transition and avoid lock-in - induce changes in the supporting structure for innovation: create institutions and support networking
Main strenghts of policies designed under this paradigm	Clarity and simplicity Analysis based on long term trends of science-based indicators	Context specific Involvement of all policies related to innovation Holistic approach to innovation
Main weaknesses of policies designed under this paradigm	Linear model of innovation (institutional) framework conditions are not explicitly considered	Difficult to implement Lack of indicators for analysis and evaluation of policy

Source: Ruud Smits, Stefan Kuhlmann and David Shapiro: The Theory and Practice of Innovation Policy, 2010

The macro-economic view tends to see innovation as a linear process from (basic) research via R&D to a commercial application. The main rationale is market failure and the main policy instrument is science or research policy. As there is also a risk of government failure, the choices on the direction of innovation should –in this view- be left to the market as much as possible: the market organises the allocation of resources. It leads to a fairly clear policy that can be monitored by trends in science-based indicators.

1. This Chapter is mainly based on the recent handbook by Smits et al. 2010

The systems of innovation view has a more complicated approach to innovation and innovation policy. The focus is on interaction between different stakeholders in the innovation process. The main rationale is that there are systemic (network) problems in the system or the creation of new innovation systems. Therefor an innovation policy is needed. However that innovation policy makes choices and is much more context specific.

While the macro-economic view is linked to the equilibrium thinking in economics, as elaborated by great economists such as Ricardo, Marshall, Walras, Coase, Hayek and Friedman (to name only a few). Innovation however is much more about bringing the economy into disequilibrium. Several great economists have contributed to that view: first of all Schumpeter with his thinking on the role of the entrepreneur, creative destruction and business cycles. He build on work by Karl Marx (on the role of the capitalist) and Friedrich List (the infant industry argument). Other thinkers are Ken Arrow on market failure and Oliver Williamson on institutional economics.

The innovation system perspective helps "to understand the dynamics of innovation processes by pointing at path dependency and structural sclerosis as well as the potential for new combinations, related chances and options, and opportunities for innovation policy" (Smits *et al.*, p.3).

2.2 The functions of a knowledge and innovation system

In the Systems of Innovation view, a well-developed knowledge and innovation system has seven functions (Bergek et al., 2010):

1. Knowledge development and diffusion
2. Influence on direction of search and identification of opportunities
3. Entrepreneurial experimentation and management of risk and uncertainty
4. Market formation
5. Resource mobilisation
6. Legitimation
7. Development of positive externalities

Innovation systems can be analysed on these functions, and blocking mechanisms to develop or improve these functions can be identified; this can be a basis for policy intervention. Seen the seven functions of a well-developed knowledge and innovation system, it is clear that such a system is not built overnight.

> *"Successful innovation systems develop their special competitive scientific, educational, technological profiles and strengths rather slowly, in the course of decades, or even centuries, and change is often slow to occur. Leading innovation systems are based on well-established exchange relationships among the institutions of science and technology, industry and political system. They make possible the formation of a characteristic, system-specific spectrum of diverse role definitions of the actors actively involved, develop their own negotiation arenas, and stabilize mutual expectations of behaviour. Finally they bear particular intermediary fora and bodies which facilitate the transactions of the actors of innovation systems"* (Smits et al., p. 3).
>
> *A classic example has been the British and German innovation systems in the first and second industrial revolution, as studied by Chris Freeman (1997). He showed the excellent*

> *links between the scientific. political, cultural and industrial sub-systems in Britain in the first industrial revolution. The system eroded in the second industrial revolution because of a widening gap between science and the other three sub-components. In the meantime Germany improved by building bridges among industrial research, production and the political and cultural sub-systems* (quoted from Smits et al., 2010, p.3)

Innovation is a broad concept. The OECD defines it as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. This implies that innovation activities are all scientific, technological, organisational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations.

2.3 The organisation of a knowledge and innovation system

After World War II the distinction between basic research ("science for science") and applied research ("science for innovation") became increasingly important[2]. Basic research became closely associated with academic research or 'pure' research. OECD applied the dichotomy in its 1963 manual. Universities (and academic institutions like Max Planck in Germany and CNRS in France) continued to see basic research as their main mission, with the American land-grant universities as one of the exceptions. This division of labour was also linked with a linear model in the chain from basic knowledge to innovation, be it science-push or (later) demand-pull. This picture was of course an oversimplification, but supported by the social sciences. Economists such as Nelson (in 1959) and Arrow (in 1962) linked it with public goods and market failure. Sociologist (Merton, 1973) linked it to the role of norms (CUDOS) in behaviour. (cited from Martin in Smits *et al.*, 2010, p 28/29).

However, this view is now discarded. Currently the relationship between innovation practice, innovation policy and even innovation theory is seen as one of co-evolution or a learning perspective in a multi-stakeholder setting (Smits *et al.*, 2010, p.7). In modern theories knowledge creation is not seen as a linear top down process, but as a complex process with many iterations. Gibbons (1994) labelled this as the change from Mode 1 to Mode 2 science. It is a Triple Helix approach (Leydesdorff and Etskowitz, 2003) in which three independent institutional structures (government, business and science) interact from time to time with each other, steered rather autonomously by their own development. This framework for analysis stresses the importance of the dynamics of networks and alliances between institutions instead of the 'how' and 'where' of creation of knowledge (extra-mural over intra-mural).

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2. There are many other terms and distinctions used, and some of them are rather country specific: Fundamental versus Applied research; Targeted and Non-Targeted (Blue Sky) research; Frontier-research, Applied Strategic and Applied Specific research (UK); Translational research (in French: *recherche appliquée*, which should not be translated as applied research). We will not add to the confusion by also using these terms in this report.
Readers that are looking for definitions are referred to the 1993 Frascati Manual published in 1994 (ISBN 926414142029 available from HMSO, UK), that offers definitions on R& D - Research and Experimental Development ("creative work undertaken on a systematic basis in order to increase the stock of knowledge of man, culture and society and the use of this stock of knowledge to devise new applications") and the three activities covered by R&D: basic research ("experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view"), applied research ("original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective") and Experimental development ("systematic work, drawing on existing knowledge gained from research and/or practical experience that is directed to producing new materials, products or devices, to installing new processes, systems or to improving substantially those already produced or installed").

Table 2.2 Mode-1 and Mode-2 Science

Mode 1	Mode 2
Academic	Oriented towards application
Discipline-oriented	Transdisciplinary
Homogeneous	Heterogeneous
Linear and stable	Non-linear and volatile
Academic quality control	Quality management on a broader set of criteria
Accountable to peers	Accountable to society
Academic	Oriented towards application
Discipline-oriented	Transdisciplinary
Homogeneous	Heterogeneous

Source: Gibbons, 1994

In this line of thinking, innovation has become a process op co-innovation or open innovation. And sometimes it is not even an end in itself but a serendipity effect of collaboration: "By and large the systemic perspective on innovation as a socio-economic and technological process has advanced - to some degrees also [via the innovation management literature] in firms- that any 'innovation success' (..) should rather be viewed as a by-products along innovation journeys than as end results. Such journeys are characterised by numerous setbacks along the road. Innovation management is not a control problem, it should be seen as one of orchestrating a highly complex, uncertain and probabilistic process of collective action in a systemic context (Smits *et al.*, 2010, p. 10).

The Mode-2 knowledge production challenges the traditional distinction between basic and applied research. Basic research seeking new understanding about the world is in agriculture (until the arrival of biotech ?) anyway less important than generating useful knowledge that can be applied in developing a new technology or way of working. The basic research is more in (systems) biology, material science and currently ICT. Mode-2 research also involves more multi-, inter- and transdisciplinairy working. The processes involved in the production of knowledge (science), the application of knowledge (technology) and the successful exploitation of knowledge (innovation) are undergoing fundamental change (Martin in Smits *et al.*, 2010, p 25).

Monitoring and evaluation tools are not very well developed for such a post-modern framework. From a public administration/public management perspective Termeer (2006), applying theories by Weick (2000) and a hypothesis formulated by Beer and Nohria (2000) suggests that the programs or instruments that managers apply do not matter that much, as long as they contribute to the basic conditions of creating meaning or relevance that is essential for learning, adapting and changing in a turbulent world. These basic conditions are:

- motivate people to keep moving and experimenting to make unknown possibilities known (vitalising);
- create a general direction to evaluate experiments;
- promote a process of adapting to local situations (updates) by precise attention to developments, context and meaningful details;
- facilitate open interactions in which trust, reliability and self-respect can grow in such a way that people can appraise the situation and developments.

Some of these conditions mirror the functions of a successful Knowledge and Innovation System, as stated in the previous paragraph.

The role of firms

The systems approach to innovation implies that the behaviour of firms cannot be understood purely in terms of independent decision-making at the level of the firm. Rather, innovation involves complex interactions between a firm and its environment, on two different levels: the interaction with other firms, and the broader factors shaping the behaviour of firms such as the social and cultural context, the institutional and organisational framework etc. This has important consequences for innovation policy (text taken from Smith in Smits *et al.,* 2010, p 89).

In economics, the firm is the place where production decisions are made, initiatives taken and inventiveness turned into real products sold for profit. Karl Marx was one of the first to point out that capitalists were a driving force behind "the development of the forces of production". Joseph Schumpeter's doctoral dissertation (1911) in the Austrian School of economics is often quoted as the first major work on innovation. In his view economics is not only about equilibria, it is above all about entrepreneurs who make 'new combinations' and by doing so create disequilibrium ('creative destruction). In the corporate laboratories of the 20th century this entrepreneurial activity was standardized in the 'routinization of innovation' (Schumpeter in 1942). (Text taken from Dankbaar & Vissers in Smits *et al*., 2010, p. 51-53).

In his work on business cycles Schumpeter also connected break through innovations with the long wave Kondratieff waves. With mass-production of the fourth industrial wave becoming more mature and ICT as the fifth industrial wave (Perez, 2002; see Chapter 6 for more details), businesses in the 1980s started to decentralise their R&D funding. Scale effects gave way to flexibility, which implied a shift from strategic research to consumer-oriented innovation. At the same time (as a compensation?) government funding of R&D increased. As a consequence new issues arose in the management of innovation: absorption capacity, intermediary institutions and commercialisation of university research, e.g. via start-ups and the existence of angel and venture capital for this. Innovation management became increasingly concerned with the organisation of processes across the boundary of organisations, with networking as a buzz-word. Clusters (Porter in 1990) and open innovation also fit into this picture (cf. Dankbaar and Vissers in Smits *et al.*, 2010, p. 60-62).

Technological change and innovation bring new ways of organising. This is true within a firm, but also for society as a whole. The concept of 'social innovation' was coined in the 1980s to indicate that new 'long wave' technologies involve major institutional changes (Freeman in 1987). Institutional economists and others noted that social institution are slow in changing, also because many different stakeholders have vested interests in fixed routines. (Dankbaar and Vissers in Smits *et al.*, 2010, p. 69, see Chapter 5 for more details).

2.4 Current EU innovation policy and the link with theory

The scientific views as summarized above have found their way in to thinking on innovation policy and are more and more used in practical innovation policy. The OECD has been active as a think tank in this respect and became one of the promoters of these lines of thinking. The recent OECD Innovation Strategy (OECD, 2010a) highlights both the economic and social roles of innovation, stating that the "objective of policy should not be innovation as such, but the application of innovation to make life better for individuals and society at large".

Policy coherence is often high on the agenda of the OECD's recommendations, and the systemic approach to innovation and innovation policy is an area for policy coherence *par excellence*: a

good policy mix can lead to important synergies or is even needed to have a system innovation adopted. For instance to introduce organic agriculture research or extension is not enough. Regulation is needed to provide a standard for what defines organic. Probably regulation on land markets (to recognise organic soils) has to be changed and procedures to handle external effects between conventional and organic production have to be established. Payments in the Common Agricultural Policy can be differentiated to stimulate the innovation. Innovative procurement by public authorities can help. And perhaps deregulation is needed to make it possible to sell cucumbers that are safe but do not look that nice. Consumer information can help, etc. This example shows that in a society where government is 50% of the economy and institutions are essential for the functioning of the market economy, innovation policy has many aspects. It also shows that managing such a policy itself is knowledge and labour intensive.

The OECD (2005) lists 14 policy principles for fostering innovation. These fall within five broad categories:

- Empowering people to innovate
- Unleashing innovation in firms
- Creating and applying knowledge
- Applying innovation to address global and social challenges
- Improving the governance of policies for innovation.

A rather broad view on innovation is also the basis for monitoring innovation in the European Innovation Scoreboard: it now measures seven dimensions of innovation (with several indicators) that are grouped in three blocks: Enablers, Firm Activities and Outputs.

Current policy agenda[3]

The current economic climate has led to new initiatives to promote innovation. As we explore in Chapter 6 of this report, these initiatives are very much needed, given the current phase of the long term business cycle. The European Commission has come forward with the Europe 2020 strategy, which is its growth strategy for the coming decade. It wants the EU to become *a smart, sustainable and inclusive economy*. These three mutually reinforcing priorities should help the EU and the member states deliver high levels of employment, productivity and social cohesion. Concretely, the EU has set five ambitious objectives - on employment, innovation, education, social inclusion and climate/energy - to be reached by 2020. Each member state has adopted its own national targets in each of these areas. Concrete actions at EU and national levels underpin the strategy. This is roughly in line with the call of the OECD for a strategy to realise "green growth".

The Innovation Union is one of the seven flagship initiatives of the Europe 2020 strategy for a smart, sustainable and inclusive economy. It contains over thirty actions points, with the aim to do three things:

- turn Europe into a world-class science performer;
- remove obstacles to innovation – such as expensive patenting, market fragmentation, slow standard-setting and skills shortages – which currently prevent ideas getting quickly to market; and

3. Some of the texts below have been taken from the European Commission's websites

- revolutionise the way the public and private sectors work together, notably through Innovation Partnerships between the European institutions, national and regional authorities and business.

These points illustrates that also in the European Commission's strategy innovation is a much broader concept than science, research & development and extension. Within the Innovation Union, Horizon 2020 is the financial instrument implementing the Innovation Union. Running from 2014 to 2020 with a propsed €80 billion budget, the EU's new programme for research and innovation is part of the drive to create new growth and jobs in Europe.

Innovation support will also be strengthened in the EU's Common Agricultural Policy if the European Commission's proposals will be adopted. In October 2011, the European Commission (EC) published its legal proposal for the Common Agricultural Policy (CAP) after 2013. The proposal acknowledges the importance of research, knowledge transfer and innovation in addressing the challenges faced by European farmers and it recognises the central role of Agricultural Knowledge and Innovation Systems (AKIS).

Among the different measures, the EC proposes to reinforce the role of the Farm Advisory Service (FAS) and to create a 'European Innovation Partnership (EIP) for agricultural productivity and sustainability'. The EIP is a new instrument created to 'facilitate the information flow between research and practice': 'The EIP should aim to promote a faster and wider transposition of innovative solutions into practice. The EIP should create added value by enhancing the uptake and effectiveness of innovation-related instruments and enhancing synergies between them. The EIP should fill gaps by better linking research and practical farming' (page 22, recital 51 of the COM(2011) 627 on rural development) and give the end-users as co-innovators a say in the research.

The impact assessment carried out by the European Commission on its proposal reflects the opinions on AKIS mentioned in Chapter 1: 'Currently new approaches take too long to reach the ground and the practical needs on the ground are not sufficiently communicated to the scientific community. This EIP will ensure a faster exchange of knowledge from research to 'practical' farming and provide feedback on practical needs to science via operational groups' (page 18, Annex 7 of the Impact Assessment2). The new tools proposed by the EC are aimed at overcoming the bottlenecks to getting research results adopted on the ground: according to the EC analysis, a major weakness is the insufficient information flow and missing links between different actors of the AKIS (farmers, advisers, enterprises, researchers etc.). Other challenges faced by the AKIS are reviewed in Annex 7 'Research and Innovation' of the European Commission Impact Assessment published on 12 October 2011. They are:

- To support pluralistic scientific approaches to meet the numerous challenges faced by the agricultural sector (to supply safe and affordable food, in sufficient quantity, in the context of a growing world population; to provide healthy food that answers consumer demand and addresses public health concerns, and to reduce its impact on the environment in a context of resource scarcity). The required innovation cannot only be technological. Social and organisational innovations are also needed.
- To boost advisory services and other stakeholders that act as an interface between research providers and users in order to counterbalance the low level of attention to these actors in recent decades and the current trend for fragmentation of the organisations of extension.

- To facilitate the inclusion of small farms in the AKIS as they are not sufficiently involved in the current research and innovation systems.
- To stimulate collaborative and learning networks that are recognised as effectively contributing to innovation as platforms for exchanging information and for learning processes.

These proposals clearly reflect the systemic approach to innovation: the systems of innovation thinking in which the concept of Agricultural Knowledge and Innovation Systems is grounded. The next Chapter explores the concept of AKIS in more detail.

3 THE CONCEPT OF AGRICULTURAL KNOWLEDGE AND INNOVATION SYSTEMS

Text by Anne-Charlotte Dockès, Talis Tisenkopfs and Bettina B. Bock

3.1 Summary[4]

The AKIS concept has been developed out of the old AKS (Agricultural Knowledge Systems) concept, that originated in 1960s in scholarly work on agricultural advise and extension. That system was driven by an interventionist agricultural policy that sought to coordinate knowledge and innovation transfer in order to accelerate agricultural modernization. In many countries this was reflected in a strong integration of public research, education and extension bodies, often under the control of the Ministry of Agriculture.

In the 1970s an I was added to the AKS: "agricultural knowledge and information systems" (AKIS). This addition was linked to the increased attention to information, probably also in connection with the large scale introduction of computers. The term AKIS popped up in policy discourses at OECD and FAO. Later and rather silently the I was redefined in Innovation: Agricultural Knowledge and Innovation systems.

There were four drivers that contributed to the move (in thinking) from AKS to AKIS:

- Research, extension and education have undergone a deep restructuring, transformed by the trend towards liberalization (privatization of service delivery, the multiplication of extension organizations, farmers contributing towards the cost of these services, competitive bidding for research and extension contracts and tighter evaluation procedures).
- Policy agenda: increasing concern over the environmental impact of industrial agriculture, the quality of life of rural populations, rural employment and the need to support the positive externalities linked to agricultural production.
- The linear model of innovation has progressively been replaced by a participatory or 'side by side' network approach, in which innovation is 'co-produced' through interactions between all stakeholders in the food chain (and especially for 2nd order change, so called "system innovation" like the introduction of multifunctional agriculture or organic farming)
- The growing disconnection between farmers' knowledge and research and extension systems.

The formal definition of an AKIS is "a set of agricultural organizations and/or persons, and the links and interactions between them, engaged in the generation, transformation, transmission, storage, retrieval, integration, diffusion and utilization of knowledge and information, with the purpose of working synergistically to support decision making, problem solving and innovation in agriculture" (Röling and Engel, 1991).

4. This Chapter is a shortened version of the reflection paper written by the authors for the CWG [Dockès et al., 2011]

An AKIS should be able to propose and develop practical ideas to support innovation, knowledge transfer and information exchange. Innovation policy needs to reflect the manner in which innovation actually occurs today: often through diffuse networks of actors who are not necessarily focused on traditional research and development.

3.2 Definitions of AKS and AKIS

Definitions of the agricultural knowledge system (AKS) have changed over time, with changing ideas about agriculture. There is a history of changing visions of, and policies towards, AKS. Leeuwis and Van den Ban (2004) claim that the AKS concept originated in 1960s, driven by an interventionist agricultural policy that sought to coordinate knowledge and innovation transfer in order to accelerate agricultural modernization. In many countries this concept was implemented through a strong integration, generally at national level, of public research, education and extension bodies, in many cases under the control of the Ministry of Agriculture.

Since the 1970s, official organizations such as the OECD and the FAO have introduced the concept of "agricultural knowledge and *information* systems" (AKIS) in policy discourses. This acronym has since evolved to describe agricultural knowledge and *innovation* systems" a concept that seeks to encompass and influence the complexity of knowledge and innovation processes in the rural sphere.

In this report we use AKIS as an operational term – not as a fixed and unchangeable definition or modus operandi. The AKIS concept contains elements that are both constructivist and proactive. It is intended to help explain how information and knowledge flow (and how innovation takes place) and how these processes can be strengthened. AKIS has the potential to be an important tool for change management and helping agricultural systems become more compatible with broader societal goals.

We end this section with a glossary of terms that characterizes the evolution of thinking about AKS/AKIS: a process that has seen the gradual contestation of linear approaches to knowledge transfer and towards a more complex and network-like vision of knowledge, learning and innovation. These new concepts try to address the more complex reality of innovation, as well as the emergence of a new paradigm based on sustainable development rather than on productivism.

AKS (Agricultural Knowledge System): a collection of actors, such as researchers, advisors and educators, working primarily in agricultural knowledge institutes. The emphasis is on these actors and the role of formal knowledge production in national agricultural research systems (NARS). This knowledge is then transferred to the agricultural sector through agricultural extension services and education (Rudman, 2010).

AKIS (Agricultural Knowledge and Information System): The original formulation described "a set of agricultural organizations and/or persons, and the links and interactions between them, engaged in the generation, transformation, transmission, storage, retrieval, integration, diffusion and utilization of knowledge and information, with the purpose of working synergistically to support decision making, problem solving and innovation in agriculture" (Röling and Engel, 1991). This concept develops the notion of AKS, emphasizing the process of knowledge generation and includes actors outside the research, education and advice sectors. More recently the AKIS concept has evolved as it has acquired a second meaning (innovation) and opening up AKIS to more public tasks and to the support of innovation (Klerkx and Leeuwis, 2009). Important

characteristics of an innovation system are the institutional infrastructure, funding mechanisms, network characteristics and market structure (Klein Woolthuis et al. 2005).

AIS (Agricultural Innovation Systems): these are defined as 'a network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect the way different agents interact, share, access, exchange and use knowledge' (Leeuwis and Ban, 2004).

LINSA (Learning and Innovation Networks for Sustainable Agriculture): this concept is linked to the network approach of AKIS. It describes thematically-focused learning networks that are made up of different actors, within and outside the formal, institutionalized, AKS. Members can include farmers, extension workers, researchers, government representatives and other stakeholders (Rudman, 2010). LINSAS are similar to 'coalitions' (Biggs and Smith, 1998)), innovation configurations (Engel, 1995) and Public Private Partnerships (Hall, 2006). The emphasis is on the process of generating learning and innovation through interactions between the involved actors. The difference between AKS and LINSAs is connected to how knowledge is conceptualized: AKS sees knowledge as a "stock to be transferred", whereas LINSA emphasizes the processes needed to make knowledge useful and applicable to other actors. In other words LINSA are one of the ways to strengthen the I of Innovation in the AKS. The LINSA concept helps to illuminate and extend some forms of AKIS, which may be otherwise hidden or marginalized.

Learning: knowledge is an interactive (social) process that takes place within cognitive frames (paradigms, cognitive rules and regimes) in response to problems, opportunities and challenges. Individual and/or collective learning occurs in various ways: learning by doing, social learning, transdisciplinary learning, transformative learning, etc. and is a necessary precondition for change.

Innovation: An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. Innovation activities are all scientific, technological, organisational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations. These activities themselves need not to be novel, but are necessary for the implementation of innovations. An innovative firm (farm) is one that has implemented an innovation during the period under review. Four types of innovation are distinguished: product innovations, process innovations, marketing innovations and organisational innovations (definition taken from the OECD/EC Oslo Manual – Guidelines for collecting and interpreting innovation data, 3rd ed., Paris, 2005).

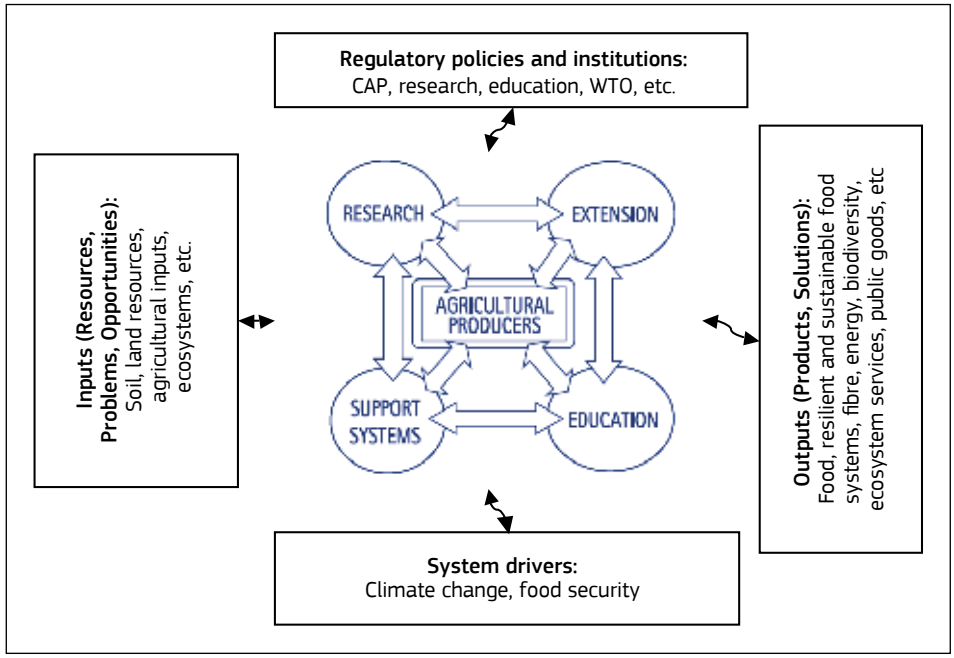
3.3 AKIS as picture

Rivera and Zijp (2002) have recently sought to broaden the AKIS concept to include rural development (RD), renaming this as AKIS/RD. Their model looks at four main actors with an interest in agricultural/RD innovation:

- Research
- Extension services
- Education and training
- Support systems (all the organizations providing credit, inputs and producers' associations, etc.).

In this model the four sets of actors act upon the knowledge of farmers and rural actors and generate innovations in response to problems and opportunities, desired outcomes, system drivers and regulative policies and institutions (Figure 3.1). However as (the left-hand side of) Figure 3.1 shows, problems are not simply given by the context. Rather, they are framed in different ways by specific paradigms. The same is true of material inputs and knowledge, which are also shaped by paradigms. Such differences are important in framing research priorities, societal choices and public accountability.

Figure 3.1 A model of an Agricultural Knowledge and Innovation System undergoing transformation



Source: Adapted by Dockès et al. from Rivera and al. 2005

3.4 The drivers for the transition from AKS to AKIS

When it emerged in the 1960s, AKS was a government driven initiative to teach farmers new skills, such as how to handle tractors. The original orientation was to diffuse knowledge to farmers and thereby unlock the knowledge embedded in products (tractors, chemicals, etc.) so as to increase productivity in food sector. AKS was not intended to promote breakthrough innovations or rural development. Over time some came to view AKS as too rigid or expensive. The policy reforms of 1990s and the privatization of advisory services in many countries saw a move away from government driven AKS and towards multi-actor systems, in which private actors (such as input industries and private advising firms) came to play a larger role. The AKS in EU member states are now very diverse: some have mainly private systems in extension, while others have multi-actor systems with governments or professional organizations as the driving force. The new emphasis on AKIS is introducing technical and social innovations into the model and is influenced by paradigm shifts (that parallel those that are occurring in research and innovation policies) towards network driven multi-actor innovations and even a step further – towards Life Long Learning.

A number of factors have led to the erosion of the traditional concept of AKS that were based on a strong integration, at national level, of public research, education and extension bodies, under the control of the Ministry of Agriculture. They include both theoretical and empirical factors.

1. Research, extension and education have undergone a deep restructuring. They have been radically transformed by the trend towards liberalization, which has led to privatization of service delivery or to public/private partnerships, the multiplication of extension organizations, farmers contributing towards the cost of these services, competitive bidding for research and extension contracts and tighter evaluation procedures.
2. The policy agenda has been modified by an increasing concern over the environmental impact of industrial agriculture, the quality of life of rural populations, rural employment and the need to support the positive externalities linked to agricultural production. This has led to new emphasis being placed on balancing and integrating agricultural policies with rural development.
3. The linear model of innovation has progressively been replaced by a participatory or 'side by side' network approach, in which innovation is 'co-produced' through interactions between firms, researchers, intermediate actors (input providers, experts, distributors, etc.) and consumers.
4. The growing disconnection between farmers' knowledge and research and extension systems.

3.5 The main actors involved

In most countries, many actors are involved in AKIS and this can lead to fragmentation and coordination issues. Yet, on the other hand it also provides an opportunity for innovation. In the In-Sight project, actors were actors into four groups (figure 3.3), that are discussed below.

Information and knowledge system

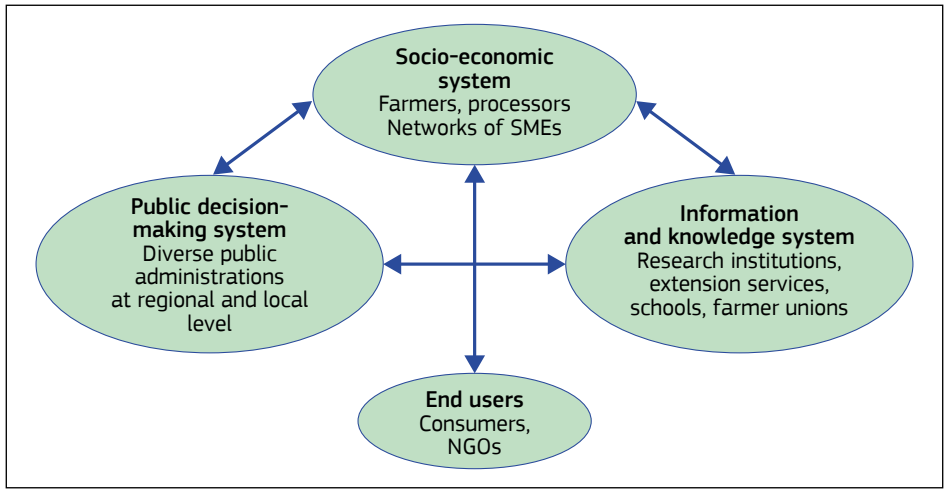
In almost all countries the information and knowledge system is composed of research, extension and educational organizations, structured and governed by the government through a sectoral agricultural policy. In all cases the historical goal was to increase the productivity of the agricultural sector, by making farmers more professional.

The structure of this system, its organization and governance (e.g. under a public or private structure) differs greatly between countries, as does the level of centralization or decentralization. Diversity can also be found within different regions and federal states in the same country (e.g. Germany). In general the systems are highly fragmented and subject to a dynamic process of emerging new structures and actors. For instance, for the extension to farmers several different models can be identified according to the level of fragmentation and sources of funding – whether central or regional administration or other sources and funding (Laurent et al., 2006).

- Mainly privatized systems (e.g. the Netherlands and some states in Germany) where the funding mainly comes from direct payments from farmers and where the AKS/AKIS is managed by private bodies. (In the Netherlands the extension system is privatized but research and education is not. A 'knowledge voucher' system has been introduced for farmers and SMEs which provides a subsidy to 'buy' knowledge).

- Co-management between farmer organizations and the state (e.g. France, Finland and some states in Germany), with public funding, partial payments by farmers and farmer organizations.
- Semi-state management (e.g. Teagasc in Ireland which has a board with representatives from the state, industry and farmer organizations);
- Management by the state through regional organizations (e.g. Switzerland, Italy and Finland).
- Uncoordinated individual innovation nucleuses.

Figure 3.3 The main categories of actors within AKIS



Source: Reflection Paper (Dockès et al., 2010)

The educational system often has strong links with the agricultural information system. Openness to innovation within the educational system is therefore a key factor in enabling actors to understand and transform knowledge and thereby to build projects.

Generally, the public systems face similar problems, including a lack of capacity, a conflict between the various roles (e.g. the same organization acting as an inspector and as an advisor), management and motivation issues, methods and staff qualifications. The private systems face a different set of problems, including unstable employment opportunities for advisers and people having unequal financial means to take advantage of extension services, which generally favours large holdings or more profitable farms. Private extension systems and training courses rarely focus on public goods, but are more focused on realizing the private objectives of companies. For example, in Ireland extension, research and education services are provided by the semi-state organization Teagasc, and inspections are conducted by a separate state department.

The OECD Innovation Strategy (OECD, 2010a) emphasizes that science continues to be an essential ingredient of innovation, even though innovation now encompasses much more than R&D. The SCAR workshop in Angers (SCAR, 2008) identified several negative aspects in the way that science influences AKIS. For example research agendas, priorities and evaluation criteria are set within the academic domain, which places great emphasis on peer reviewed publications. But the (diverse) users of knowledge and innovators need more adapted knowledge that is better translated to their understanding and needs. Therefore the concept of a broadened

AKIS requires various forms of knowledge brokerage (e.g. the dissemination of applied research results in 'grey literature', farmers' magazines, specialized websites, posters, seminars etc.). One way in which this can be achieved is to put more emphasis on networking, transdisciplinary research and cooperation between the worlds of academia (universities and research institutes) and practice (farmers, field extensionists, knowledge brokers etc.). Innovation rarely occurs in a vacuum; it is generally a highly interactive and multidisciplinary process and this implies the need for researchers to collaborate much more closely with farmers and end users.

In several countries there are challenges in transferring results from research into practice - and vice versa –channelling practitioners' demand for knowledge into research and advisory agendas. Different approaches are used to try to ensure coordination within the system, as shown in the examples below:

- In France, funding is given for special projects involving consortia of research, extension and education organizations. These projects foster exchange between the different organizations and can increase responsiveness and communication, but they are also more time consuming and costly because of the higher transaction costs. "*Pôles de compétitivité*" are being built at local level, with the idea of creating networks between firms, research centres and universities, around identified innovative projects.
- In Switzerland, platforms are in place involving actors from research, extension and education as well as committees of different farming and other organizations. This strengthens interactions between different stakeholders.
- In Baden-Württemberg (Germany), agricultural universities cooperate with governmental research units and extension services and farmers' associations. Education and extension services are supported by modern techniques and methods of knowledge sharing and by exchange platforms. Cooperation in research and innovation is adjusted to the decentralized infrastructure and increasingly done in cooperation with international partners. There is a recognition that institutional research priorities (at the European, national and the federal-state level) are not giving enough support to less formal knowledge generation and that they need to be fine-tuned to foster knowledge transfer and extension.
- In the Netherlands, the privatization of extension service has created competition. As extension organizations are competitors they are sometimes reluctant to share their knowledge. To bridge this gap and the gap between the demand and supply sides of the knowledge market, there are intermediary brokerage structures, often publicly funded. Extra incentives (funds) are needed to promote interactions between different AKIS actors (involved in education and research, extension and practitioners) to stimulate the innovation chain in different directions (not only research-driven innovation but also innovation-driven research, integrating innovations into production and the use of knowledge).
- In Latvia, the AKS/AKIS is fragmented with many actors (public-private, local-national, agricultural-rural, research-extension) involved. Recently the Latvian Rural Advisory and Training Centre and Latvia's University of Agriculture, two of the central actors, have been seeking closer cooperation and farmers' organizations, cooperatives, professional associations and commercials becoming increasingly involved in knowledge exchange, training and advice. New models of cooperation are emerging to bridge the gap between the demand for and the supply of knowledge.
- In Ireland, Teagasc, the government funded organization, provides an integrated research, advisory and extension service for farmers and stakeholders in the agri-food

and rural development sectors. Agricultural extension (and education) services are jointly financed by farmers and state subsidies, while research activities are funded by the state and funds won from competitive external research funding schemes. Interactions with stakeholders are organized through formal groups of commodity stakeholders (e.g. dairy, beef, sheep, crops, environment, rural economy and development etc.). Strategic partnerships for innovative extension activities between farmers, the private sector, and the media are fostered by targeted programs such as the BETTER (Business, Environment, Technology, Training, Extension and Research) farm programme. There is also informal contact between Teagasc staff and stakeholders, which is made possible by the relatively small size of the country and Teagasc's network of applied research centres, advisory offices and agricultural colleges. Knowledge management services are also provided by consultants operating in the private sector. Tertiary level education and research is also conducted by University College Research partnerships with Irish and European universities and fostered by a post-graduate funding scheme designed and administered by Teagasc (e.g. Teagasc's Walsh Fellowship Scheme). However, the links and coordination between the main players of the system are not always transparent.

Socio-economic actors

Farmers can be categorized and differentiated according to several criteria: professional/part-time, old/young, men/women, conventional/organic, specialized/diversified as well as according to their main motivations (entrepreneurship, ethics, innovation etc.). Farmers in these different categories have different attitudes towards innovation. In general, there is a bias among extension services towards professional, specialized, conventional and male farmers. As a result, not all farmers have equal access to support services from AKS/AKIS.

Generally, smaller farms, those engaged in extensive farming and those below certain output thresholds find it difficult to qualify for government support and extension programmes, which are largely designed for more intensive modes of production. These groups of farmers also find it too expensive to use the services of private extension providers, so they are effectively excluded from every kind of extension service. In the same way, in some countries (e.g. Germany) areas with more marginal production conditions, multifunctional farms and farm households engaged in farm-based processing and direct marketing or with non-farm sources of income can find themselves outside the official extension system because they are engaged in innovative activities in areas that do not enjoy sufficient interest and support from the state. Farmers' innovations are often ignored by the general systems, on the grounds that they are merely incremental, non-technological or not appropriate for the advisory system (Van der Ploeg, 2008). Thus there is a real challenge to develop tailored "advice products" that are appropriate for the needs of different types of farmers.

Rural entrepreneurs and SMEs are involved mainly in rural tourism, resource based activities (wood, water, etc.), food processing and social services. In most cases they have few links with the official AKIS, even though social services and care agriculture are growing in importance (Di Iacovo and O'Connor, 2009).

Relationships between producers, processors and retailers are increasingly being formalized into codes of practice that are linked to quality schemes. Actors in this group are among the major drivers of innovation, because they have to adapt their internal organization and technologies to comply with rules and standards. Input providers (usually manufacturing enterprises in

feed, fertilizers and machinery) are increasingly turning their commercial networks into knowledge systems. There is a strong tendency to strengthen customers' loyalty by giving advice to farmers. This is particularly relevant in countries where extension services and cooperation are relatively weak, such as Italy and Latvia, and in animal production and agro-food processing, or where governments see no role to correct this market process (e.g. the Netherlands).

Cooperatives and producers' organizations are often a major conduit for the flow of knowledge and information. Producers' associations and cooperatives often provide inputs as well as input-related technical advice. To this end they carry out product related research and training and provide advice related to products. For the larger cooperatives, which tend to concentrate on, and compete in, global markets, innovation is increasingly promoted through top-down approaches. In France and Switzerland inter-professional bodies play an important role. These consist of producers, processors, other professionals and consumer representatives working together. In Ireland, institutional innovations such as farm partnerships, share farming, and federated cooperatives have been developed through cross-sectoral public/private partnerships. These cooperative institutions aim to facilitate collaboration between private farmers/producer groups and industry partners through pooling knowledge, resources and innovative capacity. In the same way processing and retailing companies are among the most important drivers for innovation. In particular, retailers tend to control producers through labelling schemes. Retailers see themselves as the interpreters of consumers' needs and motivations. They pursue a top-down approach to innovation, reducing the possibilities for farmers to follow independent innovation paths.

The media and journalists (professional journals and, increasingly, web-sites) are important fora for the exchange of information and ideas in the farming community. The mass media shapes food discourses in society at large and mobilizes consumers' attitudes in terms of food safety, values, alternative food networks and new production and consumption patterns. The media is also a potentially effective tool for disseminating information on non-proprietary innovations for the agri-food sector developed by R&D activities. In Ireland, Teagasc collaborates with the media to track and profile case-studies of on-farm technology adoption (through the BETTER Farm Programme).

Also commercial service providers (veterinarians, plant and soil laboratories, brokers in the land market, providers of farm management software) and especially (fiscal) accountants and banks can be important sources for know-how on certain aspects of the farm business and related innovation.

End users

Consumers are increasingly recognized as active players in innovation, especially with regard to green technologies and sustainable lifestyles. NGOs also play a growing role in innovation. They often provide ideas, motivation and help develop the capacity to innovate. They are particularly well suited to acting as knowledge brokers, as is happening in Latvia (in the organic and in the rural tourism sectors) and in Italy (mainly in the local food sector, but recently also in the energy sector). They can also help to develop the market.

Besides all these types of actors it is worth stressing that, at the micro-level of innovation, leading personalities, with very specific knowledge skills and networks that can support or champion an idea or a project, play a crucial role in the success of projects, especially in the emergence stage. Their personal skills and networks and their capacity to unite and motivate other

actors is often essential in getting the ball rolling. While their role can diminish over time, when other skills and knowledge may be needed to further develop an initiative, these individuals often continue to play an important role in the group process. These leading personalities are often socio-economic actors (farmers) or consumers (possibly involved in NGOs). Leading personalities, vibrant networks and novel project groups often stimulate innovation focused research.

At the meso-level municipalities, cities and regions are becoming increasingly important players on food scene and in stimulating innovation. In the last decade alternative food networks have steadily gained ground, often with support from public authorities (Watts et al., 2005). Quality food production systems are being re-embedded in local ecologies (Murdoch et al., 2000) and many municipalities are orientating the public procurement of food for schools and hospitals towards organic and regional produce and using their purchasing power to support urban gardening and community supported agriculture (Morgan and Sonnino, 2008). Thus municipalities' food strategies and endeavours to promote sustainable production and consumption patterns can create positive connections between food, health, the economy, the environment and culture and become important drivers for innovation.

3.6 The main critics on the sub-systems

AKIS must now relate to a broader world than just agriculture, as it has been narrowly conceptualized in the past. New actors are entering the AKIS domain with new interests, new values and new expectations. As such AKIS has to transcend the traditional borders that have defined AKS. In an ideal world AKIS would function as interconnected system or network. However, in reality, existing AKIS is often fragmented. This section explores some of the causes and consequences of this fragmentation.

Research is often not sufficiently related to farm praxis. This is partly related to the lack of connection between the different disciplines in agricultural research. 'Translational research', valorisation of research results, the responsiveness of research to its own content and access to results are all issues that need to be addressed to improve the functioning of the research subsystem. But there are positive examples of these problems being overcome. The Dutch Dairy Academy, in which farmers and researchers collaborate as a network and jointly develop new research and new knowledge, is one notable example. Similarly, in Ireland Participatory Action Research (PAR) involves inputs from social scientists, extensionists and farmers to jointly devise effective knowledge transfer processes that are accessible and acceptable to farmers. PAR has also led to the adjustment of existing technologies, so as to enhance their usefulness and acceptability to farmers, and to the development (co-creation) of new technologies. It is important to verify the extent to which research and innovation result in actual change and what happens to the knowledge produced. One important indicator of AKS/AKIS is the societal benefit of the knowledge that it generates.

Education and Learning in an AKIS (and especially the research and education sub-systems) should be effective, rapidly and responsively taking up new issues and ideas and integrating them in education plans, course outlines and research projects. Collaborative social learning is an important aspect of this but is currently not well embedded in the institutional settings of AKIS. Farmers and other vocational actors are important drivers of innovation. Farmers have always been inventors, but they are not keen on others earning money from their inventions. Rural women are often mentioned as drivers of innovation, because they are often outward looking and stabilize the farm by generating diversified sources of income. Food is a unifying concept for

society and for AKIS – and a new set of concerns, beyond traditional agricultural discourses, is entering the arena. These include: food security, public health, new/alternative supply chains, the vulnerability of globalized markets and the search for territorial food resilience. Social connectors such as teachers, consultants, innovation brokers, organizers etc. are important in transferring new knowledge and helping to generate induced / embedded innovations.

Transfer of knowledge in AKIS has to overcome the gap between research and praxis, but often there is no sufficient funding available for the transfer of knowledge. Research generally ends with the publication of results with little further involvement of stakeholders or target groups. There is a need for more and stronger face-to-face contacts between researchers and farmers. Extension is important in relating new knowledge to praxis (and vice versa) and there is a need for both private and public interests to be involved in extension work. When it comes to innovation, the institutional elements of AKIS need to be drivers for innovation. But this does not always occur and we need to ask how this can be achieved in practice. Innovation is by definition risky, developing and applying new knowledge always implies risk and risk avoidance can be a barrier for innovation. A properly functioning AKIS can help to reduce risk.

Overall

As shown in the previous paragraphs, there are many disconnections between the various sub systems within AKIS. Actors in the subsystems are driven by different incentives and there are often no, or insufficient, incentives for them to connect with each other. To overcome this it is important to conceptualize AKIS as a network with non-hierarchical nodes; much thinking about AKIS and innovation is still linear or at best, circular/cyclic. At present there are major barriers between different parts of the system/network and hesitance and resistance among different actors to share their knowledge.

These disconnections impede learning and hamper effective research and innovation. AKS and also AKIS are often perceived as being unresponsive and overregulated. Competition between the AKIS actors (researchers and institutes) for funding impedes collaboration between researchers and innovators. AKIS is part of (and partly driven by) the wider system of education, science, research and innovation, which are driven by incentives that are not directly related to innovation outcomes. These include funding that is based on student numbers, academic excellence and publication in peer reviewed journals. These factors act a disincentive for undertaking applied research and interacting with other systems. The existing incentive structure makes it difficult to link research with praxis.

These shortcomings AKIS are also partly a result of societal transformation and new societal concerns and demands. New actors have entered the agricultural domain, importing new values, new approaches and opportunities. So far the AKIS system has not responded adequately to these changes and has been slow to take up new opportunities and adopt new ways of thinking. There are also problems with funding for innovation. Until recently LEADER was a useful source of funding for innovation, but its recent mainstreaming has reduced its previously important role in stimulating innovation. LEADER is now over-regulated and it is very complicated to get projects approved.

The reorganization or up-dating of AKIS requires governments to adopt a new role and make changes to the current governance and regulatory conditions surrounding AKIS. In so doing it is important to balance regulation with governance, be wary of the danger of over-regulating and of the importance of leaving enough space for innovation to happen.

3.7 AKIS as a system, network or hybrid?

In discussing contemporary AKIS –as done above- there is a risk of presenting the AKS and AKIS too much as polarized opposites. All systems have a certain extent of fragmentation. This is a reflection of societal conditions, including the state of the economy, the size (and homogeneity) of the territory, population density and education level, the size and embeddedness of the AKS/AKIS, cultural attitudes towards knowledge sharing and innovation and political and governmental influences on peoples´ behaviour and attitudes.

A knowledge system is an open construction. Each field of activity can be seen as a subsystem with its own identity, rules, actors, behaviour, institutional infrastructure, type of relationships etc. At the same time a knowledge system is rooted within a broader system that includes human relationships, conventions, communication infrastructure, rules, public concerns, etc.

Both system and network approaches can be useful in understanding and describing AKIS. System approaches focus more on institutional aspects and network ones look at the relationships between individual actors. While knowledge systems are institutionally embedded they are not static. The most important aspects of knowledge systems and of actors' behaviour within them are connectivity, heterogeneity and plurality. The transformation of AKS into AKIS should not neglect parts of the old AKS system (research, extension etc.), but encourage them to interact and be more open. The shift towards AKIS also implies a change from attempting to transmit a single message to farmers (e.g. "improve efficiency") towards multiple tasks and complex innovations. Methods such as Participatory Action Research allow and encourage such multiplicities and complexities in the innovation process. Learning and interaction between actors with knowledge comes to the fore in this shift from more system-centred towards more network oriented and hybrid knowledge systems. These networks are needed but they are not going to spontaneously appear. They need to be stimulated and facilitated while also nurturing and transforming the merits and capacity of the old AKS so that the different parts of system are better able to collaborate. Leeuwis (2004) stresses the importance of replacing the concept/term of "system" by that of "networks" since " the (first) term does not have in-built connotations of a common purpose and clear boundaries, and hence serves better to describe what happens in most situations".

3.8 AKIS, innovation and transition

An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method. The implementation of innovations at the farm is most easiest done by buying new, innovative farm inputs. At least in the old AKS many innovations were embedded in products: by buying a tractor and selling the draught horses, or by buying new types of pesticides, farmers innovated their business. One of the roles of the extension service was to help farmers to unlock the benefits of such new technologies on the farm.

Such embedded innovation is still occurring today. Tractors (now with precision farming technology), seeds, semen, chemicals, buildings and glasshouse all have innovations build in them. Especially farmers who have an operational excellence strategy (focussed on efficiency of scale) benefit from such a knowledge and innovation system, that has some linear characteristics with universities and multinationals developing new technologies.

But in addition there are new agricultural systems developed, especially with and by farmers who have a product-leadership strategy (focussed on market-driven product innovations) or a

customer intimacy strategy (focussed on customized solutions for specific clients). In such cases AKS has certainly giving way to AKIS. The role of science is sometimes more to understand what works and to make it more generic, or to solve bottlenecks. Innovation starts with mobilising existing knowledge and then could lead to innovation driven research. Based on a bottleneck or an idea new knowledge is developed and applied.

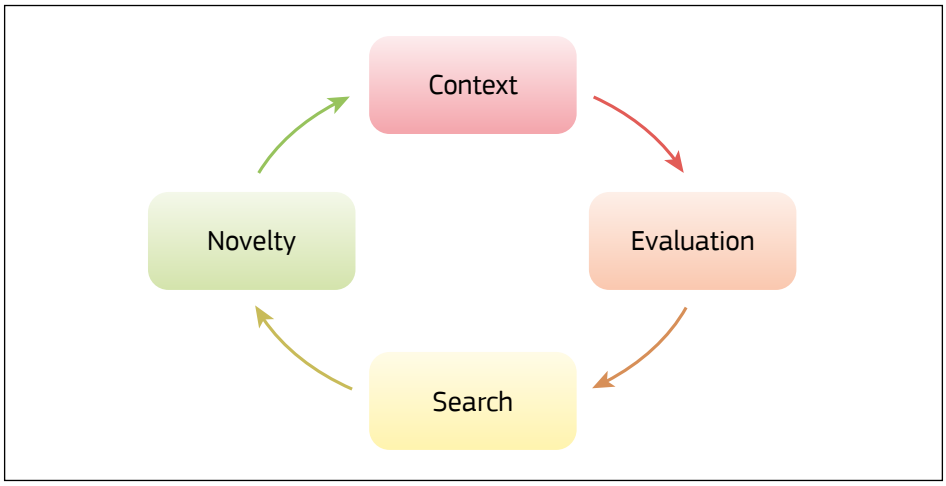
Innovation not only involves a technical or technological dimension. It also, and increasingly, involves strategy, marketing, organization, management and design. Farmers do not necessarily apply or develop 'new' technologies: their novelties emerge as the outcome of different ways of thinking and different ways of doing things and in recombining different pieces of knowledge in an innovative way. Innovation is both problem solving and opportunity taking as a response to internal and external drivers. Each innovation is characterized by a combination of technical, economic, organizational and social components. The development and application of technological or economic innovations often involves organizational innovations, breaking barriers, bringing actors and competences together and socially redefining the identities and roles of actors.

Approaches based on socio-technical networks enable a better understanding of innovation processes. Innovation occurs when the network of production changes its way of doing things. This implies that innovation is mainly related to the patterns of interactions between people, tools and natural resources. This, in turn, implies that learning is at the core of innovation processes, as any change that brings about improvements in social or economic organization also increases the available knowledge.

The dynamics of innovation

Figure 3.4 illustrates a cyclical learning process in which the subject perceives the context through the available information. Evaluation of this information leads to an assessment of a given situation. If the context is seen as the source of a problem or an opportunity, the subject may start a search process, which may eventually generate a novelty. This production of this novelty may have an impact both on the context and on the cognitive frameworks used by the subject to evaluate the context. This paves the way for a new cycle.

Figure 3.4 Innovation as a learning process



Source: Dockès et al. (2010), based on Insight project

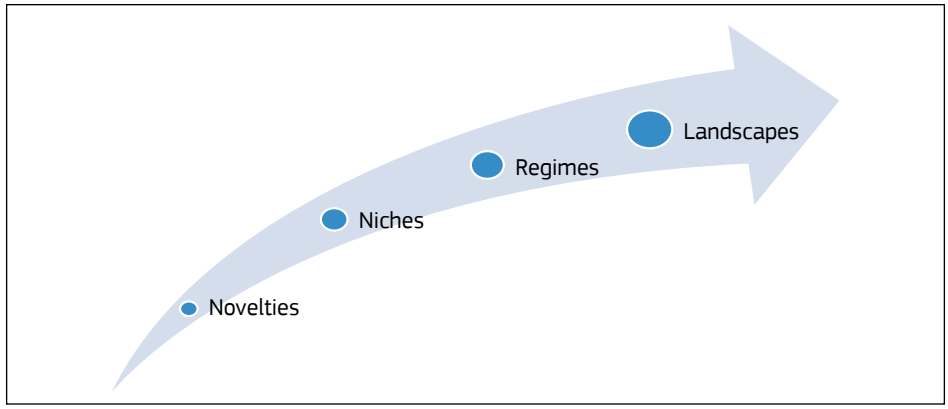
Geels and Schot (2007) elaborate the multi-level perspective, emphasizing the importance of societal struggles in influencing innovation choices. "When new technologies emerge,... social groups have different problem definitions and interpretations, leading them to explore different solutions. This variety of meanings is eventually reduced through 'closure', an inter-group process of negotiations and coalition building. In this socio-cognitive institutionalization process actors directly negotiate about rules (belief systems, interpretations, guiding principles, regulations, and roles). This dynamic is played out at conferences, in journals, at workshops, struggles for research grants, etc." (p.405). This implies the need to better understand social-institutional dynamics, through which "actors try to make sense, change perceptions as they go along, engage in power struggles, lobby for favourable regulations, and compete in markets" (ibid.).

Transitions

As innovation cycles are repeated, interactions between people, tools and natural resources become more and more structured. Four levels of structuration of the socio-technical network can be identified (Geels, 2004; see figure 3.5).

- Novelties are localized 'breaks with routines'. They are limited by external constraints, such as laws, actors and norms.
- Niches are the result of an aggregation of different smaller systems. They are the places where new paradigms emerge as a result of learning processes. They are governed by paradigms that differ from those of the dominant socio-technical systems. The norms, rules, routines of production, distribution and consumption are looser and subject to rapid evolution. Niches activate learning and societal embedding processes.
- Regimes represent the stage when paradigms are turned into practices and are incorporated into concrete socio-technical systems. Networks are structured and coordinated by rules. In the period of transition period leading towards a regime change, many contradictions can emerge, as well as strong resistance to the innovation.
- Landscapes can be changed as an effect of supranational policies or the scaling up of radical changes, but more often changes in socio-technical landscapes are important drivers for radical innovation. We may include into this category situations and events beyond the reach of national policies: global climate change, north-south divides, international trade or banking regulations, etc.

Figure 3.5 The dynamics of second order innovation or transition

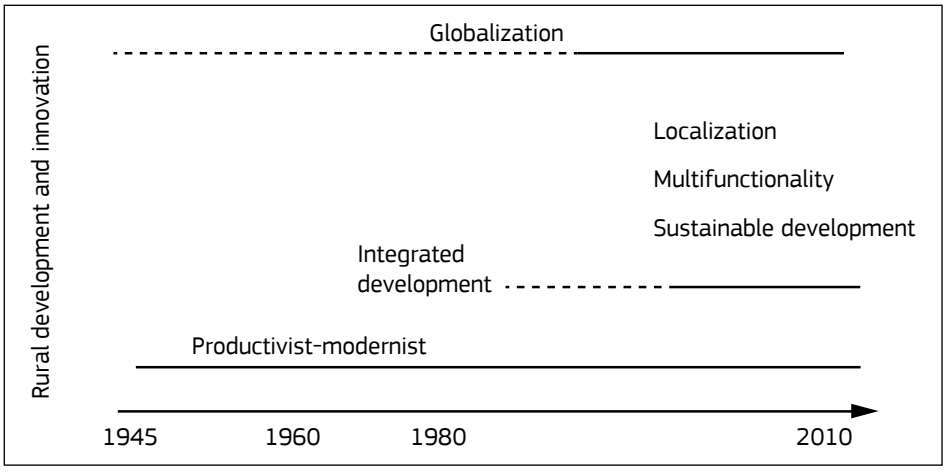


Source: Dockès et al., based on Geels, 2004; see also Poppe et al., 2009

Transitions are defined as as a gradual process of change which transforms the structural character of a societal domain (Rotmans et al., 2001). The line in the figure suggests a logical and inevitable transition from one stage to the next. However, not all novelties develop into niches; nor is every regime supportive to novelties or new niches. Transitions are difficult to manage and may require brokers and policy support. While regime shifts can be explained after the event they are very difficult to plan in advance. A change in landscape may facilitate a regime change. Socio-technical landscapes do not determine outcomes, but they do provide deep structural 'fields of force' that make some actions easier than others. Landscape changes only exert pressure if they are picked up and acted upon by regime actors. Social movements may voice protest and demand solutions. They can mobilize public opinion and lobby for tougher regulations. Outside professional scientists or engineers may have specialist knowledge that allows them to criticise technical details of regimes and propose alternative courses of action. Outsider firms, entrepreneurs or activists may develop alternative practices or technologies (Geels and Schot, 2007: 403, 406). Efforts to change the landscape and to develop regimes correspond to specific paradigms.

Different Rural Development paradigms influence different approaches to innovation. In recent decades there has been a partial shift from the modernization paradigm towards one that promotes integrated, sustainable and multifunctional development (see Figure 3.6). This new rural paradigm promotes optimal and balanced use of local resources and community engagement in development projects. This implies a broadening of the concept of innovation from something that is primarily economic and technological to include social innovation. It extends the scope of innovation to include new fields (the organization of food chains, environmental management, services etc.). The shift towards the new rural paradigm also implies a shift in emphasis away from the adoption of non-proprietary innovations originating from state and private sponsored R&D activities and towards proprietary innovations, which depend on individuals' own creativity. This 'endogenous approach', requires facilitation, capacity-building and the mobilization of local resources (Sumane, 2010).

Figure 3.6 Shifting rural development paradigms



Source: Dockès et al., copying from Sumane, 2010

This second order transition implies the need for a radical shift in policies for innovation. They need to move beyond a framework dominated by the conventional paradigms of economies of scale, specialization and concentration. The new models imply focusing on agro-ecology and

multi-functionality (as opposed to productivism and green revolution approaches); complex social, organizational, institutional and technical innovation (as opposed to technology transfer); achieving a balance between public and private goods (as opposed to an orientation towards private economic goals). All these changes will stimulate a new model of endogenous development.

3.9 AKIS and innovation policy

Innovation systems and innovation policies are complex. Support for innovation may be the responsibility of several different ministries and there may be several (overlapping or contradictory) policies to foster innovation (e,g. in the domains of research, technology and education). More recently (since the 1990s) innovation also became an objective of regional development policy, particularly in rural areas, through the LEADER programmes as well as in national policies.

Innovation policies are implemented at several decision making levels: European, national, regional and local. Many actors are involved and their number is increasing as interest in innovation diffuses into other policy arenas. This high level of fragmentation within the system, as well as the fragmentation of incentives in different parts of the system, means it is often a challenge to achieve vertical and horizontal coordination.

Actors in innovation systems are very diverse: policy makers and administrative bodies (who are sometimes perceived as "external", out of the system, actors by other participants), universities and research institutes, innovation agencies, private firms with their own R&D arms, industrial research centres etc. Some are private or public and some mobilize both public and private money. The governance of innovation systems is changing as a result of a the increasing move towards public-private partnerships and the tendency for research or innovation agendas to not only be defined by the government and universities but increasingly also by private and public stakeholders. At the same time, government, universities and research institutes maintain a strong influence over AKIS, including its innovation systems, although the degree to which they do so differs between countries.

Government bodies mobilize different financial instruments and create the right conditions, to support innovation through:

- Funding public or private organizations and institutions
- Funding projects, for example through the LEADER programmes
- Funding networks (or platforms in some countries)
- Distributing vouchers to private firms that they can use to buy knowledge from public knowledge institutes or large companies with an R&D department (e.g. the Netherlands and Ireland)

A general trend can be observed in most countries towards the creation of innovation agencies at the regional level that aim to support and further develop innovation. These may be incubators, facilitating the development of innovative enterprises with infrastructures, business support, R&D. They may also take the form of technology transfer and contact points facilitating coordination and cooperation between enterprises and R&D providers and peer-to-peer exchange. These organizations usually work as intermediaries, brokers and facilitators. However their main focus is not on farmers and agriculture, but on technological innovations and SMEs. As such these organizations have limited influence on agricultural and rural innovation. They also tend to operate under the linear paradigm and it can be a challenge for them to adopt

a wider vision and establish links with AKIS. These general innovation systems are also often urban centred. Agricultural or rural innovation systems often operate quite autonomously from general innovation systems, except through specific mechanisms, such as LEADER projects.

Enterprises in rural areas are often small and physically distant from knowledge organizations (universities, research institutes). This often means that they have less access to the innovation system than enterprises located in urban areas. At the same time, national innovation policies tend to focus their support at larger and more commercial enterprises. Enterprises in rural areas may be involved in different activities at the same time, because of risk-spreading or seasonal influences. They are often multifunctional, producing a combination of commodities and non-commodity outputs, such as environmental services, landscape amenities, social care, leisure and cultural heritage. These latter outputs are often 'public goods', and the markets for these goods may function poorly or be non-existent (IAASTD, 2008).

In recent years agricultural and rural innovations have increasingly been driven by multi actor networks, which consist of combinations of stakeholders (knowledge actors, socio-economic actors, end-users, policy actors). There are various forms of multi actor networks: learning groups, marketing networks, producer-consumer associations, communities of practice, partnerships etc. These networks are often formed outside the realms of the 'official' AKIS, especially in new areas of agricultural and rural activity, such as multifunctional farming, environmental technologies, rural services, etc. As shown by the IN-SIGHT study, AKIS institutions, research and educational institutions, regional and local governments and development agencies often get involved in these hybrid networks once they have developed to a certain point, become established and offer the potential for developing innovations.

It should be noted that in complex innovation networks and knowledge chains the Internet and new communication technologies are important tools for the exchange of information, training, providing online education, organizing networks and communicating with consumers.

3.10 Recent developments

Rural development and multi-sector aspects

The reorientation of the CAP and the increasing importance of a wider rural policy agenda have significantly altered the overall context in which agriculture is practised. The diversification of agricultural and rural activities has become a more important goal, which is embodied in the notion of the 'European Model of Agriculture' and explicitly supported by recent and anticipated CAP reforms. The Rural Development Regulation for the period 2007-2013, adopted by the Council of Ministers in September 2005, sets out three clearly defined economic, environmental and territorial objectives of the CAP: agricultural restructuring, environmental concerns and the wider needs of rural areas. In other words, the main rationale of CAP is steadily shifting away from directly supporting farmers' for producing and towards supporting public goods, often provided by farmers.

Cross compliance links the provision of CAP subsidies to compliance with several regulations about the environment, animal health and welfare and good agricultural practices. To help farmers to meet these conditions of cross-compliance, the 2003 CAP reform introduced the obligation for member states to establish, by 1 January 2007, a Farm Advisory System (FAS). This is intended to provide targeted support to ensure the implementation of cross-compliance standards. Support for rural development activities can be provided to help farmers to meet

the costs of getting advice on improving the overall performance of their holding, so long as farmers satisfy cross-compliance and occupational safety standards. This support can amount to up to 80% of the cost of the advisory service, up to a ceiling of €1500. All the EU states have implemented this system, mostly based on their existing advisory system. A few countries have chosen to use the rural development fund for this purpose.

This reorientation reflects the conclusions of the Salzburg Conference on Rural Development (November 2003) and the strategic orientations of the Lisbon and Gothenburg European Councils, which emphasized the economic, environmental, and social dimensions of sustainability. As early as 2001 the Gothenburg European Council clearly stated: 'During recent years, European agricultural policy has given less emphasis to market mechanisms and through targeted support measures become more oriented towards satisfying the general public's growing demands regarding food safety, food quality, product differentiation, animal welfare, environmental quality and the conservation of nature and the countryside'.

This reorientation corresponds with the prevailing situation and trends in rural areas. Over half of the population of the EU-25 (excluding Bulgaria and Romania) lives in rural areas, which cover 90 % of the territory. Rural development has become a vitally important policy area, while farming and forestry remain crucial for land use and the management of natural resources.

Rural areas and rural communities are increasingly seen as a platform and starting point for economic diversification and sustainable development. While farmers still are important social, cultural and economic actors in rural areas, the non-agricultural population generally represents the majority of inhabitants, especially in areas that are within commutable distance from peri-urban and urban centres. In such areas the rural economy is mainly based on activities other than farming. This broader integrated and multi-sectoral praxis is embodied in the concept of the 'living countryside' (Wilson and Rigg, 2003; Knickel et al., 2004). An important facet of this development is the emerging 'turn to quality' in the agro-food system and the new alternative agro-food networks that are linked with it. Brunori, Rossi and Guidi (2010) argue that the pace and intensity of changes in agriculture and rural areas signal a 'second-order change' which is challenging widely shared assumptions and reframing agricultural and rural relations.

The current transformation of European agriculture and the farming sector towards multifunctionality, the growing importance of sustainable technologies that rely on more efficient use of natural resources and the reorientation of agricultural production towards non-food markets (such as energy crops) and service provision, involve 'vision creation'. This involves farmers and rural actors at large making strategic choices that take into account the societal transformations that are restructuring rural areas. While it is growing, this type of production currently represents a relatively small proportion of the value of agricultural output. The government has a special role to play in supporting these types of production, as they create and protect more public goods and help farmers who are stepping off the treadmill of the productivist food chain. However this should not blind us to innovations that come from retailers and the food business, especially things such as contract farming, biotechnology and biofuels, etc.

The transformation of Europe's rural regions is also driven by a number of exogenous factors (Knickel et al., 2008). Within Europe these include socio-demographic changes, counter-urbanization, the flow of some knowledge-based industries from cities to rural areas (for example, the increasing tendency of creative industries and new technology companies to locate in rural areas), the construction of new spaces between towns and country (e.g. city regions and

metropolitan country sides) and the increased demand for quality of life based on rural amenities. At the same time there are also global trends at play that are affecting European farmers and rural communities at both the micro and meso level. Examples include climate change, the increasing scarcity of fossil fuels, the instability of financial markets and the influence of distant regional conflicts. The complexity of all these forces involves making informed and strategic choices to move towards economic and social sustainability.

Value creation is an approach to agricultural business that has largely been developed and consolidated outside the conventional knowledge systems. It is an approach that has been adopted by an increasing number of farmers in recent years. The revised CAP opens up new spaces for strategies related to value creation. It recognizes that European agriculture can only compete on global commodity markets to a certain extent. More importantly, it acknowledges that endogenous resources – human, natural and social capital – are central to increased competitiveness at a time when markets are far less protected and levels of subsidies much lower. Furthermore, it opens the way to a broader and more integrated approach to farming, understanding it as one among a number of activities employed by rural actors in their pursuit of sustainable livelihoods.

These reorientations have implications for the kinds of innovation required as well as for entire innovation systems and processes. They imply a significant transformation of agriculture and the rural sphere. Farmers and rural actors have always been part of a continuous process of restructuring. More recently this has involved fundamental changes in their roles in rural areas, which are linked with changes in urban-rural relationships. These changes are redefining 'the job' of farmers and other rural entrepreneurs. In many regions farmers are beginning to diversify their income stream by acting more as rural entrepreneurs, developing new services and exploring new markets. Often, however, there is a gap between, on the one hand, the need for change and farmers' willingness to adjust and, on the other, the ability and capacity of innovation agencies and advisory services to effectively support these changes.

It is evident that contemporary agricultural and rural development practices embody different paradigms that coexist alongside one another. The new paradigms have met strong resistance from the old ones, which are consolidated in concrete actors, discourses, institutions, socio-spatial patterns, laws and technical standards. Innovation policies should be sensitive and responsive to the coexistence between different paradigms. The central features of the AKS have often remained largely unchanged yet the issues they need to address are now far more complex. They require a wider range of responses, both in terms of the processes employed and the 'product range'. The co-existence between intensive farms producing for world markets and more extensive farmers producing environmental goods and services and the European vision of a profitable and sustainable multifunctional agriculture can give rise to conflicts. These should be recognized, clarified and, where possible, resolved.

The role of innovation policy

The changes described above should be reflected in the way rural innovation is perceived as well as in the principles underlying innovation strategies and innovation policies. Demand-driven approaches primarily follow the market to identify or prioritize which problems should be addressed. However, if we acknowledge the divergence between private and societal interests, we must then ask how innovation policies can accommodate both in a balanced way. Societal interests (or public goods related demands) tend to be – by definition – not adequately addressed through market demand and demand-driven approaches.

Clearly there is the need to make a distinction between private interests and public interests (table 3.1). We classify them here on the basis of public/private interests and on the basis of the predominant paradigm. New actors bring new interests and this can lead to a divergence and conflict of interests. However the productivist and integrated paradigms are not always in conflict with each other. As Figure 3.6 (on trends) illustrates, the two approaches coexist, although they are often effectively segregated. While productivism still plays the larger role in terms of land use, production value and research and innovation funds, this is not the case for the number of farmers involved or the share of the rural population. Though this dualism may be very real today, one challenge for AKIS might be to break down these boundaries and to mobilize resources for multifunctional agriculture and rural development in a broad sense.

Table 3.1 Different orientations for rural innovation policy goals: a structured overview

	Public	Private
Productivist paradigm	• Reduction of negative externalities (environment, food hygiene) • Non trade-distorting support • Efficiency of public spending • Spill over effects of innovation	• Growth and productivity • Compliance with public standards • Fulfilment of customers' requirements • Orientation towards larger markets
Integrated development paradigm	• Sustainable use of natural resources • Transition to a low carbon (bio-) economy • Co-production of public goods • Active creation of synergies between different activities • Equity • Food quality	• Competitiveness through sustainable practices • Emphasis on value added • Active exploration of new markets and alternative supply chains • Transition to smart, sustainable technologies and renewable energies and resource use • Diversity of farming styles

Source: Reflection paper, based on Brunori, Rand and Proost, 2007

Each paradigm guides knowledge production and innovation along different lines. The productivist paradigm remains strong in many countries and the challenge here is to make it more open to new ideas, values and novelties to allow the "old" paradigm to incorporate new products, processes and developments. Innovation policy can effectively support the exploration of these 'new' ways, the related adjustment processes that need to occur in various socio-technical constellations and the necessary collaborations. It can provide a key to competitiveness, the sustainable use of natural resources and integrated development of rural areas, and, more specifically, the structural changes required for the development of a low-carbon bio-economy and the adaptation of (agricultural) production systems to anticipated changes in climatic conditions. Implementing an effective and successful innovation policy involves renewing existing knowledge systems and knowledge brokerage processes and giving institutional support to novel approaches. Innovation services and agencies need to encourage the active development of new value-added markets, products and services. Innovation brokers need to have the skills to facilitate effective processes of learning among farmers, other rural actors and entrepreneurs.

The diversity of actors currently involved in innovation

Rural innovations are guided by different paradigms. The sectoral, social and territorial context all provide different drivers for innovation. A wealth of human and social capital, networking, supportive knowledge and communication infrastructure all contribute to novelty production (Van der Ploeg et al., 2008).

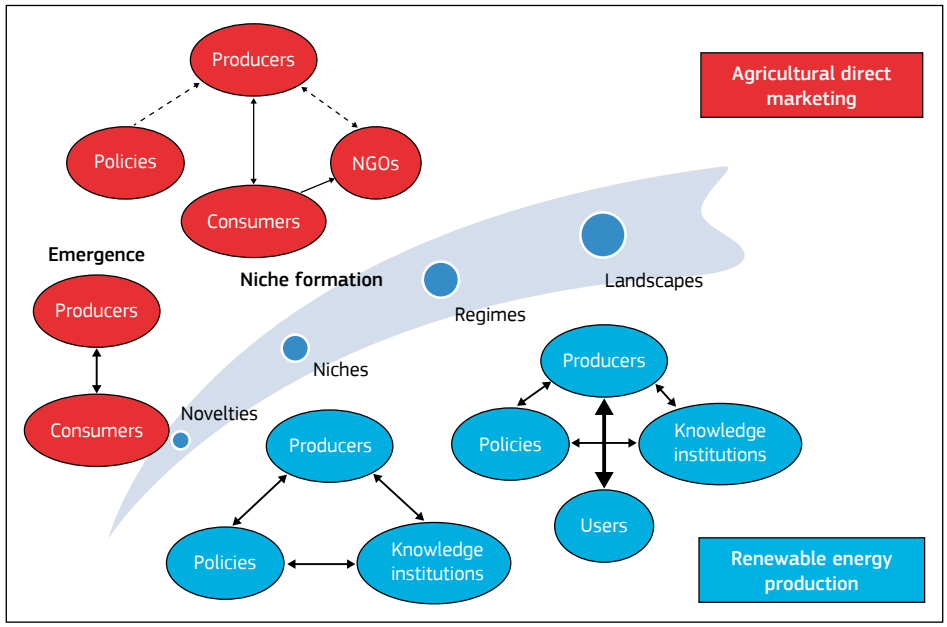
The evidence about the complex nature of rural innovation provides a stimulus for adopting a systemic, network-oriented vision. Complex socio-technical systems and hybrid networks are required to stimulate rural innovation. Multi-actor participation and collaboration are preconditions for success. The IN-SIGHT project developed the notion of co-production of rural innovation (Tisenkopfs et al., 2011). The concept of social innovation is particularly relevant here. It underlines the interrelations that exist between societal transformation and agricultural innovation. Social innovation describes the responsiveness of innovations to new societal needs and expectations and the development of new social relations, such as those that are emerging in the relations between producers and consumers. The concept of social innovation will be discussed in more detail in the next chapter.

An examination of national innovation systems (Proost et al., 2008) suggests that a systemic vision of innovation is not yet well institutionally embedded. At the same time case studies (Dockès et al., 2008; Rand et al., 2008a; Rantanen and Granberg, 2008a) have affirmed the multi-actor model and multidimensional character of innovations and their dynamics. These studies confirm that novelties, niches, regimes and landscapes are not necessarily sequential steps in the evolution of an innovation. Not all innovations follow a uniform pathway of up-scaling or vertical development. In some sectors, such as direct marketing, care farming and rural tourism, innovations remain small-scale. In rural welfare services (health care, elderly services) innovations may consolidate at the niche or regime level and foster transformation of the social welfare system. Vertical development or up-scaling is more characteristic of innovations in environmental technologies, especially in biofuels, where energy crop producers have shifted their orientation from local farming systems to regional and international markets.

According to the IN-SIGHT study, innovation starts with actors and evolves through hybrid networks. Although most innovations require the participation of many different actors, their roles at different innovations stages and fields varies. End users are recognized as playing an increasingly active role – they provide signals about new societal demands, bring about changes in production and consumption regimes and verify the results of innovation. Innovations cannot be complete without consumer/ citizen involvement. For instance, urban demand for recreation in the countryside stimulates innovation in rural tourism; the needs of 'new rural dwellers', such as second home owners, foster innovations in the market and in social services (Rantanen and Granberg, 2008); in agricultural marketing new ways of consumption stimulate novel forms of direct relations between producers and consumers, such as selling via the internet and solidarity purchasing groups (Couzy and Dockes, 2007); in bioenergy increased citizen awareness about energy issues has stimulated the development of locally organized renewable energy chains. For example in Denmark bio-energy production from manure is emerging as a side activity for conventional, large scale, productivist farmers.

Networks of innovation typically grow as an innovation develops. During the up-scaling process networks become more complex and hybrid, as new actors become engaged. Especially at the niche and regime the range of participant increases and actors in the policy and knowledge domains play a more visible role (Figure 3.7).

Figure 3.7 The increase in actor diversity as innovations develop



Source: Dockès et al., 2011

As shown by the literature on innovation and transitions, a regime change (the second order or radical innovation) is associated with a change in the set of rules and norms that govern economic or social activity. The IN-SIGHT project suggested that a regime shift is closely tied with a 'saturation' of actor networks, an enlargement in the range of involved stakeholders and more intense interactions between them. The basic mechanism through which innovations unfold and start to bring results in terms of economic, social or environmental gains can be seen in theoretical terms as the structuration of actor networks and the consolidation of interactions. In everyday language this can be expressed as cooperation.

Radical innovations can create new regimes in agriculture and RD and provide a response to a range of critical challenges (competitiveness, sustainability, public goods, new production and consumption patterns, multi-level governance etc.). The transition studies literature (Rip and Kemp, 1998; Rotmans et al., 2001; Geels, 2005) emphasizes that the move towards regimes requires institution building. Regimes are involved in power struggles and can often be hostile towards novelties and niches. Regimes also compete with each other. "Niche-actors strengthen themselves by cooperating and forming networks, thereby actually exercising innovative power. Regime-actors react by trying to 'absorb' these niches and looking for a 'synergetic' relationship with niches, in which their innovative power enforces the regime's constitutive power. If the regime 'succeeds' in absorbing niches, a so-called 'lock-in' occurs. A lock-in is a 'reverse transition path'. If, however, niches are able to resist such absorption by the regime, they become a 'threat' to the current distribution of resources (Avelino and Rotmans, 2009: 560-561). Such tensions in niche-regime relations are a necessary condition for transition to continue. Landscape transformations, or macro-level changes, involve even higher stakes and a greater number of contested interests.

Cooperation between actors, partnerships and the co-production of innovation

The clue to radical innovation is cooperation between actors. Cooperation and establishing formalized partnerships becomes more critical as an innovation evolves. Niches result from an aggregation of different small systems into a coherent actor network. Innovators get in contact with partners, knowledge providers, clients, financiers etc. The IN-SIGHT research identified several forms of innovation partnerships:

- Clusters of businesses and network companies are an efficient organizational form in rural tourism and welfare service innovations (Rantanen and Granberg, 2008b; Tisenkopfs et al., 2008b). Companies share information about clients, organize collective training, develop a common marketing strategy, coordinate investment and lobby political bodies.
- Multi-actor partnerships are a universally used organizational form of innovations, used in rural services, agricultural marketing and renewable energy projects. The partnership principle emphasizes the involvement of various stakeholders (farmers, industry actors, research institutes, etc.) and often requires that a network become formally organized.
- Territorial partnerships and alliances are complex networks organized on a territorial basis. They can be sectoral or cross-sectoral. Examples can be found in renewable energy projects, regional branding initiatives, sustainable food production and consumption programmes, community supported agriculture, care farming and more. Territorial partnerships aim to mobilize and sustainably use a variety of territorial assets and the inclusion of key stakeholders (knowledge institutions, municipalities, entrepreneurs, specialists with different backgrounds etc.). LEADER groups are one example of rural territorial partnerships that have actively contributed to the improvement of the quality of life through their activities in education, training, environmental action, social integration etc.
- Public-private partnerships between entrepreneurs, local governments and state institutions are particularly visible in new rural services, such as care farms and day care services, as well as in the renewable energy sector. Although they are effective way to organize and provide public services, several bureaucratic obstacles have been identified, including excessively complex procedures for managing public investments.
- Learning partnerships are established for learning purposes. Managing competing interests (productivity growth, environmental preservation, societal expectations etc.) requires knowledge that can more effectively be accessed through collective learning and knowledge construction. The IN-SIGHT Project showed that learning partnerships usually include grass-root innovators and their professional associations. Sometimes they are effectively assisted by agricultural knowledge and extension services. Many successful innovations have started out from small communities of practice where people learn by doing, enhance their skills and set common rules. Communities of practice often are a useful way to start open-ended innovations when there is a common goal but where skills, practices and new partners have to be acquired.

Partnership-building leads to the implementation of innovation, a consolidation of the organizational structure and the mobilization of various resources. Two examples of rural innovation (in Eastern Finland and Tuscany) suggest, not only the importance of cooperation between various stakeholders, but also the value of skilful coordination and formalized governance structures.

The development of rural services in Finland (Rantanen and Granberg, 2008b) shows how an innovation in the rural welfare service sector, initiated by a group of welfare-entrepreneurs

in Eastern Finland, has grown to the regime level by amplifying its interactions with other networks, which provide financial, learning, marketing and consulting support. A network of companies has contracted the delivery of elderly and day-care services from local municipalities. The Federation of Finnish Enterprises provided consultations for these new welfare companies, and the Employment and Economic Development Centre arranged educational courses. The role of municipalities was transformed from one of providing services to one of arranging them. The joint company used EU structural funds to build professional capacity. The Ministry of Trade and Industry provided crucial funding and support. The network of companies, together with 20 other entrepreneurs from the health and social fields founded a regional association for health and social entrepreneurs, which took over the supervision and training and started to influence the legislation for the operation of welfare companies. Thus the networks were amplified and the innovation diffused. There are now about 20-30 similar networks of service companies in Finland, providing about 200 service products at 1200 service points. The dissemination of this innovation has been a consequence of the multiplication of networks and cooperation between various stakeholders.

Another example of broad cooperation and co-produced innovations can be found in the experience of Camporgiano village in Tuscany which established a small-scale collective heating plant (Brunori and Neri, 2008). This initiative began because the municipality needed to heat some new buildings and replace the old diesel heating plant. Round table discussions began to explore the possibilities of sustainable energy provision from local sources, using locally available woody biomass. This would offer new opportunities for local forest owners and heating operators and would also help fight global warming, save energy and money. A local action group (LAG) "Garfagnana Ambiente e Sviluppo" was formed and together with the Municipality of Camporgiano made contacts with ARSIA (the Tuscan Regional Agency for Development and Innovation in Agriculture and Forestry) the regional government and environmental organization which agree to provide support. The LAG provided funding for the biomass project and involved local actors. ARSIA coordinated the project and provided training about biomass use to those involved (public administrators, farmers and suppliers). The Italian Agro-forestry Energy Association took care of the technical side. Through network enlargement and building coalitions and partnerships a local energy supply chain was established. In this case, the co-production of innovation generated new rules for forestry and energy use, new solidarities among the farmers and the village community and new technical competences for local energy companies. The local development effects included new jobs in the area and improved energy security at the local level that also helped to tackle environmental problems. The innovation reflected a transition from reliance on fossil fuel to use of renewable woody biomass.

More experiences on innovation, transitions and the (changing) role of AKIS are given in Chapter 5.

4 CONCEPTS OF SOCIAL INNOVATION

Text by Bettina B. Bock

4.1 Summary[5]

The Systems of Innovation view (Chapter 2) underlines that innovation is also a social process between different actors. This is linked to the concept of social innovation. The concept of social innovation originates in critiques of traditional innovation theory. By calling for social innovation, new theories point at the need to take the social mechanisms of innovation into account (the social mechanisms of innovation).

A second dimension of the concept of social innovation is that innovations must take a social responsibility into account. Innovations should not only focus on the profit aspect but also on the planet and profit aspects of sustainability (the social responsibility of innovation). As innovation is also disruptive, this can be a challenging demand.

There is also a third dimension of social innovation: the fact that not only commercial activities need innovation, but also social and public activities. In the context of rural development, social innovation refers to the (social) objectives of innovation – that is those changes in the social fabric of rural societies, that are perceived as necessary and desirable in order to strengthening rural societies and addressing the sustainability challenge (social inclusion / equity: the innovation of society as well as the social responsibility of innovations).

4.2 Introduction

Social innovation is often appointed as an essential part of agricultural and rural innovation. One might call it one of the buzzwords which become popular and pop up in policy arenas and feature as a container carrying a plethora of meanings. Everybody seem to agree that social innovation is important but what exactly is meant by the term remains often unclear.

In the following section we discuss the origin of the concept of social innovation and its use in the context of innovation today. We present a threefold categorisation which provides insight and creates order in the multitude of applications and interpretations. Section 4 focuses on the significance of social innovation in the field of agriculture and especially rural development, where it figures most prominently. Section 5 reports on factors of success and risks of failure in supporting social innovation in the rural context. Section 6 finally, indicates where we lack knowledge and where more research is needed. We end with some conclusions.

4.3 Defining social innovation

The concept of social innovation is born from the on-going debate and critique on traditional innovation theory with its focus on material and technological inventions, scientific knowledge and the economic rationale of innovation. It points at the need to take notice of society as a context that influences the development, diffusion and use of innovations (Edquist 2001), but also points at the possibility that innovations bear risks as well as opportunities for society.

5. This Chapter is an adapted version of the briefing paper on Social Innovation (Bock, 2011)

In the following we distinguish between three main interpretations of the social innovation concept, referring to:

- The social mechanisms of innovations;
- The social responsibility of innovations, and
- The innovation of society.

The social mechanisms of innovation

It is common knowledge by now that new technologies and products affect social relations, behaviour and attitudes. It is also commonly recognized that the successful development and introduction of new products and new technologies depend on its fit into a specific social context with a specific organisation of social relations and specific norms and values and accepted behaviour patterns. We know, for instance, that inventions may only become adopted once society is 'ready' to put them into use. Stirrups are often referred to as the classical example for how innovation diffusion depends on favourable social conditions, such as the birth of knights as a powerful social class. It is also an example of how powerfully innovations may affect society.

> "The Anglo-Saxons, a dominating enemy of Charles Martel's Franks, had the stirrup but did not truly understand its implications for warfare. The stirrup made possible the emergence of a warrior, called the knight, who understood that the stirrup enabled the rider not only to keep his seat, but also to deliver a blow with a lance (...) This simple concept permitted the Franks to conquer the Anglo-Saxons and change the face of Western Civilization. Martel had a vision to seize the idea and to use is. He did not invent the stirrup, but he knew how to use it purposefully." (Simonson 1995: 12)

That the social context matters, is also recognised by businesses that take variation in taste into account when introducing products that are new and strange in a particular place. Think for instance of the introduction of foreign food, that generally enters in an adapted form – in taste as well as presentation. This can be done by making dishes fit into the usual menu-structure of a 'proper meal' (i.e. a 'burger menu') or by adapting the original recipe and offering 'grilled sushi' (Lang et al. 2009, Chapter 7).

Recent theories about innovation use the concept of socio-technical innovation to explicate the inseparability of the social and technical in processes of innovation (Smith et al. 2010). The construction and introduction of new technologies always involves changes in the interaction of 'things' (artefacts), actors and 'ways of doing' (institutions) and affects and is affected by how society is organised and functions. This is the most evident in the case of 'system innovations' that go beyond the introduction of a new product or process but change the context, manner and meaning of how something is done, and lead to fundamental changes in many areas of society. Automobility is such a system innovation, which includes much more than the invention of the automobile.

> "The regime of automobility, for example, includes not only paradigmatic technological design for cars, but also the specialised road planning authorities, the institutions of the 'driving licence' and 'motor insurance', the lobbying capacities of car manufacturers and oil companies, and the cultural significance of automobility. In combination, these elements form a socio-technical regime that stabilises the way societal functions are realised, and gives shape to particular patterns of producing and consuming mobility" (Smith et al. 2010: 440).

Based on these insights a new (systemic) analytical framework is developed – the multi-level perspective on socio-technical transition (MLP) – that explains why, how and where innovations may occur and lead to wider transitions, what preconditions favour innovation and how such a process may be fostered by innovation policy (Smith et al. 2010; Moors et al. 2004).

The social responsibility of innovation

In classic economic thinking innovation is considered important because of its ability to increase profit and encourage economic development (Voeten et al. 2009). Still today innovation is often associated with industries developing new products and new technologies driven by their wish to maximise profit. At the same time, technological innovation is increasingly met by scepticism and concern about potential risks for i.e. human safety and the environment. The debate about genetic modification may serve as a well-known example for these concerns that more in general point at the need to evaluate the social impact of innovations and to find out who are the winners and losers in innovation processes. There is also a call for innovation that helps solving important social problems, such as environmental degradation. All this may be summarised under a call for social or socially responsible innovation: innovations that are ethically approved, socially acceptable and relevant for society.

Socially responsible innovation calls upon businesses to invest in society and to come up with socially relevant innovations, as part of their corporate responsibility for 'people and planet' and not only 'profit'.

Some theorists argue that the process of innovation has to change as well (Geels & Schot 2007). Social innovation requires new - social - methods of innovation, characterized by processes of co-design or co-construction and collaboration with society. As a result the range of innovation-actors changes and research and development are no longer the exclusive domain of science and business; with the inclusion of users the roles of, and relationships between science, market and (civil) society change. Their exchange and combination of knowledge becomes an important element of the innovation process as it goes beyond the creation of more knowledge. It changes perspectives and ways of looking at things, values and behaviour; and in doing so guides the development of socially acceptable and relevant products and processes.

Related to this process of collaboration in innovation, various authors underscore the importance of social and creative learning as the mechanism of social innovation. We discuss the idea of social or collective learning more in detail in the context of agriculture and rural development in section 4.5.

The innovation of society

Social innovation is finally referred to when indicating the need for society to change as a prerequisite for solving pertinent problems such as discrimination, poverty or pollution. Here the focus is on changes in social relations, people's behaviour, and norms and values. It is often interchanged and combined with concepts such as social empowerment and inclusion, social capital and cohesion. The Stanford Centre for Social Innovation departs from such an interpretation and defines social innovation as follows:

> *"Any novel and useful solution to a social need or problem, that is better than existing approaches (i.e., more effective, efficient, sustainable, or just) and for which the value created (benefits) accrues primarily to society as a whole rather that private individuals."*

Similar calls for social innovations can be found in various government programmes. Also the Europe2020 strategy document defines social innovation in the sense of social inclusion as one of her priorities. To design and implement programmes to promote social innovation for the most vulnerable, in particular by providing innovative education, training, and employment opportunities for deprived communities, to fight discrimination (e.g. disabled), and to develop a new agenda for migrants' integration to enable them to take full advantage of their potential (Europe 2020 strategy document, 2010, p.18).

By stressing the need to include and give voice to socially deprived groups, the political element of innovation is underlined. In any innovation processes it is important to keep a close eye on who are considered to be included in the innovation processes and who not, and who are eventually to gain or lose from the changes brought about. Social innovation is also strongly related to the innovation of politics and governance. Following Moulaert et al (2005) innovative governance allows for the inclusion of non-traditional actors, integrates various policy issues and centres on area-based development. It should, moreover, stimulate experimentation and stimulate risk taking as innovation is based on creative, out-of-the-box thinking and the possibility to learn through trial and error.

Conclusion

From the above we may conclude that social innovation is a complex and multidimensional concept that is used to indicate the social mechanisms, social objectives and/or societal scope of innovation. The social mechanisms of innovation refer to the fact that the development, diffusion and use of innovations always occur within a social context, and in interaction with social relations, practises and norms and values. As a result, there are generally winners and losers and it is important to evaluate the social impact of innovations. Innovations should be 'social' in the sense of socially acceptable, relevant and ethically appropriate. This may be achieved by socializing innovation methods and re-organising innovation as a social and collective learning process with the purpose of the common definition of problems and common design and implementation of solutions. Finally, social innovation refers to the inducement of re-organising society with the purpose of more equality and social justice. In the latter case, the concept of social innovation is not only an analytical and academic concept, but also used in a normative way, stressing the need for social and political change. It is, hence, important to be aware of the political element of (social) innovation and to analyse which kind of (social) changes are considered desirable and deserving governmental support and which not.

4.4 Social innovation in agriculture and rural development

Processes of innovation have been studied and analysed in different contexts and places and at various spatial scales – such as nations and sectors (Tödtling & Trippl 2005), but also regions, cities and (deprived) neighbourhoods (Moulaert et al. 2005). This section starts with a brief look into regional innovation and regional factors of success and failure that might be relevant for innovation in rural areas. From there it proceeds to social innovation in the context of agriculture and rural development.

Regional innovation

Scientists and politicians increasingly acknowledge the importance of knowledge and innovation for the competitive advantage of regions. Within that field 'the learning region' is a

frequently used concept to indicate those regions, which are successfully promoting innovation (Morgan 1997).

> *"Learning regions are locations with a strong social and institutional endowment that exhibit continuous creation and diffusion of new knowledge and high rates of innovation"* (Hauser et al. 2007: 76).

Taking the region as a platform for knowledge exchange underlines the importance of learning as a collective process. Regions are expected to promote collective learning because they allow for the spatial proximity of innovation organisations and actors (Tödtling & Trippl 2005). The relative proximity of actors is seen as especially important for the exchange of tacit knowledge - that is informal, non-codified, experiential knowledge, that may even be unconscious and habitual. Tacit knowledge needs personal interaction and face-to-face contacts for its transmittance (MacKinnon et al. 2002: 301). Its transference depends on what is also called "untraded interdependencies" (Storper 1997 in Tödtling & Trippl 2005) – the tacit conventions and informal agreements that people make to trust each other and to collaborate.

Critics of the learning region approach point at the fact that many networks are not place-based and stretch across different places and regions. They are especially important because they provide linkages to external networks and structures and thereby actors and knowledge that may not be available within the region (Dargan & Shucksmith 2008).

Peripheral regions are regarded as less innovative in comparison to agglomerations because of their lack of human capital and innovation attitudes. Important drivers of innovation are absent because of their "organisational thinness" and lack of dynamic clusters and support organisations and because of their distance to other regions and external knowledge (Tödtling & Trippl 2005: 1208).

Although the 'learning region' concept has been widely employed in regional studies, it has rarely been applied to rural regions, possibly because the institutional structures it prioritizes are more clearly visible in urban centres. Rural areas may be peripheral in the sense of organisationally 'thin' as well as geographically remote, but they may score high in terms of social density and, hence, social capital and a shared sense of identity, all of which are important factors promoting 'learning regions' (Wolfe, forthcoming). Rural regions, moreover, differ in peripherality and in innovativeness. There is, hence, a need to look more in depth into what defines the innovativeness of rural areas.

Agriculture, rural development and innovation

The term social innovation is popular in the context of agriculture and rural development but the use and importance attached to it differ according to the domain and scope of innovation referred to. In addition it has a considerable political or normative weight.

First of all, social innovation is most frequently used in the context of rural development as it is here where the need for social changes is most evident. When rural development is concerned, the social is presented as a core element of innovation, also in the sense of engaging society in developing new solutions.

When it comes to strictly agricultural development in the sense of production efficiency, social innovation is generally considered of less significance. Here a technology-oriented definition of

innovation predominates (Moors et al. 2004). This has also to do with the different scope of innovations referred to above; agricultural development, as such, often deals with innovations in the sense of new products or new processes whereas rural development regards the innovation of socio-economic systems.

But what kind of innovations are needed, in which domain and what the need is for social innovation, is also highly contested in the political arena of agriculture and rural development and the Common Agricultural Policy (CAP) (High & Nemesis 2007), where 'agricultural modernization' and 'multifunctional rural development' meet as conflicting paradigms and solutions to the sustainability challenge. For who supports multifunctional rural development, foresees the need for fundamental social changes – in organisation, behaviour as well as values – and attaches great importance at social innovation as essential part of the solution and part of a collective learning process (Knickel et al. 2009). For who supports agricultural modernization has high expectations of scientists and their capacity to develop and design new technologies.

The ambivalent use of social innovation, as an analytical as well as normative concept, complicates the definition and description of its significance and meaning in the field of agriculture and rural development. In order to reduce and disentangle this complexity, we make again use of the three-folded categorisation of the concept introduced in section 4.2. In practice, however, the three categories of interpretation are strongly interrelated.

Social mechanisms – co-production of rural innovation

In the past social mechanisms were considered as important when reaching the phase of diffusing innovations, when experts transferred new knowledge, products and/or technologies to users and convinced them to accept and use them. Traditional Agricultural Knowledge Systems (AKS) are based on this approach.

The new systemic approaches stress the importance of social mechanisms as basic element also during the development phase. Innovations are seen as born from collective and creative learning processes and the mutual exchange of knowledge. Learning is no longer structured as a linear transfer of knowledge from teacher to student, but becomes a shared, social, and circular process, in which the combination of different sources and types of knowledge creates something new (Oreszczyn et al. 2010; Stuiver et al. 2004). This type of learning is in itself innovative as it allows for a new (cross-border) constellation of actors to collaborate, who come from different backgrounds and have different interests (Tovey 2008). Social innovation is then put on a par with collective and creative learning. At the same time it is also more than an innovation-method, as it also produces (social) innovation in the sense of new skills, products and practices, as well as new attitudes and values (Rist et al. 2007; Bruckmeyer & Tovey 2008).

The EU LEADER programme is a good example of an innovation policy that is based on this approach. Starting as an experiment in some European regions, it has been mainstreamed as crosscutting-axis for the local delivery of rural development plans in the present CAP (2007-2013). LEADER represents a territorial, participatory and endogenous approach to rural development. Following its philosophy it is important to enable the inhabitants of rural regions to realise their own development plans, making use of local resources and local knowledge. LEADER facilitates local capacity building by supporting the creation of local and extra-local networks (Convery et al. 2010; High & Nemesis 2007; Dragan & Shucksmith 2008; Lowe et al. 2010). In doing so LEADER intends to create favourable conditions for the social mechanisms of innovation to function.

There are more examples where novel practices are born from the interaction and exchange of knowledge and experience between social groups that did not use to interact, such as farmers and citizens. Well-known examples regard environmental cooperatives in which farmers collaborate with citizens (Wiskerke et al. 2003), or consumer-buying groups where urban consumers enter in stable relations with farmers (Lamine 2005).

Based on the above we may define social innovation as collective and creative learning processes, in which actors from different social groups and contexts participate, resulting in new skills, products and/or practices, as well as new attitudes and values and new behaviour.

Social objectives – responsiveness to new social needs

The call for more responsiveness to social needs and expectations is a strong driver for innovation of the agro-food system (Lowe et al. 2010). Recent food scares are a good example, but also loudly uttered concerns about GMO, animal welfare and environmental degradation and declining biodiversity exemplify this public call. Continuously returning are also critiques that point at the damaging effect of the globalization of agricultural production and trade on developing countries. Finally, the social and economic decline of rural areas has been pointed at as one of the externalities of agricultural modernisation and the traditional production oriented agricultural support systems.

> *"Likewise, as consumers have prospered, they have become much more discerning and judgemental about the quality and wholesomeness of their food and the treatment of animals and nature in its production. As a consequence, the ethics of intensive farming have been called into question, and the discourses of commodity productivism challenged by those of 'slow food', organic, welfare-friendly and food chain localization"* (Lowe et al. 2010: 288)

The call for what might be framed as responsible agri-rural innovation is received in various ways, reflecting different approaches to innovation. At the one hand we see attempts to meet social concerns by way of new technological designs, that reduce the negative effects. This is often achieved through more efficiency and reduction in either energy demand or polluting emissions (i.e. precision agriculture). In addition, representatives of society are increasingly consulted about their concerns at some stage during the development of new products or technologies. The purpose is to find ways to reconcile social concerns with the requirements of modern production. Such consultation processes have for instance accompanied the design of new stables for pigs and poultry (Grin et al. 2004).

The promotion of a new (rural) paradigm of multifunctional, integrated development is another, more radical response to social concerns, that attempts to change the agro-food system as a whole. It seeks to replace what is indicated as the productivist modernisation paradigm by a system in which farmers no longer aim to maximise production against minimal costs but instead develop new products and services, such as local, high quality food, nature conservation as well as rural tourism and green care (Roep & Wiskerke 2004). Combined with the ideas of endogenous, territorial development (see 3.2.1) the multifunctional paradigm positions farmers as one of many rural actors who exchange knowledge and ideas, combine their products and practises and in collaboration re-vitalise the rural economy by creatively responding to the call for agricultural change.

In the above, we find two definition of social innovation. First of all, social innovation refers to a social process of innovation – a process where the creation of 'novelties' (new products,

technology and knowledge) is based on the collaboration of different social groups, that crosscut traditional borders. Secondly, innovations are referred to as social innovation when the novel products and practices respond to public needs and demands.

Social transformations - Changing (rural) society

When rural development and agriculture are concerned, social change is always implied. Changes in urban and rural lifestyles drive and demand innovations. It is, for instance, often argued that concerns about animal welfare typically arise in rich, urbanising societies, where citizens became estranged from farming (Boogaard et al. 2010). But also in the social mechanism of innovation and co-production of innovation, social change is implied through the crossing of rural-urban boundaries and re-establishment of their relations, as well as the development of new attitudes and values.

But social change may also be the explicit purpose of innovation processes. This is most prominently the case when rural development, in the sense of local development, is concerned and when the objective is to re-integrate rural societies that are perceived as marginal. Attention is then focused on the social sustainability of rural areas that may be endangered due to the loss of labour in agriculture, outmigration and the weakening of the social structure as a result of an ageing and masculinising population (Manos et al. 2010). Social innovation is then appointed as a collective strategy to rescue and revitalise rural societies.

Again, LEADER is a good example for a policy (and development philosophy) that aims at realising social change. Some even present LEADER as synonymous with social and cultural innovation (Dargan & Shucksmith 2008:274). LEADER is based on the idea that a well-functioning society is a socially cohesive society, that has large stocks of social and cultural capital, which function as a substrate for continuous innovation, needed for assuring long term sustainable rural development. LEADER seeks to strengthen communities in that sense. It seeks to promote social interaction, the creation of internal and external networks, to support capacity building, the development of knowledge and skills but also to build up confidence and self-esteem as well as a positive collective identity (Dargan & Shucksmith 2008).

Social innovation, then, refers to those changes in the social fabric of rural societies, that are perceived as necessary and desirable in order to assure their survival. It relates to social structure but also to attitudes and values and the willingness of people to engage for the collective good.

Conclusion

From the above we may conclude that the concept of social innovation is most frequently used in the context of rural development. It is rarely referred to when the development (or innovation) of agriculture as a singular economic activity is concerned.

In the discussion about rural development as an integral process of socio-economic development of rural areas, social innovation has a prominent place. The concept of social innovation is used to refer to the social changes that are considered essential to realise sustainable rural development, and at the same time at the socially innovative process of learning that is necessary to realise these changes. More in detail social innovation refers to those changes in the social fabric of rural societies, that are perceived as necessary and desirable in order to assure their survival. It relates to social structure but also to attitudes and values and the willingness of

people to engage for the collective good. It includes collective and creative learning processes, in which actors from different social groups and rural and urban contexts participate. Together they develop new skills, products and/or practices, as well as new attitudes and values, that make a difference in addressing the sustainability challenge and in strengthening rural societies.

Agricultural innovation has an important place in discussions of rural development in the sense of a multifunctional agriculture, that is seen as important part of or even motor of rural development. Here we see also discussions about the need for agriculture to change in order to produce in an ethically appropriate way, to respond to social concerns and to help contribute to more social justice in society at large. Agricultural innovation is then approached in an integral way, part of a general process of change towards sustainability.

Apart from this discussion agricultural innovation is generally approached as a singular production activity. For what concerns its innovation attention usually focuses on technical and economic aspects with social acceptability as a concern when negative reactions follow their introduction.

4.5 Success and failure of social innovation in rural development

This section summarizes the factors supporting or impeding successful social innovation in current practices of rural development. In doing so we distinguish between two levels of analysis. We start with discussing the factors that strengthen or weaken the potential for social innovation in rural development processes. We then look more in detail into the conditions that support or constrain those processes of social learning that are considered as an essential part of the social innovation process.

Success and failure of social innovation in rural development

Rural development is unthinkable without social innovation as a result as well as a mechanism: it includes the revitalisation of the social fabric of rural societies and at the same time thrives on the innovative engagement of local society members.

When it comes to the promotion of territorial rural development the existence of abundant human and social capital has been appointed as a prerequisite (Kinsella et al. 2010). Social networks need to be present in a given area that link people within the region but also connect them to other places. These networks need to be based in trust and reciprocity. People need to be willing to voluntary engage for the collective, which is fostered by a common sense of identity (Dargan & Shucksmith 2008).

Collective engagement is easier to achieve in stable long lasting networks that are used to collaborate and have mutual interests (Oreszczyn et al. 2010). But new opportunities for learning and fresh insight occur especially when different networks meet. This may also easily evoke conflicts as credibility and trust need time to grow. This is where so-called boundary agents or brokers play an important role in encouraging the development of a shared language and shared ideas.

Some individuals play a key role. They are trusted and respected by many people, thereby connecting wider networks. Their charismatic personality and personal engagement convince others that it is trustworthy and worthwhile to join in (Dargan & Shucksmith 2008). These leaders have often moved into the region from elsewhere and are able to bring in new knowledge and new networks of contacts, that link the territory to extra-local, national or even international networks.

As Elinor Ostrom (2009, 2010) has pointed out time and again trust in one another and confidence that norms of reciprocity apply, are crucial for communities to engage in collective action and to care for their 'common good'. Only then are people ready to invest time and other costly resources in order to develop something which benefits all. Research in European rural societies confirms that it is difficult to promote local development in places with a weak entrepreneurial culture, with low levels of service, a weak civil society and no history of collective action, with little institutional capacity, pre-existing clientalistic power relations, and a top down approach through the local government (Dargan & Shucksmith 2008).

Clientelism and local interest lobbies are constraining local development as they limit the extent of local participation and exclude not only certain social groups but also certain development options (Convery et al. 2010). This, again, erodes the legitimacy of local development groups and plans and undermines people's willingness to actively engage in plans that are 'captured' by powerful others (Vidal 2009). The latter is also problematic when local development becomes too much controlled by public authorities, either by way of bureaucratic requirements or by predefinition of themes and actions. Quite often government is counterproductive by framing the innovation-agenda in a certain direction.

But reluctance of community members to join local development groups and to assume responsibility may also be related to a (perceived) lack of experience and confidence (Scott 2004). It specifically hampers the inclusion of social groups that are generally weakly represented in local politics, such as women, young as well as elderly people, and less educated citizens (Bock & Derkzen 2008). This is detrimental to the process of social innovation as it thrives on the input of something new and different, and the turning around of ordinary and traditional patterns of thought and behaviour. This is why the participation of new groups, such as women and young people, and the mixture of traditional segregated actor groups are so important. But as entrance of new actors into decision making arenas changes local power relations, these actors often meet resistance. Again, the political nature of (social) innovation becomes visible, in defining who is invited in to discuss and decide on which changes need to be realised and how. Allowing new actors to effectively bring in their knowledge and ideas and have the groups function in a way that allows for social innovation, needs political attention and support (Derkzen & Bock 2007).

Success and failure in social learning and co-designing innovations

Social learning and the collective development of creative solutions are considered to be an essential part of social innovation. They are, as it where, the mechanisms that set social innovation in motion. Supporting social learning then means supporting social innovation (Cundill 2010).

Social learning means that people start questioning their traditional way of doing things, and develop new ideas, new norms and attitudes, and new modes of behaviour. That is a demanding process, that requires the creation of favourable conditions or 'spaces' (Schneider et al. 2009):

- These places are 'safe' and removed from traditional political tensions and power relations;
- There is an atmosphere of trust and respect for difference;
- There is room to get to know each other;
- There is a shared purpose that needs the combination of different experiences and different types of knowledge.

This open space of collaboration has also been indicated as the ' agora' - with the ancient Greek word for public space (Pohl et al. 2010). It indicates the need to meet and enter into dialogue as equals and to go beyond the traditional differences in roles, authorities and identities.

> *"Multi-stakeholder learning processes, if adequately conducted, opens space for people – including scientists and policymakers – to speak about their assumptions, values, and norms so that decisions become based less on the defence of autonomous interests and hidden meaning and more on appreciation of the interdependency of collective interests."* (Steyaert & Jiggins 2007: 584).

Moreover, the knowledge that is produced should be credible, salient and legitimate for all the involved actors, which requires discussion and agreement on possibly divergent goals and values (Pohl et al. 2010). Such knowledge is more readily produced when the participants are collectively engaged in action – when something has to be done and produced that is linked to concrete needs and therefore motivates and mobilises participation and engagement (Steyaert & Jiggins 2007; Wildemeersch 2007).

All this, however, takes time – as well as facilitation. Various studies point at the important role of facilitators who bring together different actors, form a bridge between different contexts and create favourable conditions (Schneider et al. 2009; Klerkx & Leeuwis 2009). Box 4.1gives an overview of successful facilitation strategies.

Box 4.1 Successful strategies for facilitating social learning

- Allowing actors with different perspectives and interests to have access to the process;
- Allowing participants to be part of the process;
- Actively integrating new participants;
- Clarifying roles;
- Establishing personal relations;
- Organising informal, bilateral meetings and meetings at the participants locations to get to know each other's' life-world;
- Showing commitment, engagement and sensitivity as facilitator;
- Collaborating on a specific product, concrete goal;
- Seeking common interests and liaisons;
- Organising situations where distinct actors are addressed as 'experts';
- Placing personal experiences at the centre of collaboration and not scientific results;
- Reflecting on the participants' distinct perspectives and knowledge;
- Enabling novel and positive experiences.
- Building on previous learning processes.

Source: Bock (2010)

Capable facilitators should also be able to facilitate conflict as conflict is part of learning and collaboration. The same is true for error, which should be acknowledged as an important source of learning (Cundill 2010). What it comes down to is creating a room for interaction where it is safe to question what one already knows, to admit that others might know something valuable, to share uncertainty and, then, to learn and create something new.

The above also points at the important role that the government can play in facilitating social innovation by offering spaces for interaction, supporting network formation and providing funds that enable continuing collaboration and facilitation (Klerkx & Leeuwis 2009).

It is difficult to encourage social learning when there are no safe and nurturing spaces available. More specifically there is a high risk of failure when possibilities for interaction are lacking (i.e. time and space). This also means that it is more difficult to achieve in areas with a weak infrastructure, long distances and/or poor transport facilities that hamper direct communication (Cundill 2010). The latter poses specific problems for the inclusion of those groups, that often have difficulty to access means of transportation such as women, the young, elderly and poor.

When the actors involved are too different in terms of their frames of reference or life-worlds, working methods, interest, and priorities, it may be difficult to collaborate in an open manner. Social learning is also inhibited when there is a lack of trust between the actors, when there is an imbalance in power and when one type of knowledge is seen as superior to other forms of knowledge (Schneider et al. 2009). The latter is often a problem when academics and non-academics meet. But it also plays a role when actors of different social standing and power meet.

Finally, the knowledge brokers or facilitators need to be capable and of good faith - their credibility and legitimacy needs to be beyond doubt. In case of public funding it must be clear that they are not acting as 'hidden messenger' on behalf of the government (Klerkx & Leeuwis 2009: 858).

> *"Government needs to realize that innovation brokers cannot be used as a directive instrument as they typically are involved in multi-stakeholders processes in which government may be one of the stakeholders and thus participates in an on-going negotiation process."*

4.6 Knowledge gaps and research questions

Rural development in marginal areas

Although there is plenty of research on rural development, we still lack insight in how to support the development of the most vulnerable rural areas. It is here where (social) innovation is most needed but where the social structure is most fragile as a result of outmigration, economic decline and social marginalisation. Especially in the new member states we may find these areas, which are not only geographically remote but also socio-politically at the periphery of the EU (Vidal 2009). LEADER projects have difficulty to start off in these regions as there is a lack of entrepreneurial people and lack of confidence in the local capacity to act. These are areas where there is little employment, where markets and clients are far away and where many and especially women and young, entrepreneurial people decide to leave and seek their fortune elsewhere. In these areas of continuous decline it may be necessary to build up the quality of life before people may be convinced that local engagement is promising and worthwhile (Bock 2010).

Sometimes participatory development policies seem to enable the most powerful to hi-jack development plans and funds. It is pertinent to know better how we manage to bring in socially marginal groups (Klerkx & Leeuwis 2009). It is also important to get more insight into the role that local governments play especially in the marginal rural areas and the new member states. We need to understand better how their close involvement in local communities might actually constrain participatory development processes because of tight knit political alliances or the double engagement of local governors in politics as well as enterprises (Convery et al. 2010).

Evaluating social innovation

There is also a need to learn more about how to evaluate processes of social innovation (Reed et al. 2010; Klerkx & Leeuwis 2009). Evaluations are generally focusing on concrete and possibly quantifiable results. But how can we measure collective learning and how can we evaluate what has been learnt? When is social innovation or social learning successful? And what is to be labelled as the outcome and the process?

> *"Although social learning may be both a process (of people learning from one another) and an outcome (the learning that occurs as a result of these social interactions), it is often defined in relation to the wide range of additional potential outcomes it may have. (..) In particular, social learning is frequently conflated with pro-environmental behaviour."* (Reed et al. 2010: 3).

In some monitoring and evaluation methods reflection upon the process of learning and changes in knowledge, attitudes and values have an important place (Mierlo et al. 2010). In doing so monitoring and evaluation becomes part of the learning process and contributes importantly to its effectiveness. The latter may even be seen as their most important objectives. But it might be useful to consider how such tools might be applied in a more detached way with the main goal not to contribute to learning but to measure outcome.

It would also be useful to compare the effectiveness of different social learning arrangements, such as multi-actor networks, partnerships, communities of practice, producer-consumer associations, hybrid innovation networks, territorial alliances. The arrangements differ in how they organise the process of collaboration and interaction that promotes learning, and whom they invite as participants. They become increasingly popular and are seen as promising ways to improve the interconnection between science, policymakers and society at large, but we still lack insight in how and to what extent they indeed encourage (social) innovation.

4.7 Conclusion

In this Chapter we clarified the different use and definition of the concept of social innovation. For the purpose of AKIS and SCAR it is most important to get insight into its meaning and significance in the context of agriculture and rural development. Policy makers need more insight into agricultural and rural innovation as a social process in order to better support the transition towards sustainable agricultural and rural development.

The analysis underlines that social innovation is part and parcel of any innovation process, be intended or not. There are social mechanisms at work in all processes of change and next to all of them bear social consequences. But when it comes to meeting the challenge of sustainability social innovation is of particular interest. Rendering agriculture and rural development sustainable requires not only changes in individual behaviour and attitudes but eventually the re-organisation of the agro-food system as a whole. And this is social innovation, par excellence.

Social innovation in agriculture and rural development appoints the outcomes that form part of a sustainable agricultural system and vital rural societies, as well as to the social processes that are necessary to realise these changes. It relates to the structural re-organisation of the agro-food system, changing attitudes and values and the willingness of people to change their behaviour and engage for the collective good. But it also includes the preceding social processes of learning, collaboration and negotiation, in which actors from different social groups and rural

and urban contexts participate. In other words - social innovation is indispensable, a sine qua non for a transition towards sustainability.

Consequentially it is indispensable for those involved in AKIS to better understand how the process of social innovation may be supported and steered in such a way that it indeed produces a sustainable agro-food system that allows for the re-vitalisation of rural societies. So far social innovation gains most attention in the context rural development and multifunctional agriculture. It is crucial, however, to gain more insight into the social aspects of any innovation in the agro-food system and to make sure that citizens' concerns are responded to.

The sequence of recent food-scares demonstrates how concerned and dissatisfied the public is and how vulnerable the existing system is to negative consumer reactions. There is an urgent need to respond to the call for a more transparent and more responsible agro-food system. This requires much more than technological adaptations and underlines the need for the re-organisation of the agricultural production-system as a whole. Such a systemic innovation necessarily includes social innovation and, hence, respect for citizens' worries about the negative effects of the actual system and their concern to create a system that safeguards human, animal and planetary welfare as well as their wish to have a voice in the governance of agro-food innovations.

This Chapter has outlined what the features of social innovation are, what its preconditions are and how it may be supported. But social innovation should not be considered as just another instrument of governance and change. The fulfilment of the promise of contributing to more sustainability includes a commitment to social responsibility and justice. The chosen direction of change needs to be socially acceptable and relevant and embedded in democratic decision making processes. Last but not least, it is essential to keep an eye on the social consequences of the changes and realised and to make sure that costs and benefits are fairly distributed.

5 EXPERIENCES IN THE MEMBER STATES

Text by Anne Vuylsteke with contributions from members of the CWG

5.1 Introduction

After the more theoretical reflections and considerations on the AKIS and the particular case of social innovation, this fifth Chapter aims to give an overview of experiences with AKIS in European countries and regions. The main focus is upon the organisation and dynamics, incentives, AKIS policy and, finally, monitoring.

The analysis builds upon countries' and regions'[6] presentations and discussions during the meetings of the SCAR Collaborative Working Group on AKIS. Additional information comes from case study reports and other relevant documents provided by the country representatives. It is important to understand that the Chapter will not attempt to compare cases (contexts differ too much to do so), but aims to learn from the country experiences and the available evidence. Rather than giving a country per country overview, the text therefore addresses common issues and illustrates these through examples.

5.2 AKIS and its actors

5.2.1 General findings

The theoretical concept of AKIS was the starting point for the analysis. The experiences indicate that AKIS do exist when studied in the actual context of countries and regions. The concept is moreover useful to describe national or regional AKIS and to reflect upon the relevant policies.

The descriptions of the AKIS under study show that there is a huge diversity between countries and regions. Differences not only exist in the relationships between the AKIS subsystems (research, extension, education and support systems), but also different actors are involved. Even actor names and their positioning within subsystems may be different between countries. Therefore we concentrated on the organisation and dynamics, incentives, motives and considerations in AKIS policy in stead of only describing systems.

It can therefore be concluded that there is no "One size fits all" formula for what the ideal AKIS is. Important differences in the national or regional farming are at the basis of this finding and concern for instance the institutional framework, the characteristics of the agricultural sector, the competitive position of the agri-food sector, the national history, etc. The question on how many or how few organisations and institutions are needed to make the AKIS work is therefore dependent on a countries' specific situation.

Particularly the link between (applied) research and farmers via extension varies in the cases under study. Dockès et al. (2011, based on Laurent, 2006) identify five archetypes of how extension services can be organized:

6. It concerns the following countries and regions: Baden Württemberg (Germany), Denmark, Estonia, Finland, Flanders (Belgium), France, Hungary, Ireland, Italy, the Netherlands, Turkey and United Kingdom.

- Mainly privatized systems for extension (e.g. the Netherlands, the UK, some states in Germany) where the funding mainly comes from direct payments from farmers, but coupled with high state funding for research.
- Co-management between farmer organizations and the state (e.g. France, Finland and some states in Germany), with public funding, partial payments by farmers and farmer organizations.
- Semi-state management (e.g. Teagasc in Ireland which has a board with representatives from the state, industry and farmer organizations);
- Management by the state through regional organizations or institutions (e.g. Switzerland, Italy and Finland).
- Uncoordinated individual innovation nucleuses.

These archetypes illustrate an evolution from a top-down and transfer-of-technology orientation (mainly in the state management archetype) to more complex new collaborative extension systems and platforms, which require the adoption of new configurations and organizational structures, open to multiple actors. The new arrangements are based on the decentralization of extension in combination with privatization measures aiming at the improvement of advice, through the involvement of NGOs, producers' organizations and private businesses (Cristóvão et al., 2011).

5.2.2 AKIS subsystems or components

From the country descriptions, it is clear that each of the AKIS subsystems is determined by other actors. Although definitions and notions can differ between countries, the following paragraphs aim to give a general overview of the actors involved in the four AKIS components or subsystems: research, extension, support system and agricultural education.

The government has a dual role in the AKIS. Government and related agencies are not only an actor within one or more subsystems, but the government has also a system responsibility. The government policies regulate each of the subsystems, but can also have a decisive role in the interaction between the subsystems. In many cases, several governance levels (EU, country, and region) are of relevance. Such multilevel governance is especially challenging in federal states, as regional structures and programs are framed within and designed by national structures. In addition each of AKIS subsystems are also part of more general systems like the general education system or science policy.

Research

A first group of actors in research are universities. Both dedicated agricultural universities and faculties or departments of general universities are involved in agricultural research. University colleges are closely related to the universities.

A second group of research actors are government research institutes, that both operate under the auspices of agriculture-related ministries or science ministries. The focus of these research institutes can be very broad and cover many agricultural-related research domains, while other countries opt for a more sector- or research domain-oriented approach. In the latter case, there are several research institutes, each with a distinct focus.

Other research actors with a public background are funding agencies, strategic research centres, knowledge centres, diverse research institutes (for applied research) regional development

agencies, technical institutes, associations and experimental stations. In many central European countries the Academies of Science play an important role.

Next to the public research and knowledge institutions, many countries also have independent (private) research providers. These research organisations can be purely focussed on basic and applied research (supported through project funding or partly through general public funding like the Research Institute of Organic Agriculture FiBL in Switzerland), while others collaborate with the private sector (e.g. collaborative research in the UK, Strategic Centres for Science Technology and Innovation in Finland and collaborative research with the industry through the Sustainable Agriculture and Food Innovation Platform in the UK). Needless to say that (big and/or international) companies in agrochemicals, seed, machinery, computer software, etc. also have their own R&D activities.

Box 5.1 Strategic Centres for Science Technology and Innovation (Finland)

The Finnish Strategic Centres for Science, Technology and Innovation are public-private partnerships for speeding up innovation processes. They are constituted as multi-shareholder limited companies and carry out long-term cooperation in fields most critical for the future. Examples are CLEEN Ltd., focused on energy and environment, SalWe Limited, concerning health and well-being, and Forestcluster Ltd.

Source: http://www.shok.fi/en

Box 5.2 Technology Strategy Board - Sustainable Agriculture and Food Innovation Platform (UK)

The Technology Strategy Board is a business-led executive non-department public body promoting research, technology and innovation (http://www.innovateuk.org). This 5 year programme (also supported by DEFRA and BBSRC) is funding collaborative projects (matching the investment by industry) on crop protection, sustainable protein production, and the next competitive call will cover the food chain.

Source: Defra/House of Lords enquiry

Box 5.3 Network for Applicative Research in Agriculture (France)

The Network for Innovative Research in Agriculture is at the cross-road of farmers' needs and the expectations of civil society. Created and managed by farmers, the agricultural R&D institutes are organisations dedicated to applied research, experimentation, technical support, expertise, training and dissemination. Their operational mission is to adapt upstream research results to the field or region context and to build and manage applied research projects to fit specific farmers' expectations. Specialised by sector, they represent a task force of 1000 applied scientists and are spread in the main regions of agricultural production. The agricultural R&D institutes are private entities supported by a scientific board and benefiting from specific public funds under the supervision of the Ministry of Agriculture. A frame agreement is signed by the network co-ordinator and the Ministry of Agriculture that sets the frame in which the agricultural institutes, actors of applied research, carry out missions of public interest and implement the national rural and agricultural development plan. They are positioned at the interface between upstream research and development (translating the needs expressed by end-users, integrating knowledge, testing technologies), support public decision, transfer and disseminate results to end-users. A majority of these R&D institutes qualify for public funding in relation to the ministry expectations, and to their scientific and technological competences. A similar type of organization and procedure exists for both agricultural and agro-food R&D institutes.

Source: http://www.acta.asso.fr and http://www.actia-asso.eu

Extension

Extension services represent a wide variety of hybrid solutions between purely public extension on the one hand and completely privatized systems on the other (Cristóvão et al., 2011). In Germany for example, the shift from public to private funding goes on. All governmental or chamber extension services charge fees now for service in private interest. Sometimes the fees are not yet fully cost recovering what leads to unfair competition with the fully private providers. Public funding for private provision is only happening in a few fields, and is not really progressing (water protection, family advice, etc.). Awarding extension programmes by contracting is not really introduced (German Solinsa report).

In most countries, a combination of different types of extensions services can be found. Many of them are (partly) funded by the government, but a gradual change towards market orientation can be noticed. Public support is directed merely to activities supporting policy targets such as the environment, biodiversity (sustainability). Other actors in the extension subsystem are membership organisations, commodity boards, experimental stations, government departments, Centres for knowledge transfer and associations.

The Farm Advisory System (FAS) within the European Rural Development Policy is an exception, as it is a mandatory element in the programming period 2007-2013. The approach taken and the degree of centrality of the service providers however differ between countries. Also the degree to which the FAS (set up to increase the awareness of farmers on material flows and on farm processes related to areas covered by cross compliance) has been interfaced with other farm advisory services and extension greatly differs between countries at this point in time (Angileri, 2011).

Because of these interactions, the organisation of the extension subsystem is rather complex in most EU member states. Some countries have for example similar extension services next to each other. This is for example the case in Hungary with the Farm Advisory System, the Farm Information Service and the Network of Village Agronomists. Other member states, like Estonia, have installed a central body in order to coordinate extension services.

In Finland, extension is well-embedded in broadly-based agriculture and rural advisory services including business planning and investment services, technical advice for production, and management and IT support. Such services are mainly carried out by membership associations, which are owned and administrated mostly by farmers. However, these services are supported by state aid from the Ministry of Agriculture and Forestry.

In some countries, there is an important degree of interaction between extension services and the support system. In Italy, the support system is even inside the extension system and is a subsystem of the latter. With its development objectives, the extension system is thereby coordinated by the public authorities but is managed and implemented by different bodies, also private in some cases. The support system, instead, is supported exclusively by the public, the only that can afford the high cost of the advanced level technical instruments the system provides.

Farmers' interest in extension services hugely differs between countries. While some services are clearly co-funded and co-managed by the sector (e.g. the Danish Agricultural Advisory Service and French and German agricultural chambers), there is a clear lack of interest and trust in other countries (e.g. in Latvia and Hungary).

Box 5.4 Danish Agricultural Advisory Service (DAAS)

The Danish Agricultural Advisory Service (DAAS) is owned and managed by farmers, via their membership of farming organizations. The DAAS' main responsibility is to supply Danish farmers with management tools and advice relating to all aspects of farming, including farm accounting, production and farm management. Its principal tasks are:

- To offer farmers the best possible technical know-how and support with regard to production methods and economy
- To provide guidance in specific situations for the planning and implementation of production
- To record and process technical and economic data as a basis for the everyday management of the individual holding
- To organize courses for the further education of farmers
- To act as a link between the farmer and the research and experimental institutions
- To prepare accounts and tax returns for the farmer and to provide farm management advice, including finance

The Advisory Service thus bridges the gap between agricultural research and primary farming, and ensures that new know-how is put into use on the farm and in the field as quickly as possible. This benefits the farming industry and its associated community. The DAAS is furthermore user paid, offers advice in all aspects of the farming business, is officially and universally recognized as impartial and it has no inspection tasks on behalf of government. Organizationally, DAAS consists of 31 independent local advisory centres throughout the country and one national knowledge centre, which provides the local centres with the latest information from both Danish and foreign research

Source: OECD AKS Response Denmark

Next to extension services, other private actors also provide support to farmers. Farmers' merchants and suppliers are very active in this field and combine product sales (e.g. animal feed, seeds, fertilizer and pesticides) with knowledge transfer. The extension cost is then included in the product price. Advice and accounting offices and NGO based advisory services are other examples of private actors involved in extension.

Support system

The support system is the most difficult subsystem to describe in a coherent way. Farmers' organisations and producers' associations are the most prominent actors within this system, just as cooperatives. Other actors in national support systems are member owned organisations (e.g. ProAgria in Finland), Chambers of agriculture, product boards, institutes to support policy making, land based colleges, apprenticeships, information systems, financial organisations (mainly agriculture-related banks and insurance offices), funding and evaluation agencies, non-sectoral innovation support tools, social security schemes and international organizations such as FAO and CGIAR.

Box 5.5 ProAgria (Finland)

The Finnish ProAgria is a member-owned organisation, that was founded in 1797. The organisation has 16 regional advisory centres nationwide, a staff of 685 people (out of which 660 in the field) and a membership base of 113 000. Funding is provided by the state (16%), clients (65%), projects (18%) and others (1%). Together, these account for an annual turnover of 49 million € (2011) and around 30 000 clients annually. Ca. 80% of Finnish farms utilize ProAgria services.

Operations concern:

- Advisory services based on face to face advice at the farm, but also a rapidly increasing number of e-services
- An on-line advisor registry where the client can search for an advisor and make an appointment
- The advisor charges the client for services
- The overall advisor skill development is supported through an integrated knowledge management system and AdvisorAcademy –in-service training
- Additionally nationwide expert teams, which form a separate organization within the ProAgria group.

Source: ProAgria public presentation

Box 5.6 DLG as a knowledge broker (Germany)

The DLG (German Agricultural Society) was founded in 1885 by engineer and author Max Eyth. It has over 20,000 members and is a leading organization of agricultural and food industry. Key characteristics of DLG are its freedom and independence, the commitment to progress and international orientation. Fields of activity are impart knowledge, exhibitions like Agritechnica and Anuga, testing of equipment and resources and testing of foods. Within the DLG center around 200 full-time staff and 3,000 volunteer experts work together to address the challenges facing the industry. More than 80 committees, working groups and committees are the foundation for expertise and continuity in the technical work. For any topic of relevance there are working groups mixing practitioners and scientists, private and public sector experts (Ausschüsse). All working groups come together once a year in the "Hauptausschuss" getting a report on current DLG activities and discussing actual issues. The information is publicly offered in congresses (DLG-Wintertagung) and in smaller events parallel to the great trade fairs (Agritechnica, Eurotier) where technical and commercial innovations are presented. Science, practice and guidance work together closely linked. The DLG Academy with its seminars and the Trainee Program provides key skills for the future.

Source: www.DLG.org and German Solinsa report

Box 5.7 EU-Platform of Chambers of Agriculture

Working in 14 European countries (Austria, Croatia, Czech Republic, Estonia, Flanders, France, Germany, Hungary, Latvia, Lithuania, Luxembourg, Poland, Slovakia and Slovenia) with about 15 000 employees in more than 150 independent Chambers of Agriculture, the chambers provide extension and advisory services for more than 5 million farmers, as well as for local authorities, applied research agencies and rural enterprises. Chambers manage numerous experimental stations, test areas and research laboratories for applied life science. Knowledge transfer from research to farm level and the way back is the daily job. On EU-level there is an informal network of Chambers of Agriculture, handling, translating and promoting EU-policies with a focus in agriculture, environment, applied life science and regional development.

Source: EU Chambers of agriculture (2011)

Agricultural education

Initial agricultural education refers to activities in the period before a professional career. Further education and formation activities during professional activities and coaching to farmers are considered as a part of the extension subsystem.

When it comes to agricultural education, distinction can be made between higher and secondary education. Secondary education in agriculture is mostly offered by specific technical and vocational schools. These either resort under the Ministry of Education (as a part of the traditional education system) or as "green education" under the Ministry of Agriculture.

Higher education follows the secondary education (whether agricultural or more general education) and is provided by universities and higher education colleges (or university colleges). Several countries have made deep changes in their structure of higher education in order to adapt it to requirements derived from the European Higher Education Area (Bologna Process). In some cases, this evolution seems to have deteriorated the quality of education.

In Finland, in addition to the universities, the technical universities, and the universities of applied science ("polytechnics"), there are wide range of vocational institutes, which are maintained either privately, or by government or municipalities. About 70 of these vocational institutes offer courses relating to management of natural resources (agricultural, forestry, horticulture, water resources, natural environment etc.). A number also offers facilities which can be utilised for experimental work and therefore these are increasingly interacting with higher education and research.

Box 5.8 Place of secondary agriculture education in the AKIS in France

France has an extensive network of secondary agricultural schools, both public and private, scattered all over the country. This network is funded by local governments and by the Ministry of agriculture, who is in charge of overseeing its activities. Most agricultural schools have a farm that represents the dominant cropping/livestock systems in the area. Although farms attached to the schools are run as genuine economic entities geared towards profit, they are also used for pedagogic purposes as well as for experiments. Such farms have a significant role as demonstrators of innovative solutions in their area. For instance the proportion of the agricultural school farming area under organic farming is 21%, much above the national average (3%). Agricultural schools and their farms are engaged in innovation and rural development projects in partnership with research centers, extension services, associative networks and private firms. Nationally thematic networks have been established within the agricultural secondary education community in order to provide technical/scientific backstopping to their members on a given subject, facilitate exchanges of knowledge and experience, as well as the launching of initiatives and projects. Through its place within the French AKIS, the secondary agricultural education system both contributes to and benefits from the general innovative effort in agriculture.

Source: Ministry of Agriculture and http://www.chlorofil.fr

Box 5.9 DEULA (Germany)

Bundesverband DEULA e.V. is a network and umbrella organization of 12 independently operating DEULA Training Centers. DEULA is the shortened form of German Training Centers for Agricultural Engineering (Deutsche Lehranstalten für Agrartechnik). All of them are non-for-profit organizations.

The existence of DEULA can be traced back to the year 1926 when Germany's agriculture underwent a great shift from animal-draft to motorization. Today, DEULA promotes agro-technical measures designed to maintain and improve agricultural and horticulture competitiveness in a global market society. DEULA supports the development of agricultural and horticulture engineering through vocational and professional training, contributes to rural planning and advocates health and safety precautions including the aims of environmental protection especially in the wide range of food production and agricultural engineering.

DEULA's clients are diverse: national and international development organizations, donor and recipient governments and ministries, agro-industrial enterprises such as manufacturers of agricultural machineries, suppliers of equipment, trading companies, professional bodies of agricultural mechanization and engineering, research centers, universities, technical colleges, education and training institutions. The areas of activities for example concern coordination of range and subject of training measures at technical colleges, training centers and at worksite, training of teaching staff, extension staff and project staff, transfer of modern teaching technologies and methods, planning and setting up management training, consultancy and planning of agricultural engineering training centers, support in development and implementation of national and regional agricultural mechanization strategies, support in development and implementation of agricultural machinery testing centers and organization and conduct of tailor-made courses, seminars and study tours as means of promoting an international exchange of experience and transfer of know-how.

For more than 80 years the central idea and registered trademark of DEULA reads "Lernen durch Begreifen" (Learning by doing). Basis of the pedagogical work is a modern teaching concept, play in the practical orientation and competence orientation an important role. History has given evidence that this experienced-based learning breeds confidence and accuracy in manufacturing, service and in the use of agricultural machinery.

Source: DEULA

Other actors within the AKIS

In some countries, there are also actors identified within the AKIS. These for example concern museums, benevolent NGO's and pressure groups for diverse topics, media, laboratories, inspectorates, boards, centres and offices within the jurisdiction of the ministries concerned. Also innovation assessment organisations fall outside the proposed components of the AKIS.

5.2.3 Relationships between subsystems

The relationships between AKIS subsystems are in most cases not made explicit by the government or the actors involved. The AKIS descriptions show that there are several factors that can facilitate interaction between AKIS components. Examples are the multiple roles of actors (e.g. universities are involved in research and education) and mixed research or technological units, but also collaborative efforts by individual actors. Collaboration between subsystems can also be promoted by common values and principles. The Dutch and Swiss AKIS are for example based on principles such as openness, proximity, synergy, absorption capacity of external information, connection mechanisms between stakeholders and institutions, public-private cooperation, and supportive institutional and organisational arrangements.

In recent years, initiatives developed to deliberately connect subsystems. Such initiatives can be found in many countries. The Dutch Transforum, Green Knowledge Cooperative and Innovation Network, the French Agreenium, the Finnish LYNET research consortium for natural resources and the environment, the Spanish Knowledge Platform for Rural Areas and Fisheries and the Flemish Platform for Agricultural Research are only some examples.

Box 5.10 Platform for Agricultural Research (Flanders)

The Platform for Agricultural Research was founded in 2004 and brings together representatives of relevant research actors (universities, the Institute for Agricultural and Fisheries Research, university colleges, experimental stations), farmers' organizations, ministerial cabinets, government departments and a funding agency. The Platform serves as a sounding board for policy development and a contact point with the agricultural research field. The Platform is the forum for consultation and agreement

- between agricultural research and agricultural policy in order to achieve innovation and to promote entrepreneurship in agriculture;
- between agricultural research and the agricultural sectors to ensure and improve mutual knowledge transfer and the use of knowledge;
- between agricultural research institutions themselves to ensure optimal alignment

In recent years, the platform has developed a vision on agricultural research, events were organized on knowledge transfer between researchers and farmers, the funding mechanism of agricultural research was evaluated and the White paper on agricultural research was published. The Platform operates in a thematic ways and the envisaged themes in 2011/2012 are knowledge transfer and coordination with the industry, international valorisation of Flemish agricultural research, development of multi-disciplinary research projects, installation large-scale infrastructure and coordination with other funding bodies.

Source: Vuylsteke & De Schepper (2011).

Box 5.11 Agreenium (France)

In France, a consortium called Agreenium has been created. This new public scientific co-operation institution comprises six actors: INRA, CIRAD and three among the biggest agricultural colleges. The consortium was set up to co-ordinate its members' resources and skills at the interfaces between research, training, development and the international dimension. It is responsible for promoting and implementing specific actions to meet the needs of its founders, as well as the expectations of its French and international partners.

Source: Solinsa paper & OECD response France

Box 5.12 Agricultural Research Advisory Board (Turkey)

The Advisory Board for Agricultural Research has been created to bring together relevant agricultural research actors such as government departments from the Ministry of Food, Agriculture and Livestock (MoFAL), relevant science departments of universities, TUBITAK, farmers' organizations, chamber of professional organizations. The responsibility of the board is to make recommendations to the General Directorate of Agricultural Research and Policies(GDAR) on the following subjects:

- developing of institutional, physical, human and financial capacity of the GDAR
- setting priority areas of agricultural research,
- making proposals in line with the needs of the policy-driven projects,
- transferring of the research results to decision-makers, industrialists and end users

Source: www.tagem.gov.tr

5.3 AKIS dynamics

Next to the differences between countries, AKIS also change over time. The evidence illustrates that several member states have restructured their AKIS considerably. Various causes and motivations are at the base of these developments, such as the improvement of efficiency, budget cuts or policy developments. These evolutions illustrate the dynamic character of AKIS. As a consequence, AKIS descriptions are only a snapshot at a certain moment, but do not give insights in the underlying developments.

The Netherlands has for example privatised its state extension service, leading to competition, and has merged its applied research and agricultural university into Wageningen University and Research Centre. It positions this Wageningen UR as a "third generation university" with innovation in its mission and close relations between strategic and applied research. Learning innovation networks are an important policy instrument to address systemic coordination issues. France has witnessed a clustering in the so called Pôle de competitivité – a regional clustering with special projects to support consortia (albeit only marginal in the field of agriculture). Denmark is a similar example, where applied research was merged into regional universities. The introduction of the Farm Advisory System led in Hungary to the introduction of a Farm Advisory System in addition to the Farm Information Service (organised by the Chambers of agriculture) and the Network of Village Agronomists (and agri-business).

These evolutions, in accordance with a countries' history, lead to very different AKIS stories and backgrounds. While the German extension services for example have a 200 year-history, Latvia's national AKIS is relatively new and has been significantly transformed during the last 20 years. In this case, many AKIS institutions were inherited from soviet times, but had to be reorganized to meet the needs of new private farmers.

Processes of constitutional reform are another factor of dynamism in AKIS and its subsystem. Especially federal states have known a gradual process of division of power between the national / federal level and the regions, states or Länder. These decisions not only structure the AKIS at a certain moment, but also shape the future. Extensive autonomy of regions can lead to important differences and a limited interchangeability. In 2001, the Italian Constitution was - in part - changed in favour of a more recognized and active role of the Regions in the agricultural research field. The Regions and Autonomous Provinces could now identify research programmes and autonomously fund research projects tailored to the specific requirements of their local agriculture and agro-industry system (Constitutional Law n. 3, 18/10/2001). Federalism in Germany - being for a

long time a relative advantage compared with more centralistic neighbour countries like France – turns into a disadvantage: uncoordinated parallel funding of organisations and actions lowers the effectiveness of the less money spent. And much energy is wasted in undesired competition instead of being used for cooperation (German Solinsa report).

The evolutions in countries and their AKIS can be observed in several ways, but a very clear example is the changes in the names and the organisation of agricultural ministries over time. While Flanders and Italy still have a Ministry of Agriculture and Fisheries, Hungary has a broader Ministry of Rural Development, Germany added Consumer Protection, and the Netherlands chose for an integration into the Ministry of Economic Affairs, Agriculture and Innovation.

5.4 Incentives

The reflection paper revealed several disconnections between the AKIS-subsystems. Differences in incentives between subsystems were identified as an important driver of this observation. The following paragraphs further explore this statement by inventorying the incentives that are used within the subsystems. The incentives that are aimed at encouraging interaction and cooperation between subsystems are also discussed.

5.4.1 Incentives aimed at the subsystems

Incentives are generally specific for each of the components (research, education and extension), but funding is the principal common incentive instrument. The following paragraphs give a more specific overview of the incentives in each of the subsystems.

Research was traditionally split into two categories - basic and applied – but recently, a third category has been included. Translational research is characterised by multi-disciplinary approaches, and by interaction between academic research and industry practice (House of Lords, 2011). These different types of research and their target audience (universities, applied research, public research, experimental stations and businesses) can all be found in agriculture.

Universities are incentivised based upon the number of students (often a combination of enrolled and graduated students), the total amounts of study points, the number of publications in (peer reviewed) journals and the citations. Together, these indicators point towards excellence in research. Governments furthermore provide funds for infrastructures, targeted and non-targeted research, baseline funding, research and development programmes. An important part of these funding mechanisms are based on competitive calls for proposals.

Recently, some countries have improved their incentives towards a more integrated system which also takes valorisation and translational aspects into account (e.g. the Netherlands and UK), the type and number of products weighed on the number of researchers (in Italy) or with a greater emphasis on the social and economic impact of research (like in the UK).

Next to government funding, research institutes can also use their self-earned resources (revolving funds) which include diverse revenues from services delivered or products sold and revenues from research contracts with the private agro-food industries, and international research organizations.

The transfer of money from universities to agricultural departments of these universities is in most countries unclear. Factors that determine the size of this transfer in other countries are

the historical money flow, the number of students (both enrolled and graduated) and strategic planning aspects.

Government research institutes are not only active in the competitive project market, but also receive a structural funding by the government. The size of this funding is mostly based on historical mechanisms, but performance indicators are designed to evaluate the implication of research programmes. Criteria in Flanders are for example the nature of research, publications, interaction with the sector, etc.

The incentives for applied research are quite different from universities, as students are here of lesser importance. Government funding is both provided at programme level (e.g. strategic research in the Netherlands, MTT's research programmes in Finland and National Research Plans in Italy) and by project funding through competitive application. In the UK, basic research is funded by Research Councils (for example the Biotechnology and Biological Sciences Research Council), while Defra and other Government Departments are important funders of the more applied agricultural R&D. Industry also funds applied research where benefits can be quickly delivered. Rural development plans also provide funding to applied research in some countries. In France, additional funding is done through recurrent funding linked to the farm gross income, the interprofessions (40%) and incentives for participation in mixed technological units and collaborative projects.

The incentives for experimental stations are similar to applied research (funding at programme and project funding), but can be extended with subsidies (sometimes based on a historical precedent) to cover operational costs, investments in infrastructures and specific funding mechanisms (e.g. demonstration projects within the rural development programmes). The experimental stations are close to the farming practices and can therefore also be driven by commercial relationships (like selling seeds) and active collaboration with farmers in order to deliver practical solutions. In Finland, former regional experimental stations now within the MTT system still play an important role in regional economic development programmes.

A final group of actors that can engage in research are businesses, mainly food companies and input suppliers. Several countries provide R&D tax credits for all companies that undertake R&D expenditures, but support is also given through innovation schemes and to collaborative projects with research institutes. The UK Sustainable Agriculture and Food Innovation Platform for example aims to stimulate new technological developments for increasing food production, whilst reducing environmental impact. The first competition calls addressed crop protection and sustainable proteins, and a future focus will be on reducing food chain waste and greenhouse gas emissions. The Dutch "Frontrunners-window" provides another angle, as it seeks ways to change innovation-blocking regulation.

Competitive project funding is an important type of incentive for all types of research institutes. The criteria used for money allocation are very diverse and cover for example the content (contemporary and innovative topic), the scientific and technological quality of the project and its management, valorisation aspects, coherence with regional programming, productive sector involvement, participation in international networks, previous projects and publications, patents or plant variety rights, etc.

Extension: the government influence is limited in the case of private extension companies. In some cases, service providers should be recognised by the government to carry out their

activities. The payments by the farmers are thus the most important driver for the actors in the private extension sector. Agri-business companies (like seed suppliers) combine their advice with a product transfer. The extension cost is in this case implicitly included in the product price.

Public extension services get incentives through diverse channels, such as the farm advisory system and other RDP measures, extension programmes on public issues and project funding. Within the agricultural chambers, elections shape the activities and incentive system. The budget is a combination of funding by the members and the government. The UK also has a levy approach within the Agriculture and Horticulture Development Board which funds applied research and related knowledge transfer/exchange to improve the competitiveness of producers in the main farming sectors.

Box 5.13 Recognition of advisory centers (Estonia)

In Estonia, there are 15 advisory centers, one in each county, mostly private and non-profit organizations related to producers or farmers unions. However, to guarantee the certain level of the services in every county, all of the centers have fulfill certain requirements (e.g. number of advisors, fields of services provided, action plan for the near future, etc.) and have been approved as advisory centers by the minister of agriculture.

Source: Ministry of Agriculture

Support systems

As with the private extension services, the government support to support systems is almost absent in this subsystem and will thus not be discussed.

Agricultural education

The funding to secondary education in the agricultural field is generally based upon the number of students (enrolled and/or graduated), the types of studies, the school and student characteristics, the teachers professionalism, student outcomes, human resources, population and age of the scholars.

Similar to secondary education, universities are funded based upon the number of students (enrolled and/or graduated) and the types of studies. Other elements are didactics evaluation (number of professors versus numbers of students, number of graduates employed) and operation costs. Often a historical basis is combined with a rewarding basis (e.g. in Italy and the Netherlands).

5.4.2 Incentives for coordination between subsystems

Although the components of the knowledge and innovation systems react to different incentives, examples of collaboration can be found in practice. A common content, proximity, mutual advantages and institutional coordination activities are the main drivers of interaction between AKIS subsystems. When it is obvious that the advantages exceed the transaction costs, cooperation is more likely to come from the actors themselves. When this is not the case, government support or illustration of benefits will be needed to stimulate actors to do so. In some countries, experiments can be found where governments provide incentives to actively stimulate these relationships, albeit sometimes on a rather ad hoc basis (without a clear or general strategy).

Overlap of actors and staff between subsystems provides a first element for further collaboration, but this interaction is also supported by the knowledge flows and the translation into practice. Examples of initiatives that stimulate such interaction are the Dutch initiatives Innovation Network and Transforum. Also in the Netherlands, applied research projects can dedicate 10% of the budget on communication and dissemination, in order to better valorise research results and the so-called "Green Knowledge Cooperative" has a budget to link educational institutes between themselves and with research. Universities of Applied Sciences in Switzerland have to offer higher education (mostly public funding) while at the same time carry out projects of applied research (mostly private funding).

Other interactions are driven by businesses and farm managers who need research support to explore their innovative ideas. Several countries have specific support schemes to stimulate this type of interaction. The Dutch SBIR (Small Business Innovation Research), the R&D support programme for private sector, university and non-governmental organisations in Turkey and the Flemish Collaboration on Innovation program are only a few examples.

Other ways of stimulating the relationships between subsystems are the coordination of innovation driven research by independent task forces (organics and multifunctional agriculture, Netherlands), joint technological networks, European Technology Platforms, innovation networks to link innovative ideas, entrepreneurs and knowledge institutes in specific innovation projects.

Box 5.14 Joint Technological Networks (France)

Joint Technological Networks are innovating partnerships between research or university, applied research, extension, higher and secondary education. They were created by the Ministry of Agriculture which provides funds devoted to management costs during a 5-year period. They aim at organizing synergies between AKIS actors in order to promote innovation by de-fragmenting research, development and education, and to form a visible, recognised competences group that can be mobilised by professional organisations or decision makers. An a priori assessment process selects networks which have identified common challenges and priorities and which present a consistent program and partnership. Networking promotes co-learning between different actors with various disciplines and professional activities. Joint Technological Networks provide expertise centers (state-of-the art, thematic synthesis, resource pooling) and a place for the emergence of common innovative projects with a real leverage effect. Dissemination and valorisation are central objectives, the products being tailored to end-users (for extension, research or education) with various communication vectors.

Source: http://www.gis-relance-agronomique.fr/Dispositifs-en-interaction-avec-le-GIS-Relance-agronomique/Les-RMT

Box 5.15 InnovationNetwork (the Netherlands)

InnovationNetwork develops ground-breaking innovations in agriculture, agribusiness, food and green spatial planning and ensures that stakeholders put these into practice. These innovations are focused on long-term sustainable development. InnovationNetwork seeks to kick-start these ground-breaking innovations by developing breakthrough concepts which, once implemented, catalyze radical and far-reaching change.The concepts are aimed at pursuing new ideas and perspectives - by abandoning established assumptions (such as with the Network's Temporary Nature concept), by embracing far-reaching ambitions (such as with Antibiotics-Free Chains and the North Sea Fisheries Projects), or by embracing a revolutionary new approach (such as with Market for Manure). Far-reaching changes can never be brought about by a single organization, no matter how big. So InnovationNetwork cooperates with many stakeholders. The organization consists of a bureau with a limited number of staff, a director and a board. Together they work on projects with an extensive network of parties comprising changing coalitions of civil society organizations, businesses, government agencies and research institutes. InnovationNetwork was set up by the Ministry of Economics, Agriculture & Innovation (EL&I). InnovationNetwork is also affiliated with this Ministry, but fulfils its tasks from a position of independence, under the management of its own board.

Source: www.innovatienetwerk.org

Box 5.16 European Technology Platforms

European Technology Platforms (ETPs) provide a framework for stakeholders, led by industry, to define research priorities and action plans on a number of technological areas where achieving EU growth, competitiveness and sustainability requires major research and technological advances in the medium to long term. Some European Technology Platforms are loose networks that come together in annual meetings, but others are establishing legal structures with membership fees. They work on developing and updating agendas of research priorities for their particular sector. These agendas constitute valuable input to define European research funding schemes. Since they are developed through dialogue among industrial and public researchers and national government representatives, they also contribute to create consensus and to improve alignment of investment efforts. Avoiding duplication and making the most of poles of excellence and best practices is one of the great challenges of European research, and ETPs are a very good vehicle to improve synergies. ETPs foster effective public-private partnerships, contributing significantly to the development of a European Research Area of knowledge for growth. Public-private partnerships can address technological challenges that could be key for sustainable development, for the improved delivery of public services and for the restructuring of traditional industrial sectors. The European Commission does not own or manage European Technology Platforms, which are independent organisations. The European Commission did, however, support their creation and remains engaged with them in structural dialogue on research issues.

Source: http://cordis.europa.eu/technology-platforms/

Box 5.17 Floriculture Technology and Innovation Network (Sietinet, Flanders)

The Floriculture Technology and Innovation Network SIETINET (Sierteelt Technologie en Innovatie Netwerk) has grown from the Flemish ornamental companies' strong focus on innovation, which has led to an important role in the world market. Nevertheless, the companies should also deal with an increasing pressure from international competitors. Technological advances are important to remain competitive and the companies can thereby rely on the leading position of Flemish knowledge institutes and to access to scientific knowledge worldwide.But the translation of research results into practice doesn't always go smoothly and it is not always clear for companies which ideas are feasible. Therefore, innovative companies in the horticultural industry and knowledge institutes together gave rise to SIETINET in 2004. In 2008, IWT granted support to the continuation of this cooperation by a four years subsidy. The subsidy covers 80% of the costs and the remaining 20% is paid by the participating companies.So far, sixty floriculture companies and nine knowledge institutes have joined the network. Through this collaboration, recently developed techniques in plant biotechnology are now easier accessible and can help the innovation process. SIETINET employs a technology consultant (based in ILVO), which ensures a smooth flow of information from scientific research into Flemish floriculture companies. Recently developed techniques in the fields of in vitro technology and processing, plant physiology and growth regulators, DNA marker technology and genes are made accessible, but the technology consultant can also help in the innovation process as product innovation and improvement are crucial for the Flemish ornamental growers.The members are informed through various channels: technological advice by phone, mail or farm visit, profound technological advice (research custom of the company), workshops, symposia, newsletter, mailing literature bimonthly and a website (with protected members' area).

Based upon http://www.sietinet.be/

The relationship and interaction between support systems and extension is a very particular and difficult one to tackle. While both systems are integrated in Italy, this is not the case in other countries. Coordination by the government (through EU and own funds) is one way to better align both systems. In Hungary, for example, the Ministry of Rural Development controls the Farm Advisory System, and funds both that and the Farm Information System (through EU funds), and the Network of Village Agronomists from its own budget. In the UK, from January 2012, the Farm Advisory Service expanded an original focus on cross-compliance to include nutrient-management, competitiveness, climate change adaptation and mitigation and provides routes to relevant online information.

Throughout all types of interactions, the internet has played a crucial role. As actors in the AKIS are spread across countries, web-based instruments are a helpful tool to make knowledge and information available. This evolution towards a knowledge exchange approach should enable greater participation in comparison with a knowledge transfer approach (Spedding, 2010). It is however difficult to measure the use and degree of cooperation initiated by these instruments.

Particular cases of cooperation between different actors is shown in the following boxes on floriculture in Flanders, fruit growing in Latvia and F1 vegetable seed production in Turkey.

Box 5.18 Latvia State Institute of Fruit-Growing (Latvia)

LSIFG is an entry point in extended knowledge and praxis complex. The institute employs 60 researchers, collaborates with Latvian Fruit Growers Association (Latvijas Augļkopju asociācija) with more than 300 members. The forms of cooperation include research, demonstrations, consultations, product innovation, popularization of science. LSIFG is engaged in many activities: research, extension, education, cultural activities, international collaboration etc. The institute is a leading organization in two broader collaborative arrangements under formation: the Latvia Food Platform (in collaboration with food industry and enterprises), and the State Research Centre for Agriculture and Food industry (in collaboration with other research institutes). Thus the case would provide multiple knowledge flows and learning between farmers, scientists, entrepreneurs, policy makers and other actors. There is a strong element of knowledge brokerage that can be studied in this case as well as changing roles and identities of researchers. The case potentially might illuminate also the young researchers as knowledge brokers and women researchers as pioneers in knowledge brokering. The proposed LINSA is interesting because the network is very diverse and there are many directions of knowledge exchange and forms of learning. LINSA as an exemplar of broader transformation of knowledge systems in Latvia characterised by universities, research institutes, policy makers, market actors and civil society opening-up for cooperation. The director of LSIFG is interested to collaborate with SOLINSA project. Although this is not farmers' network per se, farmers' involvement is strong through collaboration with LAA, several micro initiatives at local level (e.g. Pūres dzirnas – a mobile juice making equipment), individual relations with fruit growers and processors. LSIFG develops its own definitions of sustainability, like maintaining the local varieties, preserving the horticulture tradition, establishing links between horticulture, tourism and cultural activities, applying integrated pest management. Actors: research institute, state research centre, Latvia Food Platform, Latvian Fruit Growers Association, fruit growers, farmers, municipality.

Source: Latvian Solinsa case

Box 5.19 F1 hybrida vegetable seed production (Turkey)

Considering private seed companies and farmers demands, a special project "Development of F1 hybrid vegetable varieties and public private partnership for seed production" was initiated in 2004 in Turkey with the co-operation of 5 research institutes of MoFAL/GDAR, 6 public and 1 private university and 30 private seed companies. In addition to this, extension services of MoFAL, seed sellers, farmers, consumers, input suppliers (fertilizers, equipment, pesticide etc.) have also involved in this project. The Government encourages the private sector by providing infrastructure and incentives, facilitates interaction between actors.The main goal of the project is to increase the usage of hybrid seeds derived from local varieties from 10 % in 2004 to 60 % at the end of the project (in 2014).The other objectives of the project are to train of technical stuffs from public and private sector, to develop inbred materials with high quality characteristics (in plant breeding, inbred lines are used as stocks for the creation of hybrid lines), to test them against biotic-abiotic stresses and nematodes and to deliver these inbred lines to private sectors. By using these lines, private sectors can develop new commercial hybrid varieties. It is also expected that collaborations between researchers and private companies from the agricultural sector can foster long-term partnerships across sectors and improve the transfer of research results into innovative applications Although this is a good example for public research, academia and private company collaboration in the agricultural sector, there is a necessity for completing the cycle of innovation by full integration of farmers, seed associations, supporting organizations, consumers etc.

a) Hybrid Seed: seed produced by the first generation obtained from crossing parental forms.
Source: www.tagem.gov.tr and www.batem.gov.tr

5.4.3 Coherence of incentives

The previous paragraphs have shown that incentives are in general specific to the AKIS components and that a clear incentive system for cooperation in the innovation network is absent. Only individual initiatives and isolated actions stimulate interaction. The Collaborative Working Group therefore did a first and cautious exploration of the coherence of incentives. The results strongly differ between countries/regions.

In Flanders, a system analysis of the instruments that support innovation in agriculture was carried out in 2010 (Vuylsteke & Van Gijseghem, 2010). The results show that the available incentives mainly support actors on the one hand and knowledge and learning processes on the other. The coherence of the instruments is judged to be good, but there is a lack of instruments that really contribute to innovation. More attention is needed for collaboration with actors outside agriculture (e.g. in the food chain).

The debate on the importance of the relationship between the AKS components has been a distinctive Italian approach for the last twenty years: if in the'90s the subject matter was the agricultural services system, in the last decade it was the agricultural knowledge network. The most important incentives used are legislative instruments and dedicated projects, but recently the attention on the links between the AKIS components has been reduced at all levels, also in connection with the FAS system and the other extension initiatives promoted by the EU rural development policy. Then the deregulation, typical of the network, is getting the upper hand over the coordination.

In Estonia, the different components of AKIS have been made available to the producers and other interested parties. The components of AKIS are financed by different development plans, which each have indicators, which need to be fulfilled. The progress of implementing the development plans are reported to the government and Parliament. Integration of findings should therefore happen at this level. However, the components of AKIS are also evaluated through studies and analyses to plan the further actions taken.

The Ministry of Rural Development is the key actor in Hungary, as it connects different subsystems. As salaries are low, the opportunity to earn extra money is the biggest incentive for AKIS actors. There is thus a strong incentive for, for example, university lecturers to engage in consultancy and this tends to encourage some integration in AKIS. There are however also many overlaps and a lack of cooperation between subsystems, while the links between educational and research institutions are inadequate.

In France, clusters and Agreenium are factors of cohesiveness and innovation. The same goes with mixed technological units and networks. Links between academia on one hand (public goods) and applied research/extension (private or sectoral interests) on the other hand are still weak due to collective perception and funding structure.

In Switzerland, the federal research institute Agroscope is led by a New Public Management Approach. The Swiss government has 4-year contracts with Agroscope expecting impacts of research. This leads to "an impact culture" and to a close collaboration with the national extension centre Agridea as well as with farmers.

Finally, the focus in the Netherlands is on the management of the triangle Industry – Government – Knowledge Institutes in order to maintain synergy. A set of questions thereby

arises: Is it useful to link private and public investments (and how)? Can effectiveness of research money be increased through more joint programming or other innovation instruments (e.g. venture capital)? How to adapt the triangle to have a better integration of education and applied research in the regions and to improve collaboration with non-agro industries and research institutes? How can the triangle contribute to solving the world food issue 2050? Which improvements in governance of the system are possible? Etc.

5.5 AKIS policy

5.5.1 General findings

Related to the issue of incentives is the analysis of AKIS policy in the countries. The analyses of the national and regional systems show that AKIS are indeed governed by public policy, but there are no consistent AKIS policies. Officially, an AKIS does not yet exist in legal terms, there is no legislation known so far, addressing such a whole system or such a collective government policy that addressed the nature, scope and role of AKS as an overall entity. The subsystems operate within separate, individual (and occasionally) combined policies for education, research, ST&I, industrial policy, rural development policy and/or SME policy. The question can however be asked if an integrated AKIS policy is really needed to reach the objectives or is it sufficient just to coherently combine the available information. Appropriate incentives will then be needed.

Some countries (like the Netherlands and Switzerland) see research and innovation programmes as a policy instrument to reach certain public goals (e.g. regarding the environment) and combine them with other types of regulation. The interaction with innovation in the private sector (like the food industry) is often weak, and not very clearly taken into account in designing policies.

An important point of concern is that the AKIS subsystems are governed by different policies and by multiple policy levels (EU, country, region). Although incentives might be used to stimulate collaboration, this can easily be disturbed by policy changes in one of the domains. This aspect has not been discussed in depth until now.

5.5.2 Policy dilemmas

The work within the CWG was an excellent opportunity to reflect upon the certain aspects of AKIS policy. The following paragraphs give an overview on issues such as the relationship between agricultural innovation instruments and general innovation policy, the stimulation of dissemination versus knowledge production, the costs and organisational structure of extension and other issues.

Interaction between agricultural and general innovation policy

A first dilemma that occurred during the discussions within the CWG was the interaction between agricultural and other policies e.g. economy and labour, energy and natural resources. Therefore innovation policy as well as the policies on education and extension, often exert influence in a horizontal fashion.

Agriculture is of course part of the global national knowledge system, with public and private funding and establishments, but the sector has also much specificity, due to its historical and

structural organization. From the evidence that was gathered in the national and regional cases, it can be concluded that agricultural issues are often the subject of a separate policy (and are thus not included in the general policy). The Common Agricultural Policy (mainly Rural Development Policy) is an important explaining factor for this observation.

In many cases, this split between agricultural and general policy issues is rather implicit. Only exceptionally (a recent policy study in Flanders is an example) are such discussions on coherence of policy tabled. The impacts of such coherency may also vary between actors. Where there is certainly a case for better integration with regard to non-agricultural businesses and farmers who diversify their activities toward food processing, tourism and renting out buildings, this may not necessarily be the case for traditional farming activities.

The discussions on the interactions between policy fields can take different forms but occur in multiple countries. In the Netherlands, the education and extension for multifunctional agriculture were discussed as the evidence showed a mismatch between the clear demands for improved competences, know-how and an improved organisation on the one hand and an unstructured and fragmented supply of education in the traditional green schools. An improved collaboration with traditional education and extension could overcome the dilemma and bring the multifunctional farmers closer to other SMEs in the rural area. However, instruments should be available to steer in a powerful way. A similar discussion can be identified on rural businesses and organic agriculture. Should organic farmers (as an example) be integrated in the traditional systems for education and extension or should separate channels exist? Arguments go in both directions. Integration could lead to a professionalization of organic agriculture, but a stronger focus on production and a conflict with the organic values are also possible. In Flanders, there was recently a discussion on the funding of agricultural research and the inclusion into the more general instruments for collective research. Integration of instruments could offer the agricultural knowledge institutions a larger budget, opportunities for cross-sectoral research, an improved involvement of the sector and a better valorisation of research results. Potential dangers were a higher percentage of co-funding, the absence of a budget warranty and less steering by the research institutes. A clear preference was expressed for a separate instrument of agriculture because of the identity of the sector, the inability of the sector to be more involved in research and the guaranteed budget.

Balance between dissemination of results and knowledge production

The balance between the dissemination of results to the users on the one hand and knowledge production on the other is a second policy dilemma for several countries. The objective is to stimulate researchers to pay more attention to dissemination activities. Alternative ways for knowledge dissemination for example concern publications in magazines, information days in the field, lectures and seminars, training of advisors, consultations via email and telephone and webpages. The current imbalance is mainly related to the fact that researchers are stimulated to produce scientific output and not for their efforts to disseminate and implement their results in the sector and the companies. The countries try to realize this shift in several ways, while the European Commission will implement the European Innovation Partnership “Productive and sustainable agriculture” with a similar objective.

Box 5.20 European Innovation Partnership "Productive and sustainable agriculture"

The concept of Innovation Partnershipsa refers to a tool that pools forces and interlinks a wide range of innovation-related actions. The EIP 'Agricultural Productivity and Sustainability' aims at fostering a competitive and sustainable agriculture that 'achieves more from less' input and works in harmony with the environment. The agricultural EIP aims at bridging the gap between research and farming practice, notably by facilitating communication and cooperation among stakeholders. EIPs are no policy instruments of their own: they aim to achieve synergies and EU value added through informing about opportunities, encouraging uptake, ensuring exchange on good practice and promising research results, and providing a systematic feedback on practice needs to the scientific community. Concrete actions of the EIP will be implemented primarily through the establishment of operational groups as key acting entities, involving actors such as farmers, scientists, advisors, enterprises, etc. These operational groups will share knowledge and constitute themselves around topics of their interest and carry out projects aimed at testing and applying innovative practices, processes, products, services and technologies. For funding concrete innovative action, the agricultural EIP will be implemented through actions of mainly two Union policies: Rural development policy provides co-funding for innovative actions of «operational groups» involving farmers, advisors, researchers, enterprises, and other actors. The key measures include 'cooperation', 'knowledge transfer', 'information actions', 'advisory services', 'investment' and 'business development'. EU research and innovation policy ('Horizon 2020') plays its key role in providing the knowledge base for innovative actions on the ground. Key actions feeding into the EIP include applied research projects, multi-actor approaches, cross-border and cluster initiatives, pilot and demonstration projects, as well as supporting innovation brokers and innovation centres. Whilst RD programmes act normally within the boundaries of national or regional programme areas, EU Research would mainly deliver at cross-regional, cross-border, or EU-level. Other policies, namely cohesion and education policy, might offer additional opportunities. As a key instrument of the EIP, the network facility will work as a mediator enhancing communication between science and practice and fostering cooperation. It will encourage the establishment of operational groups and support their work through seminars, data bases, and help desk functions. It will facilitate the effective flow of information beyond the local and regional level. . In order to widen the knowledge base and sharing of experience, operational groups would report back to the EIP network about their innovation actions. The EIP network will ensure the dissemination of results and help sharing experience about failures, lessons learned and good practice. The network facility will also screen relevant research results and add to giving orientation to the research agenda through collecting and communicating practice needs. The network will animate activities at EU, national, regional and local level, through informing interested actors, including programming authorities, about opportunities for innovative action and funding options. Thus, the network will help actors to use effectively the opportunities provided for by EU policies.

a) Europe 2020 Flagship Initiative Innovation Union: COM(2011)
Source: DG AGRI

In Turkey, two new instruments were established to address challenges such as farmer participation in technology development, the establishment of a strong network among institutions and putting R&D outcomes into practice. It concerns a R&D support programme to promote private sector involvement in agricultural research and a public-private structure that stimulates the private sector to develop R&D-projects and collaborative projects.

In Estonia the points of concern have been the reinforcement of the cooperation between researchers, agricultural advisers and agricultural producers; the precision, reliability and availability of scientific information and its distribution, but also the possibilities to integrate research, advice and production.

Some few years ago, Agroscope, the Swiss federal agricultural research institute, established so called expert groups, to accompany the institute's different departments. These groups are composed of the institute's main clients: representatives of the advisory system, of farmers' associations, environment protection groups and consumer organizations. The experts support Agroscope by identifying the needs and requirements Agroscope should address through research programmes and projects. At the same time, they are ambassadors of Agroscope's

achievements to their respective clients. On a more technical level, fora are set up between researchers and specialists of the branches. These specialists identify research needs, follow the research process and give feedback concerning problem solving.

A similar evolution can also be found in other countries, whereby the government not only supports research but also networking activities, co-operations and bottom-up approaches. Other options are "learning together"-approaches, the enhancement of R&D and extension capacity of knowledge producers and interactive learning mechanisms. An important remark is that incentives to collaborate do not suffice, but that there is also need for a tradition and experience in cooperation (also with non-scientific people) and for an infrastructure to invite and meet each other. Case studies are seen as a valuable approach to make success stories more visible.

Extension: Free or paid? Private or public?

Extension is a third field of policy dilemmas identified within the CWG. In this particular case, the dilemma is double. The cost and budget issue is a first element (Should farmers pay for extension services or should these be free?), while the second element concerns the balance between private and public (What can be realized by markets and private extension and what is the role of the state?).

The question of the paid services or not has multiple aspects. It is not only the issue of cost and budget-recovery, but also concerns the quality of the advice, the quality of advisors, individual versus collective extension and the advantages that can be realized through the advice. While some countries have already seen an evolution towards more paying services (e.g. Denmark, Germany, the Netherlands, the UK, Switzerland and France), the discussion is still open in others, with arguments for and against (table 5.1). It seems that paying services are more likely to be successful when they create additional added-value for the farmers and that they are unfeasible for public good aspects. Additionally, the move towards a greater private sector role means that there is increasingly a market value placed upon "information" underpinning advice that was previously considered freely available.

Table 5.1 Arguments pro and contra paying extension services

Pro	Contra
System not "market oriented"	Inclination of farmers to acquire information and to seek advice is already low
Opportunities for regulations on what services should be paid for and to define any rates of co-financing and any exempt groups	Lack of funds (and time) as a reason for not accessing paid services
The public funds can be redirected elsewhere	Farmers prefer to seek free advice
Procedures for accessing/claiming back funding to cover the cost of advice can be complicated and slow.	Paid services are less able to access the majority of farmers
Farmers value more, and so act on, advice they pay for directly	Farmers only pay for advice if (a) there is no free alternative or (b) if it is a prerequisite to receiving public funding support for their business or if the benefits of the advice are higher than its costs.

The discussion on the responsibility for extension (private actors versus the government) is closely related to the previous issue. Historically, governments had an important role in the extension services, but over time private actors become active in the advice and knowledge sector. This acceptance of paying services is not only linked to the added value realized through the advice, but is also linked to the increased complexity of agricultural practices, including legal, environmental and other requirements. One person is no longer capable of covering the entire spectrum of topics and service providers specialize on certain topics. In this evolution, farmers get a more state-of-the-art advice on recent technologies, but smaller and older farmers risk getting detached from the system.

Where the state services are not detached into the private service providers, they need to confront the challenge to realign them. Where the state is interested in providing quality advisory services and is ready to support advice given in significant fields. The Farm Advisory System is one of the ways to do so.

Organisation of extension

Next to the characteristics of extension, questions can also be raised about its organization. It for example concerns the need to define FAS, the necessity to eliminate parallel services and the involvement of farmers and other stakeholders in the shaping of advisory services.

A legal definition of FAS would lead to benefits like registered consultants (and exclusion of non-specialist advisors), simplicity towards the farmers on what advice is, official supervision and quality management, guaranteed focus on important themes and potentially a simple and efficient service. At the same time, disadvantages of such a legally defined service can be found. The system could be complex, restrictive and insufficiently responsive to the real needs of users, the supply of business-specific advice could be inadequate, the "broader" aspects of AKIS (such as universities, training and research institutes) and well-known and trusted service providers would be excluded from such a definition.

A similar approach can be used to analyse the benefits and disadvantages of parallel services. Arguments in favour of an elimination of parallel services are the costs. In addition a core of full-time, specialist advisors could be established. There is at present a lack of cooperation between the various networks that provide parallel services to farmers. One extension centre with a clear offer is easier for farmers. Disadvantages are the absence of choice options on source and form of the advice, a possible lower demand responsiveness and quality in the case of a monopoly.

A final element for discussion is the question whether farmers (and other stakeholders) should be involved in the planning and the shaping of advisory services. Positive effects would be that the farmers would have a better understanding of the available range of services, the services would better address the need, it would involve an evaluation by the users, non-core actors would have a bigger opportunity to integrate themselves into the service and it could build the farmers' trust in the system. Positive elements of such an involvement are a clearer understanding of the farmers' needs by experts. Adverse elements might be a bigger impact of the stakeholders with a greater political influence and the potential deviation from the policy priorities. Usually however, the latter relates to goals the advisory service has.

Box 5.21 Two level advisory system (Switzerland)

Although a small country, the advisory system in Switzerland is organized on two different levels. Information and advice to farmers is offered by extension services at the cantonal level. They cover activities in farmers' own private interests (in the sense of advisory services: information, technical advice in crop and animal production, socio-economic expertise in farm management) as well as providing services in public interests (in the sense of extension services like soil and water conservation or landscape protection). Hence, farmers partly finance these services. At the national level, the Agridea extension centre, an association of the cantons and several farmers' organizations, but mainly funded by the federal administration, is carrying out second-line support: training cantonal extension service staff, providing practical information in manuals and guidelines, supporting regional and national networks. Agridea therefore is a link between scientific research and farmers' own experience as well as between national and cantonal institutions.

Source: Agricultural Report, Swiss Federal Office for Agriculture

5.6 Monitoring of AKIS

From the beginning, the CWG had the objective to provide a starting point for the establishment of European monitoring device of the AKIS structures and their evaluation. This was seen as a crucially necessary tool for designing and evaluating AKIS policy formation and implementation, in the perspectives of the challenges ahead: to feed the world in the long term, in a sustainable way (AKIS kick-off report).

Monitoring systems and indicators in the member states

Monitoring of the entire AKIS in the member states is virtually absent, either in terms of input, system, or output. Countries in general monitor the AKIS components, but without regarding the linkages with other components and interaction with the budget. Even within subsystems, monitoring can differ according to instrument (e.g. dedicated funding versus structured funds in Italy: in the first case the monitoring and evaluating indicators are provided by their programs; in the second, the more consolidated assessment systems for education co-exist with only some experiences – not consolidated - of a systematic R&D evaluation).

Common indicators to monitor the research subsystem concern the scientific output (mainly PhDs and publications), intellectual property rights and budget spending. In some cases, indicators exist to measure and monitor the use of the knowledge generated (Netherlands). It is remarkable that there exists little in the way of impact indicators to measure research performance. One exception is the measurement of sales from new/improved products and processes in Turkey.

The extension system consists of an important part of rural development measures (such as the Farm Advisory Services), which are monitored and evaluated within that framework. Indicators used are for example the number of participants, the number of formation days and the themes addressed. The UK also has an example (at the research pilot stage) of a more integrated system, whereby the effectiveness is measured of the delivery of integrated advice, while reducing the burden on farmers. In the case of private extension services, the main governmental monitoring is the recognition or certification of the service providers. There is little or no further monitoring of the frequency and quality of the advices provided.

The number of students, the number of courses followed and the number of diplomas are the elements measured in education.

Finally, very little monitoring at farm level was mentioned. The European Farm Accountancy Data Network (FADN) can be a way to anchor such an innovation monitoring, as in the Netherlands. In the UK, national Farm Business and Practice Survey data are for example being used, in conjunction with socio-economic research, to understand processes of decision making by representative types (segments) of agri-business.

The overview illustrates that the identified indicators struggle with important shortcomings, as they are often only rudimentary, biased or overlapping. The indicators to measure research are more developed in comparison with innovation. There seems thus to exist a major inconsistency between the high level of attention to "innovation" in the policy domain and the lack of data and research for evidence-based policy. Many countries however mention evolutions and progress on this topic.

Box 5.22 Information system on the regional agricultural research (Italy)

This network system consists of an on-line database aiming at collecting and spreading information on regional research activities in the agri-food and agri-environmental sectors. It has been created and is managed by the National Institute for Agricultural Economics (INEA) on behalf of the Regional Representative Network of Agricultural Research, an interregional coordinating organization recognized by the Conference of Presidents of the Italian Regions and the Autonomous Provinces. The initiative started thanks to the Italian Regions' interest to coordinate their efforts in achieving a wide dissemination of knowledge and experience in the agricultural fields. The overall aim of the project is to provide the regional policy makers with a multimedia information system on the main aspects of the agricultural research financed and promoted by the Regions (institutions involved, projects, objectives, main contents, financial resources), in order to start up a coordinating process aimed at the appropriate allocation of the available financial resources.

Over time, other operational objectives have been added, such as:

- to promote an active participation of research institutes;
- to find a more efficient meeting point between agricultural research supply and demand.

At present, the on line-database contains the synthetic information on more than 1600 regional researches and produces statistics and analysis useful - to policy makers, researchers, etc. - for verifying the evolution of regional agricultural research in terms of funds, objectives and contents. The database requires only detecting the main phases of research, all easily classifiable (dropdown menu) according to shared classification. This experience can also be extended to other realities and even in the EU.

Source: Materia, Di Paolo, Budapest presentation (2011); OECD response, Italy ; http://www.bancadatiregioni.inea.it:5454/index.html

Reporting to parliament

Similar to the monitoring, there is no full reporting of the AKIS-functioning to the national parliaments, next to budgets. In several member states, the parliament is not informed with regard to innovation and education, in contrast to other policy areas. From time to time, policy review or evaluations (e.g. on the progress of rural development plans) may be provided to the parliament. Individual institutions (like universities) are sometimes required by law to report yearly to the parliament (for example in Flanders).

Although reporting is rather fragmented, parliaments can also initiate specific actions with regard to innovation. This was for example the case in UK with the House of Lords Inquiry on 'Innovation in EU agriculture' (2011). This inquiry explores how innovation in European agriculture can be encouraged in the context of new challenges such as climate change, water scarcity and the need to encourage sustainable improvements in output.

Considerations on an EU monitoring

Based on the country situations and the discussions in the working group, it appears that there is an added value for a European approach on AKIS. The full scope of elements and arguments is at this moment however insufficiently clear. There is certainly a good basis to start a platform for interaction. In this way, a platform for exchange between member states can be created with learning (and thus not monitoring) as a main objective. Such a forum could also help the European Commission and the member states to test ideas and to make the link to the upcoming European Innovation Partnership "Productive and sustainable agriculture".

The diversity at EU level (in comparison with member states) is a bottleneck in monitoring exercises. The analysis shows that there is no such thing as a European-wide AKIS and that this is not the objective. Innovation and knowledge transfer mainly occur within regional and/or national systems. member states do not see an added value in an obligatory reporting system, but want to develop a common understanding of the problem setting, want to learn together and want to stimulate interaction with research projects. A monitoring system should therefore have clear objectives. Monitoring could for example help member states to benchmark their incentive system, efforts and results, but could also facilitate learning with regard to policy development at EU level or realize other objectives.

Because of the fragmented monitoring in member states, it is appropriate to first realize a further integration at this level. It should be verified how the existing indicators and monitoring systems of the AKIS components can be further developed and how these evaluation systems can be linked, in a simple way, between subsystems.

5.7 Conclusions

The country experiences indicate that the theoretical concept of AKIS can be used to describe national or regional AKIS: they exist. The concept allows us to analyse the complex relationships between AKS subsystems, their gradual transformations, involvement of new actors and progression of new initiatives. There is however no "One size fits all" formula for what the ideal AKIS is. There are both similarities and differences between countries' AKIS, partly as a result of historical developments. Some countries have also restructured their AKIS considerably to tackle new challenges or realities.

It is clear that more scientific work is possible to support fact finding and discussions on AKIS and AKIS-policy. For instance could typologies of systems (in relation to strategies of regional food chains and policies) help to get some grip on the differences between 27 EU member states or 37 countries in the European Research Area.

When it comes to AKIS policy, it is clear that AKIS components are governed by quite different polices and that the actors react to other types of incentives. Consistent AKIS policies do not exist and the AKIS components are also governed by quite different incentives. Although the interaction, communication and collaboration between components are crucial, they react to different incentives. Research is often evaluated in terms of publications, citations, and excellence, while education is funded based upon student numbers. In extension, there is a wide variety of incentive mechanisms: payments by farmers, vouchers, subsidized programmes or input finance, to name a few. To improve interaction between subsystems, several countries have developed specific incentives, but these are at this moment still rather limited.

Monitoring of AKIS in terms of input -, , output- and impact indicators is limited. Indicators, monitoring and evaluations schemes exist for parts of the subsystem, but the overall AKIS monitoring is fragmented. An overarching EU monitoring device is therefore not an option at this moment. Countries should first integrate and coordinate their existing systems to realize an improved AKIS monitoring at the member state level. A learning platform where countries could exchange experiences and good practices can be shared will have a clearer added value at European level.

6 FORESIGHT

Text by Krijn J. Poppe based on discussions in the Collaborative Working Group

6.1 Introduction

Besides theoretical considerations (chapters 2, 3 and 4) and empirical observations on AKIS in the EU member states and affiliated countries (Chapter 5) it makes sense to look to the future, with the aim of understanding where AKIS are heading and if they are fit for the future.

In the next section some attention is paid to the current situation in the economy at large and the food markets. Section 6.3 is looking further into the future, based on the 3rd Foresight report of the SCAR Collaborative Working Group. In section 6.4 we report the discussions within this Collaborative Working Group on foresight aspects of AKIS.

6.2 The current economic situation

Over the last two years, the period in which this Collaborative Working Group was active, the economic outlook has deteriorated strongly. The booming economy of the last decade has turned in to a severe stagnation. The financial and sovereign debt crisis has led to characterisations by leading European politicians as 'the biggest crisis in the life of the Euro" and even "in the existence of the EU" or "since the depression".

That these claims are not too much exaggerated can be shown by figure 6.1 that is based on historic-economic analysis in long term business cycles by Carlota Perez (2002). This theory states that economic development since the first industrial revolution is driven by technological-economic cycles (waves) that take about 50-60 years to complete. These waves start with a new technology that is not necessarily a new invention (the car existed for 25 years as a toy for the rich before Henry Ford made it cheap to produce) but starts to become cheaper and cheaper (the microchip that Gordon Moore invented in 1971 still doubles in capacity / halves in price every 18 months) at such a startling speed that it has big effects on how we can organise society.

This breakthrough typically happens in a period of standstill and capital searching for new options. After this irruption phase in which technology is leading, investors and society becomes too enthusiastic. There is overinvestment ('new economy', old paradigms for prudent investment are declared non relevant as this time is different) resulting in a financial bubble. That leads to a crash.

According to this theory we are now in the 5th wave (or industrial revolution) with ICT as key technology and the current financial crisis (that started with the Nasdaq crisis in 2000 but only really spilled over to the real economy with the default of Lehmann Brothers in 2008) can be interpreted as the mid-life crisis of this ICT wave.

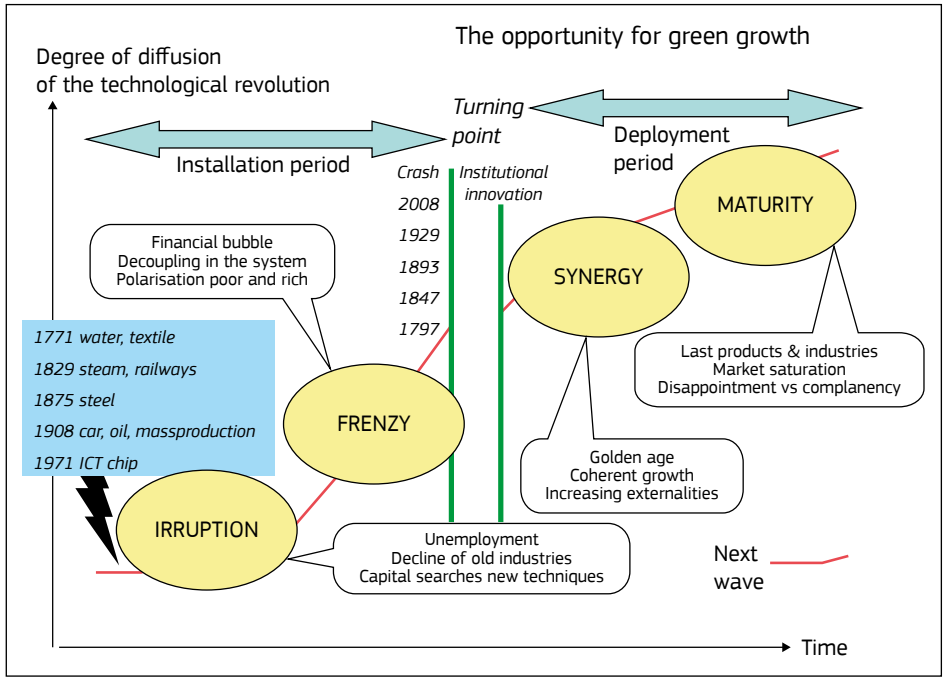
Historically such a period is a turning point that calls for (acceptance of) institutional innovation. New ways of working are accepted. Failures of the previous period are corrected and rules are put in place to make new technologies work in situations (older industries) that until now had not innovated with the new technology. Such a change can lead to an era of coherent growth, as for example happened in the 1950s. After that phase the technology has more and more walked its

course and not many profitable opportunities are left. Negative externalities (like the pollution we are confronted with from the previous wave) start to dominate and a certain level of disappointment with the technology can be sensed.

This narrative makes clear why the current economic situation is more than a normal hiccup in the economic machine, but a major crisis. It also makes clear why there are calls for institutional innovation, to renew our economic system and reduce the externalities of the previous wave. The OECD labels this "green growth". The EU has chosen the mantra "smart, sustainable and inclusive growth" that echoes a profit-planet-people approach.

Concerning agriculture and food it also makes clear that ICT could be a major driver in the few years. If drones are flying over Afghanistan, steered from faraway airbases, and metro line 1 in Paris does not need drivers anymore, one wonders how long it will take before we have unmanned tractors. Actually the Austrian company Fendt won a gold medal with a prototype on the 2011 Agritechnica in Hannover (that is controlled by the chauffeured tractor nearby which behaviour it mimics) and at a discussion on innovation under the Polish presidency a leading developer of the John Deere company explained that tractors already can do without a driver very well, but that liability considerations and the machines behind the tractor makes one necessary for the moment. This example is not given to predict but to show that in our economic system big transitions are going on, not unlike those in the 1930s and 1950s, that will have consequences for farming systems.

Figure 6.1 Long wave theory

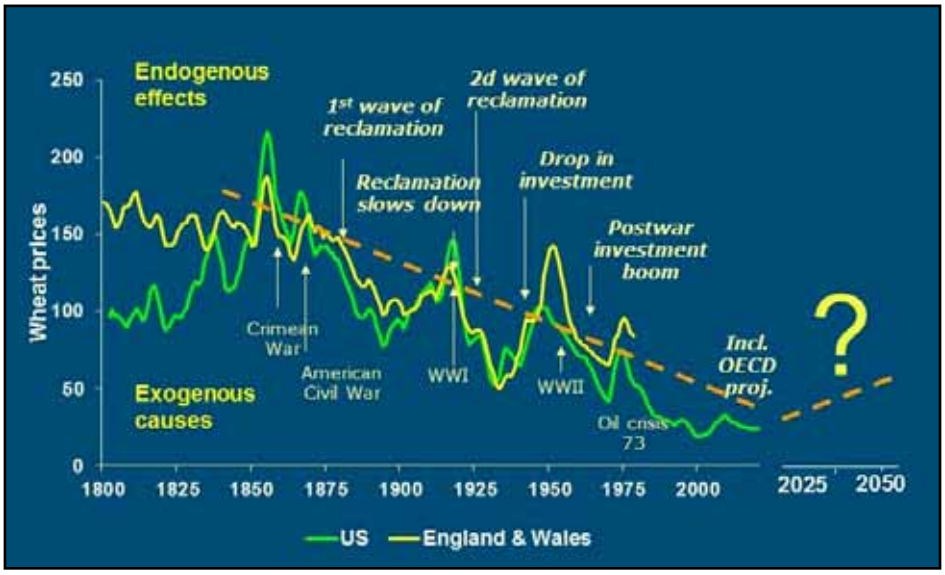


Source: Perez, 2002; see also Perez, 2010; Poppe, 2009

In addition to the transitions in the economic structure that could affect the economic situation in the coming years as well as the functioning of the EU, there is the recent turbulence in food

markets. Also here we take the long view. Figure 6.2 shows the development of cereal prices over the last 200 years, including the recent 2007/8 and 2010 price hikes and the OECD/FAO projections up to 2020. The figure illustrates that wheat prices (that are seen as quite representative for food prices in general) have come down over the last centuries, thanks to massive investment in land, infrastructure, international markets and science (fertilizers, chemicals, genetics, green revolution). From time to time crises in prices were needed as a wakeup call to trigger new investments. And although the current price hikes seem to be modest in historic perspective, and volatility at global level should not be overstressed, there is a need to invest in agriculture and food to meet the challenges for the coming decades. There is a general consensus that food prices will rise, and that the current period is a clear break with the past.

Figure 6.2 Long term trends in wheat prices



Source: N. Koning, Wageningen UR; OECD/FAO projections 2005-2020

Before we turn to that issue and its importance for AKIS into more detail in the next section, there is one other issue in the current economic situation that needs attention: the polarisation of agriculture. Statisticians are struggling with the definition of a farm, but on the broadest measure there are 13.7 million holdings in the EU-27. Nearly half of them (47%) are too small to be of any significance for food production other than self-subsistence. These farms[7] have 1.6% of production, but 23% of the agricultural work force is associated with these holdings. The real numbers are probably even higher as in some member states such farms are not counted as farms. Some of these farms are residential life-style farms that have (large) incomes from non-farming activities or pensions, most of them are very poor peasant holdings in eastern Europe.

Of the remaining group of 7.31 million holdings, a large part is also very small and contributing only marginally to food production. As (labour saving) technology develops much faster than farms restructure (farms that are too small to be viable mainly disappear at the moment the farmers retire and children have voted with their feet) this situation is inherent to the sector.

7. Technically: holdings smaller than 1 European Size Unit, Eurostat 2007 data

The EU labels about 5.4 million farms[8] (39% of the total number of holdings) as commercial due to their size and the fact they are responsible for over 90% of the production. Analysis of FADN data show that about 20% of the labour units (and that is even less farms) of this group of 5.4 million generates about 60% of the value added[9]. That suggest that less than 3 million holdings in the EU-27 are responsible for three quarter of the production and that this is the main target group to increase productivity and sustainability. It also suggests that on another 11 million holdings the challenges are more linked to social issues such as low income, poverty, hidden unemployment, lack of inclusiveness in society etc. It should be noted that the second group also includes very innovative farms with new farming systems such as services for nature management or health care, or have an income from farm shops or food processing, and is therefore a breeding place for innovation, but these are small numbers in most regions, still not well captured in standard statistics.

In addition to this polarisation there are also marked differences between different sectors in agriculture. For instance the vegetable sector contains clusters of relatively large holdings that grow their produce under glass or plastic (e.g in the Netherlands and Andalusia, Spain) or very integrated with the industry for canning and freezing (e.g. in West-Flanders, Belgium), where on the other hand there is small scale market gardening in for example Hungary. The innovation system in both is quite different. The same holds true if one compares for instance horticulture or dairy with sheep farming.

Taking all this polarisation into account is not only relevant for the differences in innovation challenges between the different classes of farming, but also for the structure of AKIS. The 3 million holdings that realise the bulk of food production are closely tight to the food chain and the innovation processes in the input and output industry. Most likely they also make much more use of commercial advise, accountants, bankers and the agricultural press. Their partners in the food chain are also becoming bigger and bigger, to realise economies of scale and be an attractive partner or countervailing power to the large international retail chains and their buying desks. Local cooperatives have made way for larger transnational cooperatives, and that trend will continue in the next years – compared to a market such as the US the European retail and food processing firms are still relatively small.

Integration of farming in the food chain via contracts and quality assurance schemes like BRC and GlobalGap will also increase. As agricultural processes become more programmable (and are less dependent on unpredictable natural events), investments are less general in nature (like a tractor) but become more tied to specific products (such as know-how on how to grow organic broccoli) and marketing is a joint effort of a producer group and a retail chain (such as with some new apple cultivars), more complex organisational forms appear, as relying on the spot market would be a big business risk for the parties in the food chain. Innovation and information becomes then more specific and valuable for business partners, which can have effects on the AKIS.

6.3 The SCAR's third foresight

This report started in its introduction with some quotes from the first and second foresight reports of the SCAR that emphasised the problems with the current AKIS and the need to address these problems. Parallel to the work of this Collaborative Working Group, a SCAR Expert Group (FEG3) has published a third foresight [EU SCAR, 2011].

8. Technically: the field of survey of the Farm Accountancy Data Network, 2007 report
9. Source: FADN 2011 report, graph 1.14

Where the previous section focussed on some major current trends and uncertainties, this 3rd Foresight exercise looks more into the future. Based on a review of more than 250 foresight studies published in recent years (a signal as such that we are living in uncertain times), it discusses the scarcities that we face. At a global scale the big question is how to feed 9 billion people in 2050, who have become richer and at the same time reduce the environmental pollution that is inherent with agriculture and food processing. The scarcities relate to:

- Climate change (and the role of livestock)
- Other environmental issues (such as water quality linked to crop protection and high stocking rates of animals)
- Loss of nature and biodiversity
- Energy-supply and the use of biomass in the biobased economy
- Phosphate availability
- Water availability
- Declining increases in (land) productivity improvement
- Resistance to industrialisation of agriculture (especially in livestock, animal welfare, use of antibiotics)

The 3rd Foresight report concludes that agriculture is in a process of transition. Different views on (desired) developments are normal in such a situation and learning from experimentation is one of the smarter things to do. To summarize the different views, the Foresight report developed two narratives: a productivity and a sufficiency narrative[10].

According to the *productivity narrative*, world population will increase to an estimated 9.2 billion people in 2050, while agricultural productivity increase has been slowing down over recent decades. Rising income levels in emerging countries will shift diets to include more protein rich food and will increase energy demand. At the same time, resource constraints and climate change will severely limit the world's capacity to expand food production. Hence, there is a serious threat that food demand will not be met in 2050, leading to more hunger and political instability. Science has the potential to develop technologies that can boost productivity whilst addressing resource scarcities and environmental problems. To achieve this, massive investments need to be made in R&D, in speeding up technology adoption by farmers and in addressing barriers in rural infrastructure, trade barriers and access to markets.

According to the *sufficiency narrative*, world population will increase to an estimated 9.2 billion people in 2050, which will lead to dramatic environmental problems as system Earth does not have the capacity to support expected rates of consumption. In addition, current food systems produce waste and over-consumption leading to mass health problems. The destruction of important ecosystems will have dramatic feedback effects that will undermine the foundations of our food systems, leading to more poverty and conflict. Science has the potential to develop technological solutions that are productive, reduce resource use and preserve biodiversity. However, to stay within the capacity of system Earth, demand increases need to be mitigated through behavioural change and structural changes in food systems and supply chains. Moreover, environmental externalities need to be internalised in markets through appropriate governance structures that also address the disruptive effect of unregulated trade.

10. The text in the remainder of this section is taken from the report

Implications for research

In the light of the major new challenges and uncertainties, the IAASTD (2009) concluded that our existing farming systems and the knowledge system that supports them are no longer fit-for-purpose and that a new approach is called for. Such an approach must enable the world to raise the productivity of agriculture in a sustainable manner and increase the resilience of systems to deliver food security, feed, fuel, fibre and other ecosystem services under current and future climate and resource availability.

Continued and increased investment in relevant research and innovation at EU and national levels is critical in addressing the transition to new food consumption and production patterns that respect the interlinked global scarcities. In particular, the Expert Group recommends that the EU must prioritise the development of an 8th Framework Programme that will place a primary focus on resource-conservation and a sustainable and knowledge-based economy, which will secure prosperity and social participation for all citizens in the European Union. A better understanding of the complexities surrounding scarcities and how they are linked is essential to ensuring that decisions are made that are conducive to the emergence of a more sustainable world. The EU could aid in the development of this understanding by including specific lines on these issues in the 8th Framework Programme. The Programme should progress the transition towards a mission-orientation for European research aiming to solve, as the Lund Declaration (2009) states, "the Grand Challenges of our time" (global warming, tightening supplies of energy, water and food).

The necessary transformation will not happen in the short term, and in the light of this the Expert Group proposes that two parallel and overlapping approaches are needed to ensure the realisation of the elements of a long term vision for European agriculture:

- Towards sustainable intensification of the elements of food production systems building on existing technologies and knowledge systems: The Expert Group recommends that sufficient publicly funded research is maintained at EU and national levels to ensure the development and adoption of new technologies that will enable farming practices to meet the diverse challenges of sustainability and increased production demands. The Expert Group also recommends that increased support be provided for research on the economic and social dimensions of these new technologies and farming practices. Approaches that promise building blocks towards low-input high-output systems, integrate historical knowledge and agro-ecological principles that use nature´s capacity should receive the highest priority for funding.
- Developing radically new farming systems: "Systems are needed that enhance sustainability while maintaining productivity in ways that protect the natural resource base and ecological provisioning of agricultural systems" [IAASTD, 2009, p.5]. Accordingly, the experts recommend that priority funding be allocated to integrated research and extension on farming systems that takes account of the interactions between productivity, environmental, economic and social sustainability goals and how such systems can be made more robust and resilient in the long run. Furthermore, in order to enhance two-way information exchange and strengthen adoption of new technologies, the experts recommend that new systems research programmes should involve participation by farmers or farmer-managed trials as one element. As these approaches only work if they are embedded in the regional context, they could be developed in pilot regions (cf. LEADER programmes). In general, this type of research does not attract private funding, so will need to be funded by the EU and member states. In particular, research

must pay renewed attention to the exploitation of feed resources in order to develop feed sources that are not competing to the same extent as they currently do with food for humans, in particular by taking advantage of the ability of ruminants to produce high quality products from grassland that is not suitable for other food crops and by maximising the use of by products and co-products in non-ruminant systems.

The Foresight group developed a set of principles upon which our food system in general and research concerning our agriculture and food system in particular should be based. The following principles concern research:

- Transdisciplinarity: research and innovation underpinning future food and agricultural systems should fully integrate the various sciences, including the social sciences and humanities, but be also transdisciplinary, that is, fully integrating the end user into research and innovation.
- Experimentation: research should be diverse, that is, ranging from blue sky research (fundamental research with no immediate applications) to applied research, but also based on different paradigms and narratives.
- Coordination and impact evaluation: research should be better coordinated across thematic domains as well as member states. At the same time, research impacts should be better monitored and evaluated.
- Public involvement: strong public investment in research remains crucial to safeguard all of the previous principles.

6.4 Foresight on AKIS

The Collaborative Working Group AKIS has reflected on the uncertainties that we face in developing AKIS and has taken the analyse above into account. These uncertainties have been mapped into a list of issues that influence the future of European AKIS:

- Globalisation versus localisation – which trend will dominate?
- Plenty or scarcity of food?
- The relation between the EU and its member states: a strong internal integration or not?
- How static or dynamic will the society and agriculture be?
- The role of climate change in agriculture and agricultural research: dominant or not?
- Will new actors from the biobased economy or big investors in land become more important?
- How will competences of the future farmers develop: are they much more trained than in the past or do we have a scarcity of farm managers and relatively many unskilled workers? Are they able to read English or are websites in future more or less automatically translatable?
- The rural demography: how empty will rural areas become and how remote (given ICT developments that can connect) will they be?
- How dominant will new technology, standards and regulation be?
- What will be the level of concentration in the industry and to which extent will social concerns be taken on board by the industry?
- How attractive will farming be (also as an education) ?

These uncertainties were used for a scenario analysis. There is not much experience with scenario analysis in foresight processes on AKIS. A Dutch study [Poppe et al., 2009] is probably

an exception. The Collaborative Working Group used the uncertainties to map some scenarios. The main driving forces for the future seem to be the global – local dimension, strong versus weak EU integration, big food international chains versus local production, the plenty versus scarcity issue, and a static versus dynamic society.

Combining and confronting such driving forces it seems that the current national / regional AKIS could develop into quite different forms over the next 30 years:

- The AKIS could develop into *one European AKIS* that caters for the 'blue sky' science driven research in some top universities that develop new technology in collaboration with big input and food processing industries, and drives applied research and extension. This form of AKIS is more likely in a situation of scarcity with an EU that focuses on central management (finance, determining objectives and themes) and a food chain dominated by large companies. In such a situation the EU is interested in investing funds in research to deal with scarcities and would like to do that in big programs (less transaction costs) with the big companies that also lobby for such facilities. These companies provide new technologies and advise to the 1 million farmers that dominate food production.
- The AKIS could merge into a *European (General) Knowledge system* where research on agriculture and food is integrated in thematic research programs for a group of industries. This form of AKIS is more likely in a situation with an EU that focusses on central management and a food chain dominated by large companies, but where scarcity of food is less of an issue and especially cross-industry innovation is seen as important to solve new challenges. Thematic programs focus on topics such as the future internet, logistics or biobased economy and agriculture is a 'case' within a large public-private research program. Interdisciplinary work and absorption capacity are then very important. Applied research and extension play that role. As above the large food- and input companies provide new technologies and advice to the 1 million farmers that dominate food production.
- The AKIS could develop into *diverse regional agricultural innovation systems*. This form of AKIS is more likely in a situation with an EU that focuses less on central management and more on managing spill-over effects between member states with a strong regional/national emphasis on food systems or a sustainable landscape in a situation with scarcities. Regional and local (large cities) authorities will than emphasise regional innovation, the blue sky research with strong spill-over effects will be harder to finance. The CAP is in such a scenario very much renationalised for example in the sense that regions can pick their options from a menu. In some regions this will develop into programmes for social innovation, in others for multifunctional agriculture and in others for innovation in food production. Such programmes will also reach many farmers that are not so dominating in food production, but are farming for other purposes and motives.

We remind the reader that scenarios are thinking exercises to analyse extremes, not predictions or stated preferences for a certain future and could be further expanded or combined. The current developments in AKIS, as reported in Chapter 5, show certain features of adaptability and experimentation. That is essential in times of transition. This implies that at a European scale member states and regional authorities as well as the EU institutions can learn from this diversity and use make optimal use of the opportunities.

7 REFLECTION AND RECOMMENDATIONS

Text by Krijn J. Poppe, based on discussions in the Collaborative Working Group

7.1 Introduction

In this Chapter the Collaborative Working Group (CWG) presents its major findings and recommendations. The material presented in the previous chapters was used for reflection in several meetings of the CWG. The next section presents seven major findings on AKIS. That is followed by a section with our reflection on innovation and its link with research. Section 7.4 discusses the European aspects of AKIS. We conclude with a recommendation to continue our work in a new CWG.

7.2 Seven major findings on AKIS

The material presented in the previous chapters and our discussions have brought us to seven major findings.

The **first major finding** to report is on the **usefulness of the AKIS concept.** AKIS is originally a theoretical concept (based in observations) that has been found relevant in the CWG to describe national or regional AKIS: they exist. Members of the CWG have been able to describe their national or regional systems in AKIS terms and find this useful to reflect on their policies. However, it is clear that national or regional situations differ strongly, for instance in institutional framework, in the competitive position and strategies of agriculture and the history of the country or region. This implies that there is no *one size fits all* formula for what the ideal AKIS is. It is also clear that more scientific work is possible to support fact finding and discussions on AKIS and AKIS-policy. For instance could typologies of systems (in relation to strategies of regional food chains and policies) help to get some grip on the differences between 27 EU member states or 37 countries in the European Research Area?

Second, AKIS are quite different between countries / regions and sectors. This is especially true for the link between (applied) research and farmers via extension. Some examples illustrate this (see Chapter 3):

- Mainly privatised systems for extension (e.g.: the Netherlands, the UK, some states in Germany) where the funding mainly comes from direct payments from farmers, but coupled with high state funding for research.
- Co-management between farmer organisations and the state (e.g. France, Finland and some states in Germany), with public funding, partial payments by farmers and farmer organisations.
- Semi-state management (e.g. Teagasc in Ireland which has a board with representatives from the state, industry and farmer organizations);
- Management by the state through regional organisations (e.g. Switzerland, Italy and Finland).
- Uncoordinated individual innovation nucleuses.

Within a country or region there can be quite different AKIS between sectors, e.g. glasshouse horticulture (with in some countries relatively large holdings), veal or processed vegetables (where the agribusiness often has an important influence) or sheep farming.

The Common Agricultural Policy has an obligation on member states to have a Farm Advisory Service (FAS), at least for advice on cross compliance. Member states have used quite different forms of implementation of this obligation, in line with their AKIS and the perceived needs of the sector.

There are several experiences with learning and innovation networks. Farm system innovation can be supported by such networks, but experiences differ.

There are not only differences between countries and sectors, there are also differences in time: AKIS are dynamic. **A third major finding** of the CWG is that **some countries have restructured their AKIS considerably.** For instance the Netherlands has privatised its state extension service and has merged its applied research and agricultural university into Wageningen University and Research Centre. It positions this Wageningen UR as a "third generation university" with innovation in its mission. Learning innovation networks are an important policy instrument to address systemic coordination issues. In France the development of AKIS is characterised by clustering in the so called *Pôle de competitivité* – a regional clustering with special projects to support consortia. Denmark is a similar example, where applied research was merged into universities in different regions. The obligation of the Common Agricultural Policy of the Farm Advisory System (to make extension available on cross compliance) has in Hungary led to the introduction of a Farm Advisory System in addition to Farm Information Service (organised by the Chambers of agriculture) and the Network of Village Agronomists (and agri-business). In Austria has recently announced an intensive collaboration between the different players in agricultural research. In the UK, the Agricultural and Horticultural Development Board (AHDB), funded by levies paid by the main production sectors, plays now a pivotal role in the delivery of knowledge transfer/ exchange to farmers and growers to improve their competitiveness sustainably.

A fourth finding of the CWG is that AKIS components are **governed by quite different incentives.** Although the communication and collaboration between the different components is seen as crucial, the components are driven by different incentives. Research is often evaluated in terms of publications, citations and 'excellence'. Education is often funded on student numbers. As suggested above, in extension there is a wide variety of incentive mechanisms: payments by farmers, vouchers, subsidised programmes or input finance, to name a view. In a food chain such an uncoordinated incentive scheme would be questionable, but it is not so clear that this is also an issue in a Systems of Innovation view that does not see innovation as a top down linear process. However the need for multi- and trans-disciplinary approach is often mentioned to overcome systemic problems in current agriculture. And in several cases it is noted that competition impedes cooperation between actors.

Related to this issue is the **fifth finding** of the CWG: AKIS are governed by public policy but **consistent, overarching AKIS policies are not apparent.** There are general policies for education and for research, sometimes by different Ministries. Some countries see research and innovation programs as a policy instrument to reach certain public goals (for example regarding the environment) and combine them with other types of regulation. The interaction with innovation in the private sector (such as the food and supply industry) is often weak, and not very clearly taken into account in designing policies. Questions can also be raised on the relationship

between agricultural innovation instruments and general innovation policy. Only exceptionally (a recent policy study in Flanders is an example) such discussions on coherence of policy are tabled.

Sixthly, monitoring of AKIS is fragmented, either in terms of input, system, or output. For the moment there seems to exist a major inconsistency between the high level of attention to "innovation" in the policy domain and the lack of data and research for evidence-based policy. Statistics and other data gathered mainly focuses on R&D in the food industry, on patents (Community Innovation System) and the number of publications of the research system and their citations (such as the Web of science). There are no monitoring reports for parliament or the public as is done in policy fields such as environmental issues or income support. However sometimes ex-post policy analysis of certain innovation programmes is carried out and made public in at least some countries.

Finally the future of AKIS is unclear as it faces uncertainty. In several foresight scenarios the AKIS is moving from a rather closed to a more open structure, to accommodate the heterogeneity of consumer demand and farming practices, supported by cheaper and easier information exchange in a time of experimenting and transition. That will bring in new stakeholders and contacts with other industrial sectors. This can be confusing as central governance is less effective.

Education seems to be a point of attention too. Financing and quality management (including staying up to date with the demands from industry on new competences and know how to be translated in new curricula) are often problematic, even more so in areas with declining populations, where children in the age group of 12 – 16 make their choice on travel distances.

In innovation that shapes the future of agriculture and food production, global multinationals play an important role (genetics, engineering), food companies (including cooperatives) in Europe are internationalising and in some cases levy organisations (such as commodity boards) are under pressure. This calls for reflection on private-public roles.

Research is relatively labour intensive and benefits from concentration itself. Although some of the increasing labour costs can be offset by productivity gains (ICT also transforms the laboratory, field experiments can sometimes be replaced by computer modelling) the still declining communication and travel costs can offer a solution too: research can be concentrated (smart specialisation) which will demand more intensive collaboration of users and funders, including the pooling of funds.

Combining and confronting such driving forces it seems that the current national / regional AKIS could develop into quite different forms over the next 30 years:

- The AKIS could develop into *one European AKIS* that caters for the 'blue sky' science driven research in some top universities that develop new technology in collaboration with big input and food processing industries. This form of AKIS is more likely in a situation of scarcity with an EU that focusses on central management (finance, determining objectives and themes) and a food chain dominated by large companies.
- The AKIS could merge into a *European (General) Knowledge system* where research on agriculture and food is integrated in thematic research programmes for a group of industries. This form of AKIS is more likely in a situation with an EU that focusses

on central management and a food chain dominated by large companies, but where scarcity of food is less of an issue and especially cross-industry innovation is seen as important to solve new challenges. Thematic programmes than focus on topics such as the future internet, logistics or biobased economy and agriculture is a 'case' within a large public-private research programme. Interdisciplinary work and absorption capacity are then very important, applied research and extension can play that role.

- The AKIS could develop into *diverse regional agricultural innovation systems*. This form of AKIS is more likely in a situation with an EU that focuses less on central management and more on managing spill-over effects between member states with a strong regional / national emphasis on food systems or a sustainable landscape in a situation with scarcities. Regional authorities will than emphasize regional innovation, the blue sky research with strong spill-over effects will be harder to finance. In some regions this will develop into programmes for social innovation, in others for multifunctional agriculture and in others for innovation in food production.

Such scenarios are not predictions, but illustrations that the future for AKIS is challenging and that systems are in transition. The current developments show certain features of adaptability and experimentation. This implies that at a European scale member states and regional authorities as well as the EU institutions can learn from this diversity and use make optimal use of the opportunities. Social innovation in the innovation system itself is challenging as well as promising.

7.3 Reflections on innovation

Innovation is first of all the responsibility of businesses. But it is a government responsibility too. Innovation has not only benefits for those who innovate, but also others win: future innovators as well as the clusters of business and the economy at large with a better competitive position and in the long run more jobs and higher incomes. These are so called positive externalities (spill-over effects) that an investor in innovation does not take into account and leads to under-investment in innovation. In agriculture this effect is especially strong as farms are small and successful innovations are easily copied. Farms are certainly too small to finance outsourced research, and therefor levy organisations (commodity boards etc.) and governments step in. This is the way to join forces for research and innovation in a fragmented sector.

A second reason for governments to promote innovation is that this is one of the policy instruments to reduce negative external effects such as environmental pollution in agriculture and food production (see table 3.1). Related to both arguments is the point made in the SCAR 3rd foresight report (EU SCAR, 2011) that agriculture and food production face a transition to a more sustainable business model in a resource-constrained world, and that this asks for experimenting with very different production and consumption patterns (such as algae, insects, reduced meat consumptions etc.) that current players in the system will not undertake. Challengers of the current industry need some support. In that sense the government has a "system responsibility".

In the current economic climate there is a great desire for innovation, also in the domain of agriculture and food. This raises the question "How to produce innovation". Within the AKIS concept the I of Innovation has been added rather recently and the relationship between Knowledge (Science) and Innovation is not always very clear. Given the mandate of the CWG to explore the relation between knowledge and agricultural innovation, and the current desire for innovation the CWG offers a number of reflections on innovation.

More agricultural research is necessary for innovation, but to do right to reality and to keep expectations realistic the CWG would like to make clear that innovation is not just an add-on to and resulting only from research.

First of all it should be noted that innovation is a social process that leads to a new product or production process or market. Already almost by definition (see Chapter 3) some process or marketing innovations can hardly be the result of an invention or scientific discovery. Innovation can be the result of a new scientific discovery but many innovations are not. A striking historic example is the three major insights that deeply restructured the automotive industry: Henry Ford's introduction of the conveyor belt to mass-produce cheap cars (after visiting a slaughter-house!), Alfred Sloan's organisational inventions that made General Motors an industry leader by product differentiation on common platforms and Toyota's Just-in-Time and related quality management methods. All these innovations created a lot of value added for the companies and their customers. But they were hardly built on scientific discoveries – science played more a role in understanding the innovations and translating them to other industries. In agriculture extension and applied research sometimes play the same role: try to understand why a successful strategy of an entrepreneur works in scientific terms and then generalise it for use in similar situations elsewhere.

That is not to say that science does not produce knowledge that cannot be used in innovation. One can also easily give examples of scientific breakthroughs that have led to significant societal progress. The green revolution and the invention of the computer are just some examples. The social value of that science has been very high. One has however to be very critical on the idea that there is a linear process from knowledge development to innovation, and that innovation can be promoted by more research dissemination.

It is much better to see science as a landscape that is needed to flourish innovation. Good education plays the same role. With those two in place, innovation benefits from institutions that reward innovation (e.g. intellectual property rights) and lower transaction costs (from attracting angel and venture capital to cross sector collaboration). In the end however the innovators need freedom in their choice of themes and partners: innovation is very much a bottom up process.

This view on innovation has consequences for innovation policies. As the OECD policy principles reported in Chapter 2 suggest, promoting innovation is not only on research policy but also on flexible labour markets, deregulation (a nice example is from Paris where in 1789 the regulation that coffee and wine could not be served in the same place was repealed and the 'brasserie' format became an export product), regulation (organic farming would not have been so quickly a success without a good regulated standard, like the GSM standard for mobile telephony) etc. When it comes to research, the process of agenda setting is probably just as important as research dissemination, as this empowers innovators.

Providing freedom to farmers and food chain companies to innovate and empowering them in this is a major challenge for the new Common Agricultural Policy, also as in the last 50 years the CAP's character was much more 'dirigiste' : setting prices and quota were central decisions. In giving freedom to innovators on themes and partners, choices are very much decentralised and government programmes are more difficult to monitor and audit. One needs to accept anyway that part of the money will be "wasted" (that means not lead to a successful innovation), otherwise governments would be doing what business (banks, stock market) can do (crowding out) - the main problem is that one does not know in advance which part will be unsuccessful.

To support the role of research in this innovation process, we strongly suggest distinguishing from now on two types of research based on their different motives:

- *Science driven research*, that leads to research driven innovation
- *Innovation driven research*.

The first one is the classical hierarchical flow from science to societal impact. Emerging science developments are important for research planning. Themes can be set centrally with stakeholder involvement as is currently done in FP7 or Joint Programming Initiatives or Technology Platforms. Science driven agricultural research is not only science for science (as carried out by the European Research Council) but also science for competitiveness and for society, linked to social issues. It is likely that this type of research can be done more efficiently at the EU level than in 27 member states plus their regions. Note that in agriculture and food many new technologies have always been coming from other science fields such as chemistry, ICT, engineering etc. Genetics is at the moment perhaps the exception to this rule. So for agriculture and food it is important to look where developments in certain disciplines can be gainfully linked to the problems and chances in agriculture. Cross-pollination can be fruitful here. The Systems of Innovation approach (Chapter 2) also suggest that the government might be active in linking sectors that do not normally co-innovate, such as agriculture and chemistry in bio-based economy or agriculture and logistics (in agri-logistics) or agriculture and health (on food and health) and why not agriculture and the creative industry (to create fun in food consumption and improve diets, or to link fashion to biodiversity issues)? Absorption capacity is an important aspect of the AKIS for such collaboration.

Innovation driven research is much more linked to empowerment of the potential innovators themselves, farmers and small business owners. As argued above: freedom to choose topics and partners is important. Choices will depend on the strategy of the actors and regional circumstances. Some regions heavily invest in agriculture and food, in others agriculture has much more a multifunctional role and the economy is focused on industrial or service activities. As the agricultural policy is a common policy that very much steers the decisions of farmers, the attention to innovation in the recent proposals from the European Commission for the CAP post-2013 are welcomed. The proposed "Operational Groups" can probably build on some of the positive experiences reported by member states with learning and innovation networks; links could be established with applied research institutes and agricultural schools that could probably act as innovation centres or innovation workshops (see Chapter 3 and 5). Farmers could link together in innovation processes with food chain partners, interest groups (non-government organisations - NGO's), government (regulation and deregulation!) and research. Extension could act as an innovation broker. Such settings (that could build upon best practices in policies such as Rural Development (incl. Leader), Interreg, the producer associations in fruit and vegetables and national public-private partnerships) could be a good start for innovation driven research, assuming the empowered farmers can set the agenda for such research. Where science driven research is mainly evaluated by impact in science (publications, citations etc.), innovation driven research should as much be evaluated on its practical relevance and potential. Quality of research at the researchers level can probably still be judged by classical output criteria, but the performance evaluation of research groups and institutes should include relevance as an important item. This calls for the development of evaluation criteria that are more suitable than the current ones.

Table 7.1 summarises the two types of motivations for research. Of course the interaction between the two types in the research community is very important for an optimal AKIS. There is a role for

professional societies in this respect, and some countries such as Denmark and the Netherlands have found it useful to institutionalise the collaboration even in the structure of their AKIS.

Table 7.1 Two types of motivation for research

Aspect	Science driven research	Innovation driven research
Incentive to program a topic	Emerging science that can contribute to solving a societal issue	An issue / problem in society that can be solved by new research, or a new idea to solve an existing issue
Participation of users	In demonstration phase / via research dissemination	In agenda setting and defining the problem
Quality criteria	Scientific quality	Relevance (for the sector or a region)
Focus	Individual organisations	Networks
Diffusion model	Linear model	System approach
Type of government policy	Science / Research Policy	Innovation Policy
Economic line of thinking (see Table 2.1)	Macro-economics	Systems of innovation
Finance	To a large extent public money: more speculative and large spill-over effects	Public-private partnerships very well possible
The role of the EU	Efficiency of scale (member states often too small), smart specialisation between member states, create European research market with harmonisation of hard- and soft infrastructures	Stimulate interaction and learning in Europe between national/regional AKIS. Enable in CAP innovation by networks with farmers
Typical EU examples	Horizon 2020, FP7, ERANETs (some of the work also aims at innovation driven research), Joint Programming Initiatives	CAP: European Innovation Partnership, LEADER, European Technology Platforms
Type of research	Interdisciplinary with absorption capacity in AKIS (to work with material science, ICT, chemistry etc).	Transdisciplinary

A last remark concerning innovation is a warning on its disruptive character. Innovation is nice for those who are successful, they and their clients benefit. As well does society at large. But innovation also has losers as many are not able to innovate or to adapt. The seller of e-books wins, the local family book shop closes. Speeding up innovation can therefor also have negative effects, especially in some vulnerable rural areas that become anyway more depopulated with less (government) services as a result. Social innovation (in its second and third meaning, see Chapter 4) to try to revitalise such communities is then an important issue. Social innovation with food, diets and urban farming can also be very important in towns and cities.

The disruptive character means also that current stakeholders are not always by definition the best innovators. Often it can be newcomers with a better business model that restructure a sector. That means that the government should have 'challenger facilities' and not always automatically support only the current operators in the food business.

7.4 The role of Europe

A report on AKIS on a European scale nearly automatically poses a question on the role of the European Union. Our findings make clear that there is not one European AKIS or a European AKIS that fulfils the seven functions of a knowledge and innovation system (see Chapter 2). AKIS exist at a national or regional (sub-national) level. In several of the aspects of AKIS, the European Union is limited in its mandate, education for instance is very much a (sub-)national domain – although the EU can have a major influence as the Bologna process and programmes like Erasmus Mundus show. In the domain of research most of the spending is done by the member states, the contribution of the EU is often quoted as about 5%.

As concluded in Chapter 6, the future of AKIS is also very much dependent on the institutional development in the EU and available budgets for AKIS in the member states. A closer union with an emphasis on research and innovation for agriculture will lead to a quite different process than a situation where the policies for agriculture are more stagnant or renationalised. Regardless of the dominant trend in the future, some reflections concerning the role of the EU in AKIS are relevant.

First of all the EU has an important mandate in realising and guaranteeing the common market for products and services. Especially in services, including research, innovation and extension activities, there is still a lot to be gained. That AKIS are very national is also due to the fact that spending of research money, recruitment of staff and target audiences of research and extension are very national with little incentives to internationalise. This lack of international competition in research and of cooperation in research funding most likely leads to a lack of specialisation and to inefficiency.

The EU has a natural role in science driven research, as efficiency of scale is a relevant issue in this domain. Seen the high (labour) cost of some of the research and educational components (e.g. university level / PhD training) and current (lower) travel and communication costs it is not to be expected that the optimal size and location of the AKIS institutes are those of 50 years ago. At the same time food companies are quickly internationalising to reap the benefits of the European market and deal with EU-wide retailers and choose new locations for research labs. Government budgets are under heavy pressure. These developments seems to call for an EU-led initiative to optimise science driven research in agriculture and food and see if more needs to be done than current ERA-Nets and JPI to get the best out of the European tax payers money. Such an initiative should not only concentrate on pooling funds, but also on other instruments such as harmonising hard and soft infrastructures (standards, laboratory facilities, accreditation procedures, quality management, training programmes etc.) and promote the exchange of researchers. The EU also has a natural role in fostering cooperation on global issues with other continents, including new players such as Brazil, China and India and science driven research is, as a more pre-competitive domain, more suitable for such cooperation than innovation driven science.

Concerning innovation driven science the national or regional AKIS seem to be the main systems and their role will be strengthened by the European Innovation Partnership in the CAP post-2013. In addition to stimulating innovation and innovation driven research in the rural development plans there are however additional roles for the EU. An important one is to have regions learning from each other. This learning could be on different levels. Regions could learn from benchmarking to see if their AKIS is still fit for purpose, or if better practices are available. Monitoring and benchmarking innovation in agriculture and food in Europe's regions with the use of the Farm Accountancy Data Network (FADN), Community Innovation System (CIS), JRC's R&D

scoreboard and the analytical country reports of the EU's ERA-Watch Research Inventory could be beneficial. This not as an audit but as a form of soft management to promote best practices.

Besides learning on AKIS between regions and member states, also a much better learning process could be organised concerning the innovations itself. As stated above the AKIS are national (or regional) and innovations do not diffuse automatically easily cross border. There is a role for the EU to promote such spill-overs, and especially to regions in central and eastern Europe that face lower productivity levels and lower levels of trust in sharing experiences. Exchange programs or study tours for agricultural journalists, (potential) board members of cooperatives, advisors in extension services, innovative farmers and teachers at agricultural schools should accompany those for researchers and students. Schools and agricultural cooperatives could be encouraged to establish a '*jumelage*' with a peer in another country, just as cities do.

7.5 Follow up of the CWG

With this report the mandate of the present CWG comes to an end. We feel however that the topic is so important in relation to the current developments in global food production and the attention to innovation that it needs the attention of the SCAR in the coming years too. There are many outstanding issues and unanswered questions. Ways should be found to include all members of the European Research Area in this work.

In our work it has become clear that there is quite some theoretical research available on innovation systems (Chapter 2) and AKIS (Chapter 3), but that the empirical know how on AKIS in the member states is scarce. That should be a worry for the SCAR and the European Commission as its interventions (from ERA networks to innovation in the CAP) depend on the AKIS to deliver their results. Discussing and judging ex-ante the effectiveness and efficiency of the policy interventions without a good (evidence-based) know-how by the EU and the member states of each other's AKIS is not a situation one wants to be in.

Chapter 5 of this report is a first attempt to describe some aspects but this is far from complete. Science policy is not only a management and political issue but also a scientific issue: more research on AKIS and AKIS policy is needed. The current call for such a descriptive research project in the FP7 programme could be a good first step.

Seen the importance of innovation, there is also a need for more research on the economic aspects of innovation, in addition to the sociological research carried out. Now that large sums are invested in innovation, some of the research spent in the past on for example the evaluation of the CAP should be addressed to this aspect of the CAP. Such research could include issues such as the measuring public and private spending on research, education and extension, cost/benefits of investments in innovation, the relationship between private benefits and public goods of innovation (and vice versa), the contribution to competitiveness of EU agriculture, incentives and disincentives to innovate and effective methods and indicators for monitoring and evaluation. Cost/benefit analysis should include the contribution to social objectives such as sustainability. The discipline could also contribute to institutional innovation and new business models in relation to consumer demand.

Given the turbulent times in research financing all over the EU, the need to increase investment in research and innovation in agriculture in the coming years and the attention of the new CAP on innovation, there is a need for the SCAR to follow the developments more closely in the future

too. The plenary SCAR meetings do not provide enough time for learning and reflections. We therefore propose to set up a new Collaborative Working Group on AKIS ("AKIS-2") with a new mandate. Some of the issues that this new CWG could study include:

- Learn from the experiences with innovation driven research. This includes for instance:
  - The experiences with innovation in the new CAP and provide reflection for the European Innovation Partnership for productive and sustainable agriculture.
  - Help to set up a regional benchmark report on innovation in agriculture (see above) and organise a yearly AKIS conference on trends and emerging topics related to innovation management in agriculture and AKIS.
  - Investigate how innovation (including the concept of social innovation) and AKIS can be promoted in the regional rural development plans.
  - Initiate work on measuring the relevance of applied research, in addition to the current criteria on scientific quality.
  - Initiate discussions on public-private collaboration in innovation driven research, including methods of finance and the role of levy organisations (commodity boards) and private industry.

- Initiate discussions on instruments to optimise the organisation of science driven research in agriculture and food in the European Research Area. This includes for instance:
  - See if more needs to be done than current ERA-Nets and JPI to get the best out of the European tax payers money.
  - Develop other tools than pooling of funds to optimise European science driven research (e.g. harmonisation of hard and soft infrastructures)

- Act as an advisory group and interact with the FP7 project on AKIS and making its results usable in policy making.

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Appendix 1

The making of - including a list of participants in activities of the Collaborative Working Group

The Collaborative Working Group started its work in spring 2010, after a proposal to SCAR in its June 2009 meeting by France (Pascal Bergeret, Ministry of Agriculture) and the Netherlands (Peter Keet, Ministry of Agriculture, Nature and Food) to start and lead the CWG on the links between knowledge and agricultural innovation in Europe. Pascal Bergeret and Krijn Poppe (Dutch Ministry of Economic Affairs, Agriculture and Innovation) were appointed as project managers / chairs of the CWG. The project plan included five work packages:

1. Reflection paper on AKIS – managed by Peter Keet
2. AKIS Policy – managed by Pascal Bergeret and Krijn Poppe
3. Social Innovation – managed by Krijn Poppe
4. Complexity and Porosity – later deleted due to lack of interest and relevance
5. Country Case Studies – managed by Owen Carton (Teagasc, Ireland)

The European Commission (DG RTD) provided funds to involve a group of experts:

- Mrs Dr Bettina B. Bock, Wageningen University (Bettina.Bock@wur.nl)
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- Mr Dr Talis Tisenkopfs, Baltic Studies Centre and University of Latvia, (Talis.tisenkopfs@lu.lv)

They wrote a reflection paper on AKIS for WP 1 and a briefing paper on Social Innovation for WP3. These papers have been made available on the SCAR website: (http://ec.europa.eu/research/agriculture/scar) and are included in this report in a shortened version as Chapter 3 and Chapter 4.

The CWG had meetings in 2010 in Brussels (twice, organised by Pascal Bergeret and by Anne Vuylsteke of the Flemish Government) and in 2011 in Dublin (organised by Owen Carton, Teagasc), Budapest (organised by Andrew Fieldsend, AKI), Tallinn (organised by Lehti Veeväli and Marja Malm (Ministry of Agriculture Estonia) and in Brussels (organised by Anne Vuylsteke and Michael Kügler, Chambers of Agriculture).

The end report was written by Krijn Poppe (in his capacity as Chief Science Officer of the Ministry of Economic Affairs, Agriculture and Innovation, the Netherlands) and Anne Vuylsteke (Chapter 5), with inclusion of the reflection paper and briefing paper by the experts. Andrew Fieldsend (AKI) checked the language of the most important parts of the final text. Mr Barna Kovács of DG RTD managed the publication process.

The discussions in the CWG benefited from feedback at dissemination presentations for the EURAGRI conferences in Helsinki (September 2010) and Prague (September 2011) and at the OECD conference on Agricultural Knowledge Systems in Paris (June 2011). The country reports and papers prepared for this OECD conference were also useful input. The CWG also benefitted from interaction with the SCAR 3rd Foresight Expert Group, the UK House of Lords Committee and the Solinsa project on this topic.

The CWG finalised the text for this report in January 2012. Its mandate ended in March 2012 with the presentation of the report at a conference in Brussels.

A list of participants to at least one of the CWG meetings is given below:

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The European Union's Standing Committee on Agricultural Research (SCAR) is mandated by the Council to play a major role in the coordination of agricultural research efforts across the European Research Area (currently 37 countries). This includes questions of advisory services, education, training and innovation. The SCAR installed a collaborative working group of civil servants from the Commission and the Member States to reflect on Agricultural Knowledge and Innovation Systems.

Innovation is an important challenge for European agriculture, but little is known about the performance of the Agricultural Knowledge and Innovation Systems (AKIS). This report gathers experiences from different countries and regions. These systems are very different between countries, regions and sectors. Although they are changing, there is no guarantee that they are fit to the challenges needed to increase productivity and sustainability in agriculture and food production.

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