European Commission

Agricultural Knowledge and Innovation Systems Towards 2020

– an orientation paper on linking innovation and research

Standing Committee on Agricultural Research (SCAR)
Collaborative Working Group AKIS-2

Research and Innovation

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Contact: Hans-Jörg Lutzeyer

E-mail: Hans-Joerg.Lutzeyer@ec.europa.eu
RTD-PUBLICATIONS@ec.europa.eu

European Commission
B-1049 Brussels

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Directorate-General for Research and Innovation
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Cover photo (© Prof.Dr. Ton Baars): Multi-actor project BIOVEEM (biologischeveehouderij management) with farmers, scientists and advisors discussing silage quality. BIOVEEM was a project on the management of organic dairy farms, on participatory, bottum-up improvement of organic dairy production in NL Partners: Wageningen-UR, Louis Bolk Institute, DLV, organic dairy farmers

Contents

Preface

Innovation is a key challenge in the current economic situation, also for agriculture. New policy initiatives have been taken, like the European Innovation Partnership for Agricultural Productivity and Sustainability.

This caused the Standing Committee on Agricultural Research (SCAR) to renew the mandate of its Collaborative Working Group (CWG) on Agricultural Knowledge and Innovation Systems (AKIS). The mandate included two expectations: a] collect and analyse experiences in EU Member States of interaction between players in the AKIS to foster innovation that could inspire operational groups and b] reflect on how such activities in the rural development programme can be linked to the European research instruments.

From the summer of 2012 to the autumn of 2013 the CWG has had an interesting and pleasant innovation journey which has resulted in the reflection offered in this report. The content is the responsibility of the CWG. We think it is important to share these results with a broader audience. However we also consider it to be a work in progress. SCAR has agreed to our recommendation to follow up this CWG with a new Strategic Working Group (SWG) 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 (EC) and the Pro-AKIS project for financing them. We thank the members of the CWG for their active participation, and especially those who have organised meetings and wrote parts of this report. More details are given in Appendix 6.

The first reflection paper of the CWG AKIS was very well received. We hope that this report will be equally useful.

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

Executive summary

S.1 Key message

Innovation is high on the agenda, in view of the deep economic crisis and the challenges of feeding 9 billion people in 2050 in a more sustainable way. For an effective and efficient response the Agricultural Knowledge and Innovation Systems (AKIS) needs to innovate itself and adopt new ways of working. This report contributes to organising this change, as it reports on experiences from different countries and regions that are useful for implementing the European Union's (EU) European Innovation Partnership (EIP) 'Agricultural Productivity and Sustainability' in relation to Horizon 2020.

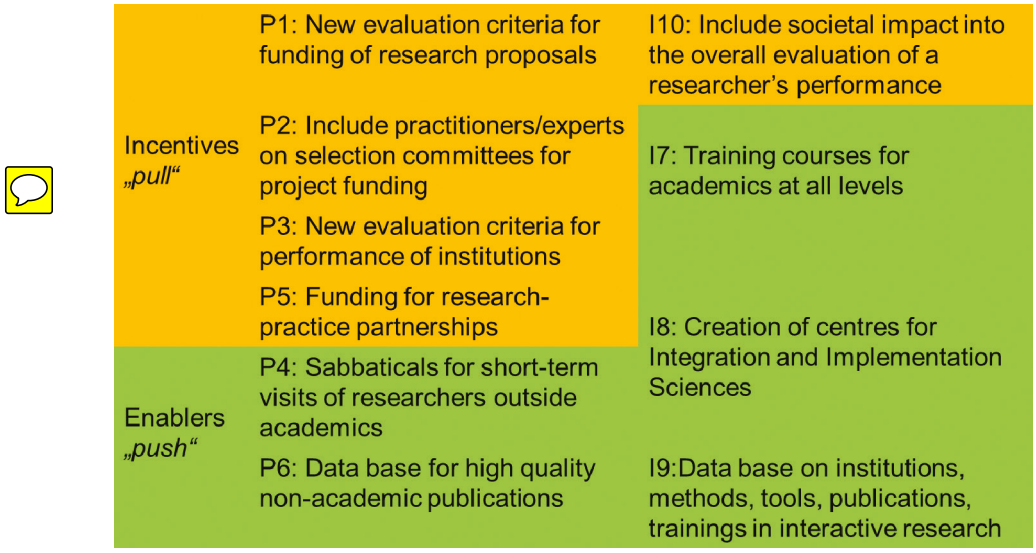
National and regional governments can stimulate innovation by implementing the EIP through multi-actor operational groups that work in a participatory way. This should be translated in an instrument portfolio that:

- Gives incentives for research, development and innovation;
- Stimulates knowledge exchange, adoption of innovation and technical application in the production process;
- Supports the activities of facilitators, innovation brokers and tutoring paths for farmers to implement innovations;
- Values the input and knowledge of farmers;
- Supports operational groups to develop cross-border interactions;
- Invests in AKIS-subsystems that have been underdeveloped in the specific national or regional situation.

Special attention is needed to incentivise research to be responsive to the needs of innovation processes. Figure S.1 presents ten recommendations (see Chapter 5). These include six potential changes at the level of research policy, e.g. the creation of evaluation criteria for both research proposals and research institutes to stimulate transdisciplinary and interactive research, the involvement of practitioners in research funding and evaluation processes, the support for sabbaticals and short-term visits to stimulate exchange of practices between stakeholders, the creation of funding for projects that involve science and practice on an equal footing and the establishment of an easily accessible database for high–quality, non-academic publications/ articles. The other four recommendations are formulated with regard to research institutions. They concern the development of targeted training courses to enhance the necessary skills for effective science-practice interaction, the creation of specialised centres and of a new discipline Integration and Implementation Sciences, the establishment of a database with information about institutions, methods, tools, publications and trainings on interactive research and, finally, including the assessment of a researcher's (non-academic) societal impact into the overall evaluation of his/her performance. The relevance of the recommendations will depend on the national or regional AKIS. But it is clear that at least for some of the Horizon 2020 project calls and national funded research better incentives can be installed to link innovation and research.

Multi-actor innovation might benefit from modern ICT support, comparable to how ICT (and in the last 10 years especially the worldwide web and social media, now enabled by smartphones) is changing working processes and collaboration in the rest of the daily life. There is great potential for using existing social software tools and platforms for communication, interaction, knowledge sharing, the preservation of information and, as such, stimulating multi-actor innovation.

Figure S.1 Ten recommendations on incentives and enablers to make research more responsive to innovation processes



Source: FIBL

S.2 Other important findings

The difference between innovation and research means that governments have more instruments than research to promote innovation. Extension and education, fiscal measures, credit guarantees, innovative procurement, inducements such as prizes and other incentives can help too. This implies that, in addition to a science and research policy, it makes sense to have an innovation policy. There is an important European dimension to innovation and innovation policies. Where cross-border collaboration in research clearly exists and increases, cross-border collaboration in innovation should be improved. This seems to be more of an issue as the research networks are biased to the oldest Member States/north-western Europe, and widening participation is a policy objective.

The operational groups can use existing experiences in the AKIS where innovative farmers develop successful new practices, products and services, or machinery and even software. One of the roles of AKIS always has been to work with those innovators in order to understand their innovation scientifically, standardise it and roll it out to other farmers. Another is to help farmers to solve questions and challenges that farmers encounter in an innovation process. This might call for innovation brokering, depending on the accessibility of the AKIS. Farm advisors with a good understanding of innovation and the AKIS might fulfil this role.

Governments should set a framework that provides continuity in the actions and activities of operational groups, introduces new methods to legally safeguard small to medium-sized enterprises' (SMEs') knowledge and facilitates partnership agreements, makes it easy to participate (low bureaucracy), gives operational groups an advantage in the application for support schemes, acknowledges the practical field experience of farmers and improves the accessibility of knowledge and the free availability of information. Innovations in innovation

policies are possible, such as the use of SBIR (Small Business Innovation Research programmes), vouchers and prizes as inducements.

Cross-border collaboration in research could benefit from a harmonisation of rules and procedures for commissioning research; to help create to a more integrated 'market' for research. That does not mean that national or regional authorities should give up their strategy and agenda setting processes, but they could adopt procedures to enable research institutes to more easily match national and international funds.

Concerning the use of ICT tools in innovation processes, it is not possible to predict which ICT tools (Table S.1) that will be best to use in a given situation, but focus should be on the end user and the purpose of the network. Regular updates in the content of the ICT tool, selecting first movers, ambassadors etc. may play an important role in a successful application.

Table S.1 Software types, evaluated tools (in bold text) and other examples of different types of tools and successful examples of their applications, mainly in agriculture

Software type	Tools evaluated	Successful examples
Knowledge portals (KP)	Search engines: Google, Yahoo Slide and document sharing: Slideshare Video and photo sharing: YouTube, Flickr	VOA3R, eXtension, Chil
E-document management systems (E-MS)	Digital libraries: Groen Kennisnet in NL, Organic Eprints	British Farming Forum, Lego Cuusoo, Climate CoLab, P&G Connect+Develop, Betacup Challenge
Data Warehouse (DW)	Eurostat, Farm Accountancy Data Network (FADN)	FADN
Groupware (GW)	Wikipedia, Yammer, Crowdsourcing	Disease surveillance and warning systems, IDRAMAP
Community of practice (CoP)	ResearchGate, Erfaland	AgTalk+, E-Agriculture, Jeunes-agricultuers, E-agriculture, Rede Inovar
Social communities of interest (SCI)	Facebook, LinkedIn, Google+, Ning, Quora	Organic Eprints, Agriwebinar
Individual communities of interest (ICI)	Wordpress, Twitter, Blogs	AG Chat

S.3 Background

The EU's Standing Committee on Agricultural Research (SCAR) is mandated by the Council of the EU 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. SCAR set up a Collaborative Working Group (CWG) with participants from the European Commission (EC) and the EU Member States (civil servants as well as researchers and extension workers) to reflect on AKIS. Its first report (*Agricultural Knowledge and Innovation Systems in Transition – a reflection paper*) was published

in March 2012. SCAR has asked the CWG to continue its work on the collection and analysis of experiences in EU Member States and at EU level of models and methods of interaction useful for fostering agricultural innovation. Special attention to the best practices in promoting innovation through operational groups was requested. Recommendations were sought on how to effectively link Rural Development Programmes with research activities in Horizon 2020 and its research instruments (EraNets, joint programming initiatives (JPIs), etc.) as well as the question as to what criteria, other than academic excellence, can be used to evaluate research.

The CWG asked experts to provide a paper on how to incentivise researchers to take part in innovation processes (reported in Chapter 5) and a paper on the role that ICT could play in innovation (included as Chapter 6). The members collected and presented material from their own countries in workshops (Chapter 4) and discussed their experience and the implications for the EIP. The reflection was very useful for the participants and for direct use for current policy development. In view of the challenges in this area and the focus on innovation in policy, we recommend SCAR follow up this CWG with a new group using an updated mandate to continue the work on outstanding questions and emerging issues.

1 INTRODUCTION

Text by Krijn J. Poppe

1.1 Innovation is top-of-mind

The current economic crisis has put innovation high on the policy agenda. In addition, recent worries about scarcities and the functioning of the food system, including negative (environmental) aspects of the production systems have led to calls for more innovation. These needs for innovation have also led to discussions on the organisation of the Agricultural Knowledge and Innovation Systems (AKIS).

Policy makers have reacted to these challenges by taking measures to speed up innovation in agriculture and the wider bio-based economy. At the level of the EU and the European Research Area (ERA) two policy initiatives, discussed in more detail in Chapter 3, have been put in place: the Horizon 2020 research programme and the European Innovation Partnership (EIP) for 'Agricultural Productivity and Sustainability'. Links between these two initiatives are foreseen, but need further development. It is one of the topics of this reflection paper.

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 EU Member States (and presided over by a representative of the EC), and has a mandate to advise the EC 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 ERA. 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 2006 in Krems (Austria), the ministers recommended 'that, in the framework of the Lisbon Strategy, the Standing Committee on Agricultural Research should invite EU Member States to include questions of advisory services, education, training and innovation in their discussions'.

In line with the renewed and extended SCAR mandate, the 2008 Communication from the EC 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 Collaborative Working Group'.

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'. In the 2009 meeting France and the Netherlands expressed their commitment to bringing together an *ad hoc* Collaborative Working Group (CWG AKIS).

The CWG AKIS started its work in spring 2010 and published the report *Agricultural Knowledge and Innovation Systems in Transition – a reflection paper* in spring 2012. The reflection paper gave an overview of thinking on innovation policy, the concept of AKIS and drew attention to the concept of social innovation. It documented experiences in the EU Member States and looked to the future. For the convenience of the reader Chapter 2 of this report summarises the main findings of that reflection paper, as this reports builds upon those results.

1.3 The renewed mandate for the Collaborative Working Group

In its first reflection paper the CWG AKIS proposed to set up a new CWG ('AKIS-2') with a new mandate, in view of the turbulent times and the issues still under discussion. The CWG members felt that given the need to increase investment in research and innovation and the attention given to innovation in the EU's new common agricultural policy (CAP), SCAR should maintain its focus on AKIS. The empirical knowledge and know-how on AKIS in the EU Member States is still scarce. Much remains to be done to provide good evidence-based know-how to policy-makers so that they can design and implement efficient and effective agriculture knowledge and innovation policy at EU and national levels. This proposal has been adopted by SCAR.

In addition, the EC's DG Agri approached the SCAR CWG with a proposal identifying some 'focus areas' where SCAR could be supportive for the setting up and implementation of the EIP 'Agricultural productivity and sustainability'. As a result the SCAR plenary decided that the CWG on AKIS should be continued with a renewed mandate. This new mandate includes:

- The collection and analysis of experiences in EU Member States and at EU level of models and methods of interaction useful to foster agricultural innovation: what are the best practices in promoting innovation through operational groups and how is it possible to transfer this experience in Europe; how is it possible to significantly improve the exchange of knowledge within Europe? How to promote education and training as a central element of innovation policy?
- The elaboration of recommendations on how to effectively link Rural Development Programmes with research activities in Horizon 2020, the EraNets, JPIs, etc. How could the rural development organisational set up and research/knowledge structural and programmatic structures tie together at regional, national, and European levels? Could researchers be more incentivised to interact with farmers and enterprises? On what criteria can we evaluate research, other than academic excellence?

The AKIS CWG with its renewed mandate has also be given the task of acting as an advisory group to DG AGRI and DG Research with regard to the EIP and to guide the work of 7th Framework Programme (FP7) projects tackling the issue of AKIS, such as the current SOLINSA and PRO AKIS projects or the policy support project on measuring the effectiveness of investment in Agricultural Research, likely to be included in the FP7 2013 work programme.

1.4 Working methods of the Collaborative Working Group (CWG)

The CWG is a network of civil servants (and some counterparts from research organisations) from the EU Member States and the EC. SCAR members endorsed the continuation of the AKIS CWG with a new mandate and stated their commitment to participate. France and the Netherlands were again available to jointly coordinate the CWG.

Given the tight timetable of the agricultural EIP (establishment of the EIP network facility before the end of 2012, elaboration of the EIP Strategic Implementation Plan and the first meeting of the High Level Steering Group in winter 2012/2013) and in order for the AKIS CWG to be in a position to support DG Agri in the writing of a strategic document with a sector approach by early 2013, the AKIS CWG has worked under high pressure during a short time period of about one year.

After a kick-off meeting (Brussels, June 2012), the work of the CWG was organised into five work sessions, each for two days:

1. Issues related to the definition and working methods of operational groups (September 2012, Brussels)
2. Innovation policy (November 2012, Rome)
3. Content of innovation themes in agriculture (January 2013, The Hague)
4. Cross-border aspects and the role of ICT in innovation (April 2013, Helsinki)
5. Motivation for extension/advisory services/education and research, including the issue of incentivising research to be relevant for innovation (June 2013, Dublin)

This programme was followed by a final meeting to discuss the end report (September 2013, Paris).

The EC requested the FP7 project PRO AKIS to make a small budget available for two studies. One concerned the issue of the incentives of researchers in academia to be active in innovation processes in farming or the food industry. This work is reported in Chapter 5. The other is the potential use of ICT in innovation processes. This study is reported in Chapter 6.

More details on the CWG, its composition and the way it carries out its work are given in Appendix 6 'The Making of'.

1.5 Introduction to the report

This report starts by restating in Chapter 2 some of the insights from the first reflection paper that are relevant to the discussion in this new report. We then describe the policy initiatives in the EU concerning the EIP and Horizon 2020 (Chapter 3). Readers familiar with the first reflection paper and the EU policy proposals can skip these chapters.

In Chapter 4 we give a number of reflections in relation to the questions raised in the mandate for the CWG (see above): we discuss the role of operational groups and innovation brokers for innovation at farm level. This is followed by a reflection on potential themes for innovation, in operational groups or the proposed focus groups of the network facility of the EIP. This is followed up with a reflection on innovative innovation policies that EU Member States could use to foster innovation and participation in the EIP. Cross-border collaboration in innovation is important for several reasons – one of them is that quite a lot of first class frontier research is carried out in north-western Europe, whereas eastern EU Member States and even some Mediterranean countries find themselves more at the periphery of developments. At the same time food business, and even some farmers, are internationalising. We also reflect on incentivising stakeholders, which preludes Chapter 5 that provides recommendations on this point.

Chapter 6 discusses the potential role of ICT in innovation processes. This role of ICT does not refer to innovation in farming with ICT, but on the question of the possibility that ICT, like in social media or *Wikipedia*, could be used to make innovation processes more effective and efficient. Appendix 5 provides information on some EU FP7 projects that readers might find interesting in terms of implementing the EIP and speeding up innovation. We end with an epilogue that also discusses the request from SCAR to continue the work on AKIS.

2 INNOVATION THINKING

Text by Krijn J. Poppe

2.1 Introduction

In this chapter we summarise the thinking of the CWG AKIS on innovation and innovation policy in European agriculture. The content of this chapter is based on the first reflection paper that the CWG published in 2012 and the following interactions with European policy-makers in discussions on the EIP and Horizon 2020. Starting from innovation theory (next section) we summarise the main findings of the first reflection paper on AKIS. That is followed by a section on the linkages between types of research and organisational arrangements, in particular in the European programmes.

2.2 Two theoretical views

Innovation is a broad concept. The Organisation for Economic Cooperation and Development (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. Innovation is often linked to businesses, but it should not be forgotten that the public domain, which is the other 50 % of the European economy, can also innovate. This includes the public aspects of agriculture ('multi-functionality'). And there is social innovation, a term that not only refers to the social aspects of innovation, but also to innovations in social life.

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 macroeconomic approach (Table 2.1).

The macroeconomic 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.

Table 2.1 Two views on innovation policy

	Mainstream macroeconomics	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: 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. Therefore an innovation policy is needed. However that innovation causes policy-making choices and is much more context-specific. 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 the direction of the search and identification of opportunities;
3. Entrepreneurial experimentation and the management of risk and uncertainty;
4. Market formation;
5. Resource mobilisation;
6. Legitimation;
7. Development of positive externalities.

Innovation systems can be analysed according to these functions, and blocking mechanisms to develop or improve these functions can be identified; this can be a basis for policy intervention.

2.3 Main findings reflection paper on AKIS

AKIS vary 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.

In confronting the AKIS in Europe with the theory, the CWG was able to draw eight conclusions in its first reflection paper:

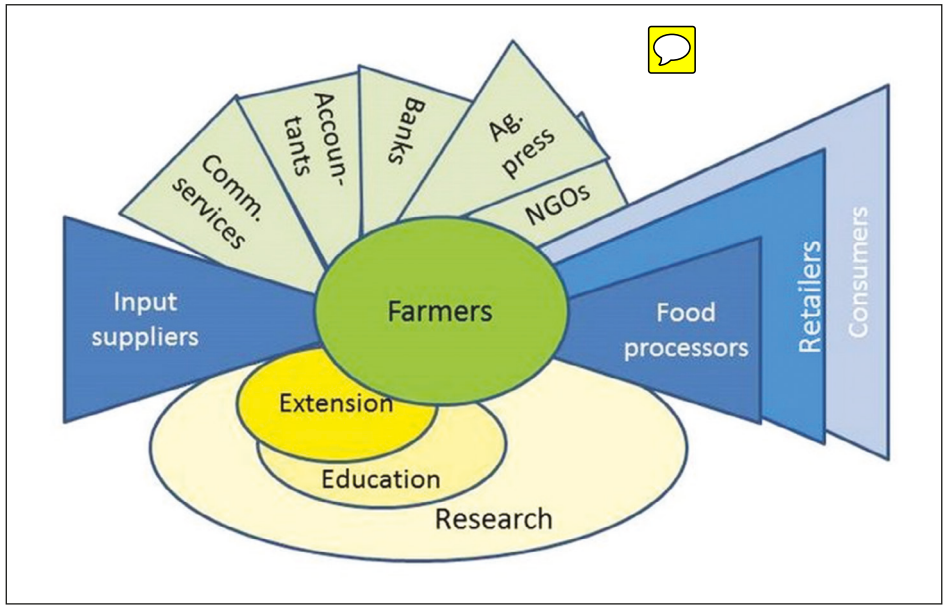
- AKIS was originally a theoretical concept (based in observations) that is relevant to describe national or regional AKIS: they exist;
- AKIS are quite different between countries and/or regions;
- Some countries have restructured their AKIS considerably;
- AKIS components are governed by different incentives;
- AKIS are governed by public policy but consistent AKIS policies do not exist;
- Monitoring of AKIS (input, system, output) is fragmented;
- The high level of attention to 'innovation' in the policy domain and the lack of research for evidence-based policy are inconsistent;
- They take different motives for research into account in research management, as shown in Table 2.2.

Different areas of AKIS, such as education, extension and research, face different challenges. They are also governed with different incentives, which can be problematic for synergy and cooperation within an AKIS. Education is often weakly connected to the other components. Applied research is often reviewed on scientific output, much less on relevance. Networking and cooperation between research, and the extension or farmers' groups, is to be promoted. Agenda setting by farmers and the food business is more important than more research dissemination. We therefore advocated a distinction between science-driven research and innovation-driven research. Programming, farmer/business involvement and the role of the EU are quite different in both types.

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 2.1).

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.

Figure 2.1 Actors in the AKIS directly relevant to agricultural innovation in the food chain



Source: This project
NB: 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 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 employment and higher incomes. These are so called positive 'externalities' (spill-over effects) that an investor in innovation does not take into account and lead to underinvestment in innovation. 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.

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 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.

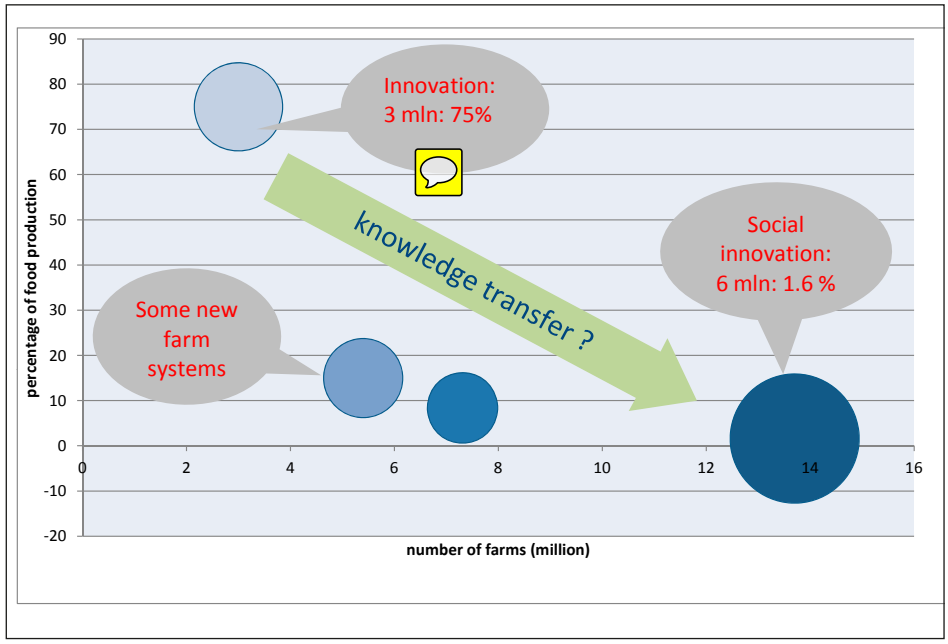
Table 2.2 Two types of motivation for research

Aspect	Science-driven research	Innovation-driven research
Incentive to programme 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)	Macroeconomics	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 are 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, JPIs	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 interactions.

Social innovation not only refers to the social aspects of the innovation process, or the objective that innovations should also be sustainable in the corporate social responsibility sense, but to the fact that social problems need innovative approaches. These include rural development in regions with ageing or declining populations, decreasing (governmental) service levels and (sometimes) uncompetitive agriculture. But also in poor neighbourhoods of big cities with high levels of unemployment and high rates of obesity, social innovation with urban farming and food projects can contribute to improved quality of life. Social innovation can go along with the desire to strengthen the link between urban life on the one hand, and food and the rural area on the other.

Farms in the EU are not a homogenous group; they produce very different products (from olives and goat's cheese to barley and flowers) with different technologies in different environmental conditions regarding soil and climate. Farm structures differ too. This all implies that a 'one-size-fits-all' solution is unlikely to be successful. Out of the 14 million holdings that are statistically counted as farms (and that includes airports as well as construction workers who live in the countryside or have a fiscal or social security incentive to stay on a farm) about 3 million are responsible for 75 % of the food production (Figure 2.2). Among these are the innovators who drive with the input, and the food industry which drives the technological innovation for higher production. At the other end of the spectrum there are millions of farms who essentially face problems of farm size, but also of a declining social fabric in the rural area, with public and commercial services closing down, few job opportunities etc. In between are farmers that are under pressure too, of which some groups are very innovative in developing new business models with, for example, 'slow food' products, care services, tourism etc. Environmental problems (including animal welfare, landscape issues etc.) are in many cases less related to farm size. This rough picture illustrates the diversity and suggests that quite different types of innovation and knowledge transfer can be needed.

Figure 2.2 Farms in the European Union, their contribution to food production and suggestions for the types of innovation



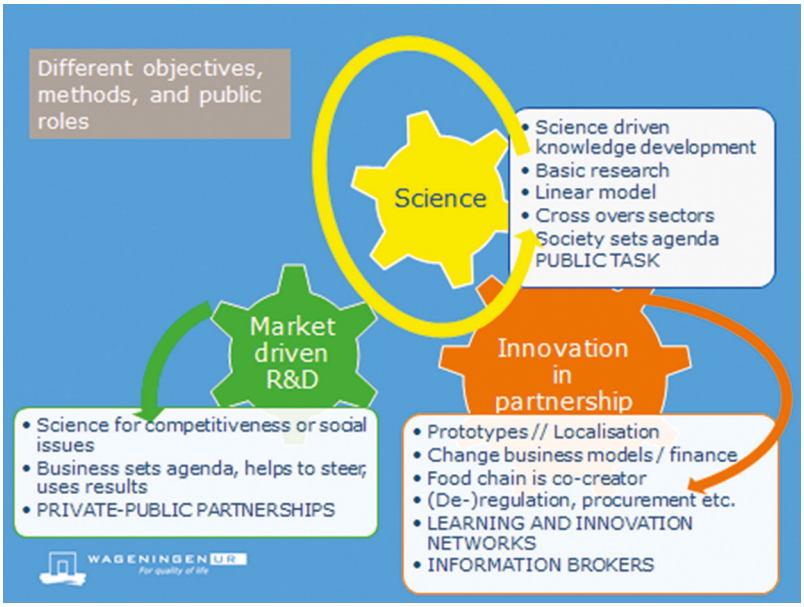
Source: This project

2.4 Linking types of research with organisational arrangements

In discussing the first AKIS reflection paper in sessions on what this means for actual policies, we have often summarised this using Figures 2.3 and 2.4. The distinction between science, research and development and innovation is illustrated in Figure 2.3. The relationship between these three components is fuzzy and can often be characterised by the thinking of the triple helix model (that describes interaction between research, government and industry) and mode-two thinking (transdisciplinary research). In (pure) science the linear model is relevant: basic discoveries such

as DNA or in computer science are the source for new science-driven activities. It also means that crossovers (for example between ICT and biology) are important. Huge spill-overs exist, which imply the risk of severe underinvestment if the government is not active, as individual investors would not be able to capture all the benefits.

Figure 2.3 Organising science, research and development and innovation by government and industry.



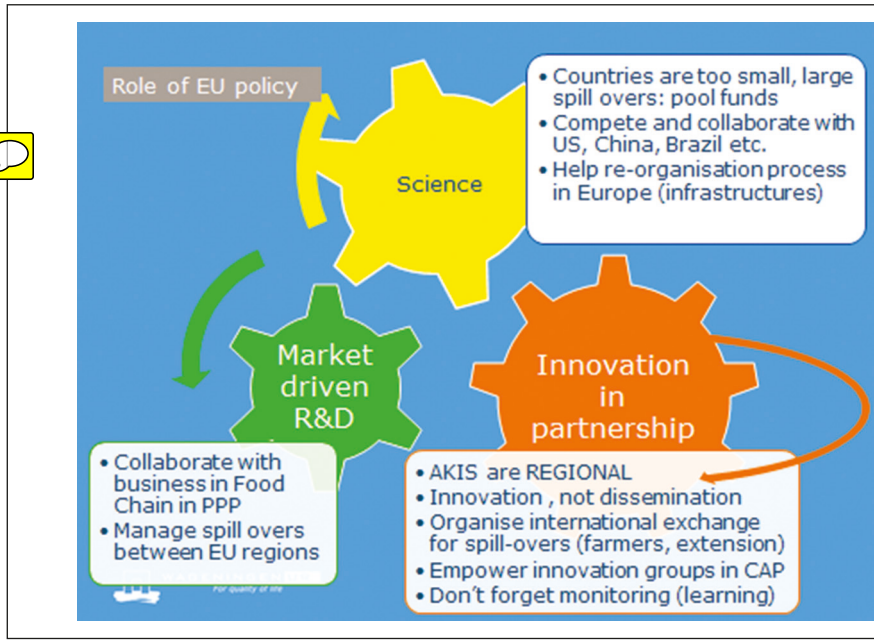
Source: This project

In R&D there is a closer relationship with business (or societal challenges). This is innovation-driven research, where collaboration between science and innovators in industry makes sense, as the industry partners have a better understanding of the needs of clients and have to turn the research results into products or services.

As explained in Section 2.2, innovation is a broad concept. There are many policy instruments to induce or support innovation. Research is one of them, but others are, for example, fiscal policy, government procurement, environmental or animal welfare policy (that, for example, forbids certain production methods), deregulation, regulation that introduces standards (such as in organic food markets), extension and brokering etc.

The role of the EU in these three components is quite different (Figure 2.4). There is a big potential role in science policy to help EU Member States to pool their resources and collaborate or compete with other continents. European research infrastructures can be created, which are in many cases more efficient than those organised on a national or regional basis, and a European research market created. Horizon 2020, JPIs, Eranets and European research infrastructures are examples of such collaboration.

Figure 2.4 The role of EU policy in organising science, research and development and innovation.



Source: This project

Innovation takes place in individual companies (or public institutes such as hospitals or schools) by changing the way the organisation operates or the products it markets. We have already concluded that the supporting AKIS are regional, and that many different national government policies can support innovation. However the EU can also play a role, especially in agriculture and food. The EU's CAP funds could be used to empower farmers to innovate and improve their competitive position. Spill-overs could be managed by bringing farmers and farm advisors across regions together, and policy-makers could learn from monitoring and benchmarking to make their national policies and AKIS more effective.

In research and development, collaboration between the private and public sector is relevant. Organising this on a European scale makes sense where the businesses are multinational. This has the advantage that spill-overs between regions are promoted. It is less clear if disruptive innovation, e.g. by SMEs (like start-ups) are well supported by such arrangements. The public authorities should guarantee that aspect when such schemes are set up. Current examples of public–private partnerships (PPP) include the EU's Future Internet public–private partnership (FI-PPP) and the new consortium JTI Bio-Based Industries in bio-based (non-food and feed) products. In primary agriculture and food this is not yet the case, but is not unthinkable that, for example, the international dairy or sugar companies would follow the same road.

3 THE EIP AGRICULTURAL PRODUCTIVITY AND SUSTAINABILITY

Text by Krijn J. Poppe, Anne Vuylsteke, Inge Van Oost and Hans-Jörg Lutzeyer

3.1 Introduction[1]

The current economic climate has led to new initiatives to promote innovation. 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 action points, with the aim of achieving 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;
- 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 illustrate that also in the European Commission's strategy innovation is a much broader concept than science, research and development and extension. Within the Innovation Union, Horizon 2020 is an important financial instrument for the implementation. Running from 2014 to 2020 with a foreseen budget of EUR 72.3 billion[2] (subject to the approval of the Multiannual Financial Framework Regulation by the European Parliament and the Council), the EU's new programme for research and innovation is part of the drive to create new growth and jobs in Europe (see Section 3.3 for more details).

Innovation support will also be strengthened in the EU's CAP. The political agreement on the CAP 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). More details are given in the next section. Readers who are interested in an introduction to the scientific evidence for linking bottom-up innovation processes to policy initiatives for a transition to a more sustainable agriculture are referred to Box 3.1.

1. Text taken from the first reflection paper (EU SCAR, 2012)
2. Situation 1 October 2013: http://ec.europa.eu/research/Horizon 2020/index_en.cfm?pg=h2020

Box 3.1 The need for a diversity of transition pathways in agro-food systems

Box written by Boelie Elzen and José Vogelezang (Wageningen UR)

Over the past decade, transition research has rendered valuable insights into strategies to make production-consumption systems more sustainable. Much of this work is based on the analysis of systems like energy and passenger mobility, systems with large, institutional players and a limited number of core innovations to open up pathways towards sustainability. To make these insights of relevance to agro-food systems, however, they have to be adapted to its specific characteristics, which differ from the aforementioned systems. Agro-food systems are far more diverse, e.g. with variation on the production side from small scale family farms to large industrial farms. Yet, even the largest farms are SMEs with relatively few workers. The diversity in the location of farms also leads to a broad spectrum of business opportunities, varying from nature conservation or recreation in rural areas to urban agriculture in cities. Diversity is also displayed in a broad variety of production-consumption chains with, compared to the other sectors, mostly relatively small institutional players. Another specific characteristic of agriculture is that normative issues play a crucial role, e.g. in connection with food-safety, animal welfare, north-south relations, etc. These normative issues have a large impact on the innovation dynamic in the sector.

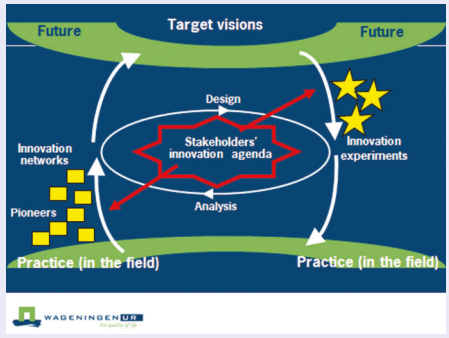
Insights from transition research are of relevance for the agro-food system, but a dedicated approach is needed that acknowledges the specific characteristics of agriculture. This approach should at least address the issues below.

Bottom-up processes as a driving force in transitions

In the agro-food sector innovation is a very distributed bottom-up process with a wide variety of farmers tinkering with new ways of doing things. Transition research has rendered strategies to stimulate transitions to sustainability like Strategic Niche Management (Schot and Geels, 2008) and Transition Management (Rotmans and Loorbach, 2010) that picture system innovation as a sort of organized, research driven process. These strategies have some relevance for the agro-food sector, but need to be supplemented with approaches that map the variety of micro-level bottom-up initiatives and the circumstances under which they can proliferate and 'scale-up'.

Still, this bottom-up process constitutes only one side of the coin. At the same time, public authorities at different levels (regional, national and EU), larger corporations and research institutes try to stimulate a transformation process via a variety of 'top-down' initiatives (Elzen et al., 2012). Both of these processes stimulate sustainability transitions and can deliver input for a stakeholders' innovation agenda where insights from scientists meet insights from practice (see Figure below; Wijnands and Vogelezang, 2009; Vogelezang and Wijnands, 2011). This interaction between science and practice can lead to an acceleration in realising sustainable farming systems.

Figure: Combining top-down and bottom-up processes in transitions



Pluralism driving transition pathways

In transition research, a limited number of transition pathways are distinguished and historical transitions tend to follow one of these (Geels and Schot, 2007). In the agro-food sector, however, innovation processes take place in very distributed ways, which also leads to the emergence of a broad variety of transition pathways that develop concurrently. Given the diversity of agro-food systems there is not a 'one-size-fits-all solution' and a variety of new approaches will be needed to achieve sustainability. The research challenge is to account for this diversity and analyse how this variety may yet lead to an overall shift towards sustainability. To be able to define strategy and policies for sustainable development will require an analysis of the stimulating and impeding factors for the occurrence of such a 'sustainable direction'.

Recent research

Fortunately, in recent years, transition studies have recognised agro-food as an interesting separate domain of transitions and several studies have appeared focusing on this field (Poppe et al., 2009; Barbier and Elzen, 2012; Darnhofer et al., 2012; Spaargaren et al., 2012). Various new approaches have recently been applied to stimulate bottom-up renewal processes (see also Box 4.5 and 4.6). One example is the so-called network approach where different stakeholders – with a focus on a certain innovation goal – meet each other regularly, and benefit from the heterogeneity in the network as a driver for a shift in perspectives and new solutions. These recent studies provide some promising starting points to address the issues above.

Source: Box written by Boelie Elzen and José Vogelezang (Wageningen UR)

3.2 European Innovation Partnership 'Agricultural Productivity and Sustainability'

3.2.1 Concept

The establishment of European Innovation Partnerships (EIPs) in different sectors represents a new approach from the Europe 2020 Strategy to advance EU research and innovation The concept of European Innovation Partnerships (EIPs) as set out in the 2010 Commission Communication 'Innovation Union[3]', refers to a tool that pools forces and interlinks different actions to achieve breakthroughs as regards major societal challenges. The 'Innovation Union' Flagship Initiative aims to improve conditions and access to finance for research and innovation, to ensure that innovative ideas can be turned into products and services that create growth and jobs. The EIPs will bring together all relevant actors at EU, national and regional levels to act across the whole research and innovation chain.

EIPs are challenge-driven, focusing on societal benefits and rapid modernisation. EIPs streamline, simplify, and better coordinate existing instruments and initiatives and complement them with new actions or a more coherent policy framework where necessary. EIPs should provide favourable conditions for research and innovation partners to cooperate and achieve better and faster results compared to existing approaches. Therefore, they will build upon relevant existing tools and actions.

EIPs are no policy instruments of their own; they aim to achieve synergies and EU value added through basing themselves on existing policies and fostering cooperation among partners in view of exploiting their potential for innovative actions. EIPs are started on several societal challenges, including agricultural productivity and sustainability. The general principles of EIPs are reflected in the design of the EIP 'Agricultural Productivity and Sustainability' (EIP-AGRI).

Interaction is key to generating innovation via AKIS. A genuine innovation is 'an idea put into practice with success', or, to quote Thomas Alva Edison, 'The value of an idea lies in the using of it'. Only when a new creative idea becomes more or less mainstream and is frequently applied, can it be called an innovation. Innovation is fuelled by co-generation and co-ownership resulting in targeted solutions and novel approaches. Therefore, the innovation model under the EIP-AGRI goes far beyond speeding up transfer from laboratory to practice through diffusion of new scientific knowledge (referred to as a 'linear innovation model'). The EIP-AGRI adheres to the 'interactive innovation model', which focuses on forming partnerships: using bottom-up approaches and linking farmers, advisors, researchers and businesses (etc.) in operational groups. This will generate new insights and ideas, and mobilise existing tacit knowledge into focused solutions.

3. Europe 2020 Flagship Initiative 'Innovation Union': COM(2010) 546 final

Such an approach helps not only the co-creation of innovation but also speeds up the introduction of innovative ideas through the generation of co-ownership: end-users and actors genuinely involved in innovation projects will be more inclined to put the novel approaches or targeted solutions into practice. It will also help target the research agenda, tackle new opportunities and switch research to a problem-solving mode.

The EIP-AGRI will not rely on one farming system only nor is it exclusively targeted to technological frontrunners. The scope of the EIP is very broad: innovation may be technological, non-technological, organisational or social, and may be based on new or traditional practices. Innovation may lead to commercialisation, if commercialisation occurs at all. Practices or processes to be developed may as well aim at the preservation or enhancement of public goods.

3.2.2 Setting up the EIP Agricultural Productivity and Sustainability

The objective and the general EIP-AGRI conception were first stated in the Commission Communication of 29 February 2012 and have subsequently been endorsed in the Agriculture and Fisheries Council Conclusions of 18 June 2012. The Council Conclusions also invite the Commission 'to undertake concrete steps toward having a strategic implementation plan of the EIP prepared with the aim of involving all stakeholders in delivering specific results and innovation in the agri-food sector.'

To this end, a High Level Steering Board (HLSB), involving 42 key stakeholders from across the agricultural research and innovation landscape (farmers' and forestry organisations, agricultural scientists, environmental and consumer organisations, up- and downstream actors) as well as Member States' and regions' representatives drafted a Strategic Implementation Plan (SIP), which was approved on 11 July 2013. With this SIP, the High Level Steering Board delivers strategic advice and gives orientations to the EIP in terms of issues, bottlenecks, solutions and the question of how to create an innovation culture in European agriculture bridging the gap between science and practice.

In the conclusions of the SIP, the High Level Steering Board acknowledges the opportunity of the EIP to involve stakeholders and to stimulate mutual learning, the importance of combining new and existing knowledge into innovations. The EIP needs to take into account the diversity of the agricultural sector and the agro-food chain and provide solutions that can be applied successfully under a wide range of circumstances without compromising the environment and public health. The members of the HLSB furthermore underline that the EIP has to create and foster a working innovation culture in the sector. The role of Member States and regions in programming Rural Development actions is considered crucial for the implementation of the EIP. Equally crucial is the development of instruments under Horizon 2020 which involve all stakeholders, such as multi-actor projects and thematic networks. This multi-actor approach needs to be reflected in the evaluation mechanism of project proposals and the reward system of researchers. The importance of Article 12 in the Horizon 2020 regulation is emphasised with a view to creating 'innovation driven' research, taking up new insights and bottom-up initiatives. Finally, the SIP states that the EIP will only be a success if all stakeholders act together and

share their ideas and experiences on innovation. Accordingly, emphasis must be given to facilitating knowledge exchange and a working flow of information at all geographical levels and in different working contexts.

The High Level Steering Board will regularly take stock of its implementation but will have no direct role in programming or the day-to-day management. The implementation of the EIP via the Rural Development Policy and actions under Horizon 2020 will be steered and monitored using the existing, well-established instruments. Both policies have their own programming mechanisms and the introduction of the overarching EIP will not change that.

3.2.3 Objectives

The EIP-AGRI aims to foster a competitive and sustainable agriculture and forestry that 'achieves more from less' input and works in harmony with the environment. It will contribute to ensuring a steady supply of food, feed and biomaterials, both existing and new ones in harmony with the essential natural resources on which farming depends. For achieving this aim, the EIP will build bridges between research and farming practice and involve farmers, businesses and advisory services, and others as actors in operational groups.

The content and priorities to be pursued by the EIP will emerge in an open manner and reflect the need for diverse solutions. Translating new technologies, methods and processes into farming practice and creating a space for practical questions requires a bottom-up approach, combined with effective networking. Several areas for EIP innovative actions have been selected on the basis of input and exchange with stakeholders. The EIP Commission Communication[4] lists these possible fields of innovative actions. This list however is non-exhaustive, as EIP actions will emerge from the bottom up:

- Primary production: technical solutions to increasing productivity and economic viability;
- Resource management: eco-system services, soil functionality, water management and genetic resources ('public goods');
- Bio-economy: innovative technology for the bio-based economy bio-refinery; new products; reduction of post-harvest loss;
- Supply chain: integrated supply-chain solutions; new services; logistics, and management systems;
- Quality and consumers: food quality, food safety and healthy lifestyles (consumer information and consumer choice)

3.2.4 Operational groups as key acting entities in the EIP

The EIP adheres to the 'interactive innovation model' which focuses on forming demand-driven partnerships – using bottom-up approaches and linking farmers, advisors, researchers, businesses and other actors (e.g. civil society like NGOs or governmental bodies) in so-called Operational Groups (Figure 3.1).

4. COM(2012)79

Figure 3.1. Operational Groups in the EIP

Source: DG Agri

The forming of operational groups will take place on the initiative of innovation actors. No specific conditions are laid down by the European Commission as regards the size, the composition and the specific undertakings of an operational group.

An operational group is meant to be 'operational' and tackle a certain (practical) problem or opportunities that may lead to an innovative solution. Therefore, operational groups have to draw up a plan, describing their specific project and the expected results of the project. Furthermore, the operational groups have to disseminate the results of their project, in particular through the EIP network. The exact content of a project plan depends on the actors involved and the problem, issue or opportunity to be tackled.

This knowledge 'exchange' will generate new insights and ideas and mould existing tacit knowledge into focused solutions that are quicker put into practice thanks to the co-ownership generated during projects. Such an approach will stimulate innovation from all sides and will help to target the research agenda.

Innovation Brokerage

To find innovative ideas, help partners to connect and set up an operational group formed around concrete projects, innovation brokerage can be supported via diverse articles under the Rural Development Regulation, such as:

- technical assistance (Article 55(2))
- animation under the cooperation measure (Article 36(5)) and
- advisory services (Article 16(1))

It makes sense to strive for a flexible and open system to create a multiplicity of operational groups. Innovation brokering does not seem to be a very expensive approach; the budget costs are closer to 'coffee money' than to big research budgets.

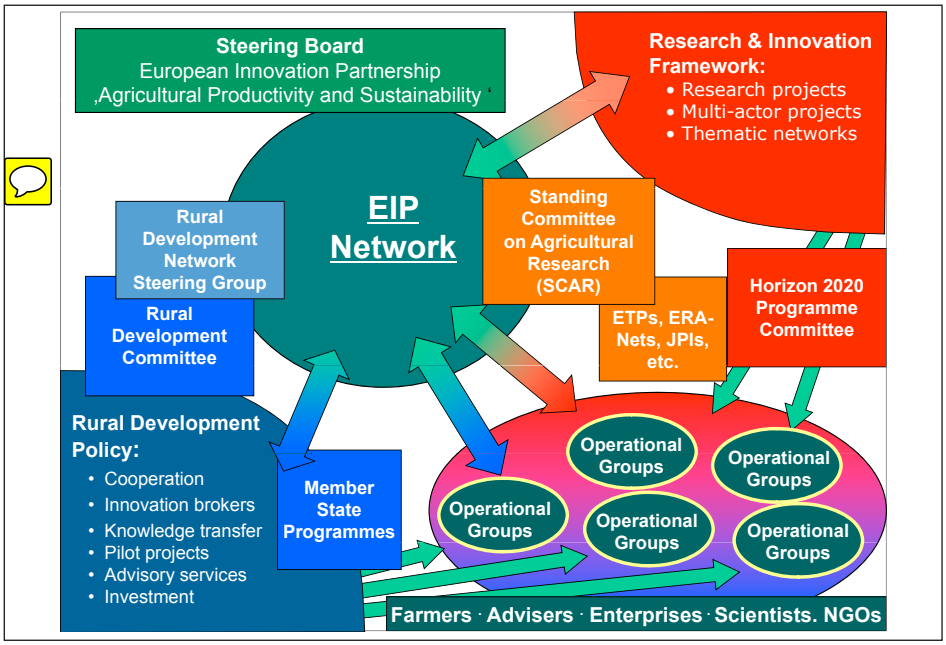
The difference between EIP and LEADER

An EIP operational group builds itself around a concrete innovation project targeted towards finding a solution for a specific issue or developing an innovation opportunity. This is partly different from LEADER Local Action Groups (LAGs). Operational groups and LAGs have in common that they capture ideas from interested actors and foster the setting up of projects. However, LAGs act on the basis of a comprehensive local development strategy. LAGs will approve several projects to implement this strategy and are active for a period of seven years. In contrast, an EIP Operational Group builds itself around a concrete innovation project, while not necessarily being bound to a specific territory or an upfront fixed strategy. Its composition varies from project to project, maximising interaction and cross-fertilisation between the actors involved. Its lifetime will be directly linked to the innovation challenge (project) and is often (much) shorter than that of a LAG.

3.2.5 Implementation of the EIP

The structure of the agricultural EIP is depicted in Figure 3.2. It shows the interplay between the policies and measures for supporting OGs in the field. For the implementation of EIP innovative actions, the actors mainly rely on the funding schemes present within the Rural Development Policy and Horizon 2020, under the governance of existing bodies (the Horizon 2020 Programme Committee and the Rural Development Committee). The work plan for the EIP network activities will be drafted in line with the general orientations laid down in the 'Strategic Implementing Plan' adopted by the High Level Steering Board of the EIP. It will be discussed with the Standing Committee for Agricultural Research (SCAR) which acts in an advisory capacity, and finally submitted to the Steering Group of the Rural Development Network.

Figure 3.2 The Implementation of the EIP



Source: DG Agri

3.2.6 Knowledge exchange – the EIP Network

The EIP network will facilitate the effective flow of information in order to ensure that successful projects of Operational Groups do not remain singular events but contribute to the advancing and mainstreaming of innovative approaches beyond the local and regional level (see Figure 3.3). In the same spirit, it will also allow Operational Groups and other innovation actors to learn from each other's mistakes and failures.

A Brussels-based EIP network facility, called the 'EIP Service Point', has been contracted as an intermediary enhancing communication and fostering cooperation. This 'EIP Service Point' will support the activities of the EIP Network and provide help for the establishment and running of Operational Groups, notably through focus groups, seminars and workshops, the establishment of databases (on relevant research results and good practice examples), support for partnering and help-desk functions.

A particularly important action format of the EIP Network is the so-called Focus Group which is established to share knowledge and practical experience from concrete innovative projects. Focus Groups will focus on building upon the outcome of Operational Groups. Focus Groups bring together up to 20 experts willing to engage in sharing knowledge and advancing practical innovative solutions to address key challenges. The general approach for a focus group is to:

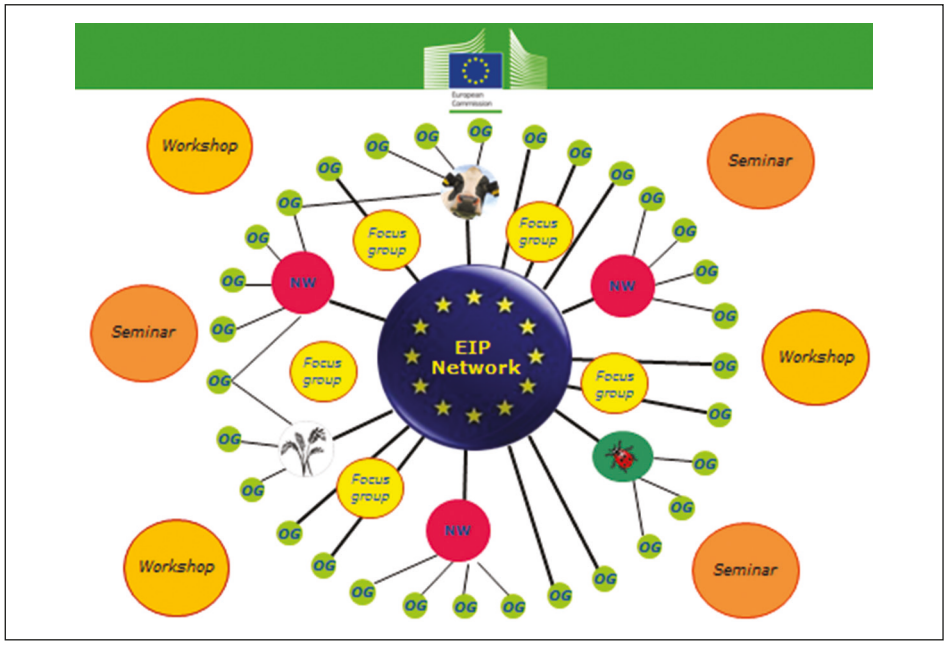
- Take stock of the state-of-the-art of practice, listing problems and opportunities (list of best practices);
- Take stock of the state-of-the-art of research, summarising possible solutions to the problems listed (incl. list of useful projects with the contacts);
- Identify the needs from the practices, propose further research;
- Propose priorities for innovative actions, e.g. a list of ideas for future interactive OG projects.

In 2013 Focus Groups were started on six topics:

- Organic farming (optimising arable yields)
- Protein crops
- Animal husbandry (reduction of anti-biotic use in the pig sector)
- Genetic resources cooperation models
- Organic-matter content of Mediterranean soils
- Integrated pest management (IPM) in *Brassicas*

Also in the following years, Focus Groups will be organised around relevant themes.

Figure 3.3 The EIP Network Facility



Source: DG Agri

Workshops and seminars are other forms of interaction between experts and operational groups. The aim is to bring people together to get inspired and connected. In addition networking and communication tools are used (ICT based or not) towards all key players in agricultural innovation to build a sustainable agricultural future.

The EIP Service point is furthermore charged with the task of disseminating knowledge developed and harvested under the different activities. This will be done both via direct contact to end users but also to a very large extent via multipliers and existing networks and structures.

3.3 Policy frameworks to operationalise the EIP

For funding concrete innovative actions, the EIP-AGRI will be implemented through actions that are mainly supported by two Union policies: Rural Development Policy and Horizon 2020. Funding, implementation and prioritisation of actions under the two policies will take place through the delivery mechanisms embedded in the policies. They are discussed in the next sections.

The two policies complement each other: Rural Development Programmes are normally applied within a specific programme region, whilst research policy must go beyond this scale by co-funding innovative actions at the cross-regional, cross-border or EU-level. Other policies, such as the Cohesion and Education Policy, might offer additional opportunities.

3.3.1 Common agricultural policy

The need for the overarching EIP approach was underlined by the impact assessment of the CAP reform proposals published by the European Commission on 12 October 2011. It states that: '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 Assessment). The new tools proposed by the EC are aimed at overcoming the bottlenecks to get 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 Impact Assessment. 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 the 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 views clearly reflect the systemic thinking about innovation in which the concept of AKIS is grounded. Within the CAP, the funding for EIP-AGRI innovative actions is in particular linked to Rural Development programming. Rural development policy has a long-standing record of stimulating innovation. Measures regarding knowledge transfer or investments have been programmed by Member States in the current period with the aim of fostering innovation, and they will be reinforced for the next programming period 2014-2020. Other elements, such as the EIP, are new to the rural development policy.

The Commission proposal for a Rural Development Regulation 2014-2020 refers to innovation in many places. The aims and means (operational groups) of the EIP are described in Title IV. Article 61 of the Rural Development Regulation lists the aims of the EIP:

- Efficient, economically viable, productive, climate and environment-friendly agriculture;
- Steady supply of food, feed and biomaterials, both existing and new ones;
- Improved processes to preserve the environment, adapted to climate change and mitigation;
- Building bridges between research and farmers, businesses and advisory services.

Several measures can be used to stimulate innovation and the activities of operational groups. The key measures include 'cooperation', 'knowledge transfer and information actions', 'advisory services', 'investment in physical assets' and 'farm and business development'.

The cooperation measure (Article 36 in the legal proposal) plays a key role in the implementation of the EIP. Support can be given both for the establishment and operation of operational groups of the EIP, and for the implementation of their projects. This support can also be combined with support under other measures such as training (Article 15), advice (Article 16), investments (Article 18), etc.

The Rural Development programme can fund bottom-up innovation projects with a 100 % support rate. For the selection of projects, the managing authorities may apply criteria like:

- relevance of the project for actors and end-users
- targeted composition of the partners in view of co-creation
- quality and quantity of knowledge exchange and cross-fertilisation
- demonstrating competences on state of play/avoiding repetition
- easy understandable and long-term communication effect

In addition to the measures aimed at operational groups and innovation more generally, the Rural Development Policy provides the means for setting up an EIP network at EU level (see 3.2.6). This European network can be mirrored in the Member States by EIP networking functions. Article 55 on the activities of this National Rural Network (NRN) states that networking by the NRN shall aim to 'foster innovation in agriculture, food production, forestry and rural areas'. The action plans of the NRNs therefore must include 'networking activities for advisors and innovation support services', be it through the general NRNs or through dedicated EIP networking functions established under the NRNs.

National rural networks, including EIP network functions, can be funded as technical assistance under Article 51 of the rural development regulation. This article can also be used to finance the implementation of the EIP for the country/region (e.g. promote innovation measures, connect with EIP activities at EU level, connect to regional EIP-networks and advisory services, innovation brokers, thematic networks etc.).

Finally, also the Farm Advisory System (FAS), under the horizontal CAP regulation, will be reinforced as regards innovation. The Member States must have an advisory system in place, which will cover innovation in its minimum scope as from 2014. Advisors can play a major role in enhancing innovation, by forming part of operational groups, by serving as an interface between research and practice, through brokering for the set-up of operational groups or through facilitating innovative actions. The establishment and use of the FAS is supported by Rural Development funding.

3.3.2 Horizon 2020

The EU Research and Innovation Policy ('Horizon 2020') plays its key role in providing the knowledge base for innovative actions on the ground. Running from 2014 to 2020 with a foreseen budget of EUR 72.3 billion, it will combine funding currently provided through the Framework Programmes for Research and Technical Development with other European innovation-related

programmes. A budget of almost EUR 3.9 billion[5] is proposed to support the societal challenge: 'Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bio-economy'. The proposals in Horizon 2020 foresee a combination of existing and newly developed instruments. As usual, the undertakings of Horizon 2020 will be translated into instruments and practical approaches via the annual work programmes and calls for proposals.

Newly developed EIP instruments: multi-actor projects and thematic networks

Within the framework of Horizon 2020, two new instruments were developed that are instrumental for the EIP: multi-actor projects and thematic networks. The key feature of multi-actor projects is to 'ensure the necessary cross-fertilising interactions between researcher, businesses, farmers/producers, advisors and end users'[6] in order to address the needs, problems and opportunities of end-users. The multi-actor approach should be reflected in the definition of the project's objectives and planning, the composition of the project consortium and the reinforced dissemination of results. The consortium should involve the key actors with complementary types of knowledge (scientific and practical) to reach the project objectives and broadly implement the results. The impact and dissemination of research results will be actively supported through specific actions on communication, knowledge exchange and the 'involvement of various actors all along the projects'[7]. Facilitation between actors and openness to involve additional partners during the project (for instance EIP operational groups) are considered important. Multi-actor projects should generate innovative solutions that are more likely to be applied thanks to the cross-fertilisation of ideas between actors, the co-creation and the generation of co-ownership for eventual results.

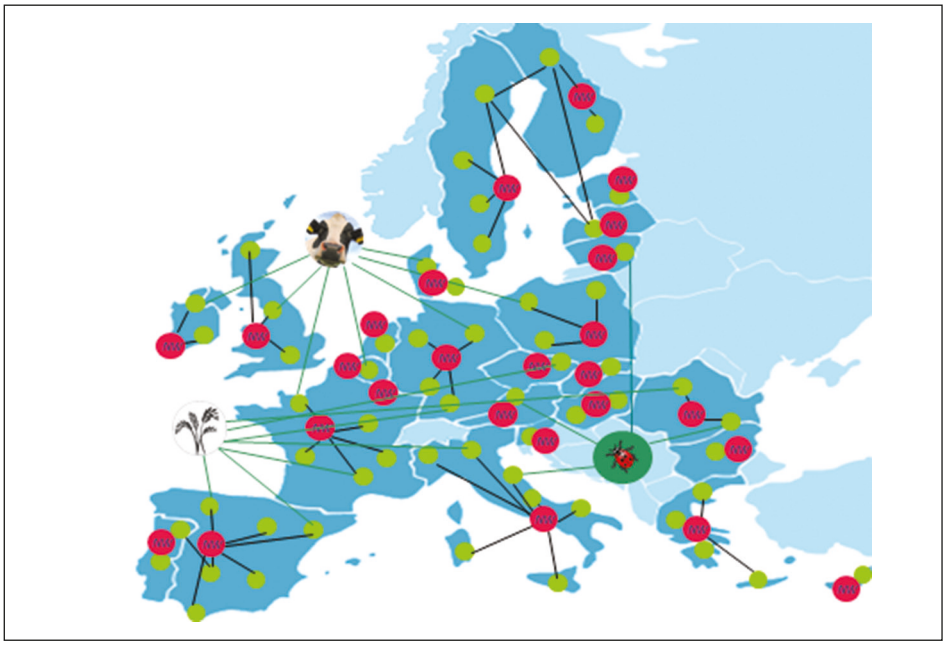
The multi-actor approach will be introduced in the Horizon 2020 Work programme 2014-2015 for a specific list of research topics where added value is expected from its application. It aims at more demand-driven innovation through the genuine involvement of various actors (end users such as farmers/farmers' groups, advisors, enterprises, etc.) throughout the project. The multi-actor approach is more than a strong dissemination requirement or what a broad stakeholders' board can deliver: it should be illustrated with sufficient quantity and quality of knowledge exchange activities and a clear role for the different actors in the work plan. Important features of multi-actor projects in Horizon 2020 are:

- Relevance of the research object for end users (importance of subject, demand driven, complementarity, creativity, absorption capacity…).
- Targeted composition of the partnership of actors (coverage of partners, complementarity, adequacy…).
- Refining of possible solutions: knowledge exchange and cross-fertilisation actions during the project (actions generating co-ownership).
- Short-term dissemination (via involvement of actors, advisors and end-users, expertise and track record of actors, translation).
- Long-term dissemination (output and outreach, easy accessible and understandable).

5. Status October 1, 2013: http://ec.europa.eu/research/horizon2020/pdf/press/horizon2020-presentation.pdf
6. Horizon 2020 Council Regulation (part III section 2.2)
7. Horizon 2020 Specific Programme (Section 2.5)

Operational groups will often work within the context of the regional AKIS. To ensure broader linkages, it makes sense to connect some of them (and perhaps indirectly all of them) between regions and countries. For instance groups that work in the same sector (e.g. dairy) or on the same topic (e.g. Integrated Pest Management or Precision Farming issues) could benefit from international contacts (respectively depicted as the cow, ladybird and cereals in Figure 3.4).

Figure 3.4 Linking Operational Groups via Thematic Networks



Source: DG Agri

Horizon 2020 therefore foresees the opportunity to fund operational groups and/or individual actors to organise themselves in thematic networks. Thematic networks will mobilise all concerned actors (researchers, farmers, advisors, enterprises, education, NGOs, administration, regulatory bodies…) on specific thematic areas to take stock of existing scientific and practical knowledge. The focus of thematic networks is on mapping, synthesising and presenting research results that are close to being put into practice, but not known or tested by practitioners. Based on state-of-the-art existing scientific knowledge and best practices project consortia should reflect on 'what do we have/what do we miss to develop useful applications', foster the circulation of existing material and map remaining research and innovation needs. Thematic network projects must develop end-user material to facilitate the discussion on, and sharing and dissemination of, knowledge in an easy accessible way, providing input for education and a research database for end users and making long-term results available in the form of info sheets in a common format and a language that is easy to understand for farmers and advisers. Themes can be linked to sectors, farming methods or products, e.g. arable crops, fruits and vegetables, pigs, organic agriculture, etc.) or a very diverse set of subjects such as crop rotation, certain farming practices or systems, energy, eco-system services, social services, bio-based products, short supply chains, etc. As thematic networks bring together possible actors, they will help the connecting, but also the building, of EU operational groups and multi-actor projects and may possibly link to demonstration or pilot farm networks.

Existing instruments

Next to the newly developed EIP instruments, a range of existing instruments will continue under Horizon 2020. Examples are the collaborative projects, ERA-NETs, JPIs and COST actions. ERA-NET consortia consist of funding agencies in Member States[8]. The objective of the ERA-NET scheme is to step up the cooperation and coordination of research activities carried out at national or regional level in the Member States and Associated States through (i) the networking of research activities conducted at national or regional level, and (ii) the mutual opening of national and regional research programmes. Under Horizon 2020, the emphasis will be on the organisation of common calls, with top-up funding from the European Commission ('ERA-NET+'). Some ERA-NETs are already reflecting on the possibility of making joint calls 'multi-actor'.

Similar to ERA-NETs, the overall aim of the Joint Programming[9] process is to pool national research efforts in order to make better use of Europe's precious public R&D resources. The main difference is the explicit focus on common European challenges in a few key areas that need to be tackled in a more effective way. It is a structured and strategic process whereby Member States agree, on a voluntary basis and in a partnership approach, on common visions and Strategic Research Agendas (SRA) to address major societal challenges. On a variable geometry basis, Member States commit to JPIs where they implement joint Strategic Research Agendas. The JPIs on 'Food security, agriculture and climate change' and 'Healthy diet for a healthy life' are the most closely related to the agricultural EIP.

Horizon 2020 will also continue the COST instrument. COST is a bottom-up, open networking mechanism that encourages international exchanges and cooperation of researchers within Europe and beyond. Joint activities such as conferences, short-term scientific exchanges and publications are supported. Within Horizon 2020, COST should further bring together 'pockets of excellence' and play a mobilising role not only for the less participating countries but also for the enlargement countries and the European neighbourhood policy countries.

A final instrument related to innovation are the Knowledge and Innovation Communities (KIC)[10]. These communities are highly integrated, creative and excellence-driven partnerships, which bring together the fields of education, technology, research, business and entrepreneurship, in order to produce new innovations and new innovation models that inspire others to emulate it. A KIC on food was under development, but has for the moment been postponed.

Other novelties within Horizon 2020

There are significant regional disparities across Europe in research and innovation performance. The Budget Review in 2010 has asked for a clear division of labour between Research and Innovation and Cohesion policies, thus removing any capacity building activity from Horizon 2020. Action needs to be taken to bolster research and innovation capacities in the Member States who lag behind and thus reduce the Research and Innovation Divide in Europe. Thus the Research and Innovation Framework Programme will have increased interactions with Cohesion policy, although each policy will keep its distinct features.

8. Source: http://www.cordis.europa.eu/coordination/era-net.htm
9. Adopted from http://ec.europa.eu/research/era/what-joint-programming_en.html
10. See http://eit.europa.eu/kics/

Increased synergies between Horizon 2020 and the Structural Funds will be achieved if after a few years of parallel operation concrete results on the ground in the supported Member States and regions could be identified such as:

- Increased investments in research infrastructures of all kinds, including those of the ESFRI List.
- Increased support to innovation, especially with regard to high-growth companies and to small innovative ones.
- Increased research and innovation activities in a few priority thematic areas that would have been freely selected by the MS and regions, in an overall context of strategies for Smart Specialisation.

Horizon 2020 will favour 'smaller' players (and smaller consortia) since it introduces a completely new approach towards supporting research and innovation in SMEs (based on the concept of the well-known US SBIR scheme, and without the current obligation to form consortia with more than one MS involved), as well as a new approach to access to risk finance especially for high-growth innovative SMEs. A major simplification effort in terms of administration and financial management has also been announced.

Harmonisation of cost eligibility rules between Horizon 2020 and Cohesion Policy (lump sums, flat rates and unit costs possible under both for funding direct and indirect costs without providing documents proving real expenses, harmonisation of VAT rules) is also in the making. That will clarify the possibility to combine Horizon 2020 funding and additional funding from the structural funds in the same project but for different expenditure items.

There are other measures foreseen to close the innovation divide in Europe. One of them is the option to establish a Policy Support Facility (PSF), which will aim to improve the design, implementation and evaluation of national/regional research and innovation policies. It will offer expert advice to public authorities at national or regional level on a voluntary basis, covering the needs to access the relevant body of knowledge, to benefit from the insight of international experts, to use state-of-the-art methodologies and tools, to receive tailor-made advice.

In addition 'ERA Chairs' will be established to attract outstanding academics to institutions with a clear potential for research excellence, in order to help these institutions fully unlock this potential and hereby create a level playing field for research and innovation in the European Research Area.

Horizon 2020 support for 'Teaming of excellent research institutions and low performing RDI regions' aims at the creation of new (or significant upgrade of existing) centres of excellence in low-performing RDI Member States and regions. It will focus on the preparatory phase for setting up or upgrading and modernising such an institution facilitated by a teaming process with a leading counterpart in Europe, including supporting the development of a business plan. A commitment of the recipient region or Member State (e.g. support via Cohesion Policy Funds) is expected. Subject to the quality of the business plan, the Commission may provide further seed financial support for the first steps of implementation of the centre. Building links with innovative clusters and recognising excellence in low performing RDI Member States and regions, including through peer reviews and awarding labels of excellence to those institutions that meet international standards, will be considered.

A facility for 'twinning research institutions' aims at significantly strengthening a defined field of research in an emerging institution through links with at least two internationally-leading institutions in a defined field. A comprehensive set of measures underpinning this linkage would be supported (e.g. staff exchanges, expert visits, short-term on-site or virtual trainings, workshops; conference attendance; organisation of joint summer-school-type activities; dissemination and outreach activities).

3.3.3 Other policies

The concept of operational groups may be applied within various funding sources. The EIP-AGRI is not exclusively linked to the Rural Development Policy and Horizon 2020. For these instruments, the link between the EIP objectives and the activities is very clear, but there are also potential synergies with other policies like the EU Regional Development Fund, national or regional funding schemes, private funding, etc.

4 REFLECTIONS

Text by Anne Vuylsteke (Sections 4.2, 4.6), Andrés Montero Aparicio (Section 4.3), Jasper Dalhuisen (Section 4.4), José António Santos Pereira Matos (Section 4.5) with contributions from members of the CWG.

4.1 Introduction

Given the policy developments described in the previous chapter and the work the SCAR Collaborative Working Group AKIS did in its first reflection paper (summarised in Chapter 2), we investigated best practices and bottlenecks in the EU Member States to progress with innovation in the regional AKIS. Our reflection is recorded in this chapter. Section 4.2 starts with experiences on Operational groups, LINSA and information brokers. It is continued in Section 4.3 with a discussion on innovation themes as a method to structure bottom-up initiatives in Thematic Networks and support them from Focus Groups. Section 4.4 discusses how innovation policies in EU Member States and regions could be innovated to support the EIP and Horizon 2020, followed by a discussion on cross-border collaboration. We end with a section on providing the right incentives to the actors in the AKIS, a topic that is extended in the next chapter on incentivising research.

4.2 Interactive innovation approaches

A first part of the reflection concerns the operational groups. The objective is to learn lessons on the start of the operational group, the key success factors and national policies from existing initiatives that could be considered as predecessors of operational groups. But at the same time, the reflection is also made on what are not features of an operational group and what could be the role of innovation brokers.

Although the term 'operational group' is new, some initiatives in European countries already applied an interactive innovation approach. Box 4.1 describes predecessors of operational groups in EU countries brought forward by the members of the CWG AKIS group. Other examples of interactive innovation approaches, some of which are more networking activities, are shown in Appendix 4. These initiatives were the basis of the discussion within the CWG AKIS-2. The main findings of the discussions are presented in the sections below.

Box 4.1 Examples of existing innovation activities that could have been Operational Groups

Innovation and Partnership Projects (France)

- An annual call for 'Innovation and Partnership' projects was set up by the French Ministry of Agriculture in 2004 using CASDAR funding. The objective of the projects is to produce operational results in a user-friendly way to farmers and to have an adequate partnership for the project work. One IP project can be funded between EUR 250 000 or EUR 450 000 for three years and the projects are conducted in partnership between development and advisory services, research and training agencies, including groups of farmers. Projects are ranked by a jury of independent experts composed of researchers, advisors, teachers etc. Farmers are involved in the project's steering committee and assist in making up the experimental plan and in orienting the project. In addition, an annual presentation of results from this call for projects is organised, and full publication of the results in the journal 'Agricultural Innovations' are available online. Projects conducted in this framework have a practical aim: to produce results conducive to innovation, easily transferable to advisors and farmers, and that can contribute to the definition of public policies. Topics to be chosen may be linked to societal challenges (described in the tender) or subjects supported by RMT (=Joint Technology Networks).

KarjaKompassi (Cow Compass, Finland)

- At the basis of the Cow Compass was the objective to develop an online management tool to support process planning, ration formulation and optimal economic operation of cattle farms. It's now an online service for farmers delivered by a rural advisory service. The development stages were highly interactive between research, extension and farmers (for testing and piloting).

Improve the quality of Danish beans by heat treatment (Denmark)

- The aim of the project was to improve the quality of Danish beans through heat treatment. This included the testing of a mobile toaster unit at a farm and the testing and monitoring of proteins in cows. The initial question was formulated by a farmer and in the end the project was carried out by a team of farmers and knowledge institutes.

Better Farm Programme (Ireland)

- The programme wants to improve the farms' profitability through technology transfer and feedback to research. This happens with the involvement of the farmers and demonstration farms. The approach has been influenced by a participatory approach.

Control of the Mediterranean fruit fly (Spain)

- A mixed group of producers, national and regional governments and research institutes aims to control the Mediterranean fruit fly (*Ceratitis capitata*) in citrus and other fruit trees by an area-wide Sterile Insect Technique Programme. This biological control approach should contribute to a significant reduction in the use of pesticides to control this key pest and to more safely produce fruits.

Riduca reflui (Italy)

- The aim of this project is to search for technological and managerial solutions for the reduction of water pollution due to the use of animal waste. The initial demand came from the farmers' organisation, but was promoted by the Veneto region and carried out together with research and extension.

Water quality groups (Belgium, Flemish Region)

- In the framework of the Nitrate directive, it was necessary to address the issue of water quality in Flanders. As one of the measures, local networks of farmers and applied researchers were established to follow up, explain and address the results of the nitrate measurements in specific water bodies.

HortLINK Project SCEPTRE – A LINK Consortium (UK)

- Defra's HortLINK is a collaborative programme with industry and end users to translate R&D into a commercial reality. In the specific case of SCEPTRE, the focus is upon improving crop protection in horticulture, especially for use in minor crops. In these minor crops, there are fewer effective products available as a result of EU legislation and the failure of the market to develop new products.

Farmersandclimate.nl network (the Netherlands)

- This network wants to identify and develop feasible steps towards more climate neutral agriculture. The initiative was started by research institutes, but the challenges faced by the farmers are at the core and there is also a close cooperation between farmers and researchers. There is a lot of attention for communication 'with more bite'.

Good Fruit (Estonia – Latvia)

- Within the Good Fruit project, a complex unit has been developed to store and process fruit and berries to provide product development service throughout the year. Researchers initiated the project and they were joined by about a hundred small farmers. They are using the processing department and the storage and product development services of the research institute.

Système Terre et Eau (France)

- The challenge to make animal production systems more eco-efficient, thrifty and self-sufficient is at the heart of this project. It started as a collaboration between knowledge institutes and regional authorities, but the requirements and specifications were written by farmers ('fodder systems input-saving' contract). The farmers are also involved in the research-action process: methodology, collecting data, steering the group and the project.

Source: Discussions CWG AKIS-2

4.2.1 Start of an initiative

The motivations that were at the origin of the above initiatives are very diverse and generally depend on the specific question/challenge on the one hand and the actual situation in the AKIS on the other. But on a more general level, four main groups of drivers to start cooperation with other stakeholders can be identified:

- *Problem, risk or challenge* faced by the (primary) sector that need to be addressed to guarantee the sector's future (both in economic and environmental terms). This problems or challenges arise from policy initiatives (e.g. Nitrate Directive), developments within the sector (like increasing costs) or other reasons;
- *Need* (often from the government) to undertake actions aimed at the realisation of public good aspects or to reach societal goals;
- *Opportunity* to address an area or realise an output that is suitable for development through a participatory approach;
- *Strategic (policy) choice* to stimulate or get actively involved in knowledge exchange, dissemination activities and the promotion of active steering or involvement of stakeholder groups.

Raising awareness and animating the participation in innovative actions are important. Single actors might have difficulties in finding partners. Innovation brokers may help in discovering innovative ideas, bringing partners together and setting up an interactive operational group around a concrete project plan. This element is elaborated in Section 4.5

4.2.2 Key success factors

Similar to the start of an initiative based on an interactive innovation approach, the key success factors strongly depend upon the specific context, challenge and constitution of the group. Still, it is interesting to give – in general terms – an overview of the success factors identified in the above cases as a lesson for the future activities of (support to) operational groups.

The composition of and way of working within the group is a first key success factor. The initiatives under study plead for a consortium with a range of stakeholders involved in the activities and this on a voluntary base. It can help if the group builds upon existing relations between people who are open to discussing their problems. Between the stakeholders, there should furthermore be a close and active cooperation and all actors should commonly define and co-construct the '*raison d'être*', goals and objectives of the group. Other supporting elements are (i) the presence of neutral actors or facilitators within the group that facilitate and drive the process forward, motivate others and resolve conflicts, (ii) a specific critical mass of the group according to its project objectives and (iii) complementarity of expertise and experience.

Facilitation is a different function from innovation brokering, although it can be done by the same actor. Both functions have neutrality as a common element but they are situated in different phases of the innovation process (brokering before the activities of the operational group start, facilitation taking place during the group's innovation project).

Secondly, the outcomes of the group are in itself a success factor. The examples teach us that the practices and solutions developed by the group should first and foremost be effective. This can be enforced by the active involvement of the stakeholders (the eventual users of the developed practices) and by testing in practice. These stakeholders (e.g. farmers) can then, in a next phase, also act as ambassadors for the results realised by the group.

But there are of course also other success factors, such as:

- The presence of a (legal) framework that frames the activities of interactive innovation approaches;
- The development or availability of (online) tools and learning methods that stimulate the interaction and integration between different activities within the AKIS;
- Establishing an appropriate mix of (public and private) funding and support.

4.2.3 National policies

The example initiatives clearly show that public policies and funding schemes are very important in most cases. The governmental actions can take different forms, but funding is by far the most important one. Examples are project, programme or structural funding (such as the CASDAR in France). The installation of advisory or participatory groups (like GINs or joint technological networks) can be supportive. Other examples of government actions incentivising interactive innovation are the promotion of projects with specific characteristics, active involvement in projects, the provision of scientific advice or technical support, changes of legislation or the identification of national priorities (which is often linked to funding). In a minority of the studied examples, the government was not involved or did not fund the initiative.

4.2.4 Features of what is not an operational group

In the discussion of what are good examples of interactive innovation approaches, the question can also be turned around: which features characterise groups or networks that would not be compatible with the concept of operational groups? It is clear that these characteristics may be very specific to countries or situations and may depend on the policy objectives, the AKIS actors and their activities and the funding schemes in place. Based on the CWG discussions, we

identified a number of characteristics that could be troublesome for forming a well-functioning and productive operational group. It concerns:

- The stakeholder involvement is limited to the steering of the overall initiative, but the stakeholders are not involved in the scoping of the project and/or the day-to-day activities;
- Actors or organisations (whether farmers, researchers, advisors or others) that are relevant to the formulated objective and actions are not represented in or contributing to the operational group;
- The group's goals and/or objectives are not set in a clear way and/or are not accompanied by a work plan aimed at a concrete output;
- The activities proposed have little added value and concern obvious developments like the introduction of already existing techniques;
- All relevant stakeholder groups are involved in the initiative, but there is an imbalance between stakeholder groups, e.g. with regard to decisional weight;
- All relevant stakeholder groups are involved in the group, but the final output only serves the benefits of one stakeholder (which is not the farming sector);
- The group focuses on one particular type of activities (such as organising a workshop for the dissemination of results or consultancy activities) instead of the whole spectrum of activities that could contribute to achieve the objectives;
- The group is not based on bottom-up, end-user or customer-driven innovation involving farmers;
- The objective of the group is limited to a political mission and interest;
- The group is economically unstable and financially weak, which threatens the fulfilment of the project;
- The group has no intention or openness to share the findings;
- The group concerns the continuation of an existing (producer, branch, trade or other) organisation, without new innovation-related activities;
- The proposed goals are far away from the needs of society;
- The group's focus is upon real research-driven questions which are tested on farms, but are far away from the farmers' needs.

4.2.5 Role of innovation supporting activities, including innovation brokers

The examples in the previous section showed that operational groups or similar initiatives require a good cooperation between different types of actors. The process of finding the right partners and establishing a suitable base for cooperation is thus very important. Innovation brokers could play a role in this process and therefore, the CWG also discussed the potential role of innovation brokers.

Innovation brokerage comprises several detailed functions (Howells, 2006) that can be reduced to three generic functions (Klerkx and Leeuwis, 2009):

- *Demand articulation*: articulating innovation needs and visions and corresponding demands in terms of technology, knowledge, funding and policy, achieved through problem diagnosis and foresight exercises.
- *Network composition*: facilitation of linkages amongst relevant actors, i.e. scanning, scoping, filtering and matchmaking of possible cooperation partners (Howells, 2006).

- *Innovation process management*: enhancing alignment in heterogeneous networks constituted by actors with different institutional reference frames related to norms, values, incentive and reward systems. This requires continuous 'interface management' (Smits and Kuhlmann, 2004) in which there is a 'translation' amongst the different actor domains, described as 'boundary work' (Kristjanson *et al.*, 2009). Furthermore, it includes a host of facilitation tasks that ensure that networks are sustained and become productive, e.g. through the building of trust, establishing working procedures, fostering learning, managing conflict and intellectual property management (Leeuwis, 2004).

The need for such intermediary activities or actors are generally well recognised, and a number of relevant structures and examples already exist in European countries (but not necessarily within the agriculture, forestry and food domain). Innovation brokers are not always essential to start up the process when all requirements for optimal networking exist, but they have an important role in the preparation of a project proposal. They should draft a proposal on which all actors can engage, with clear work packages and milestones, and which balances the different actor's interests and roles. The examples in Box 4.2 provide useful practices of innovation supporting entities and innovation brokers.

Box 4.2 Examples of existing innovation supporting activities and innovation brokering

Belgium

The Innovation Support Centre acts as an innovation broker, starting up groups around concrete research projects or around other innovative actions, be it technological or social. In view of connecting actors, the centre organises brainstorming around societal challenges. The support centre also facilitates some of the projects, coaches farmers towards new business systems and organises an innovation prize on a regular basis.

France

Chambers of agriculture may be seen as innovation brokers in some projects in France for four reasons:
- Innovation brokers may pass on farmers' projects and needs
- Innovation brokers help to share knowledge
- Innovation brokers help to scale up from novelty to innovation
- Innovation brokers are linked to research institutes, businesses and farmers

Estonia

In Estonia innovation brokers and facilitators have an important role in driving projects as project manager. Duties could include the following: development of project strategy, applying for support payments and drawing up reports.

United Kingdom (1)

Each Defra LINK programme (Arable, Horticulture, Food, Livestock) had an appointed Co-ordinating Independent expert with practical knowledge of the sector, acting as facilitator ('honest broker') between key companies, trade bodies/other interests and researchers – particularly valuable in the agricultural and food sectors characterised by many SMEs (growers, suppliers etc). Advice is given to these groups in building consortia to solve topical problems through a research proposal to the Programme Management Group (PMG). Also supported PMG management of projects and programme – monitoring, trouble-shooting and dissemination.

United Kingdom (2)

Technology Strategy Board (with co-funding from Defra and BBSRC) Sustainable Agriculture and Food Innovation Platform similarly brings together government, business and researchers to stimulate innovation, through new technologies, processes and products, for productivity/sustainable growth in sector. Competitive calls so far on crop protection, sustainable protein, food technology; next on measurement of traits.

Other innovation supporting units or networks

- Various competence centres, centres of expertise, etc. e.g. in Finland, Spain
- Animation cell within Valbiom (France)
- Networks in Animal Husbandry (the Netherlands)
- Knowledge transfer network (UK)
- Joint technological Networks Agricultural technical institutes (France)

But also activities within universities, research institutes, consultancy firms, public advisory services, etc.

Source: Country presentations and discussions CWG AKIS-2

The provisional ideas on the EIP and operational groups foresee various innovation activities supporting the start-up of operational groups: animating possible actors in the operational groups, ensure cross linking of actions, promote dissemination and uptake of results, as well as more generally promote visibility and trust. The innovation broker in particular should act as an interface that allows communication and knowledge flow between the different possible involved actors and is independent from one or the other programme. The tasks of an innovation broker are created before the start of an operational group's project and include detecting innovative ideas, refining the ideas and objectives, searching for partners, searching for possible support, clarifying the role of partners, drafting a project plan with deliverables. In case the project gets funded and if useful, optionally, the innovation broker consequently could possibly be involved as a facilitator in the project's implementation. However, this is not part of the innovation brokering function.

Based on the discussions, some questions and potential risks can be formulated. Firstly, there are concerns about the positioning of innovation brokering in relation to other activities. When is 'broker' the right term to use in process/project management/facilitation context? Particularly 'technology brokerage' is a well-defined business activity matching offers with needs/requests. It is also necessary to avoid confusion: brokering is different from consultancy. A point of attention will be understanding the solution-driven approach of the operational group.

When it comes to the effective organisation of innovation brokering, it is difficult to imagine a uniform approach across Europe for 'brokerage' structures, given the diverse AKIS in the EU Member States and the historical reason behind this (e.g. privatisation of extension services versus public systems or a mix of them). There is a clear issue in starting the development of brokering activities from the existing structures and funding within the AKIS. It also seems logical that there may be different brokers active within a national AKIS, as the themes and the issues addressed by operational groups will be very diverse. An important asset of an innovation broker should be to take a cross-sector view and connect across the existing institutes, disciplines and viewpoints etc.

Finally, it is still unclear how the brokering activity will be governed. It is important that the broker's independence is guaranteed and that trust is maintained. This needs to be covered by the governance structure and the funding mechanism.

4.3 Themes for innovation and their grouping

The innovation process within operational groups should be based on a bottom-up approach. The priorities should come from the needs and opportunities identified by the farmers and other end users involved in the knowledge and innovation process (i.e. innovation brokers and advisory services). This fully matches with the philosophy for the development of the operational groups

within the framework of the EIP based on this approach that will allow the agri-food sector to improve its competitiveness and the socioeconomic development of rural areas.

The innovation ideas should come up locally and will not only be based on existing (research) knowledge, as exists in traditional practices and evidences from the daily-basis observations of farmers and other end users. Even though innovation is often seen as a technological issue and process, the importance of non-technological innovation priorities as key to tackle needs and opportunities for the agri-food sector should be kept in mind.

A top-down approach with the pre-identification of priorities should be avoided in general terms, in any case. It could be useful for (international) collaboration in innovation in Thematic Networks and Focus Groups to use themes based upon the broader innovation priorities listed below.

Many EU Member States are implementing research and development and innovation programmes for the agri-food sector and have already identified different broad innovation priorities that the sector should develop in the coming years. Such innovation themes have some commonalities regarding the drivers that make them important, given the priorities identified by the different ongoing national agri-food R+D+i and other sources. They can be grouped as follows:

- *Policy driven innovation themes*: The different policies implemented at EU and global level have a direct influence on the development of the agri-food sector. For instance, issues like animal health and welfare through the EU Animal Welfare Strategy 2012-2015; the sustainable use of phytosanitary products with Directive 2009/128/EC of the European Parliament and of the Council establishing a framework for Community action to achieve the sustainable use of pesticides; the soil systems and water use and the influence of other activities in the contamination of ground water via the EU Water Framework Directive (WFD), are of importance for the agricultural practices and as consequence, related policy-driven innovation themes have been identified: Integrated Pest Management, also for minor crops; systems-based approaches to understand and manage interactions between soil, water and crops/livestock; soil fertility; protect watersheds and water quality; efficient use of irrigation schemes; implementation of the Nitrate Directive and improved water quality; animal health management: zootechnical prevention, less antibiotics; animal welfare; bee mortality; emerging and re-emerging animal diseases and zoonoses. Surveillance control and management.
- *Global challenges driven innovation themes*: It is well known that the agri-food system should contribute to face global challenges such as adaptation and mitigation to climate change, the EU and the global food security with a view to a sustainable development, taking into consideration resource-efficient issues. As highlighted in the third SCAR foresight exercise the agri-food sector should face these challenges in order to have the capacity to feed a growing world demand for agri-food stuffs in a sustainable manner.
- *Mitigation and adaptation to climate change topics*: Livestock sector – reduction of greenhouse emissions (animal nutrition and breeding); climatic change and forest, wine, fruit-tree (perennial crops); adaptation of existing and new crops to new production conditions; climatic change alleviation: positive energy farms.
- *Food security topics*: The need to fulfil the demand of protein for animal and human nutrition and other local products has led to the identification of different topics related to this important issue i.e. local protein supply and protein autonomy, fodder pastures; strengthening food crops production by small holders in the EU and considering also the

outermost regions of the EU; identification and valorisation of autochtonous products for healthier diet and biodiversity preservation.

- *Resource-efficient themes*: The limit for development comes up since the different production factors seems to be limited, in this regard it is compulsory to build up a more resource efficient agro-food system, and knowledge and innovation should contribute to achieving this challenge. Different topics have been identified of importance: Resource efficiency and effluents recycling; recycling of phosphate (or nutrients); treatment and management of slurry; technologies to improve the precision and efficiency of key agricultural management/food manufacturing areas; biomass valorisation; re-use and recycling of crops/animal/food by-products to increase efficiency and other non-agri food purposes (i.e. energy and bio-industry).
- *Socio-economical and non technological innovation themes*: Non-technological innovation and social innovation priorities should have a key role in the development and competitiveness of the EU agro-food chain. The different interactions between the actors along the agro-food chain and the way to structure their relationships are the basis for enhancing the sector. A whole chain approach should be considered for the innovation process in the agro-food sector; not considering innovation as something isolated within the whole system. There are some priorities already identified of interest for the different EU Member States, i.e. New organisational/chain actors relations models for a more balanced food value chain (i.e. food services for tourist areas); innovative commodity chains for territorial development; market and chain innovation; social and economic science to assist the uptake of sustainable, resilient and profitable agri-food practices; alternative models of food supply-chain organisation; socio-economy, consumer protection and consumer acceptance; labour conditions in farms; rural women: foster their status in agriculture, discuss and promote their role in agriculture and annex activities; new advice approaches; agriculture and its role in rural development; ecosystem services – biodiversity and sustainability.
- *Region-wide innovation themes*: The EU 28 is broad and diverse; this is a distinction that gives added value to the EU as a whole. In any event problems and needs should not be considered in a linear and unique way where one-size-fits-all. There are some priorities and needs that should be tackled at regional and sub-regional levels. For instance the possibility to develop cross-border collaboration at the regional level in the EU for the enhancement of the innovation process in the agro-food sector as being feasible and incremental. Some topics arose during the CWG discussion i.e. plant breeding for different regions; water management in Mediterranean vineyards; identification and valorisation of autochtonous products for healthier diet and biodiversity preservation (e.g. Mediterranean diet); enhancing the involvement of regions and countries less active in the EIP, innovation-related activities e.g. Eastern European Countries and some Mediterranean regions.

Thematic networks may focus on specific issues related to the innovation themes listed above but they could also address subjects related to the product chain in which they are involved (e.g. milk, pork, wheat, barley, wine) or – as many farmers are involved in more than one product – subjects related to the farm type (arable farms, dairy farms, glasshouse horticultural holdings, as defined in the Typology of Farms by Eurostat and the FADN). This could help them to interact with specific Technology Platforms (where active).

Another way to cluster operational groups in innovation themes is to take the objective of the EIP-Agro and to break it down it into portfolios, programmes and projects (Box 4.3): the projects being operational groups linked to research. The risk of this approach is too much top-down thinking and research orientation.

Box 4.3 Example of the programme approach for organising research and linking with bottom-up Operational Groups or Thematic networks.

LEVEL	Consists of	Essential queston
Themes	*globalisues*	What is the importance for society?
Portfolios	*group of problems*	Are the most important problems addressed
Programme	*collections of strategies to solve a problem*	Is there enough variety in strategies?
Project	*strategy to solve a problem*	Will the product of the project solve the problem?

THEME		PORTFOLIO	PROGRAMME	PROJECT
EIP for Agricultural Productivity and Sustainability				
	Resource Efficiency	1 More production per hectare	A Higher yielding varieties	1 better crop protection inputs
			B less disease damage	2 improved monitoring by ICT drones
				3 better IPM by more extension
				etc.
			C better aplication fertilisers	
		2 Less input		
		3 More hectares		
		4 High value added of products		
	Sustainability	5 More resource efficiency		
		6 More suistainable techniques		

Source: this project

4.4 Cross-border collaboration

4.4.1 Introduction

Cross-border collaboration in scientific research, and particularly in agricultural research, is fundamental for tackling global issues (e.g. climate change, pest crop infection, sustainable water usage or crop yields). Successful research projects and fast results can no longer be achieved as a result of the work of single focal research groups but rather by establishing consortiums of collaborative transnational teams sharing infrastructures, experience, human resources and expertise in different fields.

In the EU a significant number of programmes and calls have emerged in the last decade aiming to establish European research networks to tackle cross border issues. Scientists have accepted this challenge and long–lasting, cross-border collaboration platforms have been established, based both on the funding of European projects or using bilateral research collaboration agreements between countries for promoting scientific interaction.

Recently, the European Science Foundation[11] did a survey of direct international cooperation between European research funding organisations and research-performing organisations in funding, managing and performing research which provided relevant information on cross-border research collaboration in Europe both for young or senior individual scientists or for research teams (2009 data). This survey clearly pointed out as future trends that the funding organisations are faced with strong demands by their national research communities to expand resources for European and international collaborations, while having to cope with legal and budgetary limitations as well as with the reservations on spending national tax-payers' money abroad. This survey identified strong interest in multilateral cooperation in Europe and to some extent beyond, in flexibly responding to the needs of the scientific communities for joint bottom-up programmes and access infrastructure, in approaches to jointly define relevant research topics, and in joint procedures.

The issue of cross-border collaboration has therefore been a major subject within SCAR and we herein present data from the delegate countries on the experiences shared up to now and plans for the future concerning the increment of collaboration in the light of Rural Extension.

4.4.2 Experiences of cross-border collaboration among EU Member States

It is clear that international partnership is a common R&D activity for every single country. Programmes such as the ERA-Nets, JPIs, KICs, Interreg, and FP7 are common ground and most countries have experienced being partners in such programmes, at different levels of coordination and participation from which they have a global positive experience, mostly for ERA-Nets in which agri-food and environmental cross-border issues are central. They work well, particularly for Animal welfare and diseases, plant health, food, seafood, organic farming, ICT/robotics and integrated pest management).

ERA-Net type collaborative projects are considered to have the advantage of being more applied, and less heavy (less costly) to set up, integrating more professional partners and affording small or mid-size actors, therefore acting has a springboard for more ambitious FP-projects. Somehow they can be seen as natural extensions of regional projects at transnational level. It is clear that through common activities and intensive cross-border networking strength the ERA and can act as a starting point for new collaborations (e.g. Horizon 2020, EIPs).

In addition, cross-border cooperation allows collaboration with others to tackle problems within the same geographical/climate area, decreases fear of collaboration at transnational level (breaking language and cultural barriers) and provides training for future projects at EU level. It promotes the exchange of experiences from different regions and countries with the same production specificities while creating networks for future actions. It also allows the challenges to be approached from different angles to offer common solutions and it deepens the collaboration among researchers, funding bodies and ministries at EU-Level.

Although sometimes cross-border collaboration can be a useful addition to national programmes it is invaluable where a clear mutual interest is identified in complying with EU regulations (pesticides**,** nitrates, soils) or emerging/spreading threats (animal, plant diseases, invasive species, climate change).

11. http://www.esf.org/fileadmin/links/cssd/mo_fora/careers/CrossBorderRes.Collab.pdf

Cross-border projects allow satellite subjects in EU Member States to be addressed (for instance pastoralism in France) that can federate at cross-border level important stakeholders. A significant load of technical and agronomical innovation (public goods, eco-system services) is part of a cross-border interest.

In fact, most countries are extending their cross-border collaboration beyond Europe. As an example, Finland has established the TEKES: Finnode innovation network for collaboration with China, India, Japan, the USA and Russia. On the other hand, using the Interreg experience, Portugal and Spain have designed a bilateral research partnership, the RITECA project (http://www.riteca.eu) integrating 24 R&D organisations involved in dozens of projects on agricultural research.

Also, Denmark has many good examples of cross-border cooperation e.g. the ENDURE network (http://www.endure-network.eu) – all aspects of Integrated Pest Management (IPM) and European Cattle Innovation Partnership (ECIP) (http://www.scar-cwg-ahw.org/index.php/livestock-sectors/cattle).

Similarly to the Danish innovation strategy, there is an increasing understanding that innovation must be driven by societal challenges: demand for solutions to concrete societal challenges must be given higher priority in public innovation policy. More knowledge must be translated into value and the focus must be directed towards mutual knowledge exchange between companies and knowledge institutions and more efficient innovation schemes.

Central to this issue, education should be seen as a means to increase knowledge capacity and therefore be highly considered in cross-border collaboration schemes. Programmes such as Erasmus Mundi, Marie Curie and Leonardo da Vinci are examples of efforts to increase the mobility of students and educational staff.

Nevertheless, the drawbacks and disadvantages of past experience have been identified and should be taken into consideration while planning future programmes. One of the disadvantages of cross-border collaboration projects is the burdensome management, which makes it difficult for smaller countries and institutions to embrace such projects. Management rules and expected outcomes are, for instance, different from one Interreg programme to the next which creates the need for constant changes in procedures. Interreg is not pan-European with the exception of Interreg C (interregional cooperation)[12], which has a very small budget and is very competitive, while adapted for numerous subjects that need to be addressed at EU level.

The benefits of cross-border collaboration have not yet gained sufficient visibility. The dissemination of successful cases must be increased. This leads to an – incorrect – major concern that when resources are used mostly for cross-border collaboration they may not be available for national projects. It is correct when international projects are chosen that fit the national (regional) strategy, but in reality strategies are not always clearly defined and executed and administrative command over budget can play a role too. Regardless of these difficulties, it is a common belief that transnational collaborations will become more and more important in the future as most challenges do not stop at borders.

12. Interreg IIIC promoted interregional cooperation between regional and other public authorities across the entire EU territory and neighbouring countries. It allowed regions without common borders to work together in joint projects and develop networks of cooperation. The overall aim was to improve the effectiveness of regional development policies and instruments through large-scale information exchange and the sharing of experience (networks) in a structured way.

There are also some deeper concerns about cross-border collaboration. One of them is the fact that some countries are much more involved than others. More universities in north-western Europe (and northern Italy) are in the top-league (like the Shanghai-index or the Times' Higher Education ranking). That makes them more competitive and sought-after partners in programmes such as FP7. Such specialisation is good for the effectiveness and efficiency of using the research money but it runs the risk of excluding centres elsewhere (and even under-investment in some topics of research that are not well known or relevant to these competitive regions). It supports a certain brain drain from eastern regions to the west. And although the assessment of projects in the FP7 takes collaboration between the different parts of Europe into account, there is clearly a call for widening participation. A balance has to be found between the specialisation and competitive advantage of regions on the one hand and inclusiveness on the other. That is especially relevant for the eastern EU (Florianczyk *et al.* 2013) and, for example, the western Balkans, but it also applies to some Mediterranean countries.

The current situation of cross-border collaboration can be described as still a marginal activity that tops up national research programmes. The majority (experts often cite 90 % or more) of the money is spent nationally and very often in the form of staff being part of the government administration or as input budgets or subsidies. There is not a real European market for research and education. However pooling of budgets such as in JPI and ERAnets, as well as exchange programmes for students, make small inroads into this situation. Another change is the consortia of internationally active companies, such as those in the domain of ICT (Future Internet PPP) or bio-based (JTI BBI, Bio-Based Industries) that pool budgets and make a deal with the EC to run European-wide programmes. Austerity measures in some countries might also lure politicians and administrators into creating a more European research and education market. However, those that envision such a future still have a long way to go.

Cross-border collaboration in innovation and extension is probably even more marginal. Some research projects have clear links with innovation processes, and certainly some Interreg projects work on innovation. However we were not able to identify many transnational processes around innovations and supporting the spill-over effects, e.g. by exchanging staff in extension (or work on European quality certificates), to have exchange programmes for (young) farmers (as existed in the 1950s and 1960s between Europe and the USA) or that help professional agricultural journalists to cover stories on innovations in other countries.

4.4.3 Suggestions for the future

A common European strategy for future cross-border collaboration is more difficult to identify, has each country has its own science policy and particular challenges to face, specific adjustments to perform and strategic bilateral collaboration priorities with neighbouring or remote countries.

However one major point on the agenda is to create common rules and procedures between EU Member States for commissioning research and innovation programmes, and in that way create a real European 'market' for science as well as research and development. That does not mean that national or regional authorities should give up their strategy and agenda-setting processes. On the contrary, for successful cross-border cooperation these processes are essential and should in some cases even be strengthened. But commissioning of the research based on that agenda should be organised in such a way that the best results are obtained. That includes an optimal level of international collaboration, to prevent overlap and duplication

of research (and investment in research infrastructure), to benefit from efficiency of scale and spill-overs and to create further specialisation in the research system. To organise the research in such a way is helped by the pooling of resources (such as in ERA-NETs and JPI). It would also benefit from common rules and procedures in commissioning research (e.g. making it easier for research institutes to match proposals from different programmes) and by opening the market to institutes from other countries (e.g. allowing institutes to work in a national project with a foreign partner with which they team up within a European project). Box 4.4 provides insights into the suggestions for future cross-border collaboration as put forward by some EU Member States in the CWG.

Box 4.4 Suggestions for future cross-border collaboration

- *Promote coordination and collaboration*
  - Improve the collaboration of the existing networks and projects, by using the Platform projects (CSA of ERA-Nets in KBBE), SCAR, ERANET and JPI as driving forces
  - Improve networking across borders and amongst organisations
  - Improve websites with more data on ongoing research and emerging problems (pests, climate change, technology)
  - Implement better (Internet-based) communication tools
  - Increase linkage and integration with other fields of innovative activity (forest industries, ICT, engineering, clean-tech, bio-processing etc.)
- *Create opportunities for cross-border collaboration*
  - Define innovation needs at the local/territorial level
  - Integrate the vision from different regions of the EU to tackle specific problems and/or opportunities
  - Invest in international themes like trade investment, international development, food security
  - Allow for the bottom-up identification of opportunities and only use a top-down approach in a limited number of bigger projects. Use the focus groups and thematic networks as stepping stones
- *Establish supportive framework conditions*
  - Define a strategy for the future that builds upon the identification and structuring of regional, national and international priorities, while avoiding a 'one-size-fits-all approach'
  - Establish common criteria for selection and a common calendar for the calls for OGs
  - Create an environment for innovation in support of economic growth and sustainable production
  - Create a sustainable intensification: Improving the take-up of existing successful technologies by the agri-food industry, and meet regulatory and environmental/climate change challenges
  - Create a professional workforce: Fostering knowledge transfer, improving advice, training, skills, the status of agri-food careers, encouraging new entrants/apprenticeships
  - Address the issue of intellectual property rights
  - Enable broad stakeholder participation/engagement
  - Create a definition of guidelines/priorities for agricultural research and innovation
- *Establish or expand adequate funding schemes*
  - Combine CAP funding with H2020 funding, making H2020 more orientated towards innovation, interdisciplinary research and application-orientated research
  - Fill the gap between regional operational groups and transnational multi-actor projects
  - Strengthened the Interreg instrument by providing the programme with more funds, a stronger R&D component and expanding for EU-level (especially eastern EU Member State) participation.

Source: Country presentations and discussions CWG AKIS-2

In the overall analysis emphasis has been given to enlarging the geographical scope of Interreg-type projects, reducing to some extent the bureaucratic and management burden, encompassing cross-border training and education within the projects and basing the programme on the needs, creating a global environment for innovation.

The unquestionable value of cross-border collaboration is on the basis of any successful R&D strategy. Actions to promote and facilitate this collaboration must be central for a successful European programme that must create adequate tools for the integration of smaller and peripheral countries and promote global and inclusive networks.

In addition to collaboration in research, the spill-over effects of innovation need attention, as suggested at the end of the previous section.

4.5 Innovation policies

This section focuses on innovation policy instruments to foster innovation in the agricultural sector. It starts with the incentives for innovation in the agricultural sector and continues with a description of government policy instruments to foster innovation in the agricultural sector. Each section is coloured with a number of examples of instruments from the EU Member States. The section ends with the potential role of the EIP Agriculture in national agricultural innovation policies.

The agriculture sector might have many incentives to innovate but there are also a lot of potential barriers to innovation. The main goal of this section is to get a notion of incentives for the agricultural sector to innovate and the barriers which can hamper innovation. A second goal of this section is explaining the differences between the frequently used innovation models, the linear innovation model and the multi-actor use model.

Incentives to innovate

The challenges for the agricultural sector in Europe are significant. On the one hand, the challenges are related to the existence of many agricultural producers in the context of increasing liberalisation of trade in agricultural policies, strict environmental policies and the possible future decreasing impact of agricultural producers. One strategy to survive is innovation. Innovation in this context has the target of lowering cost prices or introducing new products from new markets.

Agriculture has also a societal link. The production of the agricultural sector has an impact on the physical environment. Governments have different instruments for protecting the environment. Many of these instrument are the implementations of European directives, such as the Nitrate Directive. On the one hand environmental policy protects the physical environment and on the other hand, these policy instruments influence the production possibilities of the agricultural sector. Innovation is a possible remedy to improve or increase agricultural production.

Barriers for innovation in the agricultural sector

Barriers can be categorised in different ways. The frequently used division of barriers for innovation are the barriers which are external or exogenous to the producer and the barriers which are internal or endogenous.

- *Exogenous barriers* can be supply, demand or environment related. Supply barriers can be, for example, the difficulty of getting certain materials. Demand barriers are the possible absence of a market and environmental barriers are environmental regulations, policy actions or anti-trust measures.

- *Endogenous barriers* show a more diverse picture: resource-related barriers, technical expertise or management time, culture and system-related barriers. Resource-allocated barriers are for, example, the lack of resources; technical expertise is, for example, a lack of knowledge; culture-related barriers are, for example, avoiding risks and system-related barriers are, for example, market characteristics such as a lot of small players for which the transaction cost for innovation are rather high (Hadjimanolis, 1999). Box 4.5 provides information on the issue of entrepreneurship.

Box 4.5. **Approaches for stimulating entrepreneurship in the Netherlands**

Text written by H.B. Schoorlemmer, A.C.G. Beldman, K.J. Poppe (Wageningen UR)

Farmers in Europe face a lot of challenges related to changes in markets, society and policy. So it is important that farmers are able to explore new possibilities, adapt to new circumstances and move their farm business in a direction that guarantees an income and/or continuity on the farm. This means that farmers need entrepreneurial skills. In the EU-FP6 project *Entrepreneurial Skills of Farmers* (http://www.ESOFarmers.org) entrepreneurial skills were divided in three types of skills. These were opportunity skills (e.g. recognising opportunities, innovation and risk management skills), strategic skills (e.g. receive and use feedback, conceptual and strategic decision-making skills) and cooperation skills (e.g. networking, team-working and leadership skills).

Improvement in entrepreneurship can be realised by a focus on the farmers, for example by training and education, or with a focus on enabling the environment with the idea that an entrepreneurial climate will result in entrepreneurial behaviour.

Facilitated by governments and research, in the last 5 to 10 years a number of projects and programmes in the Netherlands took place with the goal of stimulating entrepreneurship in farmers. Key elements in these activities were:

- *Activities took place in groups or networks of farmers.* Working in networks has the great advantage that farmers help each other and sharpen each other's opinions. The latest knowledge is easier to apply. Easier than in larger group meetings or in an individual setting.
- *Goals and ambitions of farmers as starting point.* The group or network was built around a concrete idea or need of the farmers. The farmers decide about the goal and innovation agenda.
- *Learning by doing.* The central point was the development of a specific business plan, product market combination or innovation. Farmers prefer to learn on the job. In a guided approach they worked on their own plan and as a side effect developed the needed entrepreneurial skills.

The table below shows a number of Dutch approaches with these elements of working in networks, goals and ambitions of farmers and stakeholders as a starting point and with learning by doing:

Goal	Approach
Farmers improve entrepreneurial skills	• Interactive Strategic Management • Innovative networks
Farmers recognise and realise opportunities	• Development of business plans and new Product Market Combinations • Co-innovation • Business model innovation (Canvas)
Stakeholders improve entrepreneurial climate	• Regional transition approaches • Stakeholder management • Network approach with innovation brokers / free actors

Three approaches will be explained further: Interactive Strategic Management, Innovative Networks and Regional Transition.

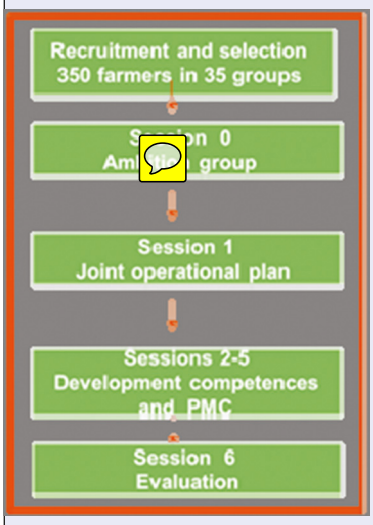
Interactive Strategic Management

The goal of Interactive Strategic Management (ISM) is empowerment of entrepreneurs (developing entrepreneurial skills) and developing a strategy that fits with their own situation. In interactive groups of 8 to 12 participants, farmers develop a farm strategy or re-orientate themselves on the current one. The farmers assess their competences and analyse the current situation of the farm (structure and performance) and the environment (including market and society). In the next step the farmer translates this into a matching strategy and an action plan. In this process the farmer is supported by facilitators and Internet tools. The approach and tools have been developed by Wageningen UR but by 'train the trainer' courses several professionals are able to facilitate a group of farmers.

Examples

Since the start more than 600 farmers have joined an ISM group in the Netherlands. For example, a programme was worked out with Rabobank and the Dutch federation of young farmers to support farm successors. In the European Leonardo da Vinci project 'Interactive Strategic Management Methodology for improvement of agricultural entrepreneurship in Central-Eastern Europe': in total 15 groups of 8-10 dairy farmers from Poland, Slovenia and Lithuania developed their own strategy.

Innovative networks



In innovative networks farmers work and/or learn together on a specific question, business plan or promise. The network is facilitated by a 'free actor'. The task of this facilitator is to mobilise the needed expertise and make use of intervention strategies if the innovation process blocks.

Examples

In recent years more than 125 innovation networks from farmers and from combinations of farmers, SMEs and others were guided in their innovation process such as the networks of livestock farmers working for sustainable innovations (http://www.verantwoordeveehouderij.nl/nl/nl/Home/netwerken.htm) and arable farmers working on the improvement of soil quality (http://www.vitalebodem.nl/het-praktijknetwerk). In the project PlattelandImpuls (Rural Impulse) 350 farmers in 35 groups participated. They used an average of six meetings with agenda setting, brainstorm sessions, internal and external analysis, master classes and excursions etc. The figure shows the process of the groups. The majority worked on market penetration or market innovation with an existing product. A few started with the development of new products for existing or new markets. Based on an evaluation 80 % indicated a development of their entrepreneurial skills.

Regional transition

The identity and economic and socio-cultural infrastructure of a region are increasingly used as important items by local governments and companies to distinguish themselves from others. But it is often unclear what specific strategies are promising given the context and dynamics of the area. This interactive approach focuses on the development of a shared regional innovation agenda in cooperation with regional policy-makers, the private sector and researchers. It results in more commitment, power and innovativeness in realising activities. Key elements are: scenario-analyses, stakeholder analysis, agenda setting and the forming of coalitions and innovation networks working on specific opportunities as a follow up to the innovation agenda. Researchers at Wageningen UR are involved in developing the future vision and in innovation networks as expert or process facilitators.

Examples

In North West Netherlands (Noord-Holland Noord) a four-year innovation programme is running to support the competiveness of regional agri-business, mainly by connecting research and education to business in innovation projects (see http://www.agriboard.nl). In the first phase of the programme, a Knowledge and Innovation Agenda was developed with stakeholders to focus the efforts of the project. This is the framework for innovation projects with regional businesses. The agenda is revisited during the project to keep up with new developments and lessons learned within the programme. The programme supports innovation projects with regional agri-business, as well as thematic projects to explore regional opportunities on specific themes. Specific opportunities could result in innovation projects, if adopted by companies.

Source: H.B. Schoorlemmer, A.C.G. Beldman, K.J. Poppe (Wageningen UR)

The linear or the multi-actor model

The innovation model under the agricultural EIP goes far beyond speeding up transfer from laboratory to practice through diffusion of new scientific knowledge (referred to as a 'linear innovation model'). The EIP adheres to the 'interactive innovation model' which focuses on forming

partnerships – using bottom-up approaches and linking farmers, advisers, researchers, businesses and other actors in operational groups.

This knowledge 'exchange' will generate new insights and ideas and mould existing tacit knowledge into focused solutions. Such an approach will stimulate innovation from all sides and will help to target the research agenda.

The role of governments

The rationale behind governmental R&D support is that the agricultural market provides too little R&D because agricultural producers perceive the chance of success to be too low or the costs of innovations and experimentations too high.

With the exception of R&D subsidies for private sectors there is also a lot of support for a role for the agricultural producers for innovations for the challenges of society. Examples of these challenges are climate change, food security, biodiversity and water management.

Example of Denmark

A project tested dairy cows in a closed chamber (oversized cheese bell) to find out which combinations of feed have the least climate impact, while at the same time producing the most milk. (The burps from the cows have a high content of the greenhouse gas methane).

Agricultural Policy Innovation Instruments

An important question in the design of innovation policy documents is: who benefits? Which innovations will be fostered? Demand-driven means: allow for an open process of research programming within the EIP.

Four types of policy instruments are available to stimulate agricultural innovation:

- Government R&D that provide spill-overs to the private sector
- Specific, or more general, subsidies for public R&D or subsidies to speed up the innovation process (such as financing innovation brokers, innovation boards)
- Awards for successful R&D efforts (prices, innovation vouchers)
- Non-financial instruments such as changing laws which hamper innovation.

These types are discussed below in more detail.

4.5.1 Knowledge spill overs from governmental R&D

An added value from governmental agricultural R&D is that it provides knowledge spill-overs. A knowledge spill-over is an exchange of ideas among individuals. In knowledge management economics, a knowledge spill-over is a non-rival knowledge market externality that has the spill-over effect of stimulating technological improvements in a neighbour through one's own innovation.

Example of Germany: The BMELV activities in Germany on Research and Innovation

In Germany there is the Programme on Organic Farming with a budget of approx. EUR 8.5 million/year. The German Federal Organic Farming Scheme focuses on practice-oriented and interdisciplinary research (applied research) and transnational research (ERA-Net Core Organic). Knowledge transfer/ exchange is included (addressing researchers, advisors, farmers). For example Stable Schools, Advisor-Farmer-Networks.

4.5.2 Specific grants or more general subsidies for public R&D or subsidies to speed up the innovation process

There are two types of R&D subsidies: generic and targeted subsidies. Generic policy would be, for example, to provide a direct *ad-valorem* subsidy to research expenditure, regardless of the research area or a tax allowance for the loans of R&D-workers. While this type of policy has certain drawbacks, related to additionality, crowding-out and policy-races with other countries it does not distort incentives for firms to experiment.

Targeted R&D subsidies, for example, distributed by running a 'beauty contest' for proposals, are more problematic if the firms applying for the subsidies, have more knowledge and information than the agencies making the allocation decisions. This is more the case for the agri-food companies at the global frontier.

Example of Innovation in the Netherlands: the top sector approach as a specific innovation approach and other more general innovation instruments

The Top Sector Approach

The Netherlands have chosen nine top sectors as a target of their innovation policy. The sectors have a strong international position. Industry and science share a wealth of knowledge and jointly develop innovations. The products and technologies produced by these top sectors contribute to finding solutions to societal issues. The food and horticulture sectors for instance invest in developing healthy foods for consumers. This will help reduce healthcare costs and absenteeism rates.

Nine sectors were chosen in the 'To the top' policy document (in Dutch). The theme "head offices" was added later. The establishment of head offices in the Netherlands helps to sustain the country's strong economic profile, and it also creates jobs, which makes it important for all top sectors.

Each sector has its own challenges and opportunities. Take for instance the port of Rotterdam and Schiphol airport, both working hard to stay ahead of other ports and airports competing in the global logistics sector. Businesses in the creative industry excel in designing and producing art, music, buildings and games. But there is unexplored potential in marketing these products. The food and horticulture sectors aim to expand their international positions. The energy sector sees opportunities in the development of renewable energy sources.

Action plans

The top sector approach is geared towards providing a solid exchange between businesses, knowledge institutes and the government (the 'golden triangle'). The government does not make its own proposals for the sectors, but invites businesses and scientists to draw up action plans. A top team has been put together for each sector, consisting of:

- an innovative SME entrepreneur
- a scientist
- a civil servant
- a standard bearer for the sector

The top teams talked to businesses and scientists and mapped out the various opportunities and challenges. They presented action plans detailing their ambitions, what they advise and a plan of approach.

Two of the top sectors are linked to the themes of the EIP: Horticulture and Agri-food. Subsidies for innovations are targeted for research and innovation for those sectors.

General Innovation Instruments in the Netherlands

The Netherlands also has more general innovation instruments. The fiscal innovation policy instruments are important instruments. Private parties investing in innovation can get a tax deduction in many ways: for investment in equipment, decreasing the loans of R&D workers or decreasing profit taxes from innovative products.

Subsidies for linking farmers to research: Innovation Broker, Technology Boards and other possibilities

The inter-linkages between different AKIS-subsystems, but especially the link between farmers and research, are an important issue when it comes to speeding up the innovation process. Innovation brokers can here play an important role, as described in Section 4.2. There are no indications of separate policy instruments aimed at the support of innovation brokering in the EU Member States, but often brokering activities are supported through broader instruments. For example through policy measures aimed at information provision and farmers' networks.

Technology boards are a second way of stimulating the interaction between different stakeholder groups. In general, technology boards have to set the research strategy in a specific research field. This is for example the case in the UK where the new cross-government Agri-Tech Strategy supports a similar partnership approach.

Example of the United Kingdom: Technology Board

Technology Strategy Board (with co-funding from Defra and BBSRC) Sustainable Agriculture and Food Innovation Platform similarly brings together government, business and researchers to stimulate innovation, through new technologies, processes and products, for productivity/ sustainable growth in the sector. Competitive calls so far on crop protection, sustainable protein, food technology; measurement of traits.

Subsidies for information provision and networks of farmers, researchers and other actors

Innovations depend on the geographical infrastructure and its capability of mobilising technical resources, knowledge and other inputs needed in the innovation process. It is crucial for the innovation process itself. Information can be knowledge, information on regulation, creation of networks. But is also important to avoid duplication of innovative solutions. This infrastructure includes sources of knowledge, such as networks of firms, concentrations of R&D and business services.

Information is crucial for innovation. Farmers might be skilled in various ways and therefore have variable competences to adapt information. The skills of farmers have an impact on their innovativeness. In some countries many farmers are educated to a Bachelor's degree level. It is therefore important to analyse the role of higher agricultural education in promoting innovation and the effects of education on the productivity, and therefore the competitiveness, of the agricultural sector. Empirical research has convincingly shown that education raises labour productivity. But being innovative is often not a process of an individual farmer. Knowledge and the exchange of knowledge and the link with research is often a driver for innovation.

Linking farmers to research – examples from the EU member states

In the **United Kingdom** there are Collaborative R&D partnerships with the agri-food industry in Defra's former LINK Programmes: Farmers/industry influencing research agenda; awarding a 50 % grant for R&D projects to consortia (research/industry partnerships). The new cross-government Agri-Tech Strategy supports a similar partnership approach.

In **Sweden** there is funding for applied research projects through the Swedish Farmers' Foundation for Agricultural Research. There are planning committees with farmers, researchers and experts from the agricultural industry to make decisions. An example of a project: Integrated weed control. The aim is a decrease in the amount of plant protection products by 70 % through precision spraying and mechanical treatment between the plants. Participants are the University (SLU) Research institute (JTI), advisory service (Hushållningssällskapet (HS)) and farmers.

The Chamber of Agriculture in **Lower Saxony** (Department for Organic Farming) and the Competence Centre for Organic Farming Lower Saxony have close connections to organic farmers through their daily work and thereby learn about current problems. Those current problems are a basis for the initiation of experiments and research projects for both organisations. The results of the experiments and research projects are passed to the farmers and other stakeholders of the organic sector through presentations, articles in circular letters and agricultural journals and individual advisory activities.

In **Belgium** there are different connections between farmers and research, for example, LA-trajectories (funded by the Agency for Innovation through Science and Technology). Strong interaction with the sector and dissemination activities are required. Co-funding (10 %) is essential. The programmes make use of pilot farms, demonstration platforms and websites. Furthermore there are Technical Committees of experimental stations where the presence of farmers and farmers' associations is required.

4.5.3 Innovative Policy Instruments Awards to successful R&D efforts

Awards

Personal and team awards for innovative solutions to be more competitive or for societal problems where the agricultural sector could play a role are relatively unknown agricultural innovation policy instruments. Awards fit perfectly with the goal to increase incentives for experimentation. Patents and copyright protection awarded to innovators also fit into this policy category. Awards are also effective in stimulating experimentation, while at the same time improving innovation in areas with high societal benefits and they allow policy-makers to commit to future expenditures on some, as yet non-existing, product or service.

A procurement process for these products or services would select as the winners those firms that developed the best and most efficient technology and service delivery, where the criteria for winning the contract becomes more specific over time. This type of guaranteed market for a future product takes away one hurdle for firms doing experimentation, namely knowing if a market for theft product exists. The firms however still face the uncertainty of whether their innovative solution to providing the service will be good enough to win the procurement process at the end of the innovation race.

SBIR

The Small Business Innovation Research (or SBIR) programme is a United States Government programme, coordinated by the Small Business Administration, in which 2.5 % of the total extramural research budgets of all federal agencies with extramural research budgets in excess of USD 100 million are reserved for contracts or grants to small businesses. In 2010, that represented over USD 1 billion in research funds. Over half the awards are to firms with fewer than 25 people and a third to firms of fewer than ten.

The example of Switzerland: Agricultural Innovation Awards

This policy is to reward planned or carried out innovative agricultural projects in order to increase their attractiveness and competitiveness; promote new technologies. The most promising aspect of this agricultural policy innovation instrument is a good media coverage and regional impact.

The example of Estonia

Estonia has a competition to promote innovation in the agricultural sector with three competition categories:

- The best agricultural joint activities project
- The best innovative agricultural project
- The best agricultural knowledge transfer project

All projects will be reviewed by the pre-selection committee, which will select four projects from each category. The best projects from each category will be selected by a panel of the members of the Estonian Rural Network Cooperation Chamber. In the course of selection, information about projects is also asked from the ARIB and the best projects from each category are inspected on-site. In 2012, 18 competition projects were delivered.

The SBIR programme is an instrument for the government to promote the development of creative solutions for societal challenges. An executive committee reviews the proposal. Good projects will get grants for different stages of the innovation projects. The costs of the three stages of the innovation process can be covered with the SBIR programme: a feasibility study, a research and development stage and a stage to make the innovation marketable. The Netherlands and the UK's Technology Strategy Board have SBIRs.

Example of the Netherlands: SBIR – good experiences – with a little bit of money, a lot of results

The Dutch Agricultural Economics Research Institute (LEI Wageningen UR) made an inventory of the experiences of actors in the agricultural sector with innovation instruments. The experiences with the SBIR programme in the Netherlands are positive. Various representatives point out that the SBIR programme stimulates innovation in the agricultural sector. An advantage is that due to the competition element only a few proposals could be performed. An improvement should be made in reducing the high cost of the evaluation committee (Van der Meulen, 2011).

Vouchers/Innovation cheques

An Innovation Voucher provides funding for agricultural producers to work with an external expert for the first time, gaining new knowledge to help the agricultural sector to develop and grow.

The help from an expert could include advice on an innovative idea, learning more about using design within the agricultural sector or the management and use of intellectual property.

The example of Switzerland: Innovation Cheques

These cheques are issued by the CTI to small and medium enterprises for the purpose of conducting R&D activities in partnership with public research institutes/pursuing R&D activities. The main advantage of these agricultural innovation policy instruments is the high response, despite the relatively low amount.

4.5.4 Non-financial instruments and institutional network

Except for the growth of the agricultural sector and the development of agriculture in general, the institutional framework in a country is a critical factor for innovation in the agricultural sector. The institutional framework is a set of rules which influences the behaviour of agents. They define the property rights and determine the transaction costs for agents. Furthermore, there are more formal institutions and a structured system of laws that is imposed by representative forms of governance.

Markets and Innovation

The intensity of competition has an ambiguous effect on the willingness to innovate. In competitive markets the willingness to innovate might be significant. The Agricultural Economic Institute in the Netherlands show in their study (Van der Meulen, 2011) on the experiences with innovation policy instruments in the Netherlands that there is a lot of innovation between the primary agricultural producers and their supplying companies. The supplying companies have an incentive for continuous innovation efforts because of the intensive competition with other supplying companies. In competitive markets, there are no losses for innovative entrants. The main reason for this is that they have no monopoly profits to lose.

(Environmental) Regulations (Mandates)

Environmental regulations in any form, command-and-control or market-based, have the potential for inducing or forcing some amount of technological change, since by their very nature, they induce or require firms to act in ways in which they would not otherwise choose to do.

Cultural Aspects: the adaptation of innovation

Another type of institution that is important for innovation is the social institutions, which refer to repeated patterns of behaviour, such as habits, routines and conventions. Innovation is strongly dependent upon the social institutions and their variety of routines and social conventions.

Labour Market Policies

Labour market policies are normally not aimed at influencing innovations. However, it is important for the innovative strategies of agricultural firms. Labour market policies affect the firms' capacity to appropriate the gains from innovation activity since these policies affect the cost of implementing innovations. The impact of job regulation depends on the system of industrial relations, and the unique characteristics of each industry.

Other aspects: Infrastructural Policies

Research has shown that knowledge flows tend to be spatially bounded and that an extension of functional regions by means of shorter travel times may stimulate knowledge production as well as productivity growth. Physical distances between actors, which might be crucial in the agricultural innovation process, might be a crucial factor in agricultural innovativeness.

4.6 Incentivising stakeholders

Within the conceptualisation of the EIP agriculture, it is important to reflect upon the incentives that can be used to motivate stakeholders to participate in relevant operational groups. Such a reflection is needed, as the first AKIS-report (EU SCAR, 2012) clearly showed that the different parts of the AKIS are governed by different incentives. This finding threatens the synergy and cooperation between the AKIS subsystems, which is aimed for by the EIP. This section therefore aims to give a flavour of existing incentives in European countries and regions. The findings are based on national/regional presentations and discussions on the issue of incentives. Elements under consideration are the existing instruments, the problems experienced at system level and blockages that may hamper stakeholder groups from participating in operational groups.

4.6.1 Existing incentives

The EIP and its operational groups are new concepts at EU level which have been building on existing instruments in countries and regions which stimulate different actor groups to cooperate in setting joint work agendas/programmes, in collaboration with each other's work and in using each other's results.

The most important group of those incentives is financial instruments, which are used to stimulate different stakeholder groups to work together in the realisation of common objectives. A distinction can be made between subsidies and fiscal instruments. Examples are levy funding, research clubs and tenders for collaborative partnerships in the UK, the applied agricultural research programme in Sweden and Flanders, the top sector approach in the Netherlands, the innovation plan for animal production in Spain, the RDP measure on vocational training in Estonia, CASDAR-projects in France, the measure on technological innovations and transfer of research results of the Italian Multiregional Operational Programme, project funding by the Finnish Funding Agency for Technology and Innovation and by the Finnish Academy (e.g. on integrated pest management), AGRO, PRODER, QREN-programmes in Portugal. Tax and fiscal instruments are for example present in the Netherlands and Italy.

The government can oblige collaboration between the agricultural research institutes (as was shown by the 'marriage' in the Netherlands leading to Wageningen UR), but it is also possible to take a softer approach and work together in developing the research agenda. Some government

measures do not directly support the cooperation between stakeholder groups, but want to create a framework that sets the scene for cooperation. This is, for example, the case if there is a bonus-mechanism within evaluation criteria. Projects that have certain envisaged qualities (e.g. a bottom-up and participatory approach, specific attention towards dissemination and the expected implementation of results) then get a benefit in the evaluation.

Interaction and cooperation can also be stimulated through the establishment of joint boards and other multi-actor networks. Examples are the Technology Strategy Boards and the new Agri-Tech Strategy (UK), the technical committees of experimental stations in Belgium, research boards in Denmark and competence networks in Germany. An example of such a sustained cooperation is the mixed technological units in France. Finally, the government can also invest in cooperation by showing good practices, investing in training and knowledge transfer networks, and involving applied researchers in giving lectures.

But the government is not the only actor that can set incentives for cooperation and coordination; this can also be done by the stakeholders. Some applied researchers are, for example, highly involved in cooperation with farmers to get information and inspiration for their research. In Denmark on the other hand, the DAAS is funded by the farmers through levies and operates a two-level system with the Knowledge Centre for Agriculture (back-office) and 31 local advisory centres (front-office). Also in the UK, levy boards are present to steer and fund applied research, but the Netherlands has recently abolished them.

4.6.2 Problems experienced

But despite the existing incentives, cooperation between AKIS subsystems and wider stakeholders also has to face problems. This paragraph aims to give an overview of the problems that have to be faced at a system level, while paragraph 4.6.3 will then focus on the barriers experienced by specific stakeholder groups.

In an economic context, it is rather normal that actors or stakeholder groups have the propensity to look after their own interests and not those of the other groups or the community. This process is enforced by the fact that different types of actors are incentivised in other ways. But even when this is not the case, problems may arise. Money or funding is, for example, a way of stimulating a certain way of working, but as a matter of fact, the researchers and other AKIS actors are then forced to follow the money. In many cases, it more concerns project funding, which has a temporary timeframe while certain problems ask for a long-term approach. Both elements feed the fear that the scientific knowledge base of a country or a scientific field may be affected if the focus of funding instruments shifts towards innovation. This fear is based on the fact that innovation approaches mean a crowding out of funding for basic research, which does not have to be the case.

A second element with regard to funding is the eligibility criteria and the eligibility of certain actors. More applied research institutes are, for example, not eligible when it comes to funding by some research councils or farms are often not considered to be SMEs when it comes to funding schemes. Finally, farmers and farmers' organisations are often not eligible as a beneficiary of agricultural research funding, despite their involvement in the project and active participation through field trials on their farm.

Administrative and bureaucratic burden can be an important barrier for actors to participate in operational groups, in particular if actors are small-scale and have insufficient technical or administrative capacity to prepare and/or take part in projects. Governments should be aware of this issue and limit the paperwork required. In federal states, it may be a good idea to work with uniform standards across the different states to promote cross-border collaboration.

Other issues are not linked to the funding, but more to the functioning of the national AKIS and broader aspects. Evolutions through time have in some countries, for example, led to a situation where the roles of the AKIS-actors are no longer clearly delineated. That is not always a problem or can even be attractive. But it can be a problem when there is confusion about the content of certain tasks. Is a researcher for example supposed to foresee extension activities to disseminate and implement his/her research results? This leads to confusion and ultimately gaps within the AKIS. Some countries are confronted with a significant degree of fragmentation in the AKIS, mainly of extension services. This leads to a lack of visibility, also for the farmers. Notably private advisory services easily remain under the radar with government services and may be forgotten when new actions are taken.

AKIS subsystems or stakeholder groups often have different cultures or 'languages', which makes it harder to cooperate with other subsystems or stakeholders. This is for example shown by the case of applied research and extension services, as both have another perspective and another time frame when confronted with a problem in practice. Whereas extensions service look for a short-term solution towards the problem, applied research tends to look for a research-based, developed reply, which may take a longer period of time to be realised. It is therefore a continuous challenge to bring subsystems closer to each other's culture and thinking patterns. Other differences concern the self implementation of support measures between states within federal countries and the different orientation between stakeholder groups, e.g. geographic area versus topic or versus product chain.

When it comes to establishing links between AKIS-subsystems, the relationship will depend upon the willingness to cooperate and the ability to formulate shared goals. There should be special attention on the involvement of extension services, NGOs and companies. As all actors, these groups want to realise benefits by participating in operational groups, but the implications on the operational group's focus and action may be more profound. This discussion is closely linked to the appropriation of the intellectual property right (IPR). The fact that the results of operational groups should be publicly available may be an important barrier for certain actors (especially companies). In many cases, companies are not used to working together and sharing results with their competitors. Open innovation is a debated concept. A solution could be to aim for common pre-commercial objectives.

There is a lack of experience to work in a bottom-up manner as requested by the EIP logic. There is a clear need for good practices and tools to do so. It is furthermore clear that operational groups should foresee the necessary time to establish their objectives during the brokering process and/or before the groups' projects start up, especially as many actors are not used to working in a participatory way with farmers and other stakeholders. A new way of funding may take the respective actors out of their comfort zone.

In recent years, it has become apparent that money is becoming tighter as a consequence of the economic and financial crises and the general pressure on government budgets. Therefore, there is often only money to fund projects via a partial solution instead of the entire problem. It

is also increasingly difficult to find co-funding from companies, as their financial breathing space is getting sparse.

Some open questions with regard to the participation in operational groups may need reflection during the operationalisation process of EIP:

- How do operational groups relate to the public procurement rules? Does the involvement of state institutes in operational groups imply that tendering procedures should follow public procurement rules?
- How to validate the 'softer' outcomes of networks?
- How to monitor AKIS with regard to cooperation and incentives in a feasible way (*ex ante*, *ex itineri* and *ex post*)?
- How to guarantee an appropriate balance between the different types of stakeholders involved in the operational group?
- How to create a better awareness of, and trust in, EU initiatives?
- How can the participation of individuals be matched with the internal strategy of the company, research institution or organisation for which they work?
- What can be done to make initiatives self-sustaining (after the funding has ended)?
- What to do if the incentive system is linked to a geographical location and required actors are localised elsewhere?
- How to take the history of an AKIS into account?

4.6.3 Barriers for participation in operational groups

Next to the problems at system level and the functioning of operational groups, the AKIS CWG listed some specific barriers that may hinder the participation of a certain stakeholder group. An overview is given in the next paragraphs.

Farmers

Innovations at farm level are at the core of the EIP, but farmers have to face a number of bottlenecks and challenges in order to become engaged in operational groups. Many of these bottlenecks have to do with the specific situation of the farmers and their businesses. In many European countries, the farming sector is characterised by family businesses, which often have a culture of stability instead of change. In this situation, it is very difficult for the farmer to feel the urgency, to engage in operational groups and to invest the necessary resources (mainly time and money) in the realisation of innovations. Certainly in difficult and unsure economic times, there is uncertainty about the financial impact of the participation and a fear of high costs. In addition, the farmers' position within the value chain and the interaction with other supply chain actors may, in some cases, hamper (and stimulate in others) the opportunities for innovation.

In many countries, farmers lack the knowledge, capacities or training to realise innovations. Interaction with the other stakeholders in the AKIS is therefore of crucial importance. This brings us to a second group of bottlenecks. Often, the farmers are (or feel) isolated within the AKIS, are territorially dispersed or have insufficient access to information. Even when the farmers are related to the other AKIS-actors, there may be a lack of trust and understanding in the other's motivations.

In a number of countries, there are also references to missing actors or system failures, which mean that farmers are in some cases not 'served' by the other AKIS actors. Examples of such shortcomings are the lack of efficient knowledge transfer and extension services, the absence of innovation networks, little encouragement for innovation by the advisors, poor weight of extension in the innovation chain, little tradition to ask (and pay) for advice and research being the only driving actor within the AKIS (which sees farmers as a consumer of so-called innovation).

Innovations furthermore come with an important cost and risk of failure, which requires a value for money for the farmers. Financial or other types of support may here be of importance. In a number of countries, a lack of sufficient support is mentioned. In cases where there are support schemes, the project application procedure and project administration are often too complicated.

Other aspects are the general difficulties of translating research results into practical application, the lack of market or other opportunities and the fear of tougher restrictions when new environmental technologies or methods are developed.

A number of potential solutions were put forward by the AKIS CWG to overcome these barriers. They are aimed at (i) the functioning of the operational group and (ii) the specific role of the government. With regard to the operational group's functioning, it is clear that the focus should be on actions that provide added value to farmers. This can be done by developing methods to capture the farmers' needs and opportunities (e.g. via social media) and address these needs in a multi-stakeholder approach. Incentives should be foreseen to involve the farmers in operational groups. Examples are giving the farmers ownership over the approach and the results, showing the relevance or added value of the solution and to show successful examples of innovations or innovative practices. Diverse actions can thereby be used, such as demonstration farms and knowledge dissemination workshops. Initially, it may be good to aim for the participation of leading or committed farmers. In a later phase, these farmers can then act as promoters and multipliers. It is furthermore important to find a balance between a wide representation of stakeholders (e.g. farmers' organisations, cultural organisations, banks, industries, cooperatives, levy bodies, trade organisations and retailers groups, etc.) on the one hand and a focus on stakeholders trusted by the farmers on the other. Once the operational group has been established, common and clear objectives should be set and mutual interaction between actors should be stimulated. The group should also pay attention to the governance structure, the decision mechanism and the scope.

In order to stimulate the participation of farmers (and other stakeholders) in operational groups, the government should make a clear political choice for the EIP way of working through multi-actor operational groups that work in a participatory way. This should be translated in an instrument portfolio that:

- Gives incentives for research, development and innovation;
- Stimulates knowledge exchange, adoption of innovation, technical application in the production process;
- Supports the activities of facilitators, innovation brokers and tutoring paths for farmers to implement innovations;
- Values the input an knowledge of farmers;
- Supports operational groups to develop cross-border interactions;
- Invests in AKIS-subsystems that have been underdeveloped in the specific national situation.

The government should furthermore set a framework that provides continuity in the actions and activities of operational groups, introduces methods to legally safeguard SMEs' knowledge and facilitate partnership agreements, makes it easy to participate (little bureaucracy), gives operational groups an advantage in the application for support schemes, acknowledges the practical field experience of farmers and improves the accessibility of knowledge and the free availability of information.

The national EIP network should provide the necessary information to potentially interested stakeholders (e.g. on funding possibilities), link up potentially interested stakeholders, provide good practices, screen the international scene for potential complementarity, etc. Within the network's activities it could also be a good idea to create a forum for proclaimed innovative farmers to share inspiration and collaborate with research and knowledge institutions.

Extension services

Extension services take many different forms and have been in evolution during recent decades (see EU SCAR, 2012). Public, private and mixed systems can nowadays be distinguished in EU countries. In many cases, (mainly public) extension services have been confronted with decreasing resources and a large degree of fragmentation.

When extension services are commercial businesses, there is a stronger focus upon added value and economic results. The time invested in operational groups should therefore be adequately rewarded by the final customer or the government. In the first case, the operational group's focus should be relevant to practitioners. In the case of public-interest issues, a win-win situation should be realised between private and public objectives. In the latter case, there is a higher need for public funding. The amount of funding will then be important, both in total as per operational group.

In the case of membership organisations and commercial businesses, there are concerns about a possible restriction on the dissemination of results and the translation of recommendations to wider stakeholders (next to their own customers or members).

In many countries, the bottom-up approach will be new for extension services and may cause some insecurity in operational groups. Because of the newness, there might also be a fear of not meeting the criteria in accomplishing the objectives.

A number of potential solutions are proposed to overcome the identified bottlenecks, as extension services are considered to be an essential component of operational groups:

- Create a solid legal framework, which foresees adequate funding for the participation of extension services to operational groups (including immaterial actions). It will be important to foresee that information on this measure reaches all (potentially interested) extension services.
- Develop collaboration agreements to cover the access to and the use of results, the roles of the participants etc.
- Delayed publishing could be a solution when sharing results is sensitive.
- Best practices, seminars and information days can be a good way of showing the objectives of an operational group to extension services that have no previous experience with bottom-up and participatory approaches.
- Organise a community of practice for advisors to share experiences and learn (see Box 4.6).

Box 4.6 An inspiring community to learn from practice

Text by Herman Schoorlemmer, Pieter de Wolf and Wim Zaalmink (Wageningen UR)

The transition to sustainable farming can be stimulated with different approaches from top-down and bottom-up perspectives (see Box 3.1). On the one hand there are effective science-based examples with grand designs and structured ways of development and rolling out results. On the other hand there is an interactive model which focuses on forming demand-driven innovation networks with an enormous diversity of partners, stakeholders, ambitions and practices. The idea is that in these groups, participants such as farmers, advisers and researchers interact intensively and bring together personal knowledge and experiences and thus co-create a solution that fits the specific problem or challenge of the group. In these groups researchers bring in scientific evidence and make bridges to other domains, solutions and the more top-down approaches

One of the tasks of a facilitator of these networks is to stimulate the learning process of the group so that they are able to realise their own innovative ambitions. These networks (and the stakeholders within them) have different ambitions, competences and contexts. As a consequence there is no standard recipe for successful facilitation of these groups. But it does not mean that these groups cannot learn from each other to accelerate their own innovation process.

This mutual learning process can be stimulated by a Community of Practice (CoP). This is a group of professionals who share a concern or opportunity and improve their performance by mutual learning and sharing of experiences. A shared theme or question is useful but differences are essential to learn. Two examples are described, the case of PURE-IPM about Integrated Pest Management in Europe and the case Networks in Animal Husbandry in the Netherlands.

A European Community of Practice on Integrated Pest Management

In the FP7 project PURE-IPM (started in 2011), one work package is dedicated to developing a participatory approach for Integrated Pest Management (IPM), called 'co-innovation'. The basic aim of co-innovation in IPM is to bring farmers into the core of the innovation process, in close interaction with researchers, advisors and other relevant stakeholders. For this, four pilots have been set up, related to on-farm experiments in four different countries. The researchers and advisors responsible for the on-farm experiments in these countries are participating in a Community of Practice, facilitated by the co-innovation work package team, consisting of a process facilitator, a monitor/evaluator and a scientist (Figure 1).

The CoP supports the pilot teams in the different stages of the pilot, from preparation and facilitation to monitoring and evaluation. The meetings of the CoP consist of a reflection part (what has happened in the past, successes, problems, questions), an instructive part (a new co-innovation tool/method is introduced) and a preparatory part (preparing for the next period). The topic of the instructive part is agreed by the national pilot teams before the meeting. The instructive part is strongly 'hands-on'; learning by doing. For example, a method for stakeholder analysis was presented briefly and then applied by the participants for their pilot. This is not only an exercise to learn how the stakeholder analysis should be done, it also gains more insight in the pilots and a shared 'language' for exchange in the CoP.

During the meetings, the learning process is visualised through individual learning flipcharts: at the start, all participants write their learning questions for the meeting on a flipchart on the wall of the meeting room. The flipcharts are updated a few times with the things they have learned and new questions, also giving input for the next CoP meeting. Between the meetings, each pilot team has two coaching moments by video conference with the co-innovation team to discuss actual questions and to monitor progress.

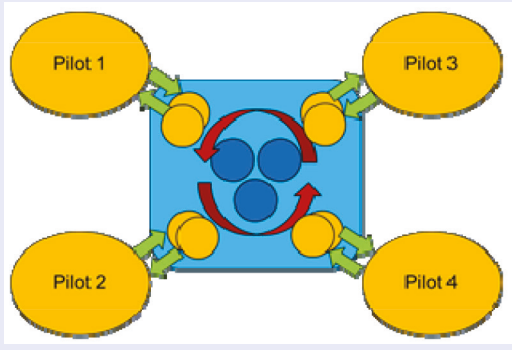


Figure 1. The blue box in the middle symbolises the CoP, in which the teams from the different pilots participate. The CoP is facilitated by the co-innovation team.

Since the start in 2011, the instructive part has gradually developed into a shared learning process: national teams have started working on their pilots, have experiences and questions to share and are more able to help each other. For this, each CoP meeting is combined with a visit to one of the pilots, starting in 2012 in Denmark. These visits enable an understanding of the differences between the pilots, not only agronomical, but also the institutional and cultural. These differences are so far not hindering, but enhancing the learning process within the CoP. The mid-term evaluation shows that all pilots have done things very differently (co-innovative), all in a different way but in line with the co-innovation idea (farmer as the key stakeholder for IPM innovation projects). The CoP has initiated these actions, without prescribing them and supported the participants in translating general approaches to tailor-made actions for their pilots.

Networks in Animal Husbandry in the Netherlands

Networks in Animal Husbandry was a four-year research programme which started in the year 2003 with the following aims:

- To stimulate innovation for sustainable animal husbandry;
- To empower entrepreneurship in animal husbandry by improving the match between knowledge-supply and demand.

The programme was set up to foster innovations for sustainable production systems, by assisting networks of entrepreneurs with expertise. The pre-requisite for assistance to the network was that the farmers themselves had to take the initiative. Preferably different (chain) parties and actors, such as veterinarians, suppliers, the processing industry, retailers, entrepreneurial organisations and NGOs, etc. could also be part of the network. A number of networks were assisted for longer than one year and during the four-year period 129 different networks were supported by the programme.

The CoP of facilitators

The facilitation of the networks was carried out by researchers. Later on private farm advisors joined the team of facilitators. An action research team monitored and evaluated during the whole programme and analysed its impact on the agricultural knowledge system.

During the first phase of the programme the first task of the facilitator was to help the network participants to detail their questions and make connections with experts who could provide the answers. Afterwards it appeared to be necessary to support the facilitators and a start was made to fill a backpack with networking tools. This was even the start to set the facilitators as fellow researchers taking part of the action research team.

This resulted in a Learning Community of Practice formed by the research action team, the researchers and private farm advisors in learning about networking and innovation processes. This CoP organised regular train-the-trainer sessions and collegial peer meetings in clusters of five to six facilitators to share experiences and analyse them as input for follow-up actions. These sessions had a double function: (a) learning and operating as a Community of Practice and (b) using the results as data for monitoring and evaluation studies on the programme.

As a result of this CoP the toolbox with networking tools was further developed. These tools (e.g. Network Analysis, Spiral of Innovations, Circle of Coherence and Effect Monitor) are even used in the learning histories of the networks, written down by the facilitators in cooperation with the network members, and the tools were very useful to get more insight in the innovation processes of the networks.

Another important result of the CoP is that it contributed to a movement in the Dutch Agricultural Knowledge System. The participating actors and parties have experienced the network approach as successful and have expressed this to other colleagues and policy-makers. There are several spin-off examples of the programme, such as the subsidy programme for Networks in Agriculture (Praktijknetwerken in de landbouw), the Dairy Farmers Academy, the Virtual Pig Producers Network and the Fisheries Knowledge Groups.

Source: Herman Schoorlemmer, Pieter de Wolf and Wim Zaalmink (Wageningen UR)

Research

A second group of actors that could be involved in operational groups are the researchers and especially the applied researchers. It is important to remind the reader that the term ‘applied research’ has different meanings in different countries and, as a consequence, there are also different types of actors involved in applied research. But in general, the feeling is that applied

research is an essential member in an operational group. The regulation and funding schemes should be suitable, without forcing researchers to solely follow the money.

In many countries, research is now a driving actor within the AKIS. Because of the specific incentives (mainly research funding and evaluation), the research system has evolved towards a situation where the researchers' focus is primarily on highly rated international science. Their efforts in research dissemination, implementation and the development of business cases are in most cases not validated (valued). This makes these types of activities less interesting for researchers, as participation may limit their academic position and outcomes. There should also be a match with the activity of the operational group for an applied research institute to get involved.

In some countries there is a fear that there is a lack of trust, culture and experience with regard to innovation and knowledge transfer, which may hamper researchers in entering operational groups. Furthermore, applied research might have too little information or time to invest in operational groups. Other potential bottlenecks for the participation of (applied) researchers in operational groups are the preference to work with well-known partners or with partners that have complementary (and not duplicative) expertise and skills, the practicalities of working with partners located in another geographical areas or the challenge to develop a common language or culture with other actors within the AKIS.

Again, solutions were proposed, leading to the following suggestions:

- Create a solid legal framework, which foresees adequate funding for activities such as networking and cooperation, systematisation of the research results already realised and increasing the accessibility of these results;
- Highlight the need and relevance of knowledge sharing as an activity;
- Develop a method of keeping an organisation's track record in collaborative research;
- Develop a framework that acknowledges collaboration in operational groups and knowledge transfer activities in the evaluation of the researchers' curriculum or the funding of the research group;
- Introduce best practices and organise seminars and information activities to get applied research acquainted with the bottom-up and participatory approach of operational groups;
- Generate a feeling of trust and continuous involvement.

Food and supply chain businesses

Another stakeholder group that might be involved in operational groups are food businesses (including here the supply industry, such as input cooperatives, machinery industry etc.). A number of barriers can be identified for this specific group.

Business usually thinks from an added-value perspective. In this situation, many businesses might be concerned about entering into cooperation with rival companies, as the information or results will not be exclusive to the company. Even more because the funding requires an open communication on the results achieved. This goes hand-in-hand with uncertainty about IPRs, while the possibilities to acquire a patent (if it comes to new commercial products) are still unclear. Large or specialised input suppliers (such as farm machinery companies) are often quite centralised with central laboratories or research departments that are used to creating standard products to be sold by dealers. That might hamper collaboration with farmers looking for specific tailor-made solutions.

Many SMEs don't have (a lot of) experience with these type of initiatives and perhaps don't really understand what participation in an operational group means, for example in terms of cooperation with other stakeholders and asking for public funding. These small companies might be discouraged from entering an operational group because they fear that the costs will exceed the benefits, and the bureaucracy of engagement. Many companies have a lack of specialised staff. And this of course assumes that there are funding possibilities for food businesses.

Finally, the ambitions and objectives of agriculture and food businesses should be reconciled within the operational group's work plan. Food businesses might fear that the operational group's work plan is too much orientated towards agricultural production.

The following suggestions were put forward to overcome the barriers to food businesses entering operational groups:

- Focus on joint, pre-commercial goals at the start of operational groups, which is useful for all actors involved. In this way, all actors involved benefit, and trust can be built for a later commercial trajectory;
- Foresee a role for a facilitator or broker in the consortium building, who can invest in relationship building;
- Work in a bottom-up way to involve all stakeholders' objectives;
- Only publish the main finding or delay publishing in order to overcome the problems of sharing results with the wider public;
- Invest in communication efforts and clear information, e.g. through information points;
- Provide support during the whole of the operational groups' lifecycle, from the initial phase until the conclusion of activities;
- Create a framework or *ex ante* conventions to settle IPRs;
- Work towards an integrated approach between upstream and downstream actors in the food supply chain;
- Reduce bureaucracy and uncertainties.

Civil servants

Civil servants of regional, national or other public authorities (e.g. food safety authority, water authority) can play a role in operational groups that address public issues or where current legislation or a lack of legislation hampers innovation. There are many examples in this area, for example efforts to reduce administrative burdens by integrating private and public auditing procedures in food safety, finding incentive mechanisms for farmers to control pollution in catchment areas for drinking water, setting up data management systems to share farm data with industry as well as government etc.

Civil servants can be reluctant to take part in operational groups, as their participation may lead to conflicts of interest. Civil servants need to retain openness, impartiality and independence. These values may be in danger when the operational group comes down to the development of a commercial product by a single company or when the operational group's objective is not in line with the civil servant's public function. It should then be considered if distraction time and resources from the national interest is acceptable for the objectives of the specific operational group, and political support might be welcome.

When it comes to the practical aspects, civil servants often have little knowledge of or experience with innovation processes, lack the resources to get involved in an operational group, are hooked into a hierarchical organisation or lack incentives. This may make it difficult to understand the purposes and reasons of the other stakeholders in the operational group. Changes in government can furthermore impede the civil servants' role in operational groups or the public governor may hamper the functioning of the operational group.

As a solution for the potential barriers and conflict of interest, the following proposals were formulated:

- Develop a well-defined mandate and clear guidelines for the participation of civil servants in operational groups;
- Focus on the pre-commercial phase of innovations, preferably influenced by policy aims;
- Provide training for the civil servants in order to develop knowledge and a culture of innovation;
- Involve civil servants because of their expertise and not as a beneficiary of the support measure;
- Invest in national coordination to avoid duplication of efforts;
- Invest in informing civil servants about EIP and operational groups, to make them aware of the process.

NGOs

Non-governmental organisations (NGOs) can be important drivers of innovations in areas like the environment and animal welfare and also in social issues. An element that came up earlier, but that is certainly valid for NGOs is the importance of mutual aims. Some NGOs are characterised by a general distrust of business and economic objectives. Participation in the operational group may feel like a consortium with the enemy. However others have a more practical approach and try to help to improve farm practices and for instance create labels for products. NGOs cannot be used as an alibi for societal approval by the other members of the operational group.

Other elements that can hamper the participation of NGOs in operational groups are differences in interests and purposes, a lack of information and a too big political orientation. The potential solutions to overcome the NGOs barriers are:

- Ensure clear and mutual aims that are shared by all members of the operational group;
- Develop a collaboration agreement covering the handling of publicity and output from the partnership;
- Give preference to operational groups with an integrated and bottom-up approach;
- Invest in interaction between NGOs and other stakeholder groups, e.g. through communication efforts and financial support.

5 INCENTIVE MECHANISMS FOR RESEARCHERS TO PARTICIPATE IN TARGETED INTERACTIVE RESEARCH AND INNOVATION PROCESSES – BEYOND ACADEMIC RELEVANCE

Text by Robert Home and Heidrun Moschitz, Research Institute of Organic Agriculture FiBL, Switzerland[13]

5.1 Summary

The objectives of this chapter are twofold. Firstly to identify possible incentives and evaluation criteria for research organisations and individual researchers that are (or can be) used in addition to scientific excellence. Secondly to identify means of strengthening incentives for individual researchers to take part in multi-actor research and innovation processes. In this study, we have developed ten recommendations on the basis of literature analysis and theoretical reflection. They include six potential changes at the level of research policy (P1-P6) and four recommendations at the level of research institutions (I7-I10).

For each recommendation we give the following details: a) a short description of the recommendation itself; b) an explanation and justification for the recommendation; c) examples of where these recommendations have already been adopted; and d) potential stumbling blocks to be considered when implementing the recommendation.

- *Recommendation P1:* Create and promote new evaluation criteria for funding research proposals that reward not only disciplinary excellence but also achievements in inter-/transdisciplinary work;
- *Recommendation P2:* Include practitioners/experts along with scientific experts on selection committees for project funding and evaluation processes for research proposals;
- *Recommendation P3:* Creation of new evaluation criteria for the performance of institutions that include achievements in interactive research;
- *Recommendation P4:* Support sabbaticals or short-term visits/internships of junior and senior researchers in industry, political and administration units or civil society organisations;
- *Recommendation P5:* Provide funding for research-practice partnership projects that involve science and practice on equal footing;
- *Recommendation P6:* Establish an easily accessible database/repository for high-quality, non-academic publications/articles;

13. E-mail addresses of the authors: robert.home@fibl.org and heidrun.moschitz@fibl.org

- *Recommendation I7:* Develop targeted training courses for undergraduates, graduates, doctoral students and experienced researchers to enhance the necessary skills for effective science-practice interaction;
- *Recommendation I8:* Creation of specialised centres and of a new discipline Integration and Implementation Sciences;
- *Recommendation I9:* Establishment of a comprehensive database assembling information about institutions, methods, tools, publications and trainings on interactive research;
- *Recommendation I10:* Include assessment of a researcher's (non-academic) societal impact into the overall evaluation of his/her performance.

5.2 Introduction

Criteria for the evaluation of the performance of researchers within the academic world are dominated by publication output and have been long established within the institutional system. While the traditional academic career incentives have proven effective in the promotion of scientific excellence, they have been found inadequate to stimulate participation in multi-actor research and innovation processes, such as inter- or transdisciplinary research (Carayol and Nguyen Thi, 2005). This has led to calls to identify new incentives for researchers to participate in targeted interactive research and innovation processes. It is fair to assume that researchers still want to engage in high-quality research, so incentives should be aligned with research quality. But what is high-quality research?

Scientific quality includes the production of high-quality data, and data quality is the capability of data to be used effectively, economically and rapidly to inform and evaluate decisions. Data quality is multi-dimensional, going beyond record-level accuracy to include such factors as accessibility, relevance, timeliness, metadata, documentation, user capabilities and expectations, cost and context-specific domain knowledge (Karr *et al.*, 2002). Furthermore scientific quality depends on scientific rigour, in that results should be reproducible, original, valid and reliable. While these are valid criteria for pure research, they appear to be lacking when thinking of applied research.

The understanding of research quality being equivalent to scientific quality ignores the end users of research. If research is to be applied in the real world, it needs to be practically relevant. Practically relevant research includes gaining knowledge of stakeholder needs, such as through qualitative research or participatory research in which there is stakeholder involvement in the research design (transdisciplinary). The second tier of practically relevant research is the communication with stakeholders, such as policy-makers, in the form of outreach work. In summary: high-quality applied research can be understood as a combination of scientific quality and targeted interactive research and innovation processes.

Interaction between researchers and actors outside research can take various forms: adapted dissemination of research results to a non-scientific audience, participation in multi-actor groups with extension workers and farmers (or other parts of society), participation in societal debates, but also taking up research questions that stem from practice partners. All such forms of science/non-science interaction share the challenge of exchanging knowledge between persons with varying backgrounds and knowledge cultures. Roux *et al.* (2006) conceptualise a 'knowledge interface' as a space where different knowledge cultures can meet, communicate, share knowledge and collectively create new knowledge. Interactive research between researchers and other relevant actors will therefore need to carefully consider the different

knowledge cultures and ways of communication. Stakeholder involvement is planned and also carried out in many research projects. Yet, this involvement often lacks effectiveness, as the ways in which stakeholders are involved are not always thought through. The challenge is how to support researchers in becoming aware of the complexity of this topic and how to address it proactively and effectively.

5.3 Objectives and definitions

The objectives of this study are two-fold. Firstly to identify possible incentives and evaluation criteria for research organisations and individual researchers that are (or can be) used in addition to scientific excellence. Secondly to identify a means of strengthening incentives for individual researchers to take part in multi-actor research and innovation processes. In this paper, the outcomes from pursuing both of these goals will be expressed as recommendations to strengthen the incentives that are identified.

There are two key terms that are commonly used in different publications, although sometimes with slightly different meanings, that require early definition for the sake of clarity:

- *Stakeholders:* Persons and organisations that are the target of research are given various names, depending on the project and the context. They are called 'end users': a term that emphasises their role at end of a process of knowledge transfer. Others use the term 'practitioners' to stress that those people actually *do* something in *real life*, while research is the theory. For the purpose of this study, which is about multi-actor agricultural research, neither term is satisfactory. The first, because we do not conceptualise a linear model of knowledge transfer from a researcher to a final user; and the second because people or organisations that apply findings from agricultural research might include not only farmers and food processors, but also advisors, administrative staff, policy-makers and market and civil society organisations. We include all these non-scientific people and organisations that have a potential interest in applied agricultural research in the term 'stakeholder'. Following Bergmann *et al*. (2005) we can make the following distinctions: 1. There are stakeholders who participate as actors in the project by contributing their immediate field of action (enterprise, state body) as pilot for a study; they can also be part of the project leadership; 2. There are stakeholders who participate as actors in a project as representatives of a particular societal group; and 3. There are stakeholders who are affected by the research topic, but not directly involved in the research (only for example as interview partners in socio-empirical surveys). In this study we look into ways of making it attractive for researchers to engage in a knowledge interface with all those different stakeholders.
- *Interactive research:* In line with the terminology used in the contract for this study, we understand 'interactive research' to mean all research that involves stakeholders outside science in a way that goes beyond looking at them as mere subjects of research. This includes their involvement in setting the research agenda, participating in the research process and critically reflecting research results. Such an approach is also known as participatory research or termed transdisciplinary. This term should not be confounded with 'interdisciplinary' research, which is defined as an approach that transcends the boundaries of conventional disciplines using a real synthesis of approaches from two or more disciplines (Dyer, 2003). By contrast, transdisciplinary research works from the problem space out to create a unity of intellectual frameworks beyond the disciplinary perspectives and can also mean inclusion of non-scientists (Dyer, 2003) and appears particularly suitable for participatory innovation.

5.4 Theoretical background to understand the motivations of researchers and institutions

To identify the most promising strategies and incentive mechanisms to increase researchers' engagement in interactive research processes, it is necessary to understand the motivations of both individual researchers and research institutions that drive their actual behaviour.

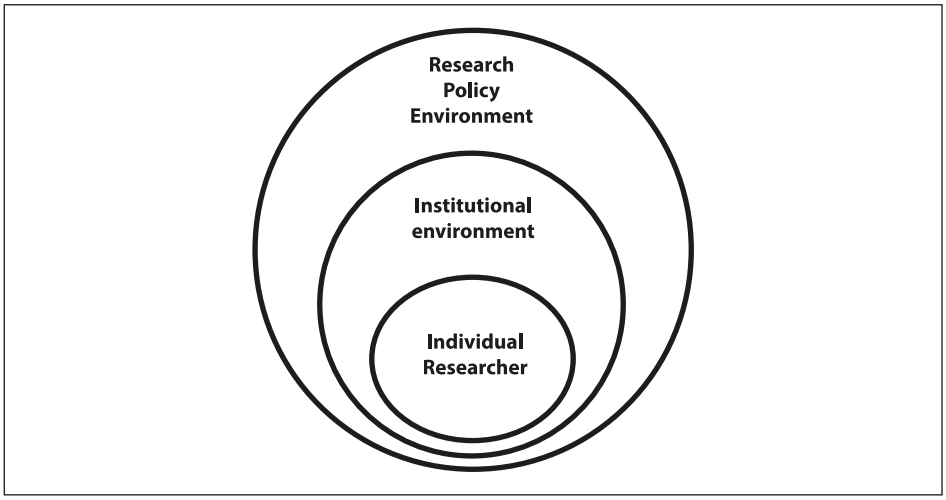
In this section we will look at the literature on what motivates an individual researcher to engage in a particular behaviour, what motivates an organisation to create a culture that enables or encourages such behaviour, and which political conditions are required for an organisation to change. We follow the logic that an individual is enabled or constrained by their institutional environment, while institutions are enabled or constrained by the research policy environment. We also make the assumption that researchers are motivated to be good at what they do, and that institutes wish to survive. The embeddedness of researchers within institutes and institutes within the political environment is shown in Figure 5.1.

5.4.1 Motivations of researchers

A further assumption is that researchers want to be seen by their institutes to be good at what they do: namely to engage in high-quality research, and have a desire for positive evaluation. In the predominant ('conventional') system, actions that are positively evaluated include Scientific publication and successful acquisition of funding. In addition, although to a lesser degree, researchers want to be visible and have a good reputation, which includes professional visibility among peers and visibility in the practical community.

Researchers' motivations, or barriers, to add practically relevant research indicators to their outputs can be understood in light of the theory of planned behaviour. Examination of how individuals, in this case researchers, can be motivated to engage in a behaviour is essentially an examination of why they choose to do so or not to do so. There is an underlying rational process in human decision-making and decisions to adopt a particular behaviour are made to maximise the individual's total utility (Friedman, 1990). The theory of reasoned action (Ajzen, 1985) is a model for the prediction of behavioural intention that suggests that attitudes and subjective norms combine to lead to behavioural intention. Furthermore, the theory suggests that attitudes and subjective norms are each formed from two factors. *Attitudes* consist of evaluation, which is the degree to which implementation of the behaviour is positively or negatively valued by the individual, and *behavioural belief*, which is the individual's subjective judgement of the consequences of the behaviour based on the likelihood that the behaviour will produce the desired outcome. There is evidence that attitude is primarily formed from a combination of individual identity and experience. It has been argued from both within (Sparks & Guthrie, 1998; Terry *et al.*, 1999) and outside (Haslam *et al.*, 2003) theory of planned behaviour research that sense of identity is likely to be a driver of behaviour (Arnold *et al.*, 2005). Subjective norms consist of normative beliefs, which are a subjective assessment of what other people think of the behaviour; and motivation to comply, which is the willingness to comply with the perceived wishes of others.

Figure 5.1 Political and institutional environments of research



Source: This project

To understand researchers' behavioural intentions and how they can be motivated to engage in multi-actor research, it is therefore necessary to understand how attitudes are formed and to gain an understanding of the role of social pressure (norms) in this context. Carayol and Nguyen Thi (2005) have shown that embeddedness in networks outside science, and in particular connections with industry, stimulate interdisciplinary research. The long association and mutual trust that are characteristic of embeddedness in networks contribute to reinforcing favourable attitudes towards interdisciplinary research, as well as equipping the researchers to conduct such research (Dawes and Helbig, 2007). There is evidence that social norms that enable research-practice partnerships are a product of institutional culture (Dawes and Helbig, 2007). The context of work in the laboratory (size, colleagues' status, age and affiliations) strongly affects the propensity to undertake interdisciplinary research (Carayol and Thi 2005).

However, decisions made by researchers are constrained by a range of practical considerations, which suggests that attitudes and subjective norms alone are insufficient to explain behavioural intention. Ajzen (1991) expanded the theory of reasoned action to include 'perceived behavioural control', which refers to an individual's confidence in their ability to implement the behaviour and produce the desired outcome. Ajzen's (1991) expansion has improved the predictive power of the theory of reasoned action (Koger and Du Nann Winter, 2010). Applying the theory of planned behaviour in situations with barriers to behavioural intention helps to explain contradictions between attitudes and behaviour. It follows that, if perceived behavioural controls can facilitate or limit the implementation of behavioural intentions, increasing facilitators or removing barriers will lead to increased adoption of the behaviour. Application of the theory therefore also requires the identification of any perceived behavioural controls. There is evidence that the relevant behavioural constraints include institutional requirements (Kitagawa and Lightowler, 2013), professional requirements such as promotion criteria (Röling, 2009), and researcher skills (Galt *et al.*, 2013; Knight *et al.*, 2005, Röling, 2009).

A researcher will be more inclined to engage in multi-actor research and innovation processes if doing so serves to contribute towards the researcher achieving their goals: namely to be perceived to engage in high-quality research. Researchers with an interest in job security will tend to align themselves with the goals of their institutes. Furthermore, if social norms favour

adding practically relevant research indicators, and behavioural constraints do not prevent the researcher from doing so, researchers will be more likely to engage in that behaviour. These conditions come at the institutional level and both of these points suggest the value of pursuing institutional change.

5.4.2 Motivations of organisations to change culture

There are many calls for institutional change, including for academia to 'renegotiate its social contract with the people' (McDowell, 2001). Bawden (2007) points out the connection between world views and the actions that people choose to take, and concludes that, if communities are to do things differently, we need to individually adjust our world views and also change our collective paradigms. The change to a paradigm of sustainability demands new ways of collective thinking and evaluation, and new and inclusive ways of achieving and evaluating the outcomes of change (Bawden, 2007). In this climate of participation and reflection, there is a need for researchers to engage with the non-academic world and not just study it, work for it or extend out to it (Fear *et al*., 2006, Knight *et al*., 2008).

Kueffer *et al*. (2012) identify several options for changing academic institutions in the direction of better supporting sustainable societal development, including recommendations for system optimisation and system innovation. They conclude that such a change must 'preserve the traditional strengths of academic research, with its emphasis on disciplinary excellence and intra-scientific rigour, while ensuring that institutional environments and the skills, worldviews and experiences of the involved actors adapt to the rapidly changing needs of society'.

Elzen *et al*. (2004) point out that institutes can be changed by either optimising their existing system or by system innovation. Optimisation is an approach that thinks of the system as a problem of logic where the best solution is found by collecting data and assessing the performance of the components of the system: in this case, researchers. System optimisation asks: what works best in the current model and what do we need to change to make the system work better? Innovation is an approach that is based on radical changes to the institute that are based on intuition, previous experience and best practices from similar institutes. The goal of innovation is to maximise the potential improvement through optimisation. System innovation asks: what is the best possible model (Elzen *et al*., 2004)?

Achterbergh and Vriens (2009) point out that we have to assume a set of multiple objectives in an organisation: one of which is to survive and maintain a separate and meaningful existence in its environment. The objective of maintaining a separate existence might, but need not, be pursued through high quality research, although it appears reasonable to assume that engaging in high quality research would contribute to meaning. Maintaining access to financial means and, through political acknowledgement, maintaining a mandate to exist are likely to have an immediate and direct impact on the strategic decisions of the organisation (Achterbergh and Vriens, 2009). The prerequisites for an institute to change are therefore the existence of a political environment that allows it to change. Furthermore, a political environment that connects engagement in multi-actor research and innovation processes with the gaining of financial means and a mandate for separate existence will encourage organisations to change as they seek to ensure their survival. Institutes will adopt the changes when they perceive that high-quality applied research leads to institute survival. Gaining funding is a way of institute survival, so decisions to connect funding with high-quality applied research are political decisions made at the funding body level.

5.5 Recommendations

Building on the theoretical considerations laid out in the previous chapter, we have analysed scientific and grey literature, as well as institutions' websites, to identify potential access points for improving the multi-actor actions of researchers. This resulted in the following set of recommendations, which can be read as a synthesis of literature analysis and theoretical reflection. Reversing the logic of the theory chapter, we firstly describe potential changes at the level of research policy, and secondly at the level of research institutions. At this level, we will also look into ways in which institutions can create an environment to enable and motivate researchers.

Each recommendation thereby follows a similar structure: a) a short description of the recommendation itself; b) an explanation and justification for the recommendation, giving some more background; c) examples of where these recommendations have already been adopted; and d) potential stumbling blocks to be considered when implementing the recommendation.

While writing the recommendations we give examples for particularly interesting approaches of various research institutes, funding bodies or the like. However, we do not present ONE overall approach of any of these as 'the best way' to do things, but only refer to particular aspects that we found especially interesting and innovative. That is, we have 'cherry picked' from the various programmes we found.

5.5.1 Recommendations for change at policy level

Recommendation P1

Create and promote new evaluation criteria for funding research proposals that reward not only disciplinary excellence but also achievements in inter-/transdisciplinary work

Explanation and justification

Institutes will adopt changes to enable engagement in multi-actor research and innovation processes when they perceive that high-quality interactive research leads to institute survival. Successful acquisition of funding for research projects contributes to institute survival so political decisions to connect funding with high-quality interactive research projects at the funding body level will encourage engagement in multi-actor research and innovation processes.

The traditional academic career incentives stimulate scientific excellence rather than participation in multi-actor research and innovation processes, such as inter- or transdisciplinary research (Carayol and Nguyen Thi, 2005). Potential criteria to evaluate interactive research proposals and projects are:

- Degree of interaction
- Degree of participation in multi-actor research and innovation processes
- Engagement in social debate
- Publications in the professional press
- Degree of implementation of results
- Production of marketable products

Alker and Fisher (2009) argue that the exact way of stakeholder participation should be described in transdisciplinary research proposals. This includes a stakeholder analysis, which should be either part of the project or funded separately, and a detailed concept of how stakeholders will be involved in the various stages of the research: planning, implementation, evaluation and dissemination of research results.

In their analysis of different strategies for policy incentives and funding allocation mechanisms, Kitagawa and Lightowler (2013) point out the importance of the policy conditions and dynamics through which knowledge flows and interactions are promoted. Röling (2009) concludes that standards used in refereeing proposals for research funding could benefit from gaining an understanding of pathways of science-for-impact. Efforts to mobilise science and technology for sustainability are more likely to be effective when they manage boundaries between knowledge and action in ways that simultaneously enhance the salience, credibility and legitimacy of the information they produce (Cash *et al.* 2003). Kitagawa and Lightowler, (2013) reported evidence that institutions embed knowledge exchange activities into their institutional strategies as the result of knowledge exchange policy and funding initiatives.

Examples

- The subject of Kitagawa and Lightowler's (2013) study is the Higher Education Innovation Fund (HEIF) in the UK. The HEIF provides funding for knowledge exchange to support and develop a broad range of knowledge-based interactions between universities and colleges and the wider world which result in economic and social benefit to the UK. The report titled *Strengthening the Contribution of English Higher Education Institutions to the Innovation System: Knowledge Exchange and HEIF Funding* stated that 'the intended outcome is the demonstration (to university, industry and government) that longer-term University-industry partnerships are effective in initiating excellent, innovative research that is more readily exploited by those outside the higher education sector. Research excellence and a return to the UK economy should be a common goal' (PACEC 2012).
- The NETSSAF (Network for the development of Sustainable approaches for large-scale implementation of Sanitation in Africa) developed a guideline for systematic stakeholder analysis (see NETSSAF deliverable 02, chapter 4.3: http://www.netssaf.net/111.0.html). Such a guideline could be useful for achieving the goal of detailed knowledge about the stakeholders and their integration into projects.
- The International Development Research Centre (IDRC) in Canada has developed the method of 'Outcome Mapping' that can be used to gain a profound understanding of a research project's target audience, expectations and potential behavioural changes. See here for details: http://www.idrc.ca/EN/Resources/Publications/Pages/ArticleDetails.aspx?PublicationID=1004
- The Competence Centre Environment and Sustainability of the ETH Domain (CCES; http://www.cces.ethz.ch) has the goal, among others, of achieving a visible societal impact and wide-ranging outreach. When funding projects, it therefore puts a strong emphasis on how research results will be implemented in practice. The GeneMig project (http://www.cces.ethz.ch/projects/sulu/genemig) is an example of a CCES funded project that involves stakeholders in defining the actual research questions to target.
- The Institute for Social-Ecological Research (ISOE) developed a guide for evaluating transdisciplinary research projects in which they name a number of quality criteria to be used (Bergmann, Brohmann *et al.*, 2005). The criteria cover the three phases of a project, namely a) definition of actors, project construction and project formulation; b) project execution and methodology; and c) results, products and publication.

Cautions

One of the key challenges for funding bodies is the establishment of criteria to distribute funds across the academic sector. Policy level (supply side) incentive processes involve strategic balancing and choice between metric-based (meaning funds are allocated according to a formula that the institutes can then use as they see fit) and project-based funding allocation. An inherent and unresolved problem is the difficulty of systematically evaluating broader 'socially' and/or 'non-transaction' orientated knowledge-exchange activities and including them in the performance metrics. The design of incentives needs to be part of an interactive process with numerous feedback loops between policy and institutional structures (Kitagawa and Lightowler, 2013).

When involving stakeholders in the various phases of a research project (agenda setting, research work, implementation and dissemination) it is crucial to be clear about a) what do we as researchers want from the stakeholders? and b) what can the project offer to the stakeholders? A reasonable amount of time needs to be dedicated to developing a comprehensive concept for stakeholder integration, and this has to be reflected in the project's budget and planning. On the other hand, a good integration of stakeholders can be motivating for researchers, when they experience an interest from practice in their research.

Recommendation P2

Include practitioners/experts along with scientific experts on selection committees for project funding and evaluation processes for research proposals

Explanation and justification

Röling (2009) concludes that standards used in refereeing proposals for research funding could benefit from taking on board an understanding of the pathways of science-for-impact. Understanding of such pathways would be served by the inclusion of the potential end users of the research in deciding which research projects are funded.

Kueffer *et al*. (2012) point out the need to develop new criteria and ways to assess the quality and impact of problem-orientated research and that the approach needs to account for both the scientific quality and the implementation of the project. The likely benefits in application and the quality of outreach can include, for example; provision of specific examples and explanations for applications, licence agreements and patents, non-academic reports or guidelines and policy briefs, media releases, non-academic training, evidence of partnership with government agencies or the private sector, and stakeholder awareness and satisfaction. To assess the quality of such outreach products proposed in research applications, it can be helpful to include the intended users of these products in the evaluation process of the research proposal. They will be in the position to judge whether the proposed outreach and the processes by which they will be shared with the end users suits their needs and if the foreseen quality is appropriate.

Examples

- The Mercator Foundation in Switzerland funds research projects that are expected to meet societal needs and which can demonstrate a sustainable impact. An interdisciplinary and/or practice-orientated approach, with findings that can contribute to solving

social issues, is important in scientific projects funded by the Mercator Foundation. The Foundation is committed to the development of networks, the transfer of knowledge to the public and active involvement of stakeholders. Projects are evaluated on a case-by-case basis, with projects that are practice orientated (meaning that the implementation of results will be done by practitioners from outside science) and evaluated by a collaboration between scientific experts and representatives from the field of practice targeted by the research. [http://www.stiftung-mercator.ch]

Cautions

It should be noted that practitioners may be ill equipped to evaluate research quality so the inclusion of experts should complement, and not replace, scientific evaluation of project proposals.

Recommendation P3

Creation of new evaluation criteria for the performance of institutions that include achievements in interactive research

Explanation and Justification

Political acknowledgement contributes to an institute's survival by allowing it a mandate to maintain a separate existence, and is therefore likely to have an immediate and direct impact on the strategic decisions of the institution. The prerequisite for an institute to adopt changes to enable engagement in multi-actor research and innovation processes is the existence of a political environment that allows it to change. Achievements in interactive research should be included in the evaluation criteria of institutes.

Achterbergh and Vriens (2009) point out that organisational survival in a broader sense means not just financial survival but also the maintenance of a separate and meaningful existence in its environment. The objective of maintaining a separate and meaningful existence is dependent on funding bodies maintaining financial support, but also that political bodies continue to give a mandate for the institute to exist, which might, but need not, be pursued through high-quality research. Maintaining a mandate to exist are likely to have an immediate and direct impact on the strategic decisions of the organisation (Achterbergh and Vriens, 2009) and will be connected to high-quality research if the performance evaluation criteria of the institute include positive consideration of high-quality research. The prerequisites for an institute to change are therefore the existence of a political environment that positively values high-quality applied research, including interactive research, so that change is both allowed and encouraged.

Examples

- Change within an institute can be strategic in how the institute wants to be perceived. In Australia, for example, Hawkesbury Agricultural College (now part of the University of Western Sydney) committed itself in 1978 to self-transformation (Bawden, 1992) so that the purpose of the university (or at least its agricultural college) would be truly reflected in its mission, with the recognition that enhancing rural well-being includes much more than increasing farm production and productivity. The motivation for the change was the perceived need to position itself within the socio-political environment as a learning organisation committed to developing and sharing innovative ways of

dealing with complex, problematic situations, and move from simply being a teaching institution that provides graduates for unspecified jobs in agriculture (Bawden, 1992).

- The Royal Netherlands Academy of Arts and Sciences (KNAW), the Association of Universities in the Netherlands (VSNU), and the Netherlands Organisation for Scientific Research (NWO) together developed a 'Standard Evaluation Protocol' (SEP). One of the four assessment criteria is 'relevance', with the sub-criterion 'societal relevance' (one out of eleven in total). It includes aspects of societal quality, societal impact and valorisation. In addition, the SEP foresees special attention and a potential adaptation of the processes for the evaluation of institutes and research programmes with multi-, inter- or transdisciplinary research. Also, they mention the need for evaluators with solid experience in assessing such research (VSNU, KNAW *et al.*, 2010).

Cautions

Despite the desirability of richness and variation in the ways that academics engage with wider society, and the evidence that such interactions often strengthen research activities, not all academics engage with external organisations: and for some it may not be necessary for the proper fulfilment of their wider university role (Abreu *et al.*, 2009). Researchers across all disciplines report that academic freedom is of fundamental importance to the future well-being of society. Caution should therefore be taken to ensure that achievements in interactive research supplement, rather than replace, scientific evaluation criteria for the performance of institutions (Abreu *et al.*, 2009).

Recommendation P4

Support sabbaticals or short-term visits/internships of junior and senior researchers in industry, political and administration units or civil society organisations

Explanation and justification

We have outlined above that experiences and commitment to societal groups are a strong incentive for researchers to engage in interactive research projects (Carayol and Thi 2005). Apart from being engaged in multi-actor conferences or other meetings, experiencing the realities outside science can enhance the understanding of particular perspectives, and support networking between science and practice.

While internships are a useful and regular activity during (some) undergraduate and graduate courses, the options and incentives for an internship in a later stage of a researcher's career are few. Yet, working together with people from administration, in organisations or industry could also be very fruitful for more senior researchers, but would need to be fitted into a programme that allows researchers to temporarily (for a few weeks to months) leave the (academic) working place.

In their study on the impact of research in primary healthcare, Kalucy et al. (2007) found that peer-reviewed publications were not necessarily indicative of the societal impact of a research project. In contrast, the strongest impact was achieved by projects that had strong collaborative links, personal relationships and involvement of practitioners, healthcare managers and policy-makers in defining the research question and in the research process. Involvement of outstanding persons with links to decision-making processes were also identified as contributing to societal impact.

Examples

- We could not find any example for this recommendation. There are numerous exchange and visitation programmes in Europe, at national and European levels, but they concentrate on visits by researchers to other scientific institutions. Similarly many industries, political administrations and NGOs offer internships on an individual basis, but we could not find examples of cases where internships or short-term visits between science and practice have been embedded in institutional processes or funding policies.

Cautions

Such particular sabbaticals or internships would need to be established in a way that they are accepted by the institutes, so that the researchers participating are not evaluated negatively for temporarily stepping out of science.

Recommendation P5

Provide funding for research-practice partnership projects that involve science and practice on equal footing

Explanation and justification

Changing to a paradigm of sustainability requires new ways of collective thinking and new ways of achieving collective outcomes (Bawden, 2007). There is a need for researchers to engage with the non-academic world and not just study it (Fear *et al.*, 2006, Knight *et al.*, 2008). Partnership projects thereby go beyond a unidirectional linear transfer of knowledge, but involve reciprocal exchange between the different knowledge cultures. In this way, research/practice partnership projects deepen the mutual understanding of the academic and non-academic world. Continued experience in partnership projects will not only raise mutual understanding, but also increase skills to collaborate effectively. Moreover, with such projects networks between science and practice are built up, and this in turn stimulates further interactive research (Carayol and Thi, 2005).

Examples

- Seed money can be an effective way to support innovative science-practice partnership projects. This money can be used for elaborating project proposals that include a thorough analysis of the stakeholders involved (Alker and Fisher, 2009). On that basis, in a next step, the project can be developed in collaboration between researchers and stakeholders.
- Within the EIP Agricultural Productivity and Sustainability it is planned to establish operational groups that assemble researchers and stakeholders, such as farmers, advisors, industry and civil society organisations.
- The EC funds collaborative research projects between science and industry via the Industry-Academia Partnerships and Pathways (IAPP) – Marie Curie Actions. This can include secondments of staff in both directions: http://ec.europa.eu/research/mariecurieactions/about-mca/actions/iapp/index_en.htm

- The Scottish Funding Council has established a programme called Demand-driven knowledge exchange proposals for Strategic Priority Investments in Research and Innovation Translation (SPIRIT) that aims at enhancing knowledge exchange between universities and business; see http://www.sfc.ac.uk/funding/FundingOutcomes/KnowledgeExchange/SPIRITstrategiccompetition2009-12/SPIRITstrategiccompetition200912.aspx.

Cautions

Such partnership projects need to include mechanisms for facilitating effective knowledge exchange between practice and science. This needs to be made clear in the call for proposals, and project proposals should carefully describe how they plan to facilitate knowledge exchange.

Research-practice partnerships always consume a considerable amount of time for negotiation about meanings, understanding or trust building. It is therefore important to plan enough time for such seemingly 'unproductive' processes within the project. Including a professional facilitator for parts of it can be a good solution, e.g. for ongoing reflection about expectations and meanings, which is crucial (Abreu *et al.*, 2009).

Another aspect to consider carefully in research-practice partnerships is the nature of research work that includes frequent changes in staff, as contracts are often limited in time, and PhD or other programmes are completed. Similarly, there are particular time cycles in industry that do not always match those of research, and which can cause delays in a project. Both may constrain the building of trust between researchers and stakeholders, as trust building takes time. In addition, many researchers make promises about the benefits of their research for the stakeholders, but after the project is finished, there is no follow-up and findings are not always shared. Honest negotiation of achievable results, expectations from both sides (research and practice) and a clear decision about the research questions that are finally addressed can help to avoid frustration and increase trust (Coburn, Penuel *et al.*, 2013).

In the evaluation report of the SPIRIT programme it is mentioned that the partnership model carries the risk that if one partner suffers from a sudden capacity loss, this can jeopardise the delivery of project objectives. On the other hand, such a model provides the potential for other partners to step in to relieve short-term capacity constraints (Public & Corporate Economic Consultants, 2011).

Recommendation P6

Establish an easily accessible database/repository for high-quality, non-academic publications/articles

Explanation and justification

We argued in the theory section that professional visibility is an incentive for researchers. Traditionally, in the academic world, professional visibility is achieved by successful publications that can be tracked in established scientific journal databases. Many national journals (often edited in the local language) are not included in such databases, and, of course, non-scientific professional journals are also not part of that system. Yet, articles in such journals can be highly relevant for the research topic and, if such publications were also considered for assessing an

institute's or a researcher's quality (see recommendations P1 and I10), it would be helpful to make them visible to a wider audience. An easily accessible database or repository for high-quality, non-academic articles would increase the visibility of the non-scientific achievements of researchers and institutes.

Examples

- The international open-access repository Organic Eprints is an archive for papers and projects related to research in organic food and farming. It contains pre-prints (pre-review), post-prints (post-review) and reprints (published) of scientific papers, conference papers and posters, theses, reports, books and book chapters, magazine articles, web products, project descriptions and other published or unpublished documents and thus goes beyond classical scientific databases. This makes the repository interesting also for a non-scientific audience looking for research results in the field of organic food and farming. See http://www.orgprints.org.
- The Council of Medicinal Sciences of the Royal Netherlands Academy of Arts and Sciences established a so-called 'blue list' that lists journals of at the national level (both peer-reviewed and not) that are relevant in the field of health research in the Netherlands. Publications of articles in one of these journals can therefore be included in the assessment of researchers' performance.

Cautions

This recommendation is in particular reasonable in combination with recommendations P3 and I10 that aim at integrating the non-scientific achievements of an institute or a researcher into quality assessments.

5.5.2 Recommendations for change at institutional level

Recommendation I7

Develop targeted training courses for undergraduates, graduates, doctoral students and experienced researchers to enhance the necessary skills for effective science-practice interaction

Explanation and justification

We have shown in the theory section that a lack of skills can constrain researchers from engaging in interactive research. Röling (2009) concludes that many agricultural scientists have not developed their thinking about how the fruits of their work can help make the world a better place. So curricula could benefit from taking on board understanding of pathways of science-for-impact; thus raising awareness of the complexity, benefits and challenges of interactive research. Students and experienced researchers can learn about the background and reasons for engaging in multi-actor research and innovation processes. Furthermore, they can learn about different methods to apply for different purposes and with different target audience.

The organisation of the training can take two forms: Firstly, sustainability and inter-/transdisciplinary research practices can be integrated into all teaching curricula and secondly, specialised

centres can be established to facilitate problem-orientated research and reciprocal knowledge exchange with society (see also recommendation I8)

On the other hand, training for policy-makers and other practice actors could help them to interact with research projects, understand the scientific context better and, as a result, enable them to engage in science/practice projects.

Examples

- The Association for Interdisciplinary Studies (AIS) has developed Guidelines for the accreditation of interdisciplinary studies in general education (AIS, 2002). The goal is to encourage interdisciplinary programmes and show ways to support such programmes effectively. Thereby they consider not only the content and organisation of teaching, but also the framework conditions at the institutes, such as faculty, administration and overall goals.
- Since 2011, the Competence Centre for Environment and Sustainability (CCES) at the ETH Zurich offers a Winter School, Science meets Practice. It provides insights into theoretical and methodological foundations together with hands-on experience in the communication and interaction with stakeholders outside the scientific environment; see https://edit.ethz.ch/cces/winterschool
- The Australian National University (ANU) offers specialised courses on integration and implementation science and on bridging the research-policy divide; see: http://i2s.anu.edu.au/courses. This is part of the new discipline Integration and Implementation Sciences (see also recommendation I8).

Cautions

In their accreditation guidelines, the AIS points out that the goals of courses and trainings need to be stated explicitly, and that they should be consistent with the institute's overall goals. The programme needs regular monitoring to ensure continuous quality at the goals, curriculum and teaching levels. They furthermore highlight the need for a shared responsibility for the implementation across the faculty, while overall responsibility should be in the hands of an appropriate leader rather than dispersed across units with other loyalties. This will need special training and professional development opportunities for the faculty itself (AIS, 2002).

Recommendation I8

Creation of specialised centres and of a new discipline, Integration and Implementation Sciences

Explanation and justification

Creating centres that specialise in interactive research could enhance the methodological knowledge of people who already engage in interactive research as well as providing skills to those who do not. They can increase research quality, support links between single institutes by initiating common collaborative projects and enlarge the applicability of research results to a wider audience (Schneidewind, 2010). Schneidewind (2010) sees that these goals could be achieved by creating cross-faculty (or independent) centres or by chairs that focus explicitly

on transdisciplinarity, or by chairs bridging the gaps between universities and non-academic institutes. Creating a completely new discipline of inter- and transdisciplinary studies/interactive research would go one step further. In either case, an institute with a clear identity on interactive research could raise awareness for the importance of this issue.

Examples

- The example that has gone furthest is probably the establishment of the Integration and Implementation Sciences (I2S) as a new discipline at the Australian National University (Bammer, 2013). This is a team of researchers aimed at providing concepts and methods for conducting research on complex, real-world problems. It supports researchers (I2S specialists) who contribute to cross-disciplinary teams tackling challenging social and environmental problems. This includes providing information, training and education, as well as establishing standards and evaluating quality of research in the field; see http://i2s.anu.edu.au/
- In Germany, the Leuphana University Lüneburg established an Institute for Integrative Studies in 2009. It bases its research on the integration of ecological, economic, social and cultural dimensions and offers courses at the Bachelor and Master's level; see http://www.leuphana.de/institute/ietsr.html
- In Switzerland, the ETH has established a Transdisciplinarity Laboratory (TdLab), which focuses on the case-study approach in sustainability science. Here, scientists and non-scientists can collaborate for a certain period of time, aspire to a mutual learning process and conduct transdisciplinary research; see http://www.uns.ethz.ch/translab
- The Centre for the Study of Interdisciplinarity (CSID) at the University of North Texas aims at '(1) providing resources and networking for researchers and students interested in interdisciplinary research and education; (2) promoting experiments in inter- and trans-disciplinarity; (3) identifying institutional barriers to interdisciplinarity; (4) establishing indicators for the success or failure of interdisciplinary projects; and (5) developing a set of best practices for interdisciplinarity' (Centre for the Study of Interdisciplinarity, 2012).

Cautions

A centre specialised on a cross-cutting theme or expertise, such as that suggested, needs to respect and valorise the existing institutional structures. Networking with other institutes at the university, as well as non-academic partners will be crucial for success. Only if links with, and borders to, existing structures are carefully dealt with, can this have the desired success of increasing visibility and awareness of the challenges and benefits of interactive research.

Recommendation I9

Establishment of a comprehensive database assembling information about institutions, methods, tools, publications and trainings on interactive research

Explanation and justification

There are already a number of existing websites that collect information on possible courses and training available, and on specific tools and methods that can help in planning and conducting multi-actor research. These take the form of simple lists or more elaborate databases.

Bringing together these various sources into one database would make it easier for interested persons to get an overview of available courses and information. Ideally, such a database would be built up in shared responsibility between leading institutions in the field, and be open to contributions from the whole community of interactive research practitioners (similar to *Wikipedia*).

Examples

- The Research to Action (R2A) initiative set up a website addressing the strategic and practical needs of people trying to improve the way social, economic and environmental development research is communicated and utilised. It includes a number of approaches, methods and tools, lists projects and discusses backgrounds; see http://www.researchtoaction.org/
- On its website, the Integration and Implementation Sciences (I2S) at the Australian National University have placed a 'resources' page that provides information about useful case studies, conferences in the field, journals publishing inter- and transdisciplinary papers, key readings on the topic, professional associations and networks and tools; see http://i2s.anu.edu.au/
- The Association for Interdisciplinary Studies (AIS) provides a directory of Master and of Doctoral programmes in inter- and transdisciplinary studies on its website; see http://www.units.muohio.edu/aisorg/index.shtml

Cautions

Such a database would need to consider existing databases and resources to avoid overlap and be developed on the basis of a common understanding of the relevant actors in the field. It will be crucial to keep it updated, feeding in new information on a regular basis, and linking it to existing websites.

Recommendation I10

Include assessment of a researcher's (non-academic) societal impact into the overall evaluation of his/her performance

Explanation and justification

Essentially, this recommendation is an institutional level reflection of the recommendation (P3) that societal impact should be included into assessments of institutional performance. If the political conditions are achieved so that engagement in multi-actor research and innovation processes contributes to an institute's survival by allowing it a mandate to maintain a separate existence, the institute will logically create conditions for the individual researchers to contribute to the collective performance.

Application of the theory of planned behaviour requires the identification of any perceived behavioural controls, and there is evidence that the relevant behavioural constraints include institutional requirements (Kitagawa and Lightowler, 2013) and professional requirements such as promotion criteria (Röling, 2009). Both of these can be considered to be whether the societal impact outcomes of participation in targeted interactive research and innovation processes are considered to be part of a researcher's performance. The prerequisites for an individual to change are therefore the existence of an institutional environment that positively values high-quality research, so that change is both allowed and encouraged.

Examples

- In their *Guidelines for the accreditation of interdisciplinary studies in general education*, the AIS included criteria that help to evaluate whether an institute has implemented appropriate criteria to assess interdisciplinary programmes, as well as the staff employed for such programmes. Similarly, they recommend looking at hiring procedures and to estimate whether these welcome qualifications that cross traditional disciplinary lines. Furthermore in the accreditation guidelines they suggest to take into consideration whether promotion and tenure criteria support interdisciplinary activities of the faculty.
- The Research School for Socio-Economic and Natural Sciences of the Environment (SENSE) in the Netherlands has developed a board document on how to measure the societal impact of affiliated research groups (Biermann, 2010).
- The Council for Medicinal Sciences of the Royal Netherlands Academy of Arts and Sciences has developed recommendations for self-evaluation of the societal impact of applied health research (Royal Netherlands Academy of Arts and Sciences, 2002). This includes a list of indicators for various aspects of societal impact and a description of a procedure to follow.

Cautions

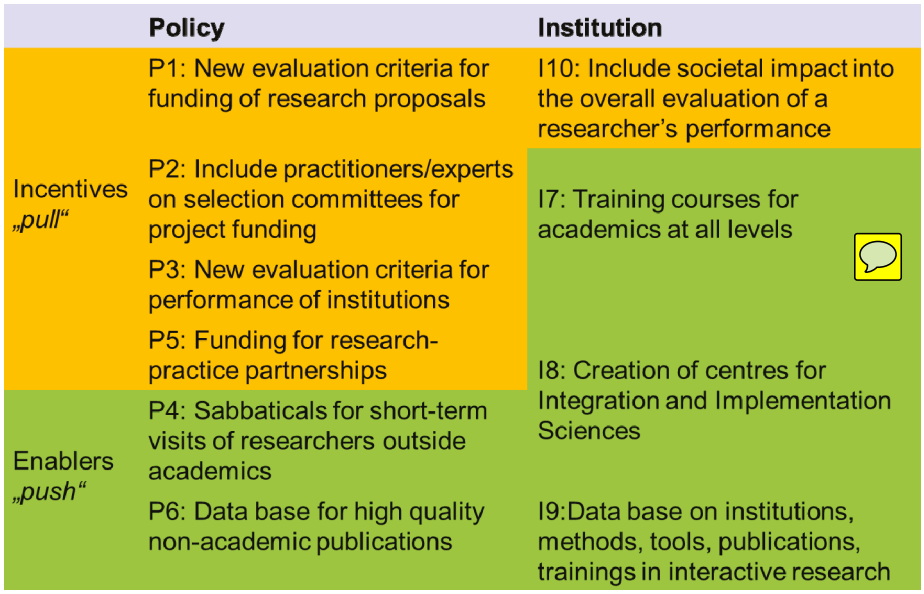
This recommendation will only be successful if the assessment of the institute also respects the societal impact (see recommendation P3).

For the evaluation of societal impact it is relevant to seek feedback from stakeholders. Therefore, also in self-evaluation, it could be beneficial to include the consultation of a stakeholder panel including professionals, interested organisations and policy-makers in the field.

5.6 Concluding remarks

In this chapter we have made ten recommendations that could support researchers' engagement in interactive research and innovation processes. They cover a wide range of potential actions, of which some work as pull factors that motivate individuals and organisations to adopt certain behaviour, as this will be positively sanctioned. Other factors work as push factors that increase the skills and range of opportunities for the action of individuals and institutions (Figure 5.2). Our recommendations cover actions that can be fairly easily implemented, as well as those that imply a more radical change of the current system of ensuring research quality. As the decision about which action is radical and which is not is often dependent on the degree to which it is implemented, we have deliberately not qualified them in this chapter. We argue that both approaches: system optimisation and more radical system innovation have their role in changing the system towards a better appreciation of the benefits of participatory research. While the former still works in the existing system, it can be a stepping stone to achieving the latter.

Figure 5.2 Ten recommendations – incentives and enablers



Source: FIBL

In the end, the turn towards sustainable development and the research environment that would enable it requires a paradigm shift. It requires a change of culture that equally respects scientific and applied quality indicators for research. Such a cultural shift is challenging, not least because it needs to take place at three levels: research policy, institutional and individual. It can only happen if the different approaches are connected. If one provides the political environment that encourages the desired behaviour, the organisational culture will follow, and so will the behaviour of researchers. Those researchers who already engage in interactive research successfully will benefit from a better recognition of their skills and actions.

We agree that not all research needs to integrate stakeholders to the same extent. Basic research can work perfectly well without participatory processes. But the large part of projects that engage in applied research should carefully consider the potential benefits of including the final target audience within the research process. And we have shown that there are many ways to encourage them to do so.

6 ICT AND SOCIAL MEDIA AS DRIVERS OF MULTI-ACTOR INNOVATION IN AGRICULTURE – BARRIERS, RECOMMENDATIONS AND POTENTIALS

Authors: Lizzie Melby Jespersen[14], Jens Peter Hansen[15], Gianluca Brunori[16], Allan Leck Jensen[17], Kirsten Holst[18], Camilla Mathiesen[1], Niels Halberg[19] and Ilse Ankjær Rasmussen[1(20)].

6.1 Summary

This chapter deals with the issue of if and how ICT (including social media) could support innovation processes in the AKIS and the EIP. It presents how innovation is defined and introduces the three factors on which innovation should be based: software, hardware and 'orgware'. As background information for an evaluation of these factors the conceptual framework of socio-technical networks, innovation and learning processes in relation to ICT is described. Various types of software tools have been evaluated for the survey, and it is shown that there are already a multitude of ICT and social media tools, which can be used in the agricultural sector for knowledge sharing and innovation. Further, what they offer and how they differ from each other are described. Some examples of the successful use of various types of ICT tools in the agricultural sector have been identified, and also some which are expected to be successful, but which are not yet widely used.

The survey has not been able to identify any successful examples of use of software (social networks and ICT tools) for innovation processes in the agricultural sector, but such examples have been identified for other business sectors. These examples have shown that especially the ICT tool, 'crowdsourcing' has proved to be a promising tool in innovation processes, but its value depends on the complexity of the subject.

Hardware (PCs, tablets, smartphones and mobile phones plus broadband connection) is a prerequisite for effective communication. There are considerable differences in the access to and speed of the broadband connections and the price for the use of it in different regions of the EU, with the northern and western Member States generally having better access and speed and lower prices for Internet connection than the eastern and southern Member States. Some of the barriers relating to hardware may be overcome with time, while others will have to be solved by investments in infrastructure.

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14. International Centre for Research in Organic Food Systems (ICROFS), DK
15. The Knowledge Centre for Agriculture, Aarhus, DK
16. Dipartimento di Scienze Agrarie, Alimentari e Agro-ambientali (DISAAA), Pisa, IT
17. Department of Engineering, Aarhus University, DK
18. Danish Centre for Food and Agriculture (DCA), Aarhus University, DK
19. International Centre for Research in Organic Food Systems (ICROFS), DK; corresponding author: Niels.Halberg@icrofs.org
20. The annexes are also downloadable at the website of ICROFS:
Appendix 1: http://www.icrofs.org/pdf/2013_SCAR_Appendix_1_Software.pdf
Appendix 2: http://www.icrofs.org/pdf/2013_SCAR_Appendix_2_Hardware.pdf
Appendix 3: http://www.icrofs.org/pdf/2013_SCAR_Appendix_3_Orgware.pdf

As regards 'orgware', i.e. the capacity building of the different institutional actors involved in the adaptation process of a new technology by networking, the role of the Internet in communication and collaboration processes by providing platforms for the development of virtual communities has been described. Furthermore, examples are presented on how the successful/promising examples of use of ICT tools in the agricultural sector fits into the theory. Finally some important barriers to the development and uptake of ICT for knowledge sharing and innovation in the agricultural sector are presented together with recommendations on how to overcome them. The report is based on analyses presented in more detail in the three appendices on software, hardware and 'orgware', respectively.

6.2 Introduction

Agriculture today is evolving in an environment of rapid changes in technology, markets, policies, demography and natural environment. The challenges these changes pose to the national agricultural sectors and rural communities in Europe are context specific and complex. This imposes new demands on all actors in and around the agricultural sector to innovate and develop new ways of collaborating to generate knowledge and put it into use at the required pace (Daane, 2010). In the EC communication *CAP towards 2020* (COM, 2010) innovation is being highlighted as being indispensable to preparing the agricultural sector in the EU for the future. The communication from the EC on the EIP Agricultural Productivity and Sustainability (COM, 2012) also states that increased and sustainable agricultural output will be achievable only with major research and innovation efforts at all levels.

Farmers have a long tradition for sharing of knowledge in cooperatives or farmer learning groups, but there is a gap between the provision of agricultural research results and the application of innovative approaches in practical farming. New knowledge does not reach, or takes too long to reach the farmers, and the needs of practical farming are not communicated sufficiently to the scientific community. Thus, new collaborative methods and ICT may be important tools to solve some of these gaps by improving access to results, knowledge exchange and communication as well as presentation and education.

Until recently the conventional concept of agricultural knowledge transfer has been the linear model with clearly distinguished roles between creating, transferring and using knowledge and technologies (Daane, 2010). The linear model has progressively been replaced by a participatory or collaborate social network approach in which innovation is co-produced through interactions between all stakeholders in the food chain (especially for second order changes, so called 'system innovation' such as the introduction of multifunctional agriculture or organic farming (SCAR, 2012). In these collaborative networks (AKIS), researchers, farmers, agricultural advisors, entrepreneurs, food and feed industries, policy-makers etc. involve themselves in the creation, diffusion, adaptation and use of knowledge as well as in providing other resources for innovation (Klerkx *et al.*, 2009).

ICT has already been used on many types of platforms for the dissemination of agricultural research results, e.g. websites, publication archives, newsletters and other channels of output from research institutions and extension services, but increasingly more advanced forms of ICT are being utilised, such as decision support systems (DSS), forecast systems, instructive videos and text message information by mobile phone between farmer and advisor (Jensen and Thysen, 2004; Jensen *et al.*, 2000). ICT and especially also social media play an ever-increasing role in society as well as in agriculture. Therefore it is important to identify how and with which

tools ICT may contribute to and speed up innovation processes in agriculture, because innovation is much more than dissemination of research: it occurs as a result of the creativity and interplay between actors combining new and/or existing (tacit) knowledge. This means that it is impossible to classify concrete actions in advance as being 'innovative' or not and that what is considered as innovative depends on the state of development, e.g. of farming systems in a given region with huge differences and time lags across the EU (Van Oost, 2012).

Innovation is usually based on a successful combination of three factors (Klerkx *et al.*, 2009):

- *Hardware* (ability to stay connected – i.e. new technical devices and practices);
- *Software* (tools for social interaction – i.e. new knowledge and modes of thinking);
- *Orgware* (communication models – i.e. new social institutions and forms of organisations).

After setting the conceptual framework (Section 6.3), this chapter presents an up-to date overview and analysis of these three factors (Sections 6.4, 6.5 and 6.6) with special emphasis on the role that social media can have in multi-actor innovation processes and sub-processes in agriculture and where possible illustrated by successful examples from agriculture or other domains. Attention is given to easy access, interactivity and long-term solutions beyond project periods, which are able to connect, create and exchange knowledge between end users and other actors. Based on the analysis, barriers are identified and recommendations given in Section 6.7 and the results are put into perspective and overall conclusions drawn in Section 6.8.

6.3 Conceptual framework

Socio-technical networks are regulated networks where actors have freedom of choice (for example, establishing new relationships and activating new flows), but within the limits established by the rules of the system. For example, supply contracts impose technical standards, specific equipment, selection of suppliers and customers on farmers. Rules governing socio-technical systems are articulated into hierarchies. At the lowest level, rules regulate relationships and flows between individual entities. At a higher level rules shape 'regimes' that govern the system as a whole. At each level, rules can be changed, but up to the limit set by higher level rules which give the system its identity and stability. Regimes may change from within, adapting to the changing environment under external or internal pressures, or from the outside, when regime rules are broken by crises, disruption etc. and new rules are established.

Innovation relates to the relationship between knowledge and action. We act on the basis of our knowledge and at the same time we know based on our experience. It is inherently linked to processes of learning. According to many scholars, learning is a social process before being an individual one. Individuals learn thanks to the instruments – first of all, language – they get from the social networks to which they belong. The quality of social interaction affects efficiency (capacity to solve given problems) and effectiveness (quality of solved problems) of innovation processes. Quality of relationships can be assessed in terms of trust and diversity among members plus connectivity (number of members each member can reach) and interactivity (frequency and direction of interactions).

Learning processes affect two levels of knowledge. The first level relates to the acquisition of new information within already existing 'frames', which are rules that allow us to classify and store information. An example of a frame is a botanical taxonomy, that allows us to classify a plant, or specialist language, that allows us to give a name to a disease. First-order learning is

the capacity to store and elaborate information within existing frames. The second level regards the development of new frames. New frames allow us to interpret reality in a different way, and this may lead to a new course of action. Second-order learning is the capacity to create new frames. Different network configurations can also provide different quality of social interaction:

- *Closed networks* are characterised by a high intensity of interaction. They generate trust and interactivity which can provide highly efficient knowledge flows, but within given frames.
- *Open networks* are characterised by a higher diversity among members (higher rate of exposure to the unknown) and higher connectivity. They can foster more innovative solutions to problems and are a favourable environment for the development of new frames.

The literature on innovation has increasingly focused its attention on the concept of 'communities of practice' (CoP) as a key to improve business performance. CoPs are 'groups of people informally bound together by shared expertise and a passion for joint enterprise' (Wenger and Snyder, 2000). CoPs magnify the capacity of individuals to learn and innovate, as they provide access to information, frames, memories, validation and legitimisation of knowledge. The concept of CoP was developed before the Internet revolution, but many of its insights are now used to foster virtual communities.

CoP can be seen as knowledge systems wherein components develop specialised functions. The following roles can be identified:

- *Facilitation*: taking care of network relationships, enlarging the network and activating interaction;
- *Brokering*: procuring the relevant information and translating it into appropriate language;
- *Memories*: storing information;
- *Retrieval*: making information easily available on request;
- *Validation*: assessing the relevance of available information to practice;
- *Framing*: developing criteria to turn information into knowledge.

Other types of virtual networks, such as social communities of interest and individual communities of interest, may have similar functions.

ICT can improve these functions in many ways:

- It can dramatically improve the access and storage of information, which potentially makes huge amounts of data available to everybody.
- It can dramatically increase the capacity to gain access to information. Imaging tools, sensors, satellites and handsets provide an unprecedented wealth of information. By providing increasing amounts of machine-readable 'information on information', ICTs allow the scaling up integration of data of any kind.
- Software, often free, can relieve people from the burden of elaborating information and turn information into ready-to-use knowledge. Instrumental operations, once carried out only by experts, for example measuring blood pressure, can be done by almost anyone.
- Data-mining technologies allow identification of 'patterns' by processing huge amounts of data, opening the way to better understanding of behaviour, and to improve search strategies to accelerate selection of information relevant to one's problems.

- By reducing the cost of interaction to nearly zero, the Internet has multiplied the connectivity and interactivity of people, creating the conditions for intense flows of information.
- ICTs also provide trust creation mechanisms, fostering the consolidation of 'virtual communities'.
- Basic principles of virtual communities are 'sharing' and 'co-creation'. Collaborative tools distribute the possibility to contribute to the creation of a common pool of knowledge among people, removing in principle – or shifting ahead – barriers between 'knowledge producers' and 'knowledge users'.
- Interactivity on a mass basis allows processes of continuous review, improving continuously the quality of knowledge produced.
- Automatic translation tools challenge one of the most powerful barriers to knowledge circulation, language barriers.
- Used in integration with physical interaction, virtual interaction amplifies the outcome of physical interaction, as it can be used to disseminate, to replicate, to store and to follow up physical encounters.

6.4 Software

In recent years many social media and other ICT tools have been developed. The SCAR CWG AKIS started off with the following types of ICT tools/networks (adapted from Omona *et al.*, 2010), which may enable the creation, sharing and preservation of knowledge:

- Knowledge portals: are ICT tools for searching and access to web-based knowledge. Knowledge portals enable a common platform for the delivery of information from diverse sources.
- E-document management systems: are pieces or collections of software that can digitise and store documents in a digital format. This ICT tool is used as a database, allowing for the searching and sorting of the documents collected.
- Data warehouses: are databases used for reporting and data analysis. It is a central repository of data which is created by integrating data from one or more disparate sources.
- Groupware or collaborate software: is software which helps the facilitation of action-orientated teams working together over geographic distances by providing tools that aid communication, collaboration and the process of problem solving. Additionally, groupware may support project management functions, such as task assignments, time-managing deadlines and shared calendars.
- Community of practice (CoP): is a group of people who share a craft and/or a profession. The group can evolve naturally because of the members' common interest in a particular domain or area, or it can be created specifically with the goal of gaining knowledge related to their field.
- Social communities of interest: is a community of people who share a common interest or passion. These people exchange ideas and thoughts about the given interest but may know (or care) little about each other outside of this area.
- Individual communities of interest: are ICT tools for individuals to manage personal knowledge and networks.

Table 6.1 shows examples of these seven types of ICT tools. Fifteen of the tool examples (with names in bold text in Table 1) have been selected and evaluated systematically according to a standardised method in Appendix 1. In addition Table 6.1 lists a number of successful examples of various ICT tools from agriculture and other domains. These are also described further in Appendix 1.

Table 6.1 Software types, evaluated tools (in bold text) and other examples of tools of the different types and successful examples of application of the tools, mainly in agriculture.

Software type	Tools evaluated	Successful examples (see Appendix 1)
Knowledge portals (KP)	*Search engines*: Google, Yahoo *Slide and document sharing*: **Slideshare** *Video and photo sharing*: **YouTube**, Flickr	VOA3R, eXtension, Chil
E-document management systems (E-MS)	*Digital libraries*: Groen Kennisnet in NL, **Organic Eprints**	Organic Eprints, Agriwebinar
Data Warehouse (DW)	Eurostat, **FADN**	FADN
Groupware (GW)	**Wikipedia**, **Yammer**, **Crowdsourcing**	British Farming Forum, Lego Cuusoo, Climate CoLab, P&G Connect+Develop, Betacup Challenge
Community of practice (CoP)	**ResearchGate**, **Erfaland**	Disease surveillance and warning systems, IDRAMAP
Social communities of interest (SCI)	**Facebook**, **LinkedIn**, **Google+**, **Ning**, Quora	AgTalk+, E-Agriculture, Jeunes-agricultuers, E-agriculture, Rede Inovar
Individual communities of interest (ICI)	**Wordpress**, **Twitter**, Blogs	AG Chat

A short description of each evaluated tool and a link to mainly agricultural examples of the tool are presented below. The tool descriptions include their characteristics, their audience and use as well as their strengths in relation to the evaluation criteria used in Appendix 1: 'Networking', 'branding', 'promotion', 'engagement', 'discussion', 'crowdsourcing', 'co-production', 'cooperation' and 'dissemination'.

Slideshare: http://www.slideshare.net/eagriculture
A knowledge portal tool for uploading and sharing slides, PDFs, videos, webinars and support documents. The website gets an estimated 58 million unique visitors each month and has about 16 million registered users. This tool is particularly relevant for dissemination and branding.

YouTube: http://www.youtube.com/user/FarmersUnions
A knowledge portal tool for sharing videos of up to 15 minutes. It has 4 billion video views a day with users uploading an hour of video each second. This tool is particularly relevant for branding, promotion and dissemination.

Organic Eprints: http://www.orgprints.org
An e-document management system tool for papers and research projects related to organic food and farming. At present it contains almost 13 000 publications from all around the world.

In 2012 the archive had an average of 5,760 daily visits. This tool is only relevant for dissemination and branding.

FADN: http://ec.europa.eu/agriculture/rica/index.cfm?new_language=en
This data warehouse tool, the Farm Accountancy Data Network is an instrument for evaluating the income of agricultural holdings and the impacts of the CAP. The annual sample covers about 80 000 holdings representing and represents about 6 200 000 farms in the EU-27 Member States. This tool is only relevant for dissemination and to some degree for engagement.

Wikipedia: http://en.wikipedia.org/wiki/ICT_in_agriculture
This Groupware tool is a multi-lingual, web-based, free-content encyclopaedia project, written collaboratively by largely anonymous Internet volunteers. This tool is relevant for co-production, cooperation and dissemination.

Crowdsourcing: http://myfarmnt.com/
This open access Groupware tool is used for obtaining needed services, ideas or content by soliciting contributions from a large group of people, and especially from an online community, rather than from traditional employees or suppliers. This tool is particularly relevant for discussion and engagement and to a lesser degree for dissemination, cooperation and branding.

Yammer: http://sustainability.psu.edu/instructions-connecting-terracycle-group-yammer
This closed groupware tool provides secure enterprise social networks within organisations or between organisational members and pre-designated groups, where employees can easily communicate, collaborate and view co-workers' projects. This tool is particularly relevant for discussion, engagement, co-production, cooperation, dissemination, crowdsourcing and networking in closed networks.

ResearchGate: http://www.researchgate.net/journal/0167-8809_Agriculture_Ecosystems_Environment
This community of practice tool is a social networking site for scientists to share papers, ask and answer questions, and find collaborators. It includes profile pages, comments, groups, job listings, and 'like' and 'follow' buttons. Currently it has 2.7 million members of which 120 000 are categorised in agricultural science. This tool is particularly relevant for crowdsourcing, co-production, cooperation, dissemination, networking and discussion and to a lesser extent for engagement, promotion and branding.

Erfaland: https://erfaland.dk
This community of practice tool is the gathering point for everybody involved in the Danish agricultural sector. The mission of Erfaland is to give future farmers a dynamic platform for knowledge sharing, collaboration and continuous development of both the individual and the farm business. This tool is particularly relevant for discussion and engagement and to a lesser extent for networking, promotion, branding and dissemination.

Facebook: https://www.facebook.com/dairyfarmingtoday
This social community of interest tool had as of users, at the start of 2013 more than one billion active users, of whom more than half use Facebook on a mobile device. Users may create a personal profile, add other users as friends and exchange messages, including automatic notifications when they update their profile. Additionally, users may join common-interest user groups, organised by workplace, college or other characteristics. This tool is particularly relevant for discussion, networking and dissemination and, to a lesser extent, for branding promotion and engagement.

LinkedIn: http://www.linkedin.com/groups/Precision-Agriculture-1561757
This social community of interest tool is mainly used for professional networking. As of January 2013 it had more than 200 million acquired users in more than 200 countries and territories. This tool is particularly relevant for networking, discussion and branding and to a lesser extent for promotion.

Google+: https://plus.google.com/communities/112192611231489743370
This social community of interest tool is Google's response to Facebook. Google+ is not a 'social layer' consisting of just a single site, but rather an overarching 'layer' which covers many of its online properties. This may make it more complicated to use. As of December 2012, it had a total of 500 million registered users of whom 235 million are active in a given month. This tool is particularly relevant for branding, discussion and networking and, to a lesser extent, for dissemination, cooperation and engagement.

Ning: http://apf-down2earth.ning.com
This social community of interest tool is an online platform for people and organisations to create custom social networks It features sets such as photos, videos, forums and blogs; and support for 'Like', plus integration with Facebook, Twitter, Google and Yahoo. There were over 90 000 (as of June 2011) social websites, known as Ning Networks, running on the Ning Platform. This tool is particularly relevant for discussion, networking, dissemination and engagement and, to a lesser extent, for branding and co-production.

Wordpress: http://technology4agri.wordpress.com
This individual community of interest tool started as a blogging system but has evolved to be used as full content management system with possibilities for using more than 24 000 plug-ins, enabling users to tailor their site to their specific needs. WordPress is currently the most popular blogging system in use on the web, powering over 60 million websites worldwide. This tool is particularly relevant for dissemination and co-production and, to a lesser extent, for branding.

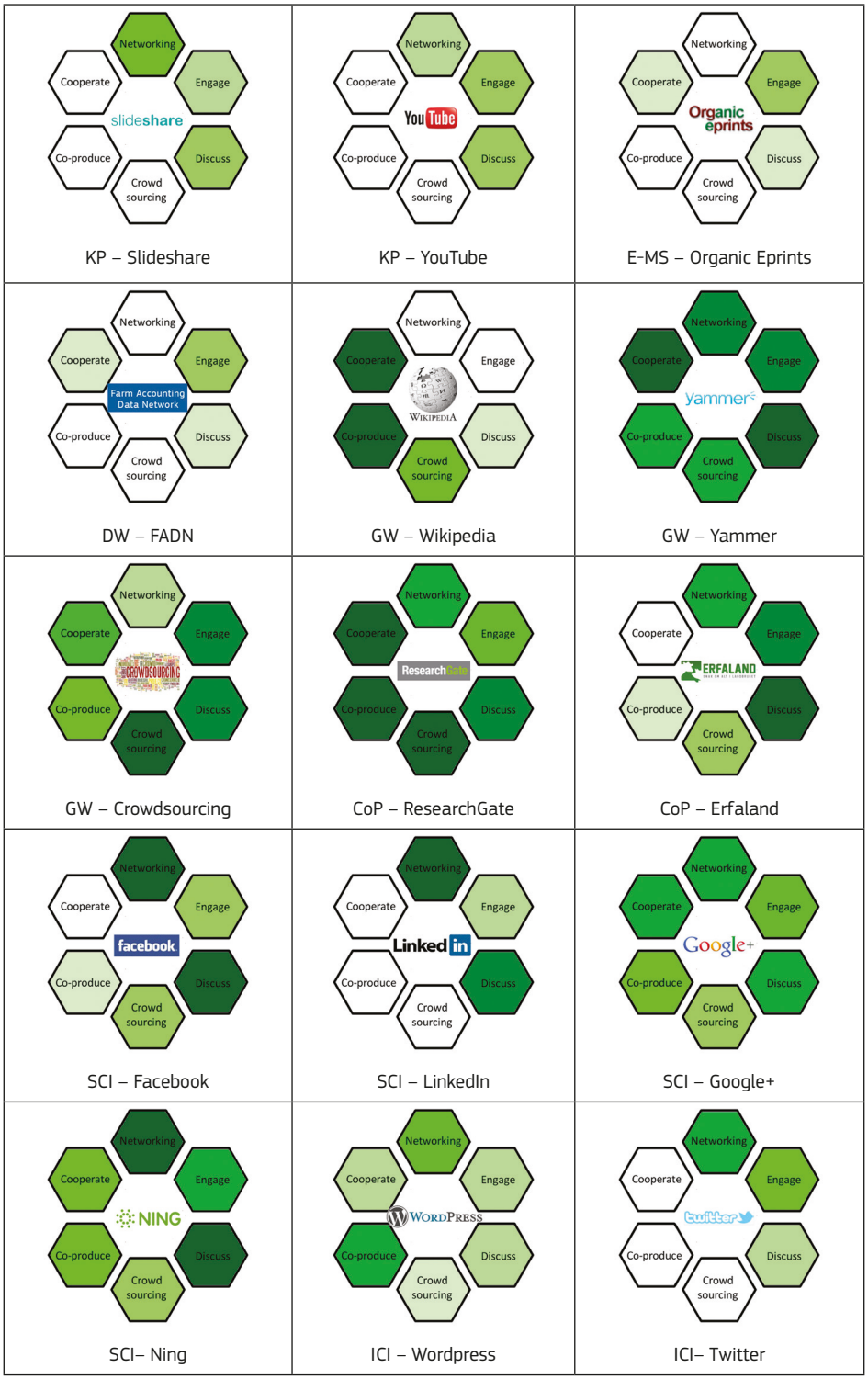
Twitter: https://twitter.com/AgBlogFeed
Twitter is a micro-blogging site via which users share updates in 'tweets' that are limited to 140 characters. Users build audiences of 'followers' and also choose to follow other users, read their content and then share some of it with their own followers through what are called 'retweets'. Twitter had over 500 million registered users as of 2012, generating over 340 million tweets daily and handling over 1.6 billion search queries per day. This tool is particularly relevant for dissemination, networking and branding.

Figure 6.1 shows a honeycomb presentation of the functionalities of the 15 selected tools in relation to their subjectively judged functionalities for the six social network functions, which are considered to be most important for innovation networks:

- *Networking* – ways for one person to meet up with other people on the net;
- *Cooperating* – working or acting together towards a common end or purpose;
- *Co-producing* – using each other's assets, resources and contributions to achieve better outcomes;
- *Crowdsourcing* – obtaining needed services, ideas, or content by soliciting contributions from a large group of people;
- *Discussing* – exchanging viewpoints about topics in open and informal debate;
- *Engaging* – making users share, connect and contribute.

The honeycomb presentation uses ten colour grades from white (not supported) to dark green (strong functionality of the tool) to describe each of the social network functions in the diagrams in Figure 6.1.

Figure 6.1: Honeycomb evaluation of selected tools in relation to six social media functions (see Table 6.1 for an explanation of type abbreviations, KP, E-MS, DW, GW, CoP, SCI and ICI).



The honeycomb evaluation of Figure 6.1 mainly demonstrates that there exists a large variety of social media with different strengths, capabilities and focuses. It is not evident which tools or platforms to choose to ensure a successful, i.e. active and vibrating community.

For example, if looking at the tools with the highest user potential for all six network functions, then the groupware tools, Yammer and Crowdsourcing, the CoP tool, ResearchGate and the social community of interest tools, Ning and Google+ perform best, but the individual community of interest tool and blogging system, Wordpress is also reasonably well rated for all six networking characteristics. However, these tools also have disadvantages, since Yammer can only be used in closed networks; ResearchGate is an open network, but with strong focus upon academia and with Ning, one has to start from scratch building the platform and gathering users.

Searching the net revealed the following successful examples of use of the various ICT tool types in the agricultural sector plus a few very promising examples of crowdsourcing from other sectors. (A more detailed description of the examples can be found in Appendix 1).

Knowledge portals:

VOA³R: http://voa3r.cc.uah.es/.
VOA³R is a three-year EU FP7 project under the ICT Policy Support Programme started in 2010. It is a social platform for researchers, practitioners and students in agriculture and aquaculture integrating open-access institutional research repositories. It combines the archive function with the social online communities of interest known from, for example, LinkedIn. The VOA³R consortium consists of 14 partners from ten different countries and three collaborators from external organisations. The platform gathers > 500 000 open access resources from 14 repositories that cover agriculture, forestry, animal husbandry, aquatic sciences, fisheries and nutrition. The platform is planned to run after the end of the project.

eXtension: http://www.extension.org/
EXtension, which was launched in the USA in 2007, provides access to the land-grant university system with rules of operation, governing committee, staff and long-term implementation plan. EXtension was launched to meet the public's expectations of a relevant and accessible Cooperative Extension Service (CES). The goal of eXtension was to become a centrally managed, but locally delivered state-of-the-art, full-service programme that uses technology and new organisational processes such as Communities of Practice (CoPs), Frequently Asked Questions (FAQ), Ask An Expert and various Wikis.

Chil: http://chil.org/
CHIL was launched by the Spanish government and Polytechnic University of Madrid in 2011. It is a portal that integrates network and free web-hosting of companies, cooperatives and related organisations within the agricultural sector. It also features tools for knowledge management such as wikis, blogs, publication of documents, forums and services such as list of accommodation and agri-food suppliers, promotion of courses etc. It also includes geo-referencing information.

E-document management systems:

Organic Eprints: http://orgprints.org/
Organic Eprints is an international open-access archive for papers and projects related to research in organic food and farming. It is the largest existing repository specialising in organic

food and agriculture and contains at present more than 13 000 publications from all around the world and has more than 23 500 registered users and 150 000-210 000 visits per month. The main objectives of Organic E-prints are to facilitate the communication of research papers and proposals, to improve the dissemination and impact of research findings, and to document the research effort. The archive accepts many kinds of papers. It has been rated as number 38 out of more than 1 500 archives in the world, and ranges as the highest with agronomic related content (http://repositories.webometrics.info/en/world). In 2011, Organic Eprints was nominated for the Oberly Award for Bibliography in the Natural or Agricultural Sciences, and received an 'Honourable mention'.

AgriWebinars: http://www.agriwebinar.com
AgriWebinar is a web-based conference developed by Farm Management Canada, which runs webinar sessions from November to March every Monday at noon EST. Speakers and topics are selected from the results of a client survey conducted previous to each new season of Agriwebinar®, so content is 100 % client-driven. All live presentations are archived and available by podcast for access by anyone at any time.

Groupware:

British farming forum: http://farmingforum.co.uk
British farming forum is an online peer-to-peer advice platform according to the same principle as AgTalk+ (see below). It has different forums focusing on different agricultural matters such as livestock, cropping machinery etc., where the users can pose a question and get input or advice from other online users. Some sub-forums have more than 200 000 views and 1 200 responses/comments within a short period of time.

Lego Cuusoo: http://lego.cuusoo.com
Lego Cuusoo is an example of crowdsourcing. It was launched worldwide by LEGO and its Japanese partner CUUSOO in 2011. Lego Cuusoo invites you to submit your ideas to be considered as future LEGO products, and it lets you vote on and discuss ideas to help the LEGO Group decide what to release next. When a posted idea reaches 10 000 supporters, it is reviewed by LEGO's Cuusoo team who then decide on whether to produce it. So far four Lego sets have been developed/accepted based on users' ideas, and more are under review.

Climate CoLab: http://climatecolab.org
Climate CoLab, developed by MIT Centre for Collective Intelligences, has the goal to harness the collective intelligence of thousands of people from all around the world to address global climate change. As of late 2012, more than 40 000 people from all over the world have visited the Climate CoLab, and over 4 000 have registered as members.

P&G Connect+Develop: http://www.pgconnectdevelop.com/
Procter &Gamble launched its Connect+Develop programme more than ten years ago and has developed more than 2 000 global partnerships, delivered dozens of global game-changer products to consumers, accelerated innovation development and increased productivity, both for P&G and its partners. The website has served as P&G's 'open front door to the world', allowing any innovator anywhere to share their innovations with the company. The site receives about 20 submissions every weekday from all over the world.

Betacup Challenge: http://www.thebetacup.com/
In the Betacup Challenge in 2010, the goal was to find ways to reduce the use of cups that cannot be recycled. There were more than 430 entries in the challenge. First place, with a USD 10 000 prize, went to a group from Boston, which proposed what it calls the 'Karma Cup', not a new design, but a new way to encourage customers to bring reusable cups to their local Starbucks shop.

Community of practice:

Disease surveillance and warning systems: http://agcommons.files.wo
Agricultural warning and surveillance systems based on ICT is a whole separate category and numerous solutions could be mentioned. An example on control of banana diseases in Uganda is presented here The system consists of a Community Level Crop Disease Surveillance system (CLCDS), a number of locals who disseminate and collect information in their communities using mobile phone applications and a team of professionals in relevant research fields, who have developed a technological system to identify, map, monitor and control banana diseases. Over the course of two months, 38 locals using mobile phones, MTN Mobile Internet and GPS devices collected more than 3 000 surveys documenting the presence of three banana diseases in two districts in Uganda.

IDRAMAP: http://www.bonificavalleserchio.it/manutenzioni/ is an online information system based on Google maps, created by a group of mountain municipalities in Toscana. The system allows local people to signal hydrogeological problems (obstruction of water lines, landslides, state of roads and of infrastructures), to indicate them on an online map, and to provide photos illustrating the problem. Local authorities collect this information, analyse and use it, intervene in urgent cases and feed the information into the maintenance plan. [Strengths: the system increases local awareness about problems of the territory and stimulates participation. Weaknesses: the system is not endowed with a social network utility that may foster the creation of a community of practice].

Social communities of interest

AgTalk+: http://agtalkplus.com/
AgTalk+ is an American platform, purely run on voluntary basis and on donations. It has forums, blog, wikis and (sharing innovations) workshop creations and very active forums – e.g. on machinery and equipment, stock, crops, IT, market and precision tools.

Jeune agriculteurs: http://www.jeunes-agriculteurs.fr/
The French Jeunes Agriculteurs Syndicat is an organisation for young people (under the age of 35) working in agriculture. It counts more than 50 000 members and has an active Facebook page with more than 5 000 followers. JA is organised on the basis of a geographical grouping of members, representing all regions and all agricultural production sectors in France.

E-Agriculture: http://www.e-agriculture.org/
E-Agriculture is a global platform, launched in 2007 by FAO, UN and the World Bank. Here people from all over the world exchange information, ideas and resources related to the use of information and communication technologies (ICT) for sustainable agriculture and rural development. It has over 9 000 members from 160 countries and territories.

REDE INOVAR: http://www.redeinovar.pt
Rede Inovar is a Portuguese network which aims at providing a technology and knowledge transfer environment between academia and the business community in the agro, food and forest sectors. The platform is supported by the EU and the Portuguese Ministry of Agriculture. It offers sector-selected search, personal profiles, event calendars, sharing of articles, images, links and videos. It also has a brokerage area which aims to strengthen cooperation between academia and the business environment and to speed up the process of technology transfer.

Individual communities of interest

AgChat: https://twitter.com/agchat
AgChat Foundation, which was founded by a group of American farmers, started AgChat in 2009**,** using Twitter. It has more than 30 000 followers, and its mission is to 'Empower farmers and ranchers to connect communities through social media platforms'. It was launched through volunteer activities but is now funded by donations and sponsorships. It now launches four programmes all focusing on how the agricultural sector can get the message cross via ICT. AgChat Foundation also has an active Facebook page https://www.facebook.com/AgChatFoundation – and a not-so-active YouTube page http://www.youtube.com/agchat and Pinterest – http://pinterest.com/agchatfound/. They also have quite passive LinkedIn and Google+ profiles.

When looking at the success stories described above, it is not possible to point to one type of software tool as being more successful than another in relation to networking, knowledge exchange and innovation in the agricultural sector – nor as regards the number of users, the activity in the network or the longevity of the network. Actually It has not been easy to find agricultural networks and platforms representing all seven types of social media, and most of those found have been within the software types, 'community of practice' and 'social communities of interest'. One of the most successful examples of ICT use in agriculture measured in number of active users is the Twitter-based AgChat, which has more than 30 000 followers although Twitter's honeycomb (Figure 6.1) scores zero in half of the communication functions evaluated. This shows that the success of a software tool as regards communication, knowledge sharing and innovation depends on many other factors than the ICT tool itself.

Despite the lack of formal metrics to determine whether social software has succeeded or not, the number of users and their level of activities offer significant evidence for success. Without users there will be no information or other kind of knowledge to fuel the innovation processes. General social software systems such as Facebook, Twitter and similar tools are indeed successful measured by this 'number of users' metric, whereas specific agricultural targeting systems such as VOA^{3}R still need to prove their potential. However, the number of participants in a virtual social network is not necessary a sign of success. There are many other factors which should be evaluated.

Apart from a few exceptions, our review of social software systems reveals that agriculture as a sector to some extent has adopted the general social software programs as tools for networking and knowledge sharing, but the potential to use it for crowdsourcing and cooperation or as a supplement to face-to-face interactions has not yet been exploited.

Crowdsourcing has proven to be a huge success in other business areas, e.g. for the multi-national company, Proctor and Gamble which, via its Connect+develop website http://www.pgconnectdevelop.com receives more than 4 000 submissions per year from all over the world. Kärkkäinen

et al. (2012) have investigated the use of crowdsourcing, especially from business-to-business companies' innovation perspective, with the aim of creating a more comprehensive picture of the possibilities of crowdsourcing for companies operating in business-to-business markets. They performed a systematic literature review and found 19 cases, in which evidence of innovation as a result of crowdsourcing activities were found in 12 cases. Use of crowdsourcing was identified in three innovation process phases: front-end, product development and commercialisation. Furthermore, evidence was found for crowdsourcing to be used in innovation mainly in the manner of crowd creation, crowd wisdom and crowd funding. It is concluded, that the role of social media was quite essential in all the analysed B2B crowdsourcing examples.

Boudreau and Lakhani (2013) have also studied dozens of company interactions with crowds in innovation projects over the last decade in areas as diverse as genomics, engineering, operations research, predictive analytics, enterprise software development, video games, mobile apps and marketing. On the basis of that work, they have identified when crowds tend to outperform the internal organisation and, equally importantly, when they do not. Crowds make sense only when a great number and variety of complements is important; otherwise a few partners or even an internal organisation will better serve the goal.

Despite the lack of identification of innovation in any of the successful agricultural examples, it is evident, when judged by the variety in capabilities of the reviewed tools and successful examples in the agricultural sector and in other sectors as well, that there is a potential for using existing social software tools and platforms much more to communicate, interact, create, share and organise information and as such stimulate multi-actor innovation in agriculture. Furthermore, instead of inventing new tools it is recommended to analyse which of the already developed ICT tools are best suited for the purpose and the cooperation of the stakeholders to be involved.

6.5 Hardware

A prerequisite for an effective communication via electronic networks is reliable hardware tools (wired and wireless broadband, PCs, tablet computers, smartphones and mobile phones) to support the various software tools for communication and search of information. Holster *et al.*, (2012) made an overview of the relative distribution of various hardware tools in Table 6.2 (farm PCs, Internet access, Farm Management Information Systems (FMIS), handheld phones/devices.

Table 6.2: Relative access level to Farm PCs, Internet access, FMIS and handheld phones/devices

Country	Farm PC	Internet access	FMIS	Handheld phones/devices
Belgium	High	High	Average	High
Bulgaria	Low	Low	Low	–
Czech Republic	High	High	High	Low
Denmark	High	High	Average	High
Estonia	High	High	High	–
Finland	High	High	High	High

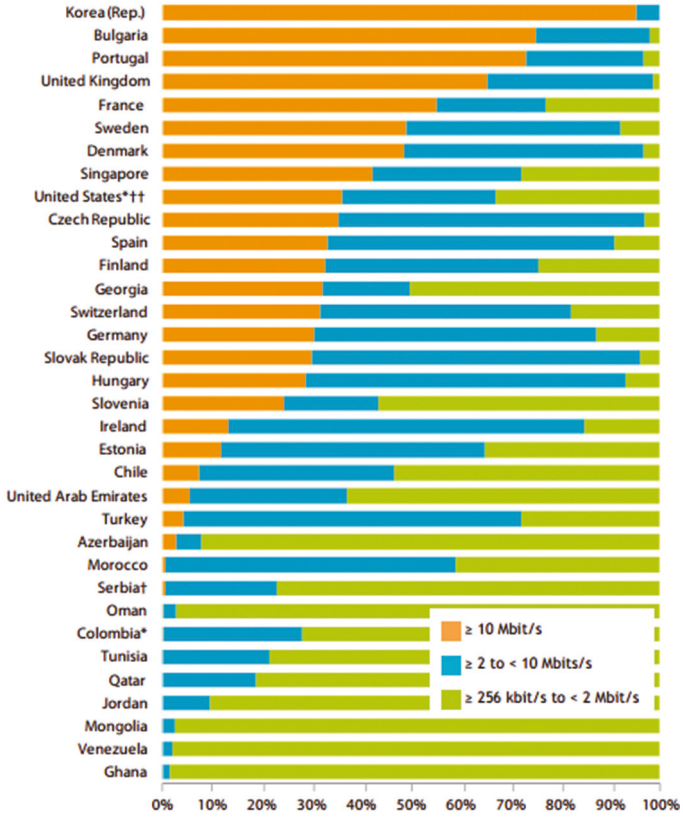
Country	Farm PC	Internet access	FMIS	Handheld phones/devices
France	High	Average	Average	High
Germany	High	High	Average	High
Greece	Low	Low	Low	Average
Hungary	Average	Average	Low	Low
Ireland	Average	Average	Average	Average
Italy	Average	Average	Average	High
Latvia	Low	High	Low	–
Netherlands	High	High	High	High
Poland	Average	Average	Average	–
Portugal	Low	Average	Low	Average
Romania	Low	Low	Low	Low
Slovakia	High	Average	Low	Low
Slovenia	Low	Low	Low	Low
Spain	High	Average	Average	High
Sweden	High	High	Average	High
United Kingdom	High	Average	Average	Low
Switzerland	High	Average	Average	Low

(source: Holster *et al.*, 2012).

In another recent survey, OECD (2012) studied the access to various types of wired and wireless broadband in 34 countries, of which 21 are EU Member States (Appendix 2). Of the 21 EU Member States examined, nine (NL, DK, FR, DE, UK, BE, SE LU and FI, in descending order) had a similar or higher number of wired broadband subscriptions than the OECD average of 30 subscriptions/100 inhabitants, while the other 12 EU Member States were below the OECD average. As regards wireless broadband access Sweden had the highest number of wireless broadband subscriptions out of the 21 EU countries with slightly more than 100 subscriptions per 100 inhabitants followed by six countries with 60 or more wireless broadband subscriptions/100 inhabitants (FI, DK, LU, EE, EI and UK). The rest of the EU Member States had less than 60 wireless broadband subscriptions/100 inhabitants.

The two surveys show that the northern and western EU countries generally have the highest level of access to ICT hardware. Another important factor for the use of communication software tools is the speed of the broadband connections. This was studied by the International Telecommunication Union (ITU) (2011) in a survey covering, among others, 15 EU Member States. There were large differences in the advertised speed of the available fixed broadband connections in the different Member States (Figure 6.2).

Figure 6.2: Advertised speed of broadband connections in various countries (ITU, 2011).



Of the 15 EU Member States, six had a speed of 10 Mbits/s or more for 50 % or more of the advertised broadband connections, while the rest had less. Bulgaria and Portugal were the highest scoring with more than 70 % of the advertised broadband connections being 10 MBits/s or more, while Germany scored surprisingly low with only about 30 %.

The price for the use of broadband connections has also been studied in the survey of OECD (2012). It showed a large variation in the price per broadband megabits/per second, both within and between countries (Appendix 6.2). This may be due to price differences between broadband providers, lack of competition and differences in the speed of the broadband advertised.

Lack of investment in high-speed broadband and low competition between broadband providers in rural areas is a well-known problem for farmers in most EU-countries. This causes reduced access to Internet connections, unreliable connections and low speed as well as high prices on broadband subscriptions (OECD, 2012). The problem will probably not be solved in the near future due to severe reductions in the EU Budget for 2014-2020 as regards investments in high-speed broadband in rural areas. According to The Guardian, 11 February 2013 '*Broadband campaigners say EU budget cuts hammered out last week will kill high-speed connections needed by rural homes and businesses, after it emerged the budget for rural broadband – seen as vital to creating new businesses – has been cut by EUR 8.2 billion (GBP 7 billion) to just EUR 1 billion…' (*http://www.guardian.co.uk/technology/2013/feb/11/broadband-budget-cut-rural-connection-billion-euro*).* However, as of 31 May 2013 the EU budget has not yet been approved by the European Parliament and the

Council, so it is not certain if the budget for ICT infrastructure in rural areas will be cut or by how much it may be cut.

The lack of high-speed broadband connections in rural areas is a major barrier for the establishment of an efficient ICT platform for communication and free exchange of knowledge in the agricultural sector (i.e. farmers, extension services, food and feed processing enterprises, agricultural scientists etc.), especially in the eastern and southern countries with poor economies and high prices on the use of the broadband connections. Therefore care should be taken to choose the right hardware tools in different countries.

There may also be a mental barrier to some (mainly older) farmers and other actors in the food chain to acquire and use ICT hardware and software tools. In 2007, 31 % of holders of agricultural holdings in the EU15 were 65 years of age or older and the number has been steadily growing since 1990 (Matthews, 2012).

Some barriers will be overcome without actions taken by public regional or national authorities. The price of ICT hardware is continuously falling while the capacity, portability and user friendliness of it is increasing. The change from monolithic to networked computers also reduces the demand for processing power and storage on the client side, because the storage and processing is done on Internet servers (in the 'cloud'). The communication platform most used among European farmers and extension workers is the mobile phone. With the technological development of more and more advanced smartphones and other portable devices the phone will also become the Internet portal for the farmer. However, there is a need for investments in reliable and high-speed broadband structures in rural areas where broadband suppliers cannot see a business opportunity, and there is a need for educating older farmers in the use of ICT.

6.6 Orgware

'Orgware' refers to the capacity building of the different institutional actors involved in the adaptation process of a new technology by networking (Wikipedia, 2013). Network models of innovation existed long before the recent developments of the Internet. The first communities of practice were face-to-face communities, of which informal social relations were the most important media. The Internet makes it possible to expand in time and space the model of informal social interaction. Face-to-face communication (characterised by co-presence) is indeed complemented by remote interaction, both synchronous (for example, Skype conversations, chat functions on Facebook and other platforms) and delayed (for example, e-mail). Progressively, the Internet expands the possibilities to broadcast information (one to many) while receiving feedback from many, contrary to traditional media. Moreover, they progressively expand the amount and type of information exchanged (sounds, texts and images). The Internet also allows the storage of growing amounts of information in remote repositories, such as Organic Eprints (http://www.orgprints.org/), making shared repertoires available without direct social interaction.

When we look at the role of the Internet in communication and collaboration processes, we can say that:

- The Internet adds human-to-machine interaction to human-to-human interaction. A lot of information can now be accessed without any human mediation.
- The Internet makes operations possible that once were possible only in person.
- The Internet reduces the time necessary to perform activities that, when done in a face-to-face setting, can be slow and complicated, though sometimes necessary.

Social media have made a step further. They provide platforms for the development of virtual communities, giving users tools to develop 'social' skills (profile description, asking connection, exploring other members' connections, publishing posts, commenting on others' posts, 'like' buttons, reputation generators – as in the case of *Amazon* book reviews –, social bookmarking, etc.). Social media provide platforms for collaborative working, such as collaborative text writing (e.g. in Google Docs) and collaborative maps (e.g. IDRAMAP, http://www.bonificavalleserchio.it/manutenxioni), not to speak of the 'open-source' software projects.

The Internet forces us to reconsider the respective roles of offline and online, face-to-face and remote, and to redesign processes accordingly. As the cost of physical interaction increases, its relative cost to remote interaction decreases – due to scarcity of time and energy costs for transportation. It is important to identify the features that still give physical interaction an advantage compared to remote interaction, thus mobilising it when it really adds value. The following could be criteria to identify future roles of different types of interaction:

- Human-to-machine interaction will replace all standardised knowledge transactions, as in the case of search for information stored in databases. This type of interaction is expanding constantly, as the progress in automatic translation, automatic text summarisation and the so called 'semantic web' – where data are accompanied with meta-data which make the data machine readable – develops.
- Remote human interaction will replace face-to-face interaction whenever unproblematic communication is involved: for example, agreeing on dates for a meeting, responding to specific questions, writing collaboratively short reports, polling on alternative options, discussing routine issues among people who already know each other. The possibility of exchanging images and voice, together with experience concerning the use of these media, progressively shifts the range of issues that can be addressed through remote interaction.
- Physical interaction is still not replaceable when information is too complex to be codified in a digital way (for example, involving taste, touch, smell and body language as well as co-production of new knowledge). Thus, in situations where it is essential to foster motivation, to mobilise emotions, to capture background information and tacit knowledge and, to interpret complex natural phenomena. Rather than mere replacement of physical interaction with remote or machine interaction, innovation systems will enjoy an integration of online-offline interaction.

However, the successful formation of networks and virtual communication platforms may not be enough to obtain innovation. The World Bank (2006) found that even when there were strong market incentives for players to collaborate for innovation, linkage formation was still extremely limited. An important role of public policy should therefore be to promote these linkages. This may be done by means of innovation brokers, i.e. a type of intermediary that is neither involved in the creation of knowledge nor in its use in innovation, but one that binds together the various elements of an innovation system and ensures that demands are articulate to suppliers, that partners connect and that information flows and learning occurs (Klerkx, 2009).

All the above-mentioned aspects will have implications on the future activities carried out in the AKIS. Social media are dramatically changing the way that agricultural research and development is organised. Social media allow the creation of communities of practice among researchers and students to exchange ideas, expertise, bibliographies, as in, for example, ResearchGate, http://www.researchgate.net/, and which is also the ambition of the EU FP7 project, VOA3R, http://

voa3r.eu/). Some specialist software media that can help people to organise their research, collaborate with others online or discover the latest research, such as Mendeley (http://www.mendeley.com), Academia.edu (http://academia.edu/), ResearchGate (http://www.researchgate.net/) and LinkedIn (http://www.linkedin.com/) have grown rapidly in recent years. The possibilities of exchanging and sharing large amounts of data and processing capacity allow the connection of laboratories/research institutions in places distant from each other. The possibility of collaboration fosters interdisciplinarity. Open access journals and repositories are making scientific outputs available for free to everybody (e.g. Organic Eprints).

Social media will provide a much faster and effective dissemination of research output and the feedback to the researchers will be much more consistent. Peer review, which is presently the key to scientific quality of research output, will be possible at a much larger scale and will become a continuous process. Civil society may have the possibility to feed back on the relevance of research output, on the possible impact and on potential risks (e.g. VOA3R).

According to Ballantyne *et al.* (2010), research in agriculture can benefit from the possibility of sourcing data from farmers through mobile digital devices. This will cut down the costs of data collection and will allow the development of locally specific solutions. This is the idea behind IDRAMAP in Tuscany, an online community of practice information system based on GoogleMaps. The system allows local people to signal hydrogeological problems (obstruction of water lines, landslides, state of roads and of infrastructures), to indicate them on an online map, and to provide photos illustrating the problem. Local authorities collect this information, analyse it and use it, intervene in cases of urgency and use the information in the maintenance plan. Application of such a community of practice system in agriculture may generate a progressive involvement of farmers in research, provided that social media allow them to give not only data but also input on research problems, feedback on research output and direct access to the use of the results. An example of this could be the social communities of interests network, E-agriculture (http://www.e-agriculture.org).

When access to information is no longer a problem, teachers will lose their role as 'content providers' and will have to concentrate on methods: thinking, finding relevant information, synthesising, contextualising, critically evaluating (Williams and Tapscott, 2010), and ICTs will transform e-learning tools from 'media' to 'platforms', in which content is created, shared, remixed, repurposed and passed along (Downes, 2005). As Downes stated, 'the control of learning will be placed in the hands of the learner', and learning will be linked to specific goals. The teacher, in this context, will become a facilitator, a resource person, and the classroom will be transformed into an environment in which to develop creative discussion and to stimulate collaborative work. In the new context, students will view learning as the process of joining a community of practice. An example of this type of virtual space is Erfaland (https://erfaland.dk/), a Danish platform for agricultural actors, which aims to be a dynamic platform for knowledge sharing, collaboration and continuous development of both the individual and the farm businesses.

When it comes to farmers, training will concentrate face-to-face activities on problem-solving activities and may also be used to increase group building, knowledge sharing and collective problem definition. Brokerage methods such as transect walks, focus groups, Venn diagrams, world cafés and card games could make the meetings more effective as they will stimulate participation, discipline of interaction, curiosity and group identity. Offline (face-to-face) encounters will be followed up by post-event social interaction, which will strengthen and disseminate learning output, such as in the Portuguese initiative, Rede Inovar.

Repeated interaction among multiple actors allows a reduction in the distance between expert advice and lay knowledge. Social media also allow the integration of expert advice with lay knowledge through peer-to-peer interaction. This might be the case in forums such as the British Farming Forum (http://farmingforum.co.uk/forums/forum.php), provided that the researchers and extension sector are willing to interact on these kinds of platforms and also 'put an ear to the ground' in order to get inspired to develop new research projects and advisory products. As in the case of research and education, also with technical advice, all the tasks that can be standardised and digitalised will be progressively performed through human-to-machine relationships; remote advice will have a much more relevant role as seen, for example, on Agriwebinar (http://www.agriwebinar.com/), especially for frequently asked questions, and peer-to-peer interaction will complement the expert advice. Physical interaction will be concentrated on the discussion of complex issues or on problems that require direct observation of the object of knowledge. Imaging and recording will allow sharing of the information gained with physical interaction and contribute to shared repertoires.

Peer-to-peer interaction will increasingly integrate technical advice, and extension services will have to design their activity in a way that fosters and monitors social learning, for example by participating in discussions on the virtual platforms used by farmers, such as the Danish Erfaland. All actors in the system will dedicate a higher share of resources to online instruments to increase their productivity. Mailing lists, content management systems and collaborative working tools will become tools of daily usage. Social Media have the potential of turning any project into a community of practice. Development projects – such as those funded by Rural Development policies – will increasingly mix different activities (research plus training plus extension) and diverse actors, including consumers, linked together by flows of information across the Internet and finalised to specific innovation objectives (see the IDRAMAP example in Appendix 1).

Extension services will increasingly dedicate themselves to the creation of communities of practice, specialising in bridging worlds characterised by different languages, bodies of knowledge and goals, to align actors around specific innovation objectives and to facilitate access to financial resources (innovation brokerage). Brokering skills, both online and offline, rather than technical specialisation, will become key elements in the new extension services. As far as face-to-face interaction is concerned, brokerage tools will increasingly be employed to increase their effectiveness. (Some examples of this may be found in Appendix 6.3: Orgware).

6.7 Barriers and recommendations

Based on the analysis of software, hardware and 'orgware' for improvement of information, communication, knowledge sharing and innovation in the agricultural sector in the previous sections, the following barriers have been identified and recommendations on how to overcome these barriers are proposed:

Barrier 1 – Limited use of social media for innovation in the agricultural sector

The agricultural sector has not yet used the full potential of ICT software tools for innovation, though some virtual networking and knowledge sharing between farmers, agricultural advisors, researchers and other actors in the agricultural sector is taking place on various types of social media platforms. However, only one example of the use of crowdsourcing in the agricultural sector has been identified (British Farming Forum) although this software tool seems to have been rather efficient in creating innovation for private companies such as Procter and Gamble and Lego (see Appendix 6.1).

Recommendations

- As a first step, utilisation of general social software systems should be promoted, while alignment of the various software systems and their strengths in relation to well-defined purposes and types of network groups and actors should be investigated.
- As a second step, application of crowdsourcing and innovation brokers in the agricultural sector should be tested in relation to creation of innovation in Horizon 2020 or in operational groups or networks under the EIP.
- Invention of new systems should not be promoted. Even if they may be superior from a technical viewpoint, it will be difficult and a steep climb to attract a critical mass of users and especially attracting peripheral users to new social platforms – these are important for spurring innovation.

Barrier 2 – Inadequate Internet connections

A stable, reliant and relatively fast Internet connection is crucial for innovation and collaboration in agriculture. The quality of both mobile and wired Internet connections varies across Europe, with northern and western European countries generally offering higher quality and speed at lower prices than southern and eastern European countries. Within each country the possibilities for high-speed, stable Internet connections are highest in urban areas and lowest in rural areas. This is clearly a barrier for the development of ICT usage in the agricultural sector.

Recommendation

- Promote the development of Internet connections in rural areas, perhaps supplemented by national, regional or EU funding for rural broadband infrastructure. Fast connections are better than slow, and slow connections are better than no connections.

Barrier 3 – Lack of access to hardware tools

The price of ICT hardware (PC, tablets and smartphones) is continuously decreasing while their capacity, portability and user friendliness are increasing. Today the majority of European farmers have a mobile phone and more and more of these are smartphones. The availability of rugged computers that can resist the tough environment of a farm is also increasing.

Recommendation

- No actions are necessary in the northern and western EU Member States because the market forces develop in the desired direction, but in the eastern and southern EU Member States public support measures for ICT hardware (robust smartphones and tablets) may help in speeding up the use of ICT by farmers.

Barrier 4 – Cultural barriers and lack of engagement in the use of social media

Several cultural barriers for optimal use of the social media and networking have been identified:

- The age of farmers. The average age of farmers in the EU is increasing and so is the percentage of farmers above 65 years of age, who are often not familiar with ICT tools and networking via Internet applications.
- Lack of engagement of researchers in open access social media which are used by farmers.

Recommendations

- Introduce education of farmers in the opportunities and use of ICT tools, promote easy access ICT solutions, advertise and demonstrate the good examples.
- Change the system of rewarding scientists so that engagement in the application of research results/innovation activities is also rewarded, in parallel to publishing in peer-reviewed journals (see Chapter 5 of this report).
- Highlight successful examples of the implementation of research results in practical farming, food and/or feed processing etc.

Barrier 5 – Overload of farmers with information and misinformation

There is a risk of information overload of farmers and other users of social media and risk of misinformation due to lack of quality control of the information available.

A *de facto* peer review via social media already exists to a wide extent in the sense that users often tend to read, visit or use the articles, websites and tools recommended by someone in their network. This adds authenticity and credibility and serves as a filter for the vast amount of online information available. This is one of the main principles of *Twitter*, where you follow someone you regard as an authority or pioneer within a given field, and then tend to read or connect to whatever this person recommends rather than visiting a generic platform on a given topic.

This pattern of individualisation on news and information usage is a megatrend in western society and can be found in a broad range of media use, from personalised music playlists on *Spotify* to tailor made 'menus' of TV channels. Filtering can thus happen on the receiving end of the information stream, but it is also important as a broadcaster or disseminator of knowledge to filter your output. This can be built into the software, as seen on Amazon (http://www.amazon.com/) or the Danish agricultural platform Landbrugsinfo (https://www.landbrugsinfo.dk/), where your start page is personalised based on your previous behaviour on the site.

Recommendations

- No actions are necessary

Barrier 6 – Lack of long-term solutions beyond the research project period

ICT systems created within a project (e.g. a webpage with a chat forum for the presentation and discussion of deliverables, meetings etc.) rarely gain a lot of users and are usually not intended to stay 'alive' after the project has ended because there is no funding for further development and activities.

Recommendation

- By using social media and ICT tools that are already available, and which have a well-established network with active communication and cooperation, the costs for maintenance can be minimised and the results of the research project may continue to be discussed and new ideas generated after the end of the project lifetime for the benefit of the researchers as well as the potential users of the results. Popular systems such as the individual community of interest tool, AgChat (http://agchat.org/) started using Twitter and volunteer activities but it now has a forum of more than 30 000 followers and is funded by donations and sponsorships.

6.8 Perspectives and conclusion

Perspectives for application in the EIP

The interest from farmers in using ICT and social media to exchange knowledge, experiences and ideas presents a potential for targeted support and development of such tools for dissemination and support of innovation. Currently these tools are used to some extent as part of extension efforts, such as the Danish advisory services ERFALAND and the Portuguese Rede Inovar. There is a large unused potential for implementing this in combination with the different types of farm-related groups and networks established within the general social network media (for example the Facebook group of the French organisation Jeunes agriculteurs).

It is a hypothesis that a combination of face-to-face interactions and social network media could not only strengthen classical linear dissemination but also encourage new forms of interaction between different actors, which could facilitate innovation processes. However, this study has not identified actual innovations being the result of the use of such tools within agriculture so far. Thus, there is a need to further explore how the social networking potential can be directed towards actually supporting innovations, for example by linking these with innovation brokers. Our analysis suggests that the challenge is to improve the cohesion behind the three conditions for ICT supported innovation: software, hardware and 'orgware'. This could be one of the challenges and roles of the coming EIP 'Agricultural Productivity and Sustainability'.

The applications of social media have perspectives for the functioning of the modalities under the EIP. It is expected that so called operational groups (OG) of the EIP at local level will be the core units of this tool aimed at innovation and knowledge exchange. The idea is that the EIP should go beyond the linear dissemination model and 'adhere to the interactive innovation model which focuses on forming demand-driven partnerships – using bottom-up approaches and linking farmers, advisors, researchers, businesses and other actors in Operational Groups' (COM, 2012). An OG will consist of members from different actor groups joined in an action- and result-orientated 'hands-on' activity, where interaction between group members is maximised for co-creation and cross-fertilisation. They will need a means of communication besides meeting face-to-face and, as shown in the analysis above, a number of tools for social networking would be useful for this purpose. Moreover, it is important to communicate with other stakeholders outside the specific OG, and between OGs, in order to secure the wide uptake of the innovations developed. Here, social media will be very useful to allow for continuous exchange of ideas and knowledge within and as part of networking between OGs. This is foreseen to be supported by Thematic Networks, which should assist in connecting OGs across regions and countries and facilitate wider knowledge exchange.

As discussed in Section 6.3 about the conceptual framework, the quality of social interaction affects capacity and effectiveness in innovation processes. These qualities again depend on diversity, connectivity and interactivity among members of networks and especially the capacity to create 'new frames' through second-order learning, which often is fundamental for radical innovation. Therefore, it seems important that an efficient use of social media by OGs and Thematic Networks may facilitate 'crowd sourcing' processes, where members of an OG could seek assistance and ideas for a particular challenge from a wider knowledge pool and thus speed up the innovation process. As mentioned in Section 6.4 about software, crowd sourcing has been used successfully in other sectors. Building up such facilities (preferably using existing infrastructures as described above) would be a valuable support for the ambitions that Thematic Networks can act as think tanks, knowledge hubs and innovation brokers.

As mentioned initially, there seems to be a significant time lag and geographical difference in the implementation of new knowledge and innovation across the EU Member States. It is a hypothesis worth testing that facilitating improved communication using social media might improve 'long-distance cross-fertilisation' in agriculture. Language differences and skills will be a challenge, but might be partly overcome by new semi-automated translation tools and the assistance of knowledge brokers and Thematic Networks within a social network infrastructure.

Conclusion

This analysis of the use of social media and other ICT tools in the agricultural sector and other sectors shows that there is a great potential for using existing social software tools and platforms for communication, interaction, knowledge sharing, preservation of information and, as such, stimulate multi-actor innovation. However it is not possible to predict which ICT tools will be best to use in a given situation, but focus should be on the end user and the purpose of the network, taking into account the target groups' pattern of ICT usage. Maintaining the platform, selecting first movers and ambassadors etc. may also play an important role in success. Moreover, a redesign of the organisational model from the top down to network models will also improve knowledge sharing and mutual learning, which are prerequisites for innovation.

The analysis has identified some important barriers which need to be overcome to obtain the full potential of the use of social media and other ICT tools in the agricultural sector The present lack of use of social media for innovation in the agricultural sector may be overcome by stepwise promotion and tailoring of social software systems and testing of crowdsourcing and innovation brokers in Horizon 2020 or in OGs under the EIP. Lack of reliable and fast Internet connections are crucial barriers for virtual collaboration and innovation in the agricultural sector. This barrier may be reduced by rural development funding for broadband infrastructure in regions with no or slow access to the Internet. The price of hardware and broadband subscription may also be an obstacle in poor regions, but rural funding programmes may also assist here.

Cultural aspects may be a serious barrier – almost one third of EU farmers are above 65 years of age and probably not familiar with PCs, smartphones and ICT tools. Promotion of easy-access ICT tools, courses and demonstration of good examples may reduce the problem. Another cultural barrier is the lack of engagement of researchers in social media for farmers. A change in the system for rewarding researchers may solve this problem. Risk of overload and misinformation of farmers, participating in multi-actor social media platforms may also be a barrier. Use of *Twitter* for following reliable experts may be used as a filter for overload and misinformation or it may be built into the software tools used for the virtual networking. The lack of maintenance of networks beyond research project periods is also a serious barrier for the establishment of stable and lasting collaborative networks within different fields of the agricultural sector. Increased use of already established ICT tools and well-established virtual social networks such as AgChat may change that.

6.9 Definitions used in this chapter

Definitions and abbreviations:

2G (GSM): Second-generation wireless telephone technology (Global System for Mobile Communications). Second-generation (2G) digital mobile networks used by mobile phones. It is the global standard for mobile communications with over 80 % market share. (Wikipedia)
3G (UMTS): Third-generation wireless telephone technology, (Universal Mobile Telecommunications System). 3G provides an information transfer rate of at least 200 kbits/s.
FADN: Farm Accountancy Data Network**:** http://ec.europa.eu/agriculture/rica/
FMIS: Farm Management Information Systems
ICT: Information and Communications Technology
PC: Personal computer
RSS: Rich Site Summary (originally RDF Site Summary) is a family of web feed formats used to publish frequently updated works – such as blog entries, news headlines, audio, and video – in a standardised format.
Venn diagram: or **set diagram** is a diagram that shows all the possible logical relations between a finite collection of sets (aggregation of things).

7 EPILOGUE

Text by Krijn J. Poppe and Anne Vuylsteke, 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 the major findings on linking innovation and research in the AKIS. We conclude with a recommendation to continue our work in a new CWG.

7.2 Major findings on linking innovation and research in the AKIS

Innovation is top-of-mind with policy-makers, also in agriculture and food. The economic crisis and the notion that the world has to feed nine billion people in 2050 in a sustainable way are the drivers for this focus on innovation.

More innovation is desirable, at least from a societal point of view. Some firms and farms are very dedicated to innovation, but others are more conservative or realise that innovation has winners and losers, especially if innovation is disruptive. Working methods and institutional arrangements have to be changed, which is difficult, risky, and sometimes require changes with business partners and also in regulations. This tension between the actual and desirable level of innovation is an incentive for policy-makers to see how they can increase the level of innovation.

Research is certainly one of the activities that contribute to innovation. Development of new technologies such as genetics, robotics, ICT and nano-technology (GRIN-technologies) are examples. However more research is not by definition more innovation. For innovation additional activities are needed when working methods have to be changed and new products or services marketed. For farmers and small businesses such innovation activities are full of risks that have to be managed and where collaboration with partners or support and feed-back from colleagues or experts can help. Traditionally farmers depend on the Agricultural Knowledge and Innovation Systems (AKIS) and their food chain partners for the innovation process.

The difference between innovation and research also means that governments have more instruments than research to promote innovation. Extension and education, fiscal measures, credit guarantees, innovative procurement, inducements such as prizes and other incentives can help too. This implies that in addition to a science and research policy it makes sense to have an innovation policy. Such an innovation policy should not only give incentives to farmers and others in the food chain or rural area to innovate, but should also incentivise the AKIS to improve its functioning.

The European dimension (see Chapter 3)

The European research programme Horizon 2020 has an increased budget compared to Framework Programme 7, where in many EU Member States austerity programmes have cut research budgets. The research programmed by Horizon 2020 is only a small part of the investments in Europe's AKIS, but it is more flexible than the input financing in many national and

regional research institutes and is strongly quality driven. At the margin its influence might be higher than its share in public spending suggests. Next to measures aimed at scientific excellence and industrial leadership, Horizon 2020 will aim at societal challenges. 'Food security, sustainable agriculture and forestry, marine and maritime and inland water research and the bioeconomy' is one of these challenges. The proposals on Horizon 2020 foresee a combination of existing and newly developed instruments to meet these challenges. The newly developed instruments are multi-actor projects and thematic networks. Both aim for added value for the end users and this is realised through multi-actor involvement in research projects or by stocktaking, mapping and state-of-the-art existing scientific knowledge and best practices. Also existing instruments such as ERAnets and Joint Programming support the collaboration in programming research at European level. PPP such as the Future Internet Programme or the Bio-based economy (JTI BBI (Bio-Based Industries initiative)) seem to be becoming more popular; this also strengthens the European dimension and cross-border collaboration as the food industry is strongly internationalising.

Innovation and operational groups (see Chapter 4)

Given the urgency to deploy the European Innovation Partnership, the work of this SCAR Collaborative Working Group AKIS and hence this reflection paper has focussed on organising innovation in the operational groups. Over the last year much more has become clear on what operational groups are (and what they are not) and how groups of stakeholders could work with farmers on innovation. There are many positive interactive innovation practices in national programmes in the EU Member States upon which the EIP can build. The operational groups are clearly a bottom-up approach with networks, based in the theory of the systems innovation approach, compared to the linear approach that is more relevant for the introduction of new basic GRIN-technologies.

The operational groups can use existing experiences in the AKIS where innovative farmers develop successful new practices, products and services or machinery and even software. One of the roles of the AKIS always has been to work with those innovators, understand their innovations scientifically, standardise them and roll them out to other farmers. Another one is to help farmers to solve questions and challenges that farmers encounter in the innovation process. This might ask for innovation brokering, depending on the accessibility of the AKIS. Farm advisors with a good understanding of innovation and the AKIS might fulfil this role.

In this bottom-up approach it is up to the operational groups to define their challenges and innovation projects. However for learning between operational groups, including cross-border collaboration e.g. in thematic networks, and for (joint) access to the AKIS, it could be useful to work with some common themes – but this should not forbid farmers from working on other, for them more relevant, innovations.

Cross-border collaboration in research could benefit from a harmonisation of rules and procedures for commissioning research, to help to create to a more integrated 'market' for research. That does not mean that national or regional authorities should give up their strategy and agenda-setting processes, but they could adopt such procedures that research institutes could easier match national and international funds.

Where cross-border collaboration in research is clearly existent and increasing (see above), cross-border collaboration in innovation should be improved, and the EIP's thematic networks are probably only a start. This seems to be even more an issue as the research networks are biased to the oldest Member States/north-western Europe, and widening participation is a policy objective.

Incentives for stakeholders (Section 4.6)

EU Member States have more policy instruments than the EIP to promote innovation. And also in innovation policy some innovations are possible. Instruments such as the SBIR (Small Business Innovation Research programme) and innovation vouchers are examples.

One of the most important policy issues in promoting innovation through operational groups is to incentivise the stakeholders to take part in the innovation process. That is not guaranteed as the different subsystems of the AKIS are governed by their own incentive mechanisms and do not cooperate automatically in time-consuming and risky innovation processes from which they do not necessarily benefit.

In order to stimulate the participation of farmers and other stakeholders in operational groups, governments should make a clear political choice for the EIP way of working through operational groups that involve relevant stakeholders and work in a participatory way. The CAP's Rural Development Programme encourages this approach. This should be translated in an instrument portfolio that:

- gives incentives for research, development and innovation;
- stimulates knowledge exchange, adoption of innovation and technical application in the production process;
- supports the activities of facilitators, innovation brokers and tutoring paths for farmers and researchers to implement innovations;
- values the input an knowledge of farmers;
- supports operational groups to also develop cross-border interactions;
- invests in AKIS subsystems that have been underdeveloped in the specific national situation.

Governments should furthermore set a framework that provides continuity in the actions and activities of operational groups, introduces new methods to legally safeguard SMEs' knowledge and facilitate partnership agreements, makes it easy to participate (little bureaucracy), gives operational groups an advantage in the application for support schemes, acknowledges the practical field experience of farmers and improves the accessibility of knowledge and the free availability of information.

As Operational Groups will often be informal groups without a clear juridical form this will not always be easy. This is even more of the case as some of the money spent on innovation will with hindsight not have been useful. If there was no risk involved and all money has to lead to a successful innovation, there would be crowding out of markets and much less need for government intervention. The approach is a portfolio-approach where some will be successful and others not.

Incentives for research (Chapter 5).

This report paid extra attention to the incentives for researchers to take part in participatory innovation processes. We had two reasons for that. First of all SCAR has a special responsibility for the link between innovation and research. And second there are many observations that research has become very much orientated on its own process of aiming at scientific publications: '*The irony (..) is that the concept of a publication has been reversed: what counts as a publication does not reach any public any more, while that which is read by the public is not recognised as a publication (and for that reason will be written less often)*'[21].

A special study for the Collaborative Working Group (reported in Chapter 5) comes with ten recommendations. These include six potential changes at the level of research policy: the creation of evaluation criteria for both research proposals and research institutes to stimulate transdisciplinary and interactive research, the involvement of practitioners in research funding and evaluation processes, support for sabbaticals and short-term visits to stimulate exchange of practices between stakeholders, the creation of funding for projects that involve science and practice on an equal footing and the establishment of an easily accessible database for high-quality, non-academic publications/articles. The other four recommendations are formulated with regard to research institutions. They concern the development of targeted training courses to enhance the necessary skills for effective science-practice interaction, the creation of specialised centres and of new discipline Integration and Implementation Sciences, the establishment of a database with information about institutions, methods, tools, publications and trainings on interactive research and, finally, including the assessment of a researcher's (non-academic) societal impact into the overall evaluation of his/her performance.

It will depend on the national or regional AKIS how relevant the recommendations are. But it is clear that at least for some of the Horizon 2020 project calls and national funded research better incentives can be installed to link innovation and research.

ICT support for innovation (Chapter 6)

Multi-actor innovation might benefit from modern ICT support, comparable to how ICT (and in the last ten years especially the worldwide web and social media, now enabled by smartphones) is changing working processes and collaboration in the rest of daily life. A special analysis for the Collaborative Working Group (reported in Chapter 6) on the use of social media and other ICT tools in the agricultural sector shows that there is a great potential for using existing social software tools and platforms for communication, interaction, knowledge sharing, preservation of information and stimulate multi-actor innovation.

It is not possible to predict which ICT tools will be best to use in a given situation, but focus should be on the end user and the purpose of the network. Regular updates in the content of the ICT tool, selecting first movers and ambassadors etc. may play an important role in a successful application.

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21. Citation from a report *published by the Dutch Learned Society for Sociology (Nederlandse Sociologische Vereniging: Losgezongen van het eigen land, 2013)*

7.3 Follow up of the CWG

With this report the mandate of the present CWG comes to an end. However we feel that the topic is so important in relation to the current developments in global food production and the attention to innovation that it also needs the attention of SCAR in the coming years.

In this reflection paper we have concentrated on existing and newly developed instruments to promote innovation, and other issues that are of importance for the deployment of the EIP in the Rural Development Plans. Attention was paid to the link with research (especially concerning incentivising researchers), but there are several issues in the links between research and innovation that warrant further investigation. We currently see the following issues:

1) Supporting the implementation of the EIP

- Interface with DG Agri and the EIP service point on EIP activities and work programme, as regards focus groups, seminars, workshops, databases, etc.
- Development of linkages between the EIP and H2020 research instruments such as:
  - existing instruments such as EraNets, European Technology Platforms (ETPs), JPIs, PPP JTI BBI (Bio-Based Industries initiative), etc.;
  - newly developed instruments, e.g. multi-actor projects and thematic networks.
- Support for building national/regional EIP networks and sharing the first experiences of operational groups at national level, with special attention for Eastern European countries, e.g. through joint workshops and conferences with VALERIE and other relevant EU projects;
- Development of linkages between the EIP at EU level and national/regional EIP networks;
- Development of linkages between the EIP and instruments under European policies not yet covered until now, such as Interreg, regional funds, etc. For example through interaction with other relevant DGs;
- Deeper understanding of national innovation funding instruments;
- Explore non-financial incentives to promote interactive innovation methods;
- ICT related to AKIS and EIP networking including the role of E-Science, Open Data and Big Data;

2) Co-learning on interactive innovation with countries beyond Europe: neighbouring policy, GFRAS, etc. To be explored with the EIARD/SCAR SWG;
3) Foresight as regards matters of relevance to the EU and national AKIS (including research infrastructure). In interaction with the SCAR foresight group and a possible new CWG on research infrastructures.

There is widespread interest among the SCAR WG members and among the members of the AKIS-2 Collaborative Working Group to continue the work on AKIS beyond 2013. The SCAR WG will decide on new terms of reference along the lines above to continue the work as a Strategic Working Group AKIS-3 in 2014.

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Appendix 1 (to Chapter 6)

Social media and other ICT tools for supporting multi-actor innovations

Introduction

This Appendix to Chapter 6 contains a standardised overview covering 15 social media and other ICT tools, and focuses on functionalities which potentially can be used for stimulating and supporting multi-actor innovation. This is followed by a description of specific examples of existing ICT and social media, mainly within the agricultural sector, covering the different categories mentioned below:

The tools have been selected to cover:

Knowledge portals	Slideshare, YouTube
E-document management systems	Organic eprints
Data warehouse	FADN
Groupware	Wikipedia, Yammer, crowdsourcing
Communities of practice	ResearchGate, Erfaland
Social communities	Facebook, LinkedIn, Google+, Ning
Individual communities of interests	Wordpress, Twitter

For each tool, a short text explains the purpose, history and use and it is stated, to which extent the tool offers possibilities for:

- **Personal profile** – who you are, your work and interests; photo
- **Friends** – establishing connections with other users
- **Groups** – create or participate in groups around a common interest
- **Tagging** – marking content with tags to help yourself and others to find the content
- **Comments** – discuss content uploaded by other users
- **Blogs** – having your own blog
- **Pages** – having your own web pages
- **Events** – announcing events
- **Sharing** – general sharing of content from this tool to other tools/platforms
- **Photo** – contribute with photos
- **Video** – contribute with videos

The tools have been subjectively judged to what extent their functionalities supports following tasks:

- **Networking** – ways for one person to meet up with other people on the net
- **Branding** – establish a differentiated presence that attracts and retains loyal followers
- **Promoting** – use of publicity and marketing to sell goods, ideas, viewpoints etc
- **Engage** – making users share, connect and contribute
- **Discuss** – exchanging viewpoints about topics in an open and informal debate

- **Crowdsourcing** – obtaining needed services, ideas or content by soliciting contributions from a large group of people
- **Co-produce** – using each other's assets, resources and contributions to achieve better outcomes
- **Cooperate** – working or acting together toward a common end or purpose
- **Disseminate** – broadcast information to the public without direct feedback from the audience and similar, they have been rated to what extent they can be categorised as belonging to these services:
- **Social network** – services that allow you to connect with friends or other people of similar interests and background
- **Wiki** – a website that allows its users to add, modify, or delete its content via a web browser
- **Multi-media sharing** – services that allow you to upload and share various media such as pictures and video
- **Blogs** – discussion or informational site consisting of discrete 'posts' typically displayed in reverse chronological order
- **Micro-blogging** – services that focus on short updates that are pushed out to anyone subscribed to receive the updates
- **Video blogging** – a form of blog for which the medium is video and a form of web television
- **Podcast** – services that allows upload of typically audio files into a system, which offer subscription and download through web syndication or streamed online to a computer or mobile device
- **RSS** – family of web feed formats used to publish frequently updated works in a standardised format
- **Bookmark sharing** – services that allow you to save, organise, manage and share links to various websites and resources around the Internet

For each tool, there are given a number of examples of how this tool is used. These examples are primarily related to agriculture.

slideshare

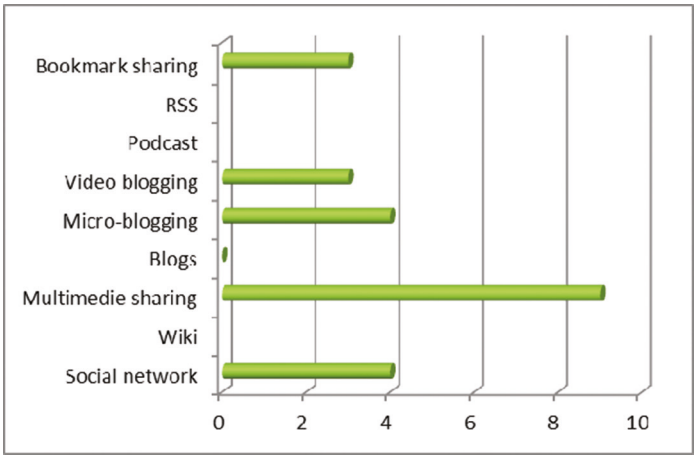
With this tool, you can upload and share slides with a private network, such as your internal innovation team, or with the world. You can also upload PDFs, videos, webinars and support documents. If you're going to create a PowerPoint presentation for a conference, SlideShare is a great way to expand its reach far beyond that conference. SlideShare also provides users with the ability to rate, comment on and share the uploaded content and to follow other users. The website gets an estimated 58 million unique visitors a month and has about 16 million registered users. Issuu is an alternative to Slideshare with more focus upon media which traditionally were printed such as magazines, newspapers and books.

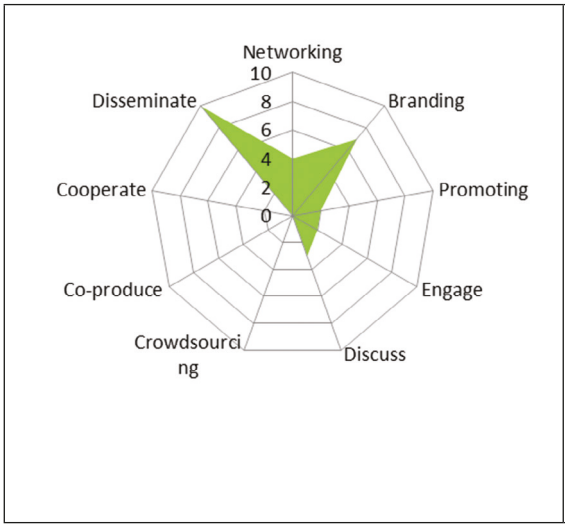
Slideshare is a strong tool regarding the establishment of thought leadership and the other side of this coin is to get inspiration by following users, which has managed to establish themselves as leaders.

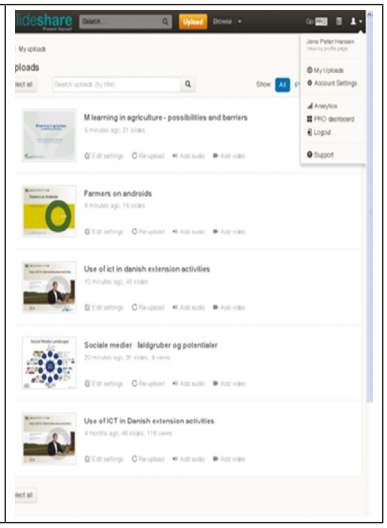
FACTS	
URL:	http://www.slideshare.com
Cost	Free
Language	English & more
Users	58 million
Learning	Medium

INSPIRATION
http://www.slideshare.net/ericw01/seeds-of-innovation
http://www.slideshare.net/ethanmcc/omma-slides-ibmsxsw
http://www.slideshare.net/nbrier/thinking-about-innovation
http://www.slideshare.net/activistiam/experience-cocreation-vs-crowdsourcing

FUNCTIONALITIES	
☒	Personal profile
☒	Friends
☐	Groups
☒	Tagging
☒	Comments
☐	Blogs
☐	Pages
☐	Events
☒	Sharing
☒	Photo
☒	Video
☐	Applications
☐	Mobile version




Networking
10
8
6
4
2
0
Branding
Promoting
Engage
Discuss
Crowdsourcing
Co-produce
Cooperate
Disseminate


slideshare
Upload
Browse
M learning in agriculture - possibilities and barriers
Farmers on androids
Use of ict in danish extension activities
Sociale medier faldgruber og potentialer
Use of ICT in Danish extension activities

YouTube

YouTube is the hugely popular, Google-owned video-sharing website where everyone from individuals and media companies to global corporations can upload videos of up to 15 minutes in length. The site garners four billion video views per day, with users uploading an hour of video each second. Anyone can view the site, but you need to set up a free public channel to upload video. The most viewed video on YouTube is the music video of the song Gangnam Style. It was added to the site on 15 July 2012, and became the first YouTube video to receive over one billion views on 21 December 2012.

Innovation uses:

- **Identify needs**. Instruction and how-to videos are popular on YouTube, and some of these can inspire uncovered needs not covered by existing products.
- **Reach new global audiences**. With four billion video views per day, there is potential to reach a very wide audience If you succeed in creating compelling content, there is no reason why you should not be able to build an audience on YouTube that would want to be engaged in your innovation efforts.
- **Get new insights**. You might have products – or challenges related to these products – that are easier to explain by video rather than words. Here YouTube offers an interesting opportunity to show – rather than just describe – how innovation can make a difference. This can be very relevant in some industries although the process of making videos that people want to watch is more difficult than 'just' creating good content.
- **Establish thought leadership**. Posting a series of informative, thought-provoking YouTube videos is a great way to establish thought leadership in your field. These can be leveraged through your other social media outlets to attract new people who might be interested in becoming part of your innovation ecosystem.
- **Follow your competitors and stakeholders**. If your competitors or relevant stakeholders are active on YouTube, you should of course watch frequently as a way to monitor any new activities that might be related to innovation.

FACTS	
URL:	http://www.youtube.com
Cost	Free
Language	English & more
Users	> 1 billion
Learning	Medium

INSPIRATION
http://www.youtube.com/user/DairyFarmingToday
http://www.youtube.com/user/FarmingFirst
http://www.youtube.com/user/NewHollandAG
http://www.youtube.com/user/DanishCrownDK
http://www.youtube.com/user/FarmersUnions

FUNCTIONALITIES	
☒	Personal profile
☐	Friends
☐	Groups
☒	Tagging
☒	Comments
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☐	Applications
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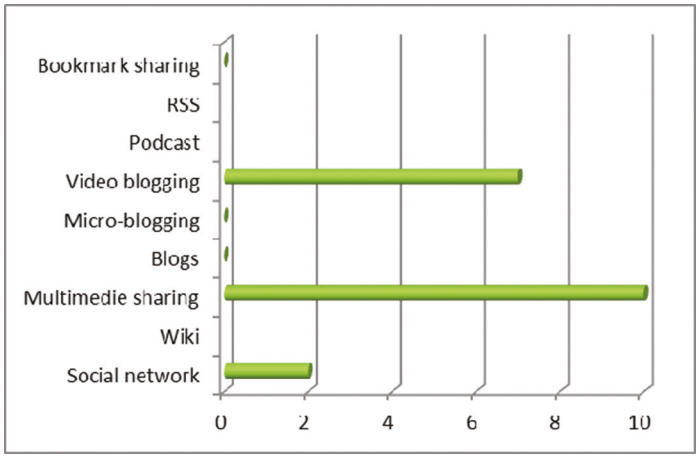

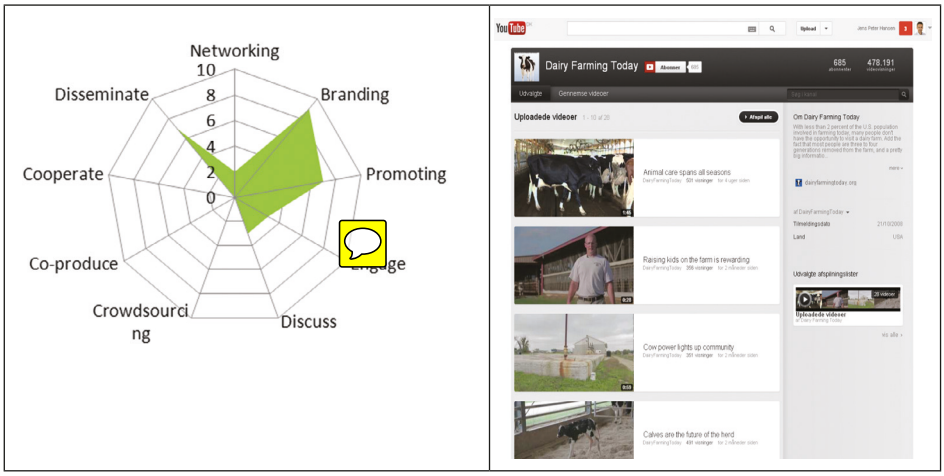

Figure 1.

Organic eprints

Organic eprints (http://www.orgprints.org) is an Open Access archive for publications and other information about research in organic farming systems. Organic eprints is being used as a source of information by advisors in extension services, NGOs in development and researchers. It includes peer-reviewed publications as well as 'grey' literature such as conference papers, reports and popular articles in newspapers and magazines. Web product and videos as well as teaching resources can also be stored there. The ten-year-old archive was developed in Denmark, but quickly became international and at present contains almost 13 000 publications from all around the world. The archive has been rated as number 38 out of more than 1 500 archives in the world, and rates as the highest with agronomic-related content (http://repositories.webometrics.info/en/world).

FACTS	
URL:	http://www.orgprints.org
Cost	Free
Language	English & more
Users	> 150 000 visits/month
Learning	Medium

INSPIRATION
http://www.fibl.org

FUNCTIONALITIES	
☒	Personal profile
☐	Friends
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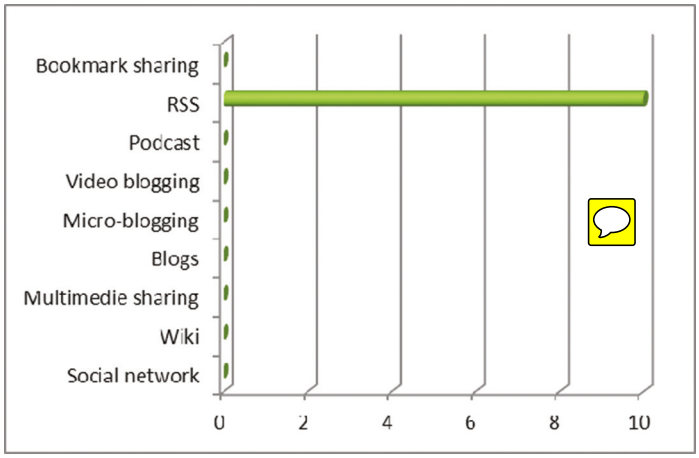

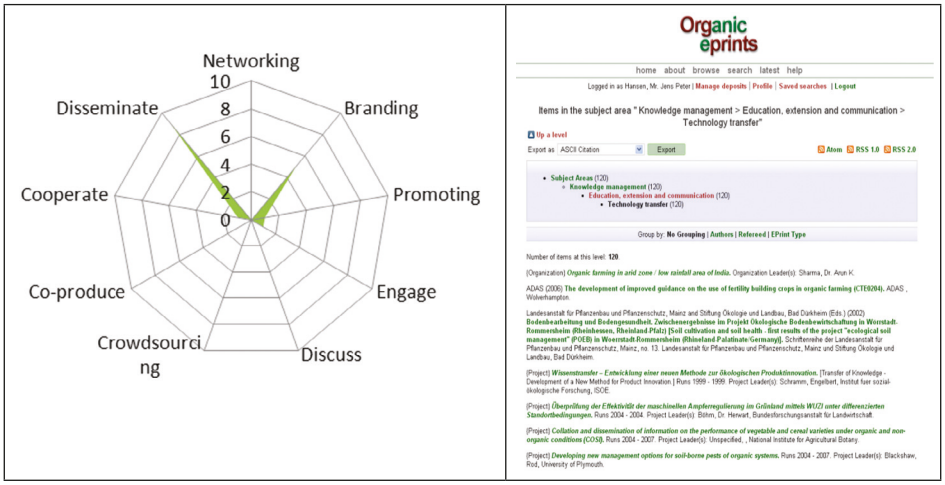
Networking
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Disseminate
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Items in the subject area " Knowledge management > Education, extension and communication > Technology transfer"
Up a level
Export as ASCII Citation
Export
Atom RSS 1.0 RSS 2.0
Subject Areas (120)
Knowledge management (120)
Education, extension and communication (120)
Technology transfer (120)
Group by: No Grouping | Authors | Refereed | EPrint Type
Number of items at this level: 120.
[Organization) Organic farming in arid zone / low rainfall area of India. Organization Leader(s): Sharma, Dr. Arun K.
ADAS (2006) The development of improved guidance on the use of fertility building crops in organic farming (CTE0704). ADAS , Wolverhampton.
Landesanstalt für Pflanzenbau und Pflanzenschutz, Mainz and Stiftung Ökologie und Landbau, Bad Dürkheim (Eds.) (2002) Bodenbearbeitung und Bodengesundheit. Zwischenergebnisse im Projekt Ökologische Bodenbewirtschaftung in Worrstadt-Rommersheim (Rheinhessen, Rheinland-Pfalz) [Soil cultivation and soil health - first results of the project "ecological soil management" (POEB) in Woerrstadt-Rommersheim (Rhineland Palatinate/Germany)]. Schriftenreihe der Landesanstalt für Pflanzenbau und Pflanzenschutz, Mainz, no. 13. Landesanstalt für Pflanzenbau und Pflanzenschutz, Mainz und Stiftung Ökologie und Landbau, Bad Dürkheim.
[Project] Wissenstransfer – Entwicklung einer neuen Methode zur ökologischen Produktinnovation. [Transfer of Knowledge - Development of a New Method for Product Innovation] Runs 1999 - 1999. Project Leader(s): Schramm, Engelbert, Institut fuer sozial-ökologische Forschung, ISOE
[Project] Überprüfung der Effektivität der maschinellen Ausbringregulierung im Grünland mittels WIGI unter differenzierten Standortbedingungen. Runs 2004 - 2004. Project Leader(s): Böhm, Dr. Herwart, Bundesforschungsanstalt für Landwirtschaft.
[Project] Collation and dissemination of information on the performance of vegetable and cereal varieties under organic and non-organic conditions (COSI). Runs 2004 - 2007. Project Leader(s): Unspecified, , National Institute for Agricultural Botany.
[Project] Developing new management options for soil-borne pests of organic systems. Runs 2004 - 2007. Project Leader(s): Blackshaw, Rod, University of Plymouth.

Figure 2.

FADN

Farm Accounting Data Network

The Farm Accountancy Data Network (FADN) is an instrument for evaluating the income of agricultural holdings and the impacts of the CAP. The concept of the FADN was launched in 1965. Derived from national surveys, the FADN is the only source of microeconomic data that is harmonised, i.e. the bookkeeping principles are the same in all countries. Holdings are selected to take part in the survey on the basis of sampling plans established at the level of each region in the Union. The aim of the network is to gather accountancy data from farms for the determination of incomes and business analysis of agricultural holdings. Currently, the annual sample covers approximately 80 000 holdings. They represent a population of about 5 000 000 farms in the 28 Member States, which cover approximately 90 % of the total utilised agricultural area (UAA) and account for about 90 % of the total agricultural production of the Union. For the EU-27, that includes Bulgaria and Romania, the FADN represents about 6 400 000 farms. The information collected, for each sample farm, concerns approximately 1 000 variables.

FACTS		INSPIRATION
URL:	http://ec.europa.eu/agriculture/rica/	http://ec.europa.eu/agriculture/rica/concept_en.cfm
Cost	Free	http://aginfra.eu
Language	English & more	
Users		
Learning	Medium	

FUNCTIONALITIES	
☐	Personal profile
☐	Friends
☐	Groups
☐	Tagging
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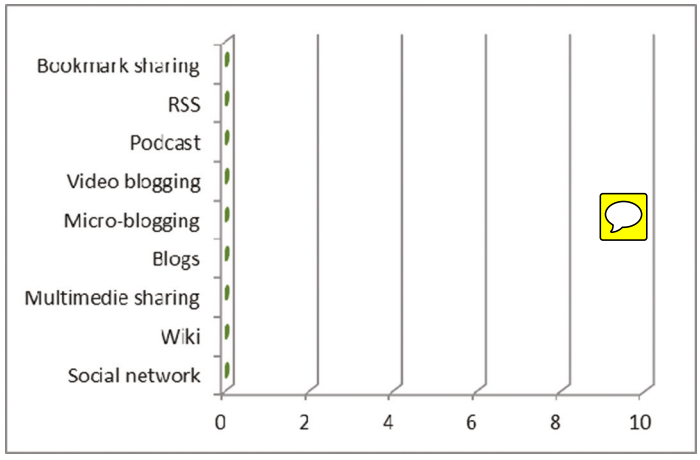


Networking
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AGRICULTURE AND RURAL DEVELOPMENT
Farm Accounting Data Network
Public Database
Latests News
About FADN
Publications
Contributions
Public Database
Links
FADN PUBLIC DATABASE
Introduction
Report by theme
THEMES

Figure 3.

Wikipedia

Wikipedia is a multi-lingual, web-based, free-content encyclopaedia project operated by the Wikimedia Foundation and based on an openly editable model. Wikipedia is written collaboratively by largely anonymous Internet volunteers. Anyone with Internet access can write and make changes to Wikipedia articles, except in limited cases where editing is restricted to prevent disruption or vandalism. Users can contribute anonymously, under a pseudonym, or, if they choose to, with their real identity. Wikipedia is a live collaboration differing from paper-based reference sources in important ways. Unlike printed encyclopaedias, Wikipedia is continually created and updated, with articles on historic events appearing within minutes, rather than months or years. Older articles tend to be more comprehensive and balanced; newer articles may contain misinformation, unencyclopaedic content or vandalism.

FACTS	
URL:	http://www.wikipedia.org
Cost	Free
Language	English & more
Users	400 000 editors
Learning	Difficulty

INSPIRATION
http://en.wikipedia.org/wiki/Innovation
http://de.wikipedia.org/wiki/Open_Innovation
http://fr.wikipedia.org/wiki/Crowdsourcing
http://it.wikipedia.org/wiki/Social_media
http://es.wikipedia.org/wiki/Conocimiento

FUNCTIONALITIES	
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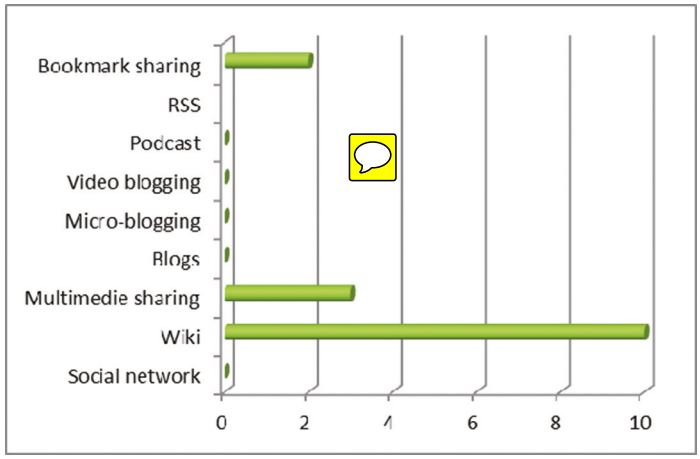

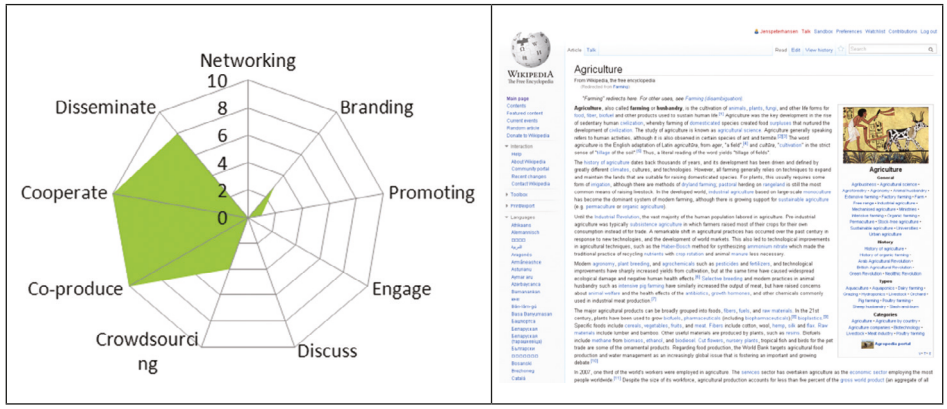
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Crowdsourcing
Co-produce
Cooperate
Disseminate
Agriculture

Figure 4.

Crowdsourcing

Crowdsourcing is a type of participative online activity in which an individual, an institution, a non-profit organisation or company proposes to a group of individuals of varying knowledge, heterogeneity and number, via a flexible open call, the voluntary undertaking of a task. The undertaking of the task, of variable complexity and modularity, and in which the crowd should participate bringing their work, money, knowledge and/or experience, always entails mutual benefit. The user will receive the satisfaction of a given type of need, be it economic, social recognition, self-esteem or the development of individual skills, while the crowdsourcer will obtain and utilise to their advantage what the user has brought to the venture, the form of which will depend on the type of activity undertaken.

FACTS	
URL:	Many alternatives
Cost	Free or fee
Language	English & more
Users	
Learning	Difficulty

INSPIRATION
http://myfarmnt.com
http://ideascale.com
http://agrotestigo.crowdmap.com (Spanish)
http://www.greenwish.nl (Dutch)
http://challengepost.com

FUNCTIONALITIES	
☒	Personal profile
☒	Friends
☒	Groups
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☒	Pages
☒	Events
☒	Sharing
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☐	Applications
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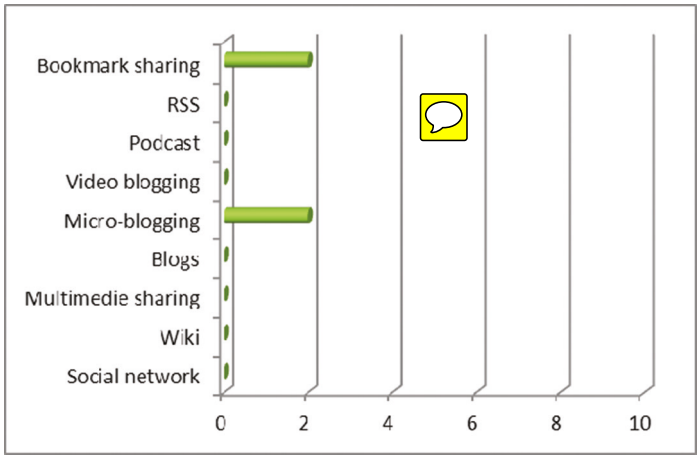

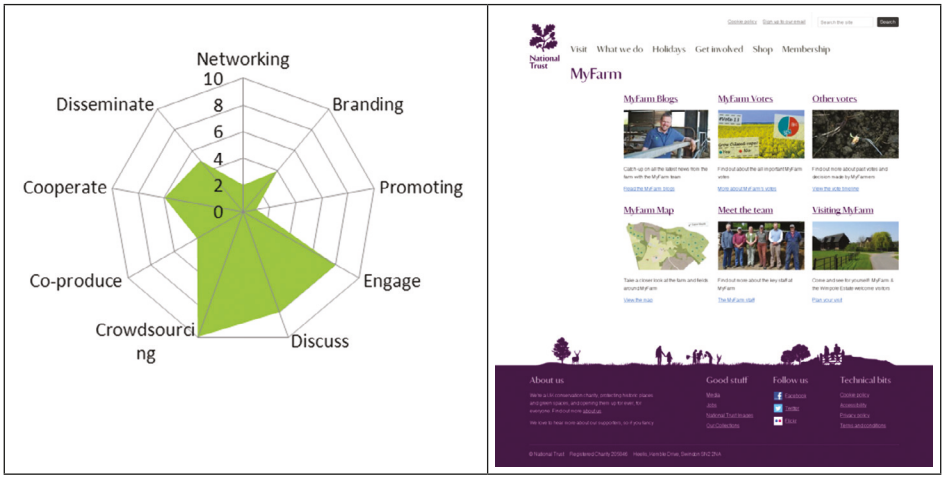
Networking
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Disseminate
National Trust
Visit What we do Holidays Get involved Shop Membership
MyFarm
MyFarm Blogs
MyFarm Votes
Other votes
MyFarm Map
Meet the team
Visiting MyFarm
About us
Good stuff
Follow us
Technical bits

Figure 5.

Yammer

Yammer provides secure enterprise social networks within organisations or between organisational members and pre-designated groups, where employees can easily communicate, collaborate and view co-workers' projects. Access to a Yammer network is determined by a user's Internet domain, so only those with appropriate e-mail addresses may join their respective networks. Many companies use Yammer to drive innovation and especially idea generation/development within their company. They often learn that it is fairly easy to recruit people for the Yammer platform which lets employees share and connect with co-workers in a private, secure enterprise social network.

Yammer is now owned by Microsoft, so many organisations might consider if they should use social features in Sharepoint or use Yammer. Gartner analyst Larry Canell says that organisations that are 'Microsoft shops' and trying to decide between going with Yammer or SharePoint for social networking should choose Yammer. The rationale comes from Microsoft itself. Cannell cited Jared Spataro, senior director of the Microsoft Office Division, as saying that organisations should 'go hard with Yammer' for social networking.

FACTS		INSPIRATION
URL:	http://www.yammer.com	http://www.slideshare.net/CPWF/cpwf-yammer-survey-results
Cost	Free or fee	http://www.slideshare.net/michelle1908/why-we-should-use-yammer
Language	English & more	http://www.slideshare.net/Jan_Govaerts/20120503-yammer
Users	> 6 million	http://www.slideshare.net/bryonycoleslides/yammer-in-5-minutes
Learning	Easy	http://www.slideshare.net/UM_DART/yammer-groups-tutorial

FUNCTIONALITIES	
☒	Personal profile
☒	Friends
☒	Groups
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☒	Blogs
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☒	Applications
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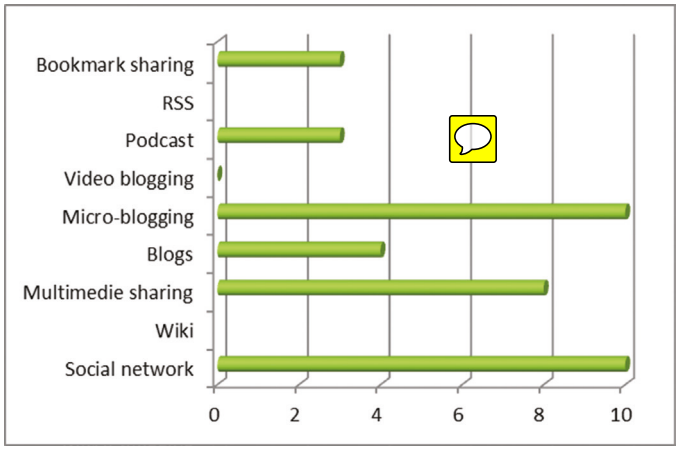

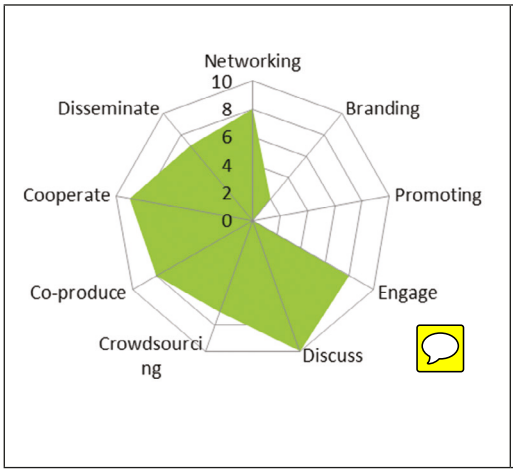

Figure 6.

ResearchGate

ResearchGate is a social networking site for scientists and researchers to share papers, ask and answer questions, and find collaborators. The site has been described as a cross between Facebook, Twitter and LinkedIn that includes profile pages, comments, groups, job listings and like and follow buttons. Members – 2.7 million and 120 000 categorised in agricultural science – are encouraged to share raw data and failed experiment results as well as successes, in order to avoid repeating their peers' scientific research mistakes. ResearchGate members receive automatic alerts for new publications authored by their contacts, a feature it shares with other social networks for scientists.

ResearchGate features a reputation score that allows members to review the contributions and input of other scientists. The ultimate goal is to overturn the journal system that has served science for centuries and replace it with something more open and responsive.

FACTS	
URL:	http://www.researchgate.net
Cost	Free
Language	Only English
Users	> 2.7 million
Learning	Easy

INSPIRATION
http://www.economist.com/node/21547218
http://goo.gl/cg45t

FUNCTIONALITIES	
☒	Personal profile
☒	Friends
☒	Groups
☒	Tagging
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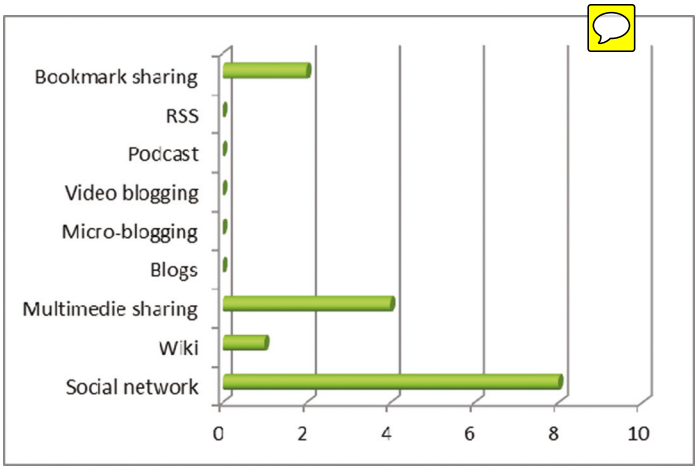

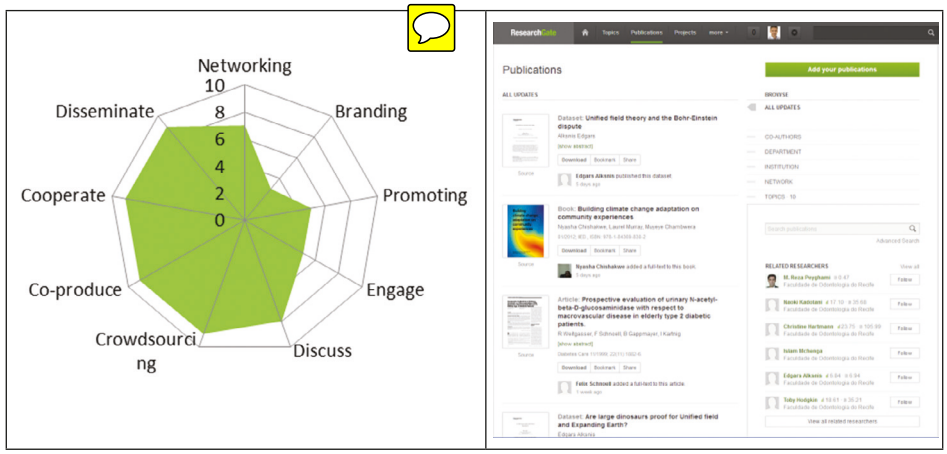
Networking
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Crowdsourcing
Co-produce
Cooperate
Disseminate
Publications
Add your publications

Figure 7.

Erfaland

Erfaland acknowledge that exchange of experience is very important within the agricultural sector. Every day the site is used to network and maintain communications between colleagues, photos are uploaded, videos and links are shared and forum speeches are written as well as inspiring expert blogs. All this to create a closer network between persons involved in agriculture and at the same time accelerate the agricultural dissemination flow. Erfaland is a private initiative run by a young female farmer. There is cooperation with the Knowledge Centre for Agriculture around a single sign-on between Erfaland and the personal portal Landmand.dk.

FACTS	
URL:	https://www.erfaland.dk
Cost	Free
Language	Non-English
Users	< 1 000
Learning	Medium

INSPIRATION
https://erfaland.dk/ekspertblogs.html
https://erfaland.dk/Erfagrupper/Gruppe/
https://erfaland.dk/forum
https://erfaland.dk/om-erfaland.html

FUNCTIONALITIES	
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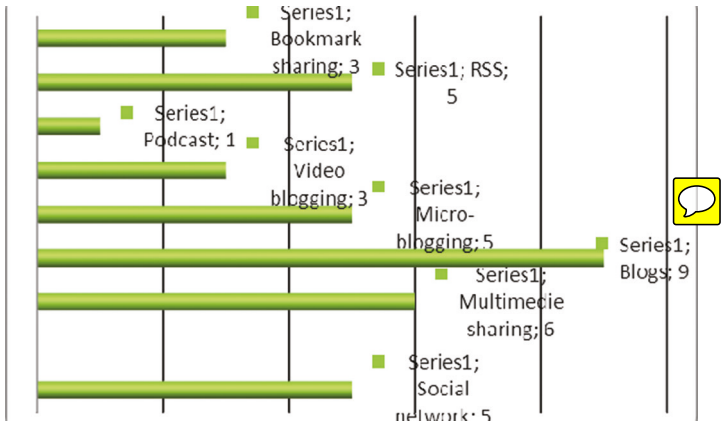


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ERFALAND
SVINEPRODUKTION
KVÆGPRODUKTION
ORDET ER FRIT

Figure 8.

Facebook

Facebook has become a daily part of life for millions of people around the globe. As of spring 2013, this social networking service had more than one billion active users, more than half of whom use Facebook on a mobile device. Users must register before using the site, after which they may create a personal profile, add other users as friends and exchange messages, including automatic notifications when they update their profile. Additionally, users may join common-interest user groups, organised by workplace, school or college, or other characteristics, and categorise their friends into lists such as 'People From Work' or 'Close friends'. Facebook Pages allow businesses and brands to connect with any Facebook users, who must click on a 'like' button on a Page to access the information provided and to have the ability to make comments on the Page. Anyone who is an official representative of an organisation can create a Page.

The primary use of Facebook by businesses is marketing, but it also has the potential to be used for innovation purposes:

- **Listen**. Like other social media, Facebook is an excellent place to 'listen' if you manage to gather a crowd of people from your target group, and these people starts 'talking' about their daily life and encountered problem. Talk can be catalysed by injecting new ideas and you will hear unvarnished opinions – viewpoints that aren't guided by questions asked in a focus group, for example.
- **Spread the word**. You can invite your Facebook community to virtual events as well as live events. For example, Dell hosts Storm Sessions http://www.ideastorm.com/SessionsList), which are hyper-focused, idea-generating sessions.
- '**Like' Facebook Pages related to innovation**. For example, some innovation intermediaries have formed communities on Facebook, such as the InnoCentive Open Innovation Network, which shares a steady stream of interesting information about innovation with over 7 000 Facebook users. This can be another spot where you not only learn interesting information but also make contacts for your innovation ecosystem while also gathering business intelligence.

FACTS	
URL:	https://www.facebook.com
Cost	Free
Language	English & more
Users	> 1 billion
Learning	Easy

INSPIRATION
https://www.facebook.com/landwirtcom
https://www.facebook.com/dairyfarmingtoday
https://www.facebook.com/KenyaDairyFarmersFederation
https://www.facebook.com/StottaSvensktJordbruk
https://www.facebook.com/challengepost

FUNCTIONALITIES	
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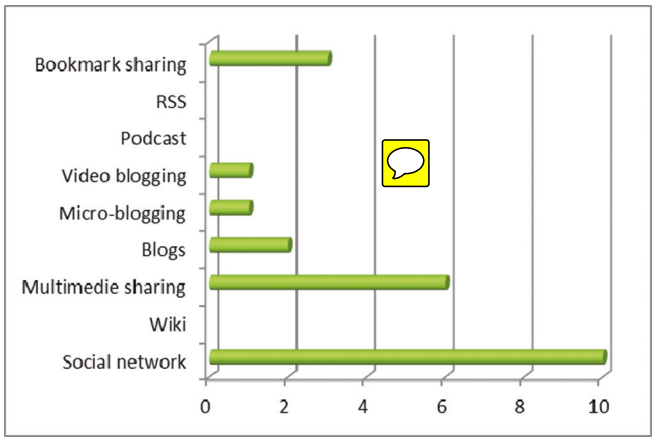

Figure 9.

LinkedIn

LinkedIn is a social networking website for people in professional occupations and is mainly used for professional networking. As of January 2013, LinkedIn reports more than 200 million acquired users in more than 200 countries and territories. The major purpose of the site is to allow registered users to maintain a list of contact details of people with whom they have some level of relationship, called Connections. Users can invite anyone to become a connection as long as the inviter has some kind of relationship with the invitee.

LinkedIn is the place to develop and maintain your personal professional brand. This includes showcasing current and earlier positions; work you have succeeded with; events you have participated in, books you have read and LinkedIn groups of which you are a member.

This motivation amongst LinkedIn members can be utilised to approach relevant people and activate them in your innovation processes, as you are giving them a chance to show off and thereby strengthen their brand.

FACTS		INSPIRATION
URL:	https://www.linkedin.com	https://www.linkedin.com/profile/view?id=451945
Cost	Free	https://www.linkedin.com/groups/Precision-Agriculture-1561757
Language	English & more	https://www.linkedin.com/groups/agriXchange-3807971
Users	> 200 million	https://www.linkedin.com/company/537608
Learning	Medium	https://www.linkedin.com/groups/Food-Agribusiness-71251

FUNCTIONALITIES	
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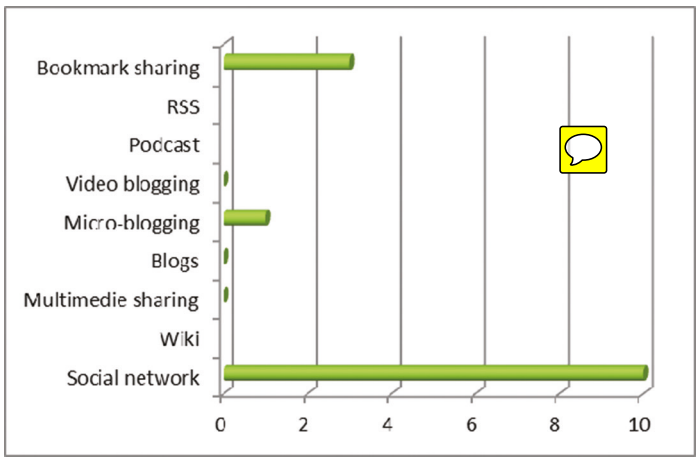

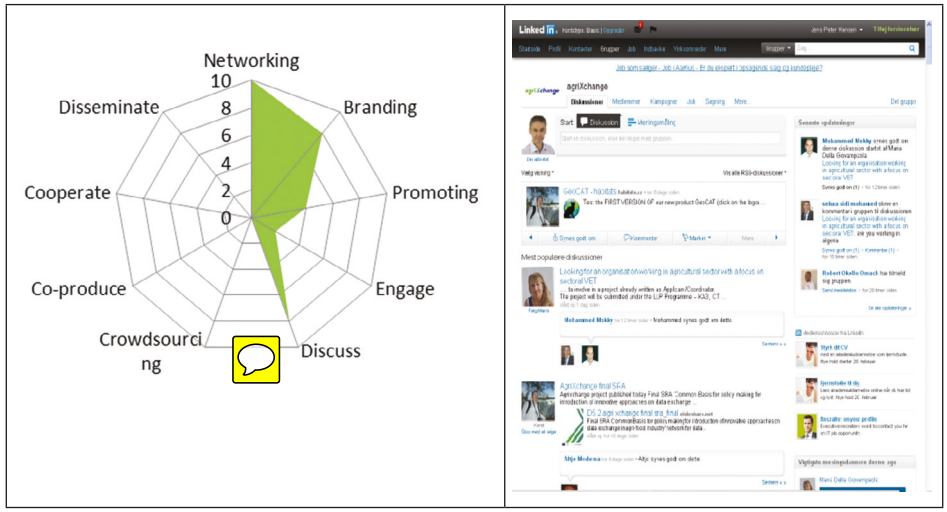
Networking
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Disseminate

Figure 10.

Google+

This is Google's response to Facebook. Unlike other conventional social networks which are generally accessed through a single website, Google has described Google+ as a 'social layer' consisting of not just a single site, but rather an overarching 'layer' which covers many of its online properties. This is both a strength and a weakness. A strength if people climb the learning curve and utilise the many possibilities, and a weakness if people – even if it is in the long run more ineffective – stick to their palette of current tools. As of December 2012, it has a total of 500 million registered users of whom 235 million are active in a given month.

Concerning innovation, Google+ offers similar possibilities as Facebook and Twitter, but with Google+ you have the ability to divide your community into 'Circles', and then decide which of your circles should get to read what you post, so you have better options for working focused on different ideas at the same time

FACTS		INSPIRATION
URL:	https://plus.google.com	https://plus.google.com/115793993048649222458/
Cost	Free	https://plus.google.com/111193894818128580437
Language	English & more	https://plus.google.com/communities/116348677241879454135
Users	> 235 million	https://plus.google.com/+EuropeanCommission
Learning	Difficulty	https://plus.google.com/+GoogleDanmark/

FUNCTIONALITIES	
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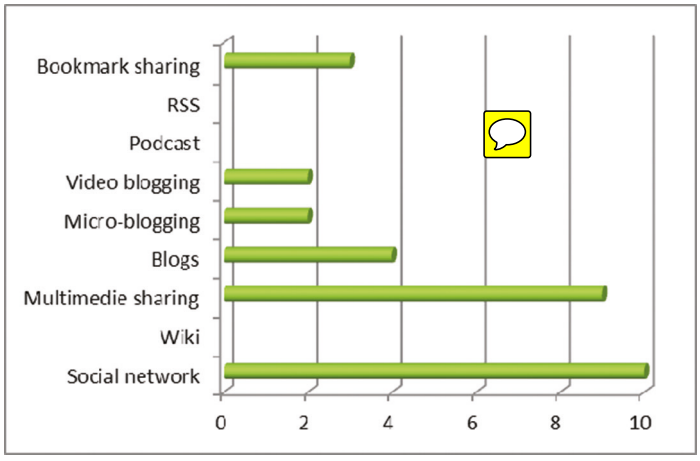
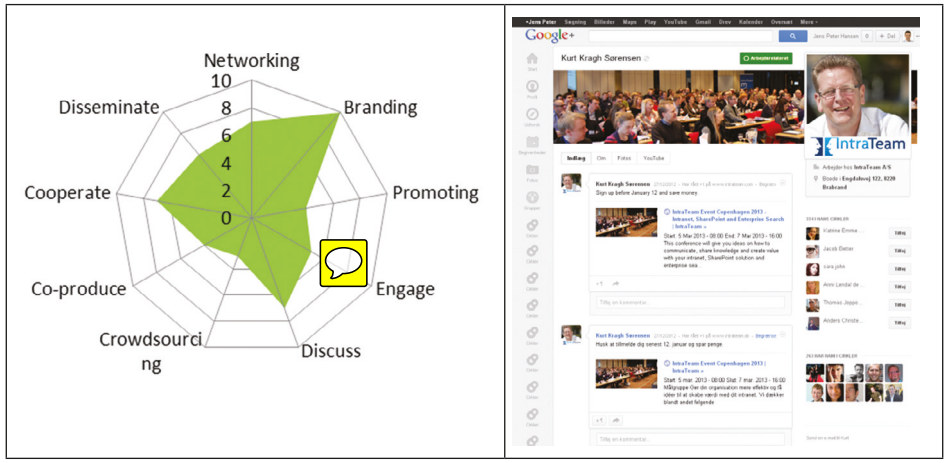
☒	Video
☒	Applications
☒	Mobile version




Networking
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4
2
0
Branding
Promoting
Engage
Discuss
Crowdsourci
ng
Co-produce
Cooperate
Disseminate
Kurt Kragh Sørensen
IntraTeam

Figure 11.

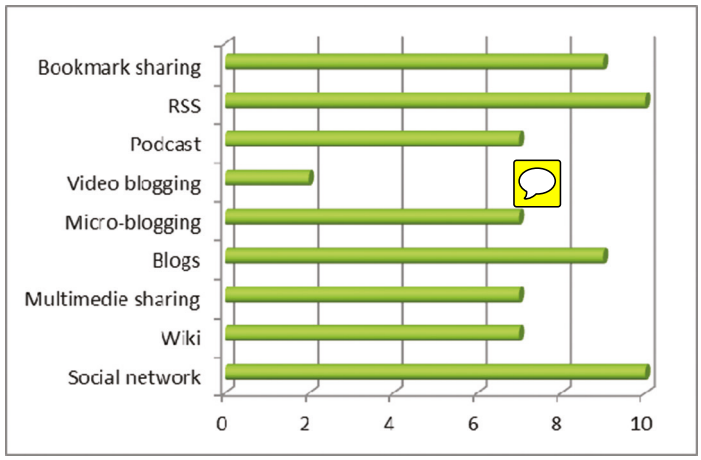
Ning

Ning is an online platform for people and organisations to create custom social networks offering customers the ability to create a community website with a customised appearance and feel; feature sets such as photos, videos, forums and blogs; and support for 'Likes', plus integration with Facebook, Twitter, Google and Yahoo. People joining a Ning Network have their own profile pages within the community. There are over 90 000 (as of June 2011) social websites, known as Ning Networks, running on the Ning Platform. Ning appeals to people who want to create their own communities and social networks around specific interests, choice of features and member data. The central feature of Ning is that anyone can create their own social network for a particular topic or need, catering to specific membership bases or community needs.

FACTS	
URL:	http://www.ning.com
Cost	Free or fee
Language	English & more
Users	> 90 000 sites
Learning	Difficulty

INSPIRATION
http://apf-producers.ning.com
http://farmersforthefuture.ning.com
http://edialogo.ning.com (Spanish)
http://inovadefesa.ning.com (Portuguese)
http://www.agro20.com (Spanish)

FUNCTIONALITIES	
☒	Personal profile
☒	Friends
☒	Groups
☒	Tagging
☒	Comments
☒	Blogs
☒	Pages
☒	Events
☒	Sharing
☒	Photo
☒	Video
☒	Applications
☒	Mobile version




Networking
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Branding
Promoting
Engage
Cuss
Crowdsourci
ng
Co-produce
Cooperate
Disseminate
Organised farmers
as partners in agri-business
Main
News
Forum
eDisc Farm-Firm Relation
Business models
Resources
Professionals
About us
Help
My Page
Welcome!
E-discussion farm-firm relations
9 April 2013
'Firms understand Farmers,
but Farmers do not understand Firms'
...or is it the other way around?
What is the role of farms, firms and supporters (NGOs, government, BDS suppliers, etc.) in establishing and improving the understanding between farms and firms?
Business Models
Welcome to the section Business Models !
Forum
Professionals
Translate this page
Subscribe by e-mail
Find us on:

Figure 12

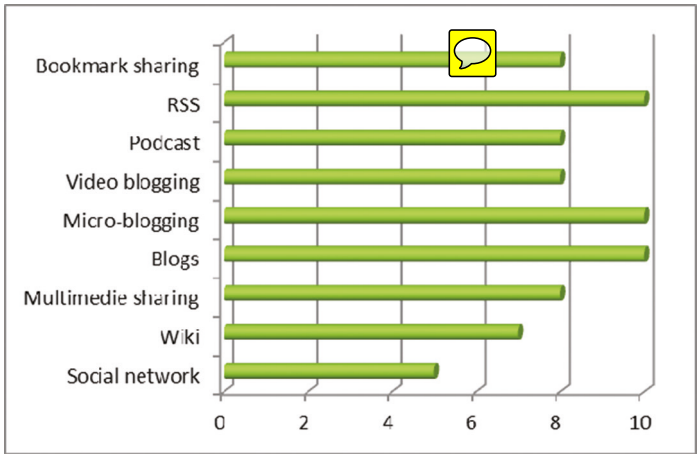
Wordpress

WordPress started as simply a blogging system, but has evolved to be used as full content management system and so much more through the possibility of using more than 24 000 plug-ins, each of which offer customisable functions and features, enabling users to tailor their site to their specific needs. These customisations range from SEO (Search Engine Optimisation) enhancers to content-displaying features, such as the addition of widgets and navigation bars. WordPress is currently the most popular blogging system in use on the web, powering over 60 million websites worldwide.

FACTS	
URL:	http://www.wordpress.org
Cost	Free
Language	English & more
Users	> 60 million sites
Learning	Medium

INSPIRATION
http://www.organictoday.dk
http://www.farmingfirst.org
http://technology4agri.wordpress.com
http://gcardblog.wordpress.com
http://www.agconsultants.org

FUNCTIONALITIES	
☒	Personal profile
☒	Friends
☒	Groups
☒	Tagging
☒	Comments
☒	Blogs
☒	Pages
☒	Events
☒	Sharing
☒	Photo
☒	Video
☒	Applications
☒	Mobile version




Networking
10
8
6
4
2
0
Branding
Promoting
Engage
Discuss
Crowdsourcing
Co-produce
Disseminate
Cooperate
FARMING FIRST
Keep informed
Follow us on Twitter
Watch expert videos
Explore the principles
Get email updates
Subscribe to RSS
Guide to Food Security Initiatives
Global and regional agriculture projects
Event calendar
Farming First TV
Latest news
World Water Day 2013: Collaboration Key for Food, Water and Energy Security
Latest tweets

Figure 13.

Twitter

Twitter is a micro-blogging site via which users share updates in 'tweets' that are limited to 140 characters. Users build audiences of 'followers' and also choose to follow other users, read their content and then share some of it with their own followers through what are called retweets. Twitter has over 500 million registered users as of 2012, generating over 340 million tweets daily and handling over 1.6 billion search queries per day. Since its launch, Twitter has become one of the ten most visited websites on the Internet.

Innovation uses:

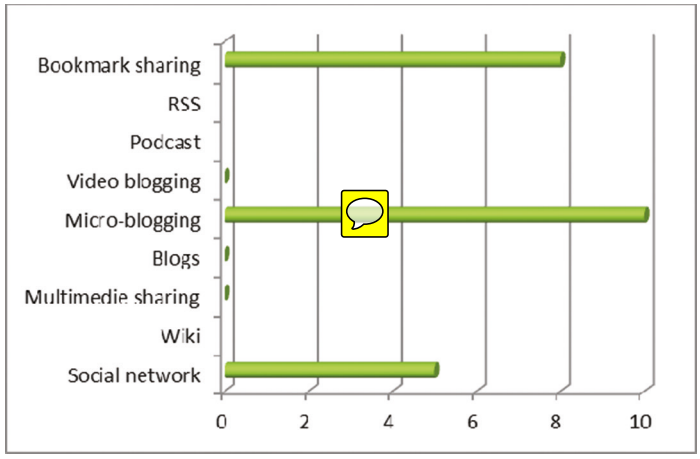
• **Business intelligence**. The key benefit you can extract from Twitter is business intelligence. It is a great tool for monitoring keywords and since many tweets include links to articles and more, you get access to a wealth of information. You need to use a filtering service such as HootSuite or TweetDeck in order to be able to sort through the information available. You can also use a mechanism known as hashtags to track tweets related to topics that interest you. A hashtag is a keyword or phrase that has the symbol # added in front of it.

• **Broadcast your ideas and insights**. You can tweet about new developments in your innovation programme or simply share ideas and insights. Here you can include links to websites allowing readers to read further. When you tweet like this, you hope others will pick up on your messages and re-tweet to their followers. Twitter has strong viral opportunities, but you need to have some patience and be prepared to spend significant time to build up your reputation – and the number of followers – before you can expect this to happen.

• **Conduct Twitter chats**. This occurs when you set a date and time when you're going to be on Twitter talking about a specific topic as done by AgChat with close to 30 000 followers. You develop a hashtag for the topic and then you invite people to join you at the appointed time and tweet about the topic. You can use Twitter chats to talk with any group that you wish to involve in your open innovation effort. For example companies cover 'internal' topics in the sense that it starts out as a chat for employees, but since this is public to everyone, they hope for others to jump in on the discussions.

FACTS			INSPIRATION
URL:	https://www.twitter.com		https://twitter.com/agchat
Cost	Free		https://twitter.com/NtlDairyCouncil
Language	English & more		https://twitter.com/AgBlogFeed
Users	> 500 million		https://twitter.com/ agricoltura24 (Italian)
Learning	Easy		https://twitter.com/TractorView

FUNCTIONALITIES	
☒	Personal profile
☒	Friends
☐	Groups
☒	Tagging
☒	Comments
☐	Blogs
☐	Pages
☐	Events
☒	Sharing
☐	Photo
☐	Video
☐	Applications
☒	Mobile version



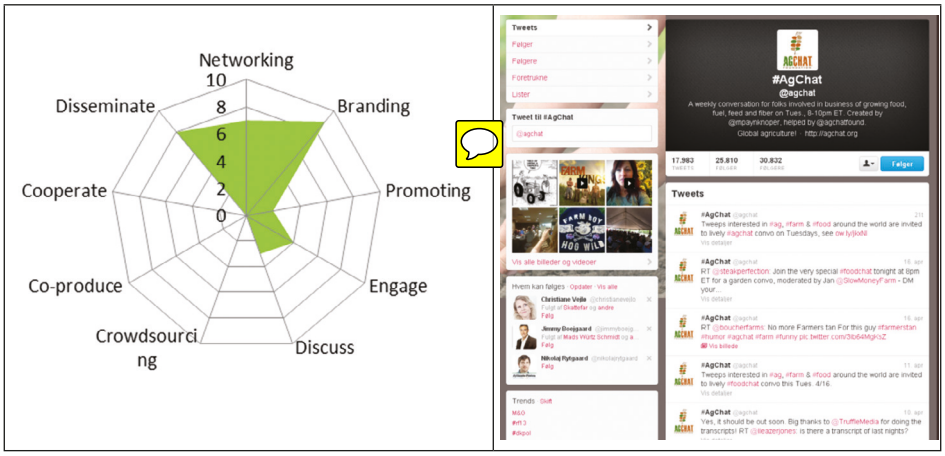


Figure 14.

List of successful examples

In the following, a dozen examples show the variation in usage of ICT. The examples are, with one exception, from the agricultural or agricultural research areas and show the span from top-down initiated repositories over disease-surveillance systems and knowledge portals to bottom-up user-generated platforms and how social media are used as a channel for people employed in the agricultural sector.

Knowledge portals:

1. VOA³R http://voa3r.cc.uah.es/: VOA³R is a three-year European project launched in June 2010 and funded by the European Commission under the seventh framework ICT Policy Support Programme. VOA³R is a social platform, planned to run after the project period as well. It is a platform for researchers in agriculture and aquaculture integrating open access institutional research repositories and using the AGROVOC thesaurus combined with terminologies specific to research methods. VOA³R combines the archive function with the social online communities of interest known from a.o. linkedin. The VOA³R consortium consists of 14 partners from 10 different countries and 3 collaborators from external organisations. The platform gathers > 500 000 open access resources from 14 repositories that cover agriculture, forestry, animal husbandry, aquatic sciences, fisheries and nutrition. The main target group of VOA³R is researchers, but also students and practitioners will be provided with interfaces tailored to applied needs, thus connecting outcomes of research with practical needs.

2. eXtention http://www.extension.org/ was launched in 2007. EXtension provides access to the land-grant university system with rules of operation, a governing committee, staff and a long-term implementation plan. EXtension was launched to meet the public's expectations of a relevant and accessible Cooperative Extension Service (CES). The goal of eXtension was to become a centrally managed, but locally delivered state-of-the-art, full-service programme that uses technology and new organisational processes such as Communities of Practice (CoPs), Frequently Asked Questions (FAQ), Ask An Expert and various Wikis. eXtension is predicated on the voluntary labour of CoP members, who form to create and deliver content around their areas of expertise. CoPs were outlined by Lave and Wenger (1991) as informal professional networks that exist to enhance professional development, mentoring and expertise through observation, interaction, discourse and practice. CoPs provide the structure for professionals to learn, problem solve and create a space for interaction around a specific focus. (Text from A Model for Evaluating eXtension Communities of Practice) The eXtension Foundation supporting the eXtension Initiative was created for the land-grant universities.

3. Chil – http://chil.org/: Is an initiative which was born by the Polytechnic University of Madrid and the Spanish Government. It was launched in 2011. The aim of this project is to bring IT to farmers and to the food industry. CHIL is a portal that integrates networks and free web-hosting of companies, cooperatives and related organisations within the agricultural sector. It also features tools for knowledge management such as wikis, blogs, publication of documents, forums and services such as list of accommodation and agri-food suppliers, promotion of courses etc. Chil includes geo-referencing information and thus can show interactive maps that links the sectors' institutions, associations, cooperatives and technicians in a certain area.

http://www.agriregionieuropa.univpm.it/dettart.php?id_articolo=907
http://www.chil.org/blogpost/marm-%28ministry-of-the-environment-and-rural-and-marine-affairs %29-oficially-presents-chil/299
http://www.besana.es/es/web/noticias/201109/el-marm-presenta-el-portal-chil-de-conocimiento-especializado-en-el-sector-agricola-agroindustrial-y-rural

E-document management systems:

4. Organic E-prints http://orgprints.org/. Organic E-prints is an international open-access archive for papers and projects related to research in organic food and farming. Organic eprints is the largest existing repository specialising in organic food and agriculture. The archive presently contains more than 13 000 publications from all around the world and has more than 23 500 registered users and 150 000 to 210 000 visits per months The main objectives of Organic E-prints are to facilitate the communication of research papers and proposals, to improve the dissemination and impact of research findings, and to document the research effort. The archive accepts many kinds of papers: pre-prints (pre-review), post-prints (post-review) and reprints (published) of scientific papers, conference papers and posters, theses, reports, books and book chapters, magazine articles, web products, project descriptions, and other published or unpublished documents. The only criteria for acceptance are that the documents are relevant to research in organic agriculture, and that they have a finished form. Organic Eprints has been developed and managed by the International Centre for Research in Organic Food Systems, ICROFS since 2002. In 2003 the Research Institute of Organic Agriculture, FiBL joined the project with editorial responsibilities for the German language region and responsibility for the German language version of Organic Eprints. FiBL also have the task of entering all the research results from the Federal Organic Farming Scheme and other forms of sustainable agriculture (Bundesprogramm Ökologischer Landbau und andere Formen nachhaltiger Landwirtschaft, BÖLN) into Organic E-prints.

5. AgriWebinars http://www.agriwebinar.com – is a web-based conference developed by Farm Management Canada. Farm Management Canada runs webinar sessions from November to March every Monday at Noon EST. Speakers and topics are selected from the results of a client survey conducted previous to each new season of Agriwebinar®, so content is 100 % client-driven. All live presentations are archived and available by podcast for access by any one at any time. The aim is to bring the expertise of today's agricultural leaders that will inform and inspire. Agriwebinar® is free and anyone can participate as long as they have a computer and an Internet connection.

Groupware:

6. British farming forum http://farmingforum.co.uk/ is an online, peer-to-peer advice service according to the same principle as AgTalk+. It has different fora focusing on different agricultural matters such as livestock, cropping machinery etc., where the users can pose a question and get input or advice from other online users. Many of the subfora are very active and some posts have more than 200 000 views and 1 200 responses/comments within a short period of time.

7. Lego Cuusoo http://lego.cuusoo.com is an example of **crowdsourcing**. LEGO and its Japanese partner CUUSOO started working together in 2008 and in 2011 the LEGO Cuusoo page was launched worldwide. Lego Cuusoo invites you to submit your ideas to be considered as

future LEGO products, and lets you vote on and discuss ideas to help the LEGO Group decide on what to release next. When a posted idea reaches 10 000 supporters, it is reviewed by LEGO's Cuusoo team which then decide on whether or not to produce it. So far four Lego sets have been developed/accepted based on users' ideas, and more are under review. The users of Cuusoo are very engaged people, and the concept has a transparent and a clear strategy for dealing with ideas. There is a strict set of guidelines for the ideas posted in order not to violate existing copyrights etc. Other well-known related examples includes Dell's IdeaStorm and Starbuck's My Starbucks Idea.

8. Climate CoLab http://climatecolab.org. The goal of the Climate CoLab developed by the MIT Centre for Collective Intelligence (http://cci.mit.edu/) is to harness the collective intelligence of thousands of people from all around the world to address global climate change. As of late 2012, more than 40 000 people from all over the world have visited the Climate CoLab, and over 4 000 have registered as members. By constructively engaging a broad range of scientists, policy-makers, business people, investors and concerned citizens, Climate CoLab hopes to develop, and gain support for, climate change plans that are better than any that would have otherwise been developed.

9. P&G Connect+Develop http://www.pgconnectdevelop.com/. P&G launched its Connect+Develop programme more than 10 years ago and has developed more than 2 000 global partnerships, delivered dozens of global game-changer products to consumers, accelerated innovation development and increased productivity, both for P&G and its partners. The website has served as P&G's 'open front door to the world,' allowing any innovator anywhere to share their innovations with the Company. The site receives about 20 submissions every weekday – or more than 4 000 a year – from all over the world.

10. Betacup Challenge http://www.thebetacup.com/ In the Betacup Challenge in 2010, the goal was to find ways to reduce the use of cups that cannot be recycled. There were more than 430 entries in the challenge. First place, with a USD 10 000 prize, went to a group from Boston, which proposed what it calls the 'Karma Cup': not a new design, but a new way to encourage customers to bring reusable cups to their local Starbucks café.

Community of practice:

11. Disease surveillance and warning systems. Agricultural warning and surveillance systems based on ICT are a whole separate category and here only one among numerous solutions is mentioned: In Uganda banana diseases have destroyed large parts of the country's banana harvest. The Grameen Foundation, IITA (International Institute of Tropical Agriculture), Uganda's National Agriculture Research Organisation (NARO), and MTN-Uganda worked together to develop and test a Community-Level Crop Disease Surveillance system (CLCDS). The CLCDS used the framework of the Grameen Foundation's Community Knowledge Worker (CKW) Initiative. Community Knowledge Workers are locals who disseminate and collect information in their communities using mobile phone applications. A team of professionals in the fields of plant pathology, agriculture-based data analysis, geographic information systems and communication technology (ICT) was assembled. They developed a technological system to identify, map, monitor and control banana diseases. Over the course of two months, 38 CKWs using mobile phones, MTN Mobile Internet and GPS devices collected more than 3 000 surveys documenting the presence of three banana diseases in two districts in Uganda. The CKWs also instructed the

participating farmers in scientific methods for banana disease detection, preventative measures and disease-control procedures.

http://www.ictinagriculture.org/sourcebook/module-11-ict-applications-agricultural-risk-management#community
http://agcommons.files.wo
rdpress.com/2010/05/cropdiseasesurveillance-execsummary.pdf

12. IDRAMAP http://www.bonificavalleserchio.it/manutenzioni/ is an online information system based on Google Maps created by a group of mountain municipalities in Tuscany. The system allows local people to signal hydrogeological problems (obstruction of water lines, landslides, state of roads and of infrastructures), to indicate them on an online map, and to provide photos illustrating the problem. Local authorities collect this information, analyse it and use it, intervene in urgent cases and feed the information into the maintenance plan. (Strengths: the system increases local awareness about problems in the territory and stimulates participation. Weaknesses: the system is not endowed with a social network utility which may foster the creation of a community of practice).

Social communities of interest

13. AgTalk+ http://agtalkplus.com/ is an American platform, run purely on a voluntary basis and on donations. It has forums, blog, wikis and (sharing innovations) workshop creations and very active forums – e.g. on machinery and equipment, stock, crops, IT, market and precision tools. See example: Precision talk http://talk.newagtalk.com/forums/forum-view.asp?fid=6.

14. Jeune agriculteurs http://www.jeunes-agriculteurs.fr/. The French Jeunes Agriculteurs Syndicat is an organisation for young people (under the age of 35) working in agriculture. It counts more than 50 000 members and has an active Facebookpage with more than 5000 followers. JA is organised on the basis of a geographical grouping of members, representing all regions and all agricultural production sectors in France. While the organisation itself arrange a broad variety of events and publishes magazines, give educational lectures, meetings etc., the Facebook page is mainly used as a channel for documenting the more activistic happenings, strikes, tractor convoys etc. Their aim is to lower the barriers for young people to enter the agricultural sector.

15. E-Agriculture http://www.e-agriculture.org/ is a global platform, where people from all over the world exchange information, ideas and resources related to the use of information and communication technologies (ICT) for sustainable agriculture and rural development. With over 9 000 members from 160 countries and territories, the e-Agriculture Community is made up of individual stakeholders such as information and communication specialists, researchers, farmers, students, policy-makers, business people, development practitioners and others. The e-Agriculture Community officially launched in 2007 and the founding partners include the United Nations, FAO and the World Bank.

16. REDE INOVAR http://www.redeinovar.pt is a Portuguese-wide network which aims at providing a technology- and knowledge transfer environment between academia and the business community in the agro, food and forest sectors. The platform is supported by the European Union and the Portuguese Ministry of Agriculture. It offers sector-selected search, personal

profiles, event calendars, sharing of articles, images, links and videos. The platform also has a brokerage area which aims to strengthen cooperation between academia and the business environment and to speed up the process of technology transfer and promotion of projects in consortiums in the agriculture, food and forest sectors. REDE INOVAR users can have one or more Technology to business (T2B) profiles, based on three types of interest:

- Technologic Offer/Technology Competence
- Technology Need
- Networking

Once a profile is created, it becomes available to users of the platform with complementary profiles.

Individual communities of interest

17. AgChat https://twitter.com/agchat started in 2009**,** using Twitter having had more than 30 000 followers. Run by AgChat Foundation with the mission of 'Empower farmers and ranchers to connect communities through social media platforms'. A group of American farmers founded the AgChat Foundation. The foundation was launched through volunteer activities but is now funded by donations and sponsorships and has started investment talks with a variety of stakeholders. It now launches four programmes all focusing on how the agricultural sector can get the message cross via ICT. The four programmes are: 1. Agvocacy 2.0 Training: Assist farmers in learning how to effectively and safely use existing social media tools. 2. Technology Scholarships will assist in equipping farmers with the infrastructure needed to use social media, e.g. advocate to expand rural broadband. 3. Strategic 'Agvocacy' Coordination: Coordinate social media campaigns that benefit American agriculture. Some of the farm agvocacy campaigns that have been launched are #thankafarmer & #moo. 4. Assist in Data Analysis. The AgChat Foundation also has an active Facebook page – https://www.facebook.com/AgChatFoundation – and a not-so-active YouTube page – http://www.youtube.com/agchat and Pinterest – http://pinterest.com/agchatfound/. They also have quite passive LinkedIn and Google+ profiles.

Use of crowdsourcing in B2B innovation

Kärkkäinen et al. (2012) have investigated the use of crowdsourcing especially from a business-to-business innovation perspective with the aim of creating a more comprehensive picture of the possibilities of crowdsourcing for companies operating in business-to-business markets. A systematic literature review was performed and 19 cases were found in which evidence of innovation as a result of crowdsourcing activities were found in 12 cases. Use of crowdsourcing was identified in three innovation process phases: front-end, product development and commercialisation. Furthermore, evidence was found for crowdsourcing to be used in innovation mainly in the manner of crowd creation, crowd wisdom and crowd funding. It is concluded, that the role of social media was quite essential in all the analysed B2B crowdsourcing examples.

Over the past decade Boudreau and Lakhani (2013) have studied dozens of company interactions with crowds in innovation projects, in areas as diverse as genomics, engineering, operations research, predictive analytics, enterprise software development, video games, mobile apps and marketing. On the basis of that work, the supporting body of economic theory and rigorous empirical testing, they have identified when crowds tend to outperform the internal organisation

and, equally important, when they don't. Crowds make sense only when a great number and variety of complements is important; otherwise a few partners or even an internal organisation will better serve the goal.

Conclusion

As the above list shows, ICT can be used for many purposes and to reach quite different target groups: It can be used both within the sector, as a knowledge-building tool or to influence external stakeholders.

One example of the successful use of social media is AgChat, an initiative started by American farmers with the main aim of telling the story of current agricultural life and conditions from the farmer's point of view. Using Twitter as their main channel, AgChat, which started in 2009, has grown rapidly, and now has 30 000 Twitter followers. The recipe for this growth is continuous, relevant tweets within short intervals, live chats on a regular basis, and to a very wide extent, answering and following up on the followers' questions and enquiries within a short period of time. Some of the examples also have barriers regarding usability. This is the case for VOA3R, a platform combining research repositories with social communities of interest. The platform is however continuously developed to overcome these barriers e.g. making it easier for new users to register and optimising the search functions.

The examples primarily serve as inspiration and show that the potential for using ICT in agriculture to an even wider extent than today is present, but focus on the end user and knowing your target groups' pattern of ICT usage is crucial. Regarding social media, maintaining your platform, selecting first movers and ambassadors etc. also play an important role.

Appendix 2 (to Chapter 6)

Review of ICT hardware tools

This appendix gives a review of the ICT hardware tools available to actors in the innovation processes at different levels in different parts of the EU. We are interested in finding variations in relation to the availability, usage and capacity of ICT hardware tools across Europe, in order to be able to judge which software tools are relevant (Appendix 1) in which regions of EU. We define hardware here in a broad sense, including both the ICT devices (computers) and the Internet connections. We only consider devices with Internet connection (PC, tablet computer, smartphone, mobile phone), as – in order to have an open and effective communication between actors in the agricultural innovation processes in the EU – it is necessary to have an efficient network structure and hardware tools to support those communication systems. The software programs need support from good Internet access or else they will not be relevant for the average farmer to use the ICT platforms and utilise the possibilities of the social and professional platforms.

To establish an overview of the ICT platforms in the EU, we have evaluated recent surveys. From one of the most recent surveys an overview of the distribution of various hardware tools is shown in Table 1 below. This survey focuses, among other perspectives, on the relative level of ICT in European countries. Table 1 shows that northern and western Europe have the highest level of use of both farm PCs, handheld phones/devices, farm management information systems and Internet access.

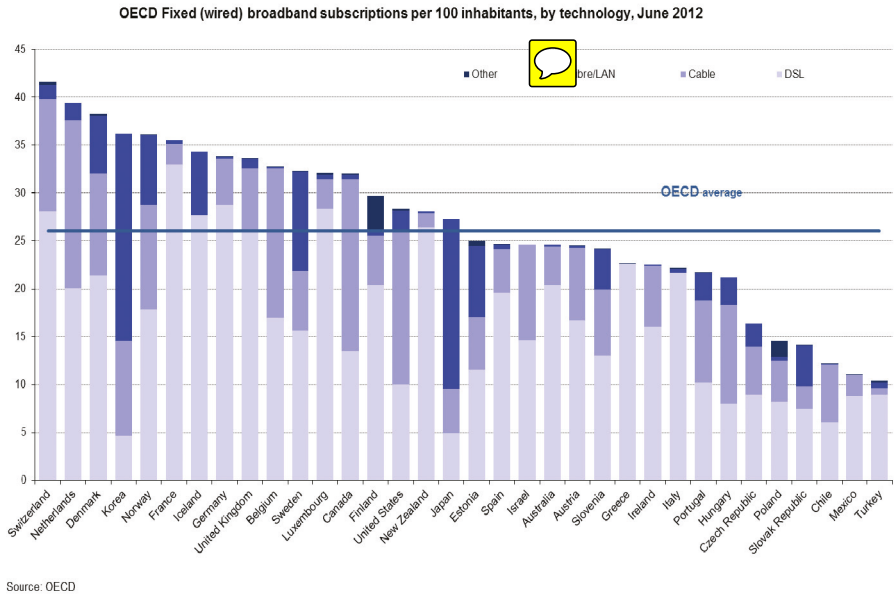
Table 1. Relative level of access to Farm PCs, Internet, FMIS (i.e. software to manage the data and information of the farm) and Handheld phones/devices in 23 European countries. Excerpt from Table 4 in Holster et al. (2012).

Country	Farm PC	Internet access	FMIS	Handheld phones/devices
Belgium	High	High	Average	High
Bulgaria	Low	Low	Low	–
Czech Republic	High	High	High	Low
Denmark	High	High	Average	High
Estonia	High	High	High	–
Finlad	High	High	High	High
France	High	Average	Average	High
Germany	High	High	Average	High
Greece	Low	Low	Low	Average
Hungary	Average	Average	Low	Low
Ireland	Average	Average	Average	Average
Italy	Average	Average	Average	High

Country	Farm PC	Internet access	FMIS	Handheld phones/devices
Latvia	Low	High	Low	–
Netherlands	High	High	High	High
Poland	Average	Average	Average	–
Portugal	Low	Average	Low	Average
Romania	Low	Low	Low	Low
Slovakia	High	Average	Low	Low
Slovenia	Low	Low	Low	Low
Spain	High	Average	Average	High
Sweden	High	High	Average	High
United Kingdom	High	Average	Average	Low
Switzerland	High	Average	Average	Low

The EU in general is characterised by a high level of ICT hardware with a broad range of computers and with high-speed Internet coverage of most of the country area (OECD, 2012). A high proportion of the inhabitants have Internet access, as shown in Figure 1 (wired) and 2 (wireless) below, but there are differences between countries and regional differences within the individual countries.

Figure 1: OECD fixed broadband subscriptions per 100 inhabitants (OECD, 2012).

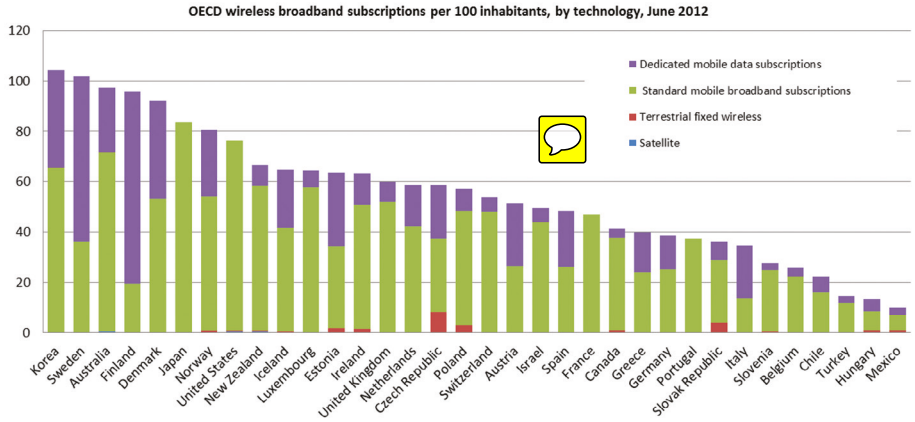


Source: OECD

The most efficient Internet connection is achieved with a fixed broadband subscription, but it is a large investment for a country to build a fine-mesh network of fibre cables. Figure 1 shows

that in Europe fixed broadband connections are generally more used in northern and western countries and less in southern and eastern countries.

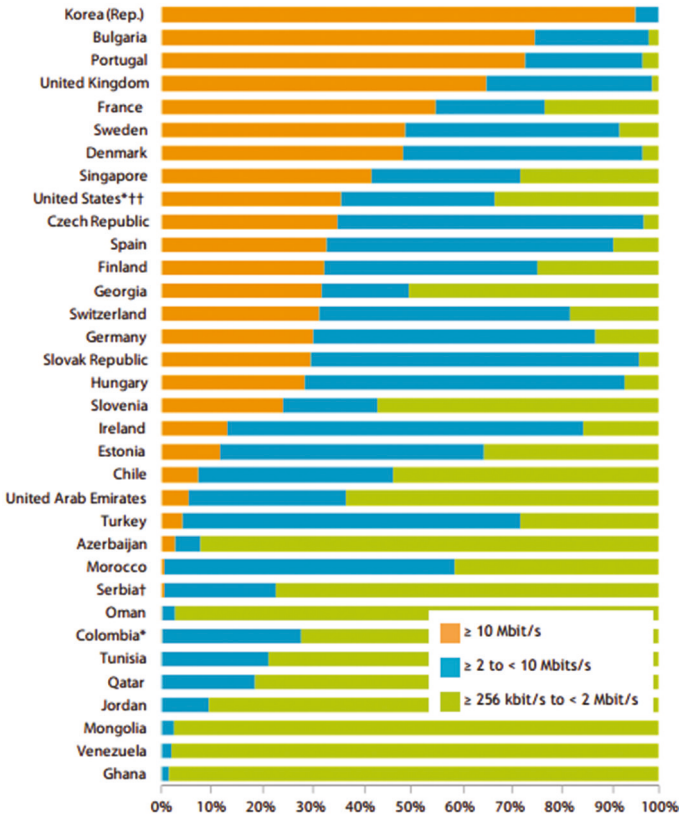
Figure 2: OECD wireless broadband subscriptions per 100 inhabitants (OECD, 2012).



It could be expected that countries with a low proportion of fixed broadband subscriptions, may be due to low availability or the high price of subscription, would compensate with a high proportion of wireless subscriptions. This is the case for some countries, e.g. Australia, Ireland and the Czech Republic, as shown in Figure 2. For other countries, e.g. Germany and Belgium, the opposite applies – they have relatively many fixed subscriptions compared to wireless. For most European countries, however, it is the same pattern; the northern and western countries have a high proportion of both wired and wireless broadband subscriptions, while the southern and eastern countries have a relatively low proportion.

Figure 3 shows some significant differences in the advertised speed of the available fixed broadband connections in different countries. Again, there is a tendency that the speed correlates with the country's level of economy, i.e. the highest speed in the northern and western countries of Europe. Portugal and Bulgaria are remarkable exceptions to this rule at the high end. Likewise, Ireland and Germany are exceptions at the low end of the scale.

Figure 3. Advertised speed of broadband connections in various countries (ITU, 2011).



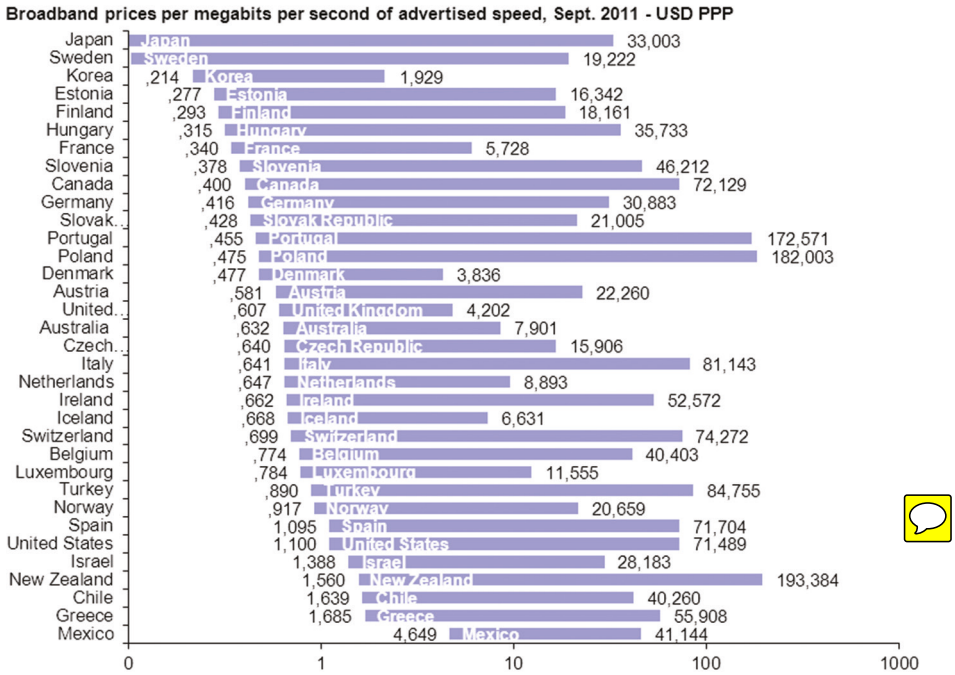
Generally, it is a problem for farmers in all countries that the development of the Internet infrastructure is happening primarily in the most densely populated areas. Therefore access to the Internet, as well as the speed of the available Internet, is generally better in urban than in rural areas. In 2011, 90 % of the world's population lived in areas with coverage of 2G (GSM), while 45 % also had 3G (UMTS) coverage (ITU, 2011). Many rural areas only have 2G mobile coverage and unstable connections.

Lack of investment in high-speed broadband and low competition between broadband providers in rural areas is a well-known problem for farmers in most EU-countries. The problem is most likely not going to be solved in the near future due to severe reductions in the EU Budget for 2014-2020 as regards investments in high-speed broadband in rural areas. According to The Guardian, 11 February 2013 'Broadband campaigners say EU budget cuts hammered out last week will kill high-speed connections needed by rural homes and businesses, after it emerged the budget for rural broadband – seen as vital to creating new businesses – has been cut by EUR 8.2 billion (GBP 7 billion) to just EUR 1 billion…' (http://www.guardian.co.uk/technology/2013/feb/11/broadband-budget-cut-rural-connection-billion-euro). However, as of 31 May 2013, the EU budget has not yet been approved by the European Parliament and the Council, so it is uncertain if or how much the budget for ICT infrastructure in rural areas will be cut.

The limited and slow Internet access in rural areas is one of the major barriers to the development of an open and free communication environment. This factor should be of national or regional concern when planning to build a stronger environment for the exchange of knowledge and communication.

When trying to create a stronger ICT platform in order to develop the agricultural sector, specific attention should be given to the potential problems arising from barriers and physical restrictions; examples of these are sparse population, great distances and technical limits (Lehmann et al., 2012). Another barrier is the economic factor; as shown in Figure 4, the price of broadband connection varies significantly – from country to country, and within each country due to price differences between broadband providers and differences in broadband speed. The span between the minimum and maximum price is surprisingly large.

Figure 4. Min and max broadband prices per megabits per second, expressed in purchasing power parity in US dollars (OECD, 2012).



It is likely, though not supported by the available data, that the lower broadband prices are mainly available in urban areas, where the competition between multiple Internet access suppliers is largest. In Denmark the Internet access supplier, Skyline, specialised in providing high-speed broadband to rural areas, but unfortunately the company went bankrupt in 2012 leaving farmers and other rural companies with severe problems (Hansen, 2013a). No other company has wanted to fill the gap, and thus the result has been slower connections at higher prices in rural areas.

An opposite example is the local Danish electricity companies, who are responsible for the regional electricity grids. In many rural areas these companies have provided fibre cables for high-speed Internet connection to all households. This investment is paid by the joined households due to collective savings from the electricity companies. However, the business case is not balanced; earnings are not reasonable/sufficient when delivering high-speed fibres compared to the costs of providing fibre cables to every household in the rural areas. The question might be whether society is willing to support the procurement of Internet access in rural areas with a view to the fact that ICT is part of the basis for modern living. In addition, there is a wish to maintain a population of a reasonable size in the rural districts and to support those who work and live in secluded areas to maintain agricultural production at a professional level.

The mobile phone is probably the most used communication platform among European farmers and extension workers. To people being out of office most of the work day, a mobile phone is crucial. With the technological development of more and more advanced smartphones and other portable devices the phone also gradually becomes the Internet portal for the farmer. A recent survey in Denmark (Hansen, 2013b) (Table 2) shows that less than 2 % of the farmers in Denmark work without a mobile phone. From 2012 to 2013 the proportion of farmers using a smartphone has increased from 17 % to 37 % (Hansen, 2013b).

Table 2. The work mobile of farmers in Denmark (Hansen, 2013b).

Mobile type	Number	Percentage
Conventional	3 755	61.2 %
Android	1 442	23.5 %
iPhone	581	9.5 %
Windows	238	3.9 %
No mobile	115	1.9 %
Total	6 131	100.0 %

The examples show us that there are major barriers (Internet access in rural districts, high-speed mobile networks to smaller populations, economy, stability and habits etc.) which might prevent the establishment of an efficient ICT platform for communication and free exchange of knowledge in the agricultural sector. In particular, there is an economic problem regarding high prices in south and east Europe, and lower prices in the northern part of Europe. The price of Internet access is negatively correlated to national income. But if society and/or government invests in the broadband structure, it will be possible to establish a platform of high quality and thus create the foundation to develop improved communication and knowledge transfer. The biggest need for a stronger Internet and mobile structure is seen in the countries with the lowest national income. Therefore, the goal might be to choose the right tools in each different country. In some countries of eastern and southern Europe it might be SMS and mobile phone systems that are most likely to be successful. While in the north and west there are better reasons for choosing ICT systems based on Internet and more broadband-demanding services.

In conclusion: This review shows that even though European countries are among the countries with the highest frequency of both wired and wireless broadband Internet subscriptions, there are distinct differences between the countries. Likewise, the available speed and price of Internet communication vary between countries. The pattern is the same: the northern and western countries in general have more, faster and cheaper Internet connections than the southern and eastern countries. This is a potential barrier to the network communication between agricultural actors in the latter regions.

The price of ICT hardware is continuously decreasing while capacity, portability and user friendliness are increasing. The change from monolithic to networked computers also reduces the demand for processing power and storage on the client side; the storage and processing is done on Internet servers/in the cloud. Therefore, ICT hardware is not a technical barrier to the agricultural actors. It may be an economical barrier to some actors with low income, and a mental barrier to others (mainly older or technophobic farmers).

It is important to be aware of the fact that many rural areas have no access to wired broadband and must rely on relatively slow and often unstable mobile connections. Today the majority of European farmers have mobile phones and more and more of these are smartphones. The availability of rugged computers and smartphones that can resist the tough environment of a farm is also increasing. However, the low bandwidth may be a barrier in many rural areas of Europe.

Appendix 3 (to Chapter 6)

Review of Orgware

Innovation and relational patterns

Innovation policies in the agricultural sector are inspired by two alternative models. The first one – called the linear model – is based on a clear distinction between knowledge producers and knowledge users. This model was a pillar of the Green Revolution, which aimed at increasing productivity by introducing high yielding varieties and related agricultural technologies. The model works well when the innovation goals are already set – for example, by specific environment regulation or quality standards. It is also adopted when – as in the case of commercial inputs – knowledge is subject to property rights and is paid by users as a component of the price of the product.

The second model – called the 'circular model' (Kline and Rosemberg, 1986) – highlights the value of information flows running from knowledge users to knowledge producers. It is based on the principle that, when knowledge users have a say in the process, the resulting output is adopted much faster and gives a better performance when applied. In fact, interaction anticipates problems and barriers to adoption, and takes into account users' needs, experience and knowledge of local specificities. In this second model, innovation goals are adjusted to users' needs, and it is more difficult to attribute property rights, as both counterparts become knowledge users and knowledge producers. In agriculture, one of the fields where the model has been applied is participatory plant breeding (Ceccarelli et al., 2009).

The second model has gained credit in other industries when analysed in regional firm agglomerations, like the industrial districts of the 'third Italy' in the '80s or the Silicon valley in the '90s. In these cases, it was observed that the large numbers of small firms operating in the same industry and located in the same place generated intense flows of information. Porter (1985) highlighted the role of relations between firms belonging to the same industry but to different stages of the production process: client-supplier exchange turned out to be not only about money and commodities but also about information.

Becattini (1991) and Saxenian Lee (2006) among others have added a new dimension to the circular model, stressing the fact that, being part of the same community, employees could not avoid talking with peers about their work in the many occasions of encounter that a community offers, from the bar to the stadium to the children's schools. In other words, they highlighted the role of interaction between knowledge users. Intense flows of information between peers, together with the mobility of employees across companies, were identified by observers as the reason for the development of an 'industrial atmosphere' beneficial to all firms belonging to the same agglomeration, and explained the higher degree of competitiveness of the firms belonging to these agglomerations in comparison with bigger, isolated firms organised according to hierarchical principles.

Mobilisation of social interaction for innovation purposes, however, is not only a characteristic of business agglomerations. Employees of big companies can develop patterns of interaction outside the official flows of communication designed by the firm's organisation. The first experiments of exploiting this property were done by the Xerox Corporation in Palo Alto (Seely Brown, 1998).

Studying the properties of informal networks, Wenger developed the concept of 'communities of practice', 'groups of people informally bound together by shared expertise and passion for joint enterprise' (Wenger, 1999). Wenger focused on social interaction as a basis for learning. By interacting, people enter into contact with the social world of the others, expose themselves to the unknown and activate processes of exchange of respective knowledge. Interaction, mediated by language, progressively reduces barriers between areas of respective knowledge and develops shared meanings.

Knowledge sharing contributes to the development of shared repertoires, which eventually constitutes stocks of knowledge to which all communities will have access. Wenger explains that actors' interactions lead to the continuous refinement of 'knowledge objects' until 'reification' occurs, that is consolidation into outputs such as written reports, technical standards, prototypes, routines or any other things embodying shared knowledge.

On these premises, firms have increasingly adopted this principle of 'open' innovation (Chesbrough 2003), realising that, in order to keep innovation pace and to maintain their competitiveness, they need to tap knowledge from the outside by systematically exploring the opportunities coming from the connection to the outside environment.

The organisational evolution of agricultural knowledge and innovation systems

Traditionally, institutional agricultural knowledge systems were built upon the linear model. A clear institutional delimitation was set between universities and research centres (dedicated to research and education), extension services (dedicated to training, advice and general communication), and farmers (as final users). The concept of the AKIS, an evolution of the AKS concept, added a fourth set of actors into the model, generically called support systems (for example, input and service providers) (Rivera et al., 2005). Further refinements of the concept have tried to represent the 'ecosystemic' dimension through which farms activate processes of innovation: any agent of the environment where the farm is embedded can contribute to innovation.

The evolution of the AKS concept and its application to innovation policies has progressively taken into consideration bidirectional communication. In general, this has led to market-driven approaches to innovation, that postulate the creation of 'markets of innovation', with interaction between innovation demand and innovation supply. In order to implement this approach, innovation policies have fostered privatisation of extension services, funding under-competitive bids and farmers' participation to costs. As a consequence, a plurality of actors operating in the field of innovation has emerged, each of them trying to respond to an increasing variety of demand for innovation, including the one emerging within society. Agricultural knowledge systems have thus fragmented and developed more flexible organisational patterns, based on network configurations rather than on hierarchical structures. We can now list the following typologies:

- Input-based networks, commanded by the agribusiness and aiming at ensuring correct use of the input by farmers and at creating brand fidelity;
- Product-based networks – putting together actors belonging to different segments of the product chains and aiming at aligning farmers around quality standards;
- Place-based networks – as in the case of LEADER local action groups, linking together local actors of different natures (public, private, civil society) around objectives of local development;

- Value-based networks – as in the case of so called 'alternative food networks' (Renting et al., 2003), that link together producers, consumers and civil society organisations around transformative goals. The key of these new organisational patterns is hybridity; that is the cooperation among actors with different goals, interests, languages and regulatory fields.

What is evident in this evolution is that specific networks are built around specific problems, and their lifecycles are related to the lifecycle of the problem. Generic knowledge systems tend to be replaced by object-specific knowledge systems which are much more flexible and transient than the previous ones. In the new model, it is the problem that generates research for appropriate knowledge and not the reverse (Knickel et al. 2009).

Another characteristic of this evolution is the progressive involvement of different sets of actors, first of all civil society organisations (CSOs), local administrations and consumers, who try to respond to problems emerging in society and to which the private system is not able to respond, such as sustainability and ethical problems. The network approach also fosters a much more intense involvement of experts who, albeit belonging to specific institutions, participate in the networks with their own ideas and positions, which sometimes may be different from the official rules of their respective organisations.

A key to innovation is the integration between diverse actors, tasks such as aligning actors around strategic goals, stimulating the emergence of research needs, facilitating access to funds, liaising between experts and research centres have become central and specialised bodies provide these functions (Klerks et al. 2009).

The role of the Internet

Network models of innovation pre-exist in relation to the recent developments of the Internet. The first communities of practice are face-to-face communities, of which informal social relations are the most important media. The Internet allows the model of informal social interaction to expand in time and space. Face-to-face communication (characterised by co-presence) is indeed complemented by remote interaction, both synchronous (for example, Skype conversations) and delayed (for example, e-mail). Progressively, the Internet expands the possibilities to broadcast information (one-to-many) while receiving feedback (contrary to traditional media which have very rudimentary feedback channels such as 'letters to the editor'). Moreover, they progressively expand the amount and type of information exchanged (sounds, texts and images). The Internet also allows the storage of growing amounts of information in remote repositories, making shared repertoires available without direct social interaction.

When we look at the role of the Internet in communication and collaboration processes, we can say that:

- the Internet adds human-to-machine interaction to human-to-human interaction. A lot of information can now be accessed without any human mediation;
- the Internet makes operations possible that once were possible only in person;
- the Internet reduces the time necessary to perform activities that can be slow and complicated when done in a face-to-face setting.

Social media take a step further. They provide platforms for the development of virtual communities, giving users tools to develop 'social' skills (profile description, asking connections, exploring other members' connections, publishing posts, commenting on others' posts, 'like' buttons, reputation generators – as in the case of Amazon book reviews – social bookmarking, etc.). Social media provide platforms for collaborative working, such as collaborative text writing and collaborative maps, not to speak of the 'open-source' software projects.

The integration between offline and online

The developments offered by ICTs do not imply, however, that physical interaction is obsolete. Rather, the Internet forces us to reconsider the respective roles of offline and online, face-to-face and remote, and to redesign processes accordingly. As the cost of physical interaction increases its relative cost compared to remote interaction – due to scarcity of time and energy costs due to transportation – it is important to identify the features that still give physical interaction an advantage compared to remote interaction, thus mobilising it when it really adds value. The following could be criteria to identify the roles of different types of interaction:

- Human-to-machine interaction will replace all standardised knowledge transactions, as in the case of search for information stored into databases. The area of application of this type of interaction is constantly expanding, as the progress in automatic translation, automatic text summarisation and the so called 'semantic web' – where data are accompanied by metadata which make data machine-readable – develops.
- Remote human interaction replaces face-to-face interaction whenever unproblematic communication is involved: for example, agreeing on dates for a meeting, responding to specific questions, writing collaborative short reports, polling on alternative options, discussing routine issues among people who already know each other. The possibility of exchanging images and voice, together with experienced use of these media, progressively shifts the range of issues that can be addressed through remote interaction.
- Physical interaction is still not replaceable when information is too complex to be codified in a digital way (for example, involving taste, touch, smell, body language). It is still essential to foster motivation, to mobilise emotions, to capture background information and tacit knowledge, or to interpret complex natural phenomena. Rather than mere replacement of physical interaction with remote or machine interaction, innovation systems will enjoy an integration of online-offline interaction.

These aspects will have implications on the activities carried out in the Agricultural Knowledge Systems.

Research

Social media dramatically change the way research is organised. Social media allow the creation of communities of practice among researchers and students to exchange ideas, expertise and bibliographies. Some specialist media have grown in the last years, such as Mendeley (http://www.mendeley.com), Academia.edu, ResearchGate, LinkedIn. The possibilities of exchanging and sharing large amounts of data and processing capacity allow the connection of laboratories in places distant from each other. The winning pattern of organisation of research is now based on large consortia of laboratories and on networks of researchers. Collaboration possibilities foster interdisciplinarity. Open-access journals allow access to scientific outputs to everybody.

As Brossard and Scheufele (2013) state, social media will provide a much faster and effective dissemination of research output. Feedback to researchers will be much more consistent. Peer review, which at present is the key to scientific quality of research output, will be possible at a much larger scale and will become a continuous process. Civil society will have the possibility to provide feedback on the relevance of research output, on the possible impact and on potential risks.

According to Ballantyne et al. (2010), research in agriculture can benefit from the possibility of sourcing data from farmers through mobile digital devices. This will reduce the costs of data collection and will allow the development of locally specific solutions. The implication of these developments is the progressive involvement of farmers in research, provided that social media allow them to give not only data but also input on research problems, feedback on research output and direct use of it.

As said above, offline interaction will also play an important role in the new research organisational models. They will be employed to establish first contacts, to strengthen already-existing contacts, to be exposed to new ideas and tips, to develop strategic issues and new concepts, to gain expertise on specific techniques where tacit knowledge is heavily implied, to set shared priorities and align network members around them.

Education and training

Tapscott claims that, as access to information is no longer a problem, teachers will lose their role as 'content providers', and will have to concentrate on methods: thinking, finding relevant information, synthesising, contextualising and critically evaluating. With the increasing availability of online courses, students will have the possibility of following lectures of 'teaching pop stars' from home, and will have access to reading lists, assignments, online forums, as already provided by the MIT among others (ocw.mit.edu).

Downes (2005) claims that ICTs transform e-learning tools from 'medium' to 'platforms', in which content is created, shared, remixed, repurposed and passed along. As Downes states, 'the control of learning will be placed in the hands of the learner', and learning will be linked to specific goals. The teacher, in this context, will become a facilitator, a resource person, and the class will be transformed into an environment in which creative discussion and stimulating collaborative work is developed. In the new context, students will view learning as the process of joining a community of practice.

When it comes to farmers, training will concentrate on face-to-face activities in relation to problem-solving activities and will increase group building, knowledge sharing and collective problem definition. Brokerage methods such as transect walks, focus groups, Venn diagrams, world café and card games etc. will make the meetings more effective as they will stimulate participation, discipline of interaction, curiosity and group identity. Offline encounters will be followed up by post-event social interaction, which will strengthen and disseminate learning output.

Technical advice

Repeated interaction among multiple actors allows a reduction of the distance between expert advice and lay knowledge. The role of the Internet in this context has been analysed in depth in the field of healthcare. As Loader et al. (2002) state, 'increasingly netters will arrive at a doctor's

surgery having already accessed the Internet, and may be more informed about their medical condition and its potential remedies than the medical practitioner'. Social media also allow the integration of expert advice with lay knowledge through peer-to-peer interaction: 'the advice provided through face-to-face medical consultation can be checked, verified and discussed within a virtual forum'. As in the case of research and education, also with technical advice all the tasks that can be standardised and digitalised will be progressively performed through human-to-machine relationships; remote advice will have a much more relevant role, especially for frequently asked questions and peer-to-peer interaction will complement expert advice (see the eXtension example below).

No-fruit Strawberries

I have strawberry plants that bloom very nicely. After the blooms die off, the fruit starts as a small fruit and that is where it stops. This has happened for two or three years. Not sure what is causing the problem. They are in direct sun. Can you help?

Answered

Fillmore County Minnesota horticulture fruits and vegetables about 17 hours ago

(from: ask.extension.org*)*

Physical interaction will be concentrated on the discussion of complex issues or on problems that require direct observation of the object of knowledge. Imaging and recording will allow the sharing of information gained with physical interaction and contribute to shared repertoires.

Within the project FOODLINKS (foodlinkscommunity.net) a group of researchers, local administrators and civil society organisations went to Rennes and visited a co-operative farm shop. They asked questions to the people in the farm shop, took pictures, discussed the relevant issues. After the visit, a short report of the visit was written by the coordinator and posted on the wiki of the project. All the others contributed by integrating the report with their own notes and added pictures, and people of the community of practice who did not participate in the visit could ask questions and make comments.

In Wengers' terminology, the farm shop is a knowledge object. Visiting participants have the opportunity to get a lot of information from physical interaction among themselves and with the situation they have observed. They share their knowledge in relation to the farm and develop a shared view through interaction. This view is 'reified' into a report that eventually constitutes a resource for all the people belonging to the community of practice.

The emerging brokerage function

Instead of the hierarchical and institutionalised Agricultural Knowledge Systems we have experienced in the past, the new Agricultural Knowledge Systems will develop around specific innovation objectives and will turn into something else when the objectives are achieved. Social media and social technologies accelerate the cycle of development for communities of practice. Extension services will increasingly dedicate themselves to the creation of communities of practice, specialising in bridging worlds characterised by different languages, bodies of knowledge and goals, to align actors around specific innovation objectives and to facilitate access to financial resources.

The increasing demand for food quality has encouraged farmers and small and medium enterprises to develop specific, local products which are based on local raw materials, local breeds or varieties and traditional production and processing techniques. These products are branded under collective labels, which can be used by producers who adhere to specific codes of practice. The process of product development and of the relative code of practice, often ending in EU recognition under the regulation 1151/2012, implies an intense work of brokering performed by local actors at different stages of the production process: farmers, processors, health authorities and local administrations.

Brokering skills, both online and offline, rather than technical specialisation, will become key tools in the new Extension services. As far as face-to-face interaction is concerned, brokerage tools will be increasingly employed to increase their effectiveness. See the following examples.

The System Analysis Matrix has been experimented with in the Netherlands to make project participants reflect on barriers to the achievement of project goals. It is based on the building of a matrix of relevant stakeholders, X relevant system characteristics, and the broker encourages stakeholders to discuss the barriers in each cell of the matrix (van Mierlo et al 2010).

The World Café is a method for fostering a creative process for collaborative dialogue and the sharing of knowledge and ideas, particularly in large groups. World Café is set up around a collection of tables. Each table discusses one topic, theme or question. A facilitator or moderator introduces the host at each table. After 15 to 30 minutes participants leave the table and visit another one while the hosts stay at their respective stand. The host sums up briefly the content of preceding discussions and starts a new discussion. The World Café concludes with a reflection phase.

Participatory video making is a method to build a group around a knowledge object. The principle is that participants create their own film. This process can enable a group to take action to solve their own problems and communicate their needs and ideas to decision makers (http://en.wikipedia.org/wiki/Participatory_video). The process is generally organised by a broker who facilitates the agreement over the script, the use the camera and editing of the video. Given the decreasing cost and ease of using imaging tools, this method can be easily applied in many situations. The limit of the method is that it is time consuming.

Peer-to-peer interaction will increasingly integrate technical advice, and extension services will have to design their activities in a way as to foster and monitor social learning. All actors in the system will dedicate a higher share of resources to online instruments to increase their productivity. Mailing lists, content management systems and collaborative working tools will become tools of daily usage.

Social media has the potential of turning any project into a community of practice. Development projects – such as those funded by Rural Development policies – will increasingly mix different activities (research+training+extension) and diverse actors, including consumers, linked together by flows of information across the Internet and finalised to specific innovation objectives (see IDRAMAP).

Increased use of social media and the involvement of civil society and consumers will broaden the field of learning. Consumers can interact directly with farmers and develop new quality

criteria. Producers increase the possibility of managing reputation building among consumers and to create their own consumer market. Participation in civil society activities will expose farmers to new ideas and will tune them up with societal values, and at the same time it will give them a 'voice' in the policy process.

Conclusions

In today's information society, information is one of the cheapest available resources. This encourages a restructuring of economic processes in a way to replace, when possible, processes that imply exchange of materials with exchange of information, physical interaction with remote interaction or even human-to-machine interaction. The intensity of information flows depends on connectivity – the number of people with which each actor can communicate – and interactivity – frequency and direction of interaction. In this chapter we have highlighted how social interaction can be the engine for learning and innovation, and how the Internet and available software allows us to support the creation and management of communities of practice and collaborative work.

Agricultural Knowledge Systems, so far designed around a model of face-to-face interaction between knowledge producers, knowledge brokers and knowledge users, will benefit immensely from a redesign of the organisational model based on a network approach and heavy use of social networks. As shown above, the available Internet tools encourage a change of innovation models: from top-down models to network models, from generalist extension structures (for example, 'crop management' departments) to problem-specific structures (for example, 'participatory plant breeding' networks), and will allow direct interaction between farmers, researchers, extension workers, consumers and civil society organisations. Innovation policies can support the restructuring process by raising the level of digital literacy, encouraging collective development projects with explicit Internet-based experiments, and introducing methods of monitoring and evaluation of learning processes.

Appendix 4

A list of existing interactive innovation initiatives discussed in the CWG AKIS-2

Although the concept of operational groups is new, in several countries there are already examples of initiatives that apply an interactive innovation approach. This appendix describes a set of existing initiatives that offered valuable insights for the discussions within the AKIS 2-group and the text in Sections 4.2.2 till 4.2.5.

CASDAR: RMT and 'innovation & partnership' projects (France)

The funding comes from Casdar *(Compte d'Affectation Spécial pour le Développement Agricole et Rural)*, a tax on a percentage of farmers' annual turnovers that is managed by the French Ministry of Agriculture to finance agricultural development and R&D organisations. This scheme is managed by six different tenders. Two kinds of tenders can be highlighted to illustrate the aim of this fund.

RMT (Réseau Mixte Technologique) – Joint Technological Network: Networking of actors in development, research and education to promote innovation and knowledge transfer.

The RMT, Joint Technological Networks were created by the Ministry of Agriculture in 2006 as part of the Farm Bill. The RMT gather research (basic and applied), education, advisors and various development actors around themes with high socio-economic and environmental issues. One RMT is funded for a duration of five years, at around EUR 60 000 a year for animation. It gathers, as a minimum, one Agricultural Technical Institute (ACTA Network), one Chamber of Agriculture (APCA), one technical education organism and one superior education centre (university) or research institute (INRA, IRSTEA, etc.). RMT often have broader participation and include farmers' groups, cooperatives, etc. depending on the theme the RMT is covering.

The *ex-ante* and *ex-post* evaluation of the tenders are delegated to a scientific and technical committee taking into account the cross-fertilisation potential between the partners for particular themes, the operational outputs and/or the pertinence of the theme in the framework of policies.

These partnership arrangements with scientific and technical actors aims to create or strengthen interactions between actors in development, research and training, working on themes of common interest and strong challenges for the agriculture and food sectors. These arrangements allow therefore a more horizontal approach to issues by the pooling of human and material resources. Competence groups mobilised by professional and economic organizations, such as the government, are now visible and recognised.

A steering committee is made up of representatives of each organisation but also professionals (farmers) and policy-makers to orientate the action plan and assess the progress. Synergies with the RMT aim to promote innovation in agriculture and agri-food development.

Specifically, the activity of the RMT must translate scientific and technical production (setting up of research and development projects, synthesis of knowledge, decision support tools, methods and new production systems, innovative techniques, etc.) and valorise the development and

transfer of these, in particular by training (teaching, training modules, production of educational materials, demonstrations, books and guides, support and advice to farmers, etc.).The RMT end up being places where new research questions emerge.

IP (Innovation et Partenariat): Innovation and Partnership Projects

An annual call for projects 'Innovation and Partnership' was set up by the French Ministry of Agriculture in 2004. The call aims to mobilise stakeholders in agricultural and rural development on applied research and innovation actions. The objective of the projects is to produce operational results in a user-friendly way to farmers and to have an adequate partnership for the project work. One IP project can be funded at between EUR 250 000 and EUR 450 000 for three years.

Laureates are nominated by the French Ministry of Agriculture after evaluation and ranking of projects by a jury of independent experts composed of researchers, advisors and teachers etc. Farmers are involved in the project's steering committee and assist in making up the experimental plan and in orientating the project. In addition, an annual presentation of results from this call for projects is organised, and full publication of the results in the journal 'Agricultural Innovations' are available online.

Projects conducted in this framework have a practical aim: to produce results conducive to innovation, easily transferable to advisors and farmers, and that can contribute to the definition of public policies. Topics to be chosen may be linked to societal challenges (described in the tender) or subjects supported by RMT networks.

These programmes are conducted in partnership between development and advisory services, research and training agencies, including groups of farmers.

Defra's Genetic Improvement Networks (GINs) (UK)

The GINs provide a forum and focus with industry and end users to support (i) public and private sector pre-breeding R&D partnerships, (ii) shared genetic resources and (iii) tools for key UK crops. The objective is to improve crop varieties through genetics and obtain sustainability gains on diverse topical issues.

HortLINK Project SCEPTRE – A LINK Consortium (UK)

Defra's HortLINK is a collaborative programme with industry and end users to translate R&D into a commercial reality. In the specific case of SCEPTRE, the focus is upon improving crop protection in horticulture, especially for use in minor crops. In these minor crops, there are fewer effective products available as a result of EU legislation and the failure of the market to develop new products.

Benchmarking agricultural water use in key commodity sectors (UK)

The aim is to develop a benchmark to improve business and water use efficiency in irrigated agriculture in England and Wales. The system is developed and tested on two key commodity sectors, potatoes and strawberries, with approaches that are transferable and applicable to a broader range of agricultural and horticultural crops.

Control of the Mediterranean fruit fly (Spain)

A mixed group of producers, national and regional governments and research institutes aims to control the Mediterranean fruit fly (Ceratitis capitata) in citrus and other fruit trees by an area-wide Sterile Insect Technique Programme. This biological control approach should contribute to a significant reduction in the use of pesticides to control this key pest and to produce more safe fruits.

Methyl bromide (Spain)

As methyl bromide was no longer acceptable to control pests, diseases and weeds, a project involving diverse stakeholders was started to develop alternative chemical solutions and new application methods for those chemicals. But there was also attention for the development and transfer of knowledge on non-chemical alternatives based on bio-fumigation in combination with soil solarisation.

Development of a triploid watermelon (Spain)

Because of changes in consumer acceptance and household patterns, a mixed group of actors came together to develop a triploid seedless watermelon with a lower weight. The aim was to develop a higher added value in comparison with the traditional watermelon production system by using novel techniques like grafting onto resistant varieties.

Fruit.net (Spain)

In the framework of the new legislation on sustainable use of pesticides, fruit.net aims to optimise the use of pesticides and provides alternatives for the control of various diseases, pests or post-harvest disorders in apple, peer, peach and citrus fruit crops. Both producers and researchers are involved in the project.

Olive oil panel (Spain)

The olive oil panel wants to set up and monitor programmes to improve olive oil quality, through the rationalisation of decision-making. This is done by producers associated under a designation of origin together with researchers.

Riduca reflui (Italy)

The aim of this project is to search for technological and managerial solutions for the reduction of water pollution due to the use of animal waste. The initial demand came from the farmers' organisation, but was promoted by the Veneto region and carried out together with research and extension.

Consortium of research, experimentation and dissemination for the horticultural chain in Piedmont (CRESO, Italy)

The consortium was established to keep R&D fastened to the needs expressed by the fruit and vegetable chain in Piedmont. CRESO has both a Board of Directors with a prevailing public component and Technical Committees with mostly private components (producer groups). The latter decide upon the research topics and supervise how the projects are carried out.

Multi-regional Operational Programme (POM) activities in support of services for agriculture: Measure 2 'Technological innovations and transfer of research results' – 1994/1999 (Italy)

Measure 2 was included in the POM programme to more efficiently disseminate the innovations produced by research activities. The measure funded applied research which involved both research facilities and advisory structures.

Promoting a regional approach to integrated pest management for the greenhouse sector in Southern Ostrobothnia (Finland)

The aim is to control the greenhouse whitefly in a regional setting, but also to learn how the sector can prepare for the possible arrival of another exotic whitefly or possible pest. This is being done through use of an interactive co-learning process (Change Lab) to jointly develop the innovation and transformative capacity of growers and practitioners, researchers and advisors.

Finnish Cereal Committee (Finland)

The Finnish Cereal Committee was founded to improve information exchange across grain chain actors and to integrate raw material production with industry needs, in order to improve the functioning and general efficiency of the sector. It is a general and neutral platform that publishes guides, produces surveys to help decision-making in the sector, provides information on web pages and maintains databank on the cereal sector, etc.

KarjaKompassi (Cow Compass, Finland)

At the basis of the Cow Compass was the objective to develop an online management tool to support process planning, ration formulation and optimal economic operation of cattle farms. It is now an online service for farmers delivered by a rural advisory service. The development stages were highly interactive between research, extension and farmers (for testing and piloting).

Finnish Bioeconomy Cluster (FIBIC, Finland)

To devise and conduct research programmes aimed at creating sustainable bio-based solutions, FIBIC is one of the six Strategic Centres for science, technology and innovation in Finland. It offers businesses, research organisations and end users a new way of engaging in close, long-term cooperation with the aim of building the future, sustainable bio-based economy.

Good Fruit (Estonia – Latvia)

Within the Good Fruit project, a complex unit has been developed to store and process fruit and berries and to provide product development service throughout the year. Researchers initiated the project and they were joined by about a hundred small farmers.

Micro Dairy (Estonia)

Micro Dairy refers to a milk technology research laboratory and is used to carry out practical, educational and research tasks and to initiate product development. Micro Dairy cooperates

with agricultural producers to develop new product lines, based on extremely small quantities of raw material.

Baltic Deal (countries bordering the Baltic Sea)

Baltic Deal aims to reduce the negative impact of agriculture on the environment, but not to harm competitiveness and production capacity. The participants are agricultural producers, small rural entrepreneurs, researchers and advisers. One of the objectives is to build a strong cooperative platform and network for farmers and advisory services.

Measures and techniques to use securing water environment in farm areas (Denmark)

Based on the Water Framework Directive, the objective is to develop measures and techniques that can help to secure the water environment in farm areas. A broad group of stakeholders is involved and the project has tested innovative methods and has initiated new research projects.

Herd navigator (Denmark)

Herd navigator is an advanced, automatic milk analysing unit that can be the basis for developing new techniques to improve reproduction, health and feeding conditions in milk cattle herds. It was initiated by knowledge institutes, but all relevant stakeholders (advisory service, farmers, manufacturing companies and universities) were involved.

Improve the quality of Danish beans by heat treatment (Denmark)

The aim of the project was to improve the quality of Danish beans through heat treatment. This included the testing of a mobile toaster unit at a farm and the testing and monitoring of proteins in cows. The initial question was formulated by a farmer and in the end, the project was carried out by a team of farmers and knowledge institutes.

German Federal Organic Farming Scheme (Germany)

This funding scheme for research on organic farming involves farmers in steering groups and for the prioritisation of research topics. Within the projects there is emphasis on workshops and meeting aimed at knowledge transfer, but also activities on a toolbox for evaluation or practice-orientated research.

Organic farmers' networks (Belgium)

The organic farmers' networks aim for an exchange of practical knowledge and information between farmers themselves and with applied researchers. The networks use a bottom-up approach to identify demand-driven research questions in organic farms. The groups are initiated and facilitated by (farmers') organisations, while a research institute does the methodological follow-up.

Sietinet, the ornamental plant production technology and innovation network (Belgium)

The Sietinet-initiative has grown from the need for technological advances in ornamental plant production. For the farmers, it was very difficult to keep up with all developments and the project therefore aimed to stimulate the cooperation between growers and knowledge institutes. By

doing so, the access to scientific knowledge was improved and an informal mixed network was developed. The initiative however stopped after the end of the project funding.

Water quality groups (Belgium)

In the framework of the Nitrate Directive, it was necessary to address the issue of water quality in Flanders. As one of the measures, local networks of farmers and applied researchers were established to follow up, explain and address the results of the nitrate measurements in specific water bodies.

Swine Innovation Centre Sterksel (the Netherlands)

The Swine Innovation Centre was established in 1968 by a farmers' interest group and has the objective to carry out affordable research which is profitable for the pig sector, for the environment and for animal welfare. There are PPP-initiatives to cooperate with networks and organisations that disseminate knowledge to diverse stakeholder groups.

Cows and Opportunities (the Netherlands)

The Cows and Opportunities project concerns applied research for farmers to cope with (planned) manure and environmental legislation. The cooperation between farmers and research resulted in farms which can cope with future legislation and therefore, there is a high demand to enter the network.

Farmersandclimate.nl network (the Netherlands)

This network wants to identify and develop feasible steps towards more climate-neutral agriculture. The initiative was started by research institutes, but the challenges faced by the farmers are at the core. There is therefore a close cooperation between farmers and researchers. There is a lot of attention for communication 'with more bite'.

Better Farm Programme (Ireland)

The programme wants to improve the farms' profitability through effective technology transfer and provide signals to research with regard to areas needing further research.. This happens with the involvement of key stakeholders (farmers, researchers, advisors and industry) in a collaborative project to identify relevant profit-enhancing technologies, experiment with, and validate (or otherwise), these technologies prior to the wider adoption of these technologies, and to identify areas for further research.

Agricultural Catchment Programme (Ireland)

The main challenge is to evaluate the national measures of the Nitrate Directive, to facilitate economically sustainable farming which also achieves the water-quality objectives and to disseminate the results to the stakeholders. Important elements are the thorough consultation at the outset, regular contact and communication with the stakeholders, clear well-communicated objectives with potential impacts at farm-level of the participants and on-farm/local demo/ research projects.

Dairy Efficiency Programme and Beef Technology Adoption Programme (Ireland)

This programme uses the discussion group model as a vehicle to reach more farmers to adopt critical livestock practices (like grassland management, financial management and breeding) at farm level. *Circa* 6 000 farmers have been involved in this peer-to-peer learning format.

Valbiom (France)

The Valbiom-initiative refers to the development of a local production system related to non-food valorisation of agro-resources with eco-conception. It is based on local synergies between agricultural and industrial enterprises and has been co-created with a group of farmers who were searching for new markets.

Système Terre et Eau (France)

The challenge to make animal production systems more eco-efficient, thrifty and self-sufficient is at the heart of this initiative. It started as a collaboration between knowledge institutes and regional authorities, but the requirements and specifications were written by farmers ('fodder systems input-saving' contract). The farmers are also involved in the research-action process: methodology, collecting data, steering the group and the project.

'Joint Technological Network' Florad (France)

Join Technological Network is a flagship initiative (with five-year incentives) of the French Ministry for Agriculture, allowing broad networking and partnership between a wide range of stakeholders, tackling themes of common interest. During the first 'generation' of Join Technological Network, 17 networks have been granted. A new call for projects will fund around 20 new networks (including the continuation of 'some' networks from the first generation) for the second 'generation' of Join Technological Network by the end of 2013.

Florad focuses upon weed knowledge and management. The network started as an informal group of researchers, which opened up to other stakeholders. The objective is to promote and lead research projects on priority questions, provide operational knowledge and results and establish an expert group.

Appendix 5

Some relevant EU Projects

Introduction

Readers who want to keep up with the latest developments in European research projects, related to AKIS and linking innovation and research, find below an introduction to projects that are currently running.

SOLINSA

http://www.solinsa.net

The overall objective of this project is to identify effective and efficient approaches for the support of successful LINSA (Learning and Innovation Networks for Sustainable Agriculture) as drivers of transition towards Agricultural Innovation Systems for sustainable agriculture and rural development. In order to achieve this objective the project will:

- Explore LINSAs empirically as bottom-up drivers of transition;
- Improve understanding of barriers to complex learning processes and developing recommendations on how to avoid/remove them;
- Create open learning spaces for actors outside the project by sharing and disseminating project findings;
- Identify institutional determinants that enable or constrain existing AKS in supporting effective LINSA in the context of changing knowledge and innovation policies;
- Develop a conceptual framework for innovation for sustainable agriculture and rural development.

The study will be carried out in 3 fields: a) consumer oriented networks (b) non-food orientated networks and c) purely agricultural networks or networks for sustainable land use.

Strategic objectives:

- Contributing to more effective research-practice linkages in the complex innovation and value chains;
- Contributing to a policy framework for innovation in agriculture.

PRO-AKIS

http://www.proakis.eu/

European farmers need topical knowledge, training and support to remain competitive and respond to manifold demands in a continuously evolving environment. Functioning agricultural knowledge and information systems (AKIS) are needed to tackle challenges like (i) giving small-scale farmers access to relevant and reliable knowledge, (ii) bridging scientific research topics and farmers' demands and (iii) offering appropriate support for diverse rural actors that form networks around innovations in agriculture and rural areas. Advisory services are one essential means to enhance problem solving, information sharing and innovation-generating processes.

In a functioning AKIS these services can be provided by various actors, among them formal extension services, training and post-secondary education bodies and NGOs, but also by members of administration or research institutions. PRO AKIS will thoroughly review international literature sources on AKIS and provide an inventory of the AKIS institutions and interactions in the EU-27. Furthermore, PRO AKIS will highlight the mentioned challenges through a selection of case studies that are conducted for each topic in parallel in several Member States. Comparative analyses and assessments of these cases will reveal the successes, strengths and weaknesses of the specific knowledge flow systems. AKIS stakeholders and policy advisors will accompany PRO AKIS, share interim findings and participate in workshops and seminars. They will be invited to intervene repeatedly in the projects' courses and to contribute through feedback and in assessments of results. On these bases policy recommendations for the strengthening of European agricultural innovation systems will be developed and further research needs will be designated. A range of dissemination activities will ensure that findings are timely available for the interested communities and for the public at large.

JOLISAA

http://www.jolisaa.net/

The JOLISAA project aims to increase understanding of agricultural innovation systems focusing on smallholders' livelihoods and the articulation of local/traditional and global knowledge. Lessons learnt about past and ongoing experiences with agricultural/rural innovation in East, Southern and West Africa will be synthesised by combining joint case-study assessment with capacity-strengthening and networking on various scales.

Case studies will tackle diverse innovation types and scales: from natural resource management to production and agri-business, from local initiatives to national and regional ones. Joint learning will be fostered by engaging diverse stakeholders, including researchers, practitioners and policymakers. The project will deliver relevant, pragmatic and collectively validated recommendations to the EC and to African decision makers for future research, practice and policy. Over 30 months, a small consortium of European and African partners involving highly experienced and motivated research, development, capacity-strengthening and networking institutions will facilitate an iterative process consisting of five interlinked thematic Work Packages (WPs).

In WP1, an analytic framework and an operational approach will be developed based on an innovation-system perspective and carefully adapted to the context and experiences of three regions in Africa. WP2 will involve joint assessment and learning from a series of case studies in Kenya, South Africa and Benin. In WP3, the capacity of members of existing multi-stakeholder innovation platforms to assess their experiences and to facilitate innovation will be strengthened, in close interaction with case-study development. In WP4, lessons will be shared and discussed within existing national innovation platforms across Africa and with European/international institutions. WP5 will compile and share the project outputs and deliver them in formats suitable for a range of audiences, from academia to policymakers.

FARM PATH

http://www.farmpath.eu/

In FarmPath, increasing sustainability in agriculture is addressed by enabling flexible combinations of farming models, which vary to reflect the specific opportunity sets embedded in regional culture, agricultural capability, diversification potential, ecology, and historic ownership

and governance structures. We will enable progress towards this goal of increased regional sustainability of agriculture through a transdisciplinary research approach, where knowledge is co-produced by scientists, stakeholders and practitioners. FarmPath will specifically integrate theoretical and conceptual approaches to transition and transition management with recent research on adaptive capacity and resilience in farming systems, food regimes and farm-level transitions to multi-functionality, and build on previous EC-funded research projects on sustainability and innovation in farming systems, and production and consumption chains. FarmPath will assess a set of farm and regional-level sustainability initiatives to identify conflict and complementarity, focusing on how combinations of initiatives, actors, technologies and policies can achieve synergies which initiate transition pathways at regional level. FarmPath will engage in participatory visioning and scenario assessment in contrasting national and European regions, to identify transition pathways: combinations of visions and the social and technical mechanisms and innovations needed to reach these visions. This will lead to the development of a handbook for assessing and identifying actions which can be taken by policy-makers to facilitate transition towards regionally sustainable agriculture. FarmPath will also investigate issues surrounding young people and new entrants to farming in specific relation to these initiatives and scenarios. Research findings will be presented and discussed in an international conference, and developed into an academic book.

VALERIE

VALorising European Research for Innovation in agriculture and forestry
(website not yet launched)

Many EU and nationally funded research projects in the fields of agriculture and forestry provide excellent results, but the outreach and translation of these results into field practices is limited. The overall aim of VALERIE is to boost the outreach of research by facilitating integration into innovative field practices. The work in VALERIE consists of three major approaches. (1). Stakeholder-driven approach. Ten case studies set the central stage for the bottom-up approach of the project, aided by the highly effective tools of web semantics and ontology. Cases are centred around a specific supply-chain, a farming sector or a landscape. The stakeholder communities (SHC) represent the natural networks engaged in innovation. They drive the process of articulating innovation needs, enabling the retrieval of precisely matching knowledge and solutions, and evaluating their potential in the local context. (2) Theme-driven approach. VALERIE retains six thematic domains that are at the heart of sustainable production and resource use. These six provide the back-bone for structuring the annotation and summarising activities, which in turn will provide a vast body of knowledge accessible via the Communication Facility (CF). (3) Knowledge disclosure. VALERIE will launch a 'Communication Facility' (CF) for the EIP-Networking Facility. The CF supports communication amongst actors in the field and researchers. Next it injects new knowledge into the innovation process, by enabling users to retrieve highly relevant (tailored-to-needs) information, based on their own vocabularies. In offering tools for communication, as well as content structured for efficient knowledge retrieval, the CF fuses the advantages typical of 'learning networks' and 'linear' modes of knowledge sharing. The CF will be set up, tested and integrated into the EIP-NF platform, as a generic infrastructure for use by 'fresh' stakeholder communities, also beyond the life of the VALERIE project.

FI-PPP

http://www.fi-ppp.eu/

FI-PPP is a European programme for Internet-enabled innovation. The FI-PPP will accelerate the development and adoption of Future Internet technologies in Europe, advance the European market for smart infrastructures and increase the effectiveness of business processes through the Internet.

Two FI-PPP projects are especially related to agriculture and food:
Smart Agri-food: http://www.smartagrifood.eu/
FIspace: http://www.fispace.eu/ that builds a collaboration service platform for businesses, with trials from the Smart Agri-food project.

Appendix 6

The making of – including a list of participants in the activities of the Collaborative Working Group AKIS-2

The CWG started its work in summer 2012, after a proposal to SCAR by France (Pascal Bergeret, Ministry of Agriculture) and the Netherlands (Annet Wijering, Ministry of Economic Affairs) to start and lead the CWG on the links between knowledge and agricultural innovation in Europe. Pascal Bergeret and Krijn Poppe (LEI Wageningen UR acting for the Dutch Ministry of Economic Affairs) were appointed as project managers/chairs of the CWG. The project plan included five work meetings (after a kick-off meeting in Brussels organised by Anne Vuylsteke of the Flemish government):

1. Issues related to the definition and working methods of operational groups (September 2012, Brussels, organised by Andrés Montero Aparicio of the Spanish delegation to the EU).
2. Innovation policy (November 2012, Rome, organised by Serenella Puglia at the Ministry of agricultural, food and forestry policies and Valentina Cristiana Materia at INEA).
3. Content of innovation themes in agriculture (January 2013, Den Haag organised by Krijn Poppe, LEI Wageningen UR).
4. Cross-border aspects and the role of ICT in innovation (April 2013, Helsinki, organised by Roy Tubb, MTT).
5. Motivation for extension/advisory services/education and research, including the issue of incentivising research to be relevant for innovation (June 2013, Dublin, organised by Kevin Heanue, Teagasc).

The draft end report was discussed in a meeting in Paris (September 2013, organised by Adrien Guichaoua, Acta).

The European Commission (DG RTD) linked the PRO-AKIS project (managed by Andrea Knierim, ZALF) with the work of the collaborative working grouped, which made it possible to involve experts by commissioning two small studies, that are reported in Chapters 5 an 6. The studies were commissioned via a tender procedure.

The writing of the final report was coordinated by Krijn Poppe. Andrew Fieldsend (AKI) provided editing services and carried out the language correction of the final text. Mr Hans-Jörg Lutzeyer of DG RTD managed the publication process.

The CWG finalised the text for this report at the beginning of October 2013. Its mandate ended in December 2013 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:

Volker Hoffmann (University of Hohenheim, Baden-Württemberg, Germany)	vhoff@t-online.de
Anton Stockli (Federal Office for Agriculture, Switzerland)	anton.stoeckli@blw.admin.ch
Anne Vuylsteke (Ministry of Agriculture and Fisheries, Vlaanderen, Belgium);	Anne.Vuylsteke@lv.vlaanderen.be
José António Santos Pereira Matos (Portugal)	jose.matos@iniav.pt
David Alan Cooper (Defra, United Kingdom)	David.Cooper@defra.gsi.gov.uk

Anna Vagnozzi – National Institute of Agricultural Economy (INEA, Italy)	vagnozzi@inea.it
Serenella Puliga, Italy, MIPAAF	s.puliga@mpaaf.gov.it
Annamaria Marzetti (MIPAAF, Italy)	a.marzetti@mpaaf.gov.it
Andrea Knierim, ZALF (Pro-AKIS, ZALF, Germany)	knierim@zalf.de
Annette Abildskov (Denmark)	anab@naturerhverv.dk
Kevin Heanue (Teagasc, Ireland)	kevin.heanue@teagasc.ie
Roy Tubb (MTT Agri-food Research, Finland)	roy.tubb@mtt.fi
Diana Laur (Ministry of Agriculture, Estonia)	Diana.laur@agri.ee
Andrés Montero Aparicio (INIA, Spain)	amontero@inia.es
Isabel Bombal Díaz (MAGRAMA, Spain)	ibombald@magrama.es
Jaume Sió (Gov. Catalonia, Spain)	Jaume.sio@gencat.cat
Elisenda Fatjo Vila (Gov. Catalonia, Spain)	efatjovilas@gencat.cat
Valentina Cristiana Materia, Università Politecnica delle Marche and INEA, Italy	v.c.materia@univpm.it
Ines Di Paolo (National Institute of Agricultural Economics, Italy)	dipaolo@inea.it
Elie Faroult (Israel)	efaroult@hotmail.com
Jasper Dalhuisen (Ministry of Economic Affairs, DG Agro, the Netherlands)	j.m.dalhuisen@minez.nl
Jan van Esch (Ministry of Economic Affairs, DG Agro, the Netherlands)	j.w.j.vanesch@minez.nl
Krijn Poppe (LEI Wageingen UR on behalf of Ministry of Economic Affairs, the Netherlands)	krijn.poppe@wur.nl
Pascal Bergeret (Ministry of Food, Agriculture and Fisheries, France)	pascal.bergeret@agriculture.gouv.fr
Sonia Ramonteu (ACTA, France)	Sonia.ramonteu@acta.asso.fr
Stratmann, Rolf, Ministry, Bonn	Rolf.Stratmann@dlr.de
Stephan Micha	stephan.micha@dlr.de
Elke Saggau (Germany)	Elke.Saggau@ble.de
Andrew Fieldsend (Research Institute of Agricultural Economics, Hungary)	andrew.fieldsend@aki.gov.hu
Eduardo Cuoco (TP Organics)	Eduardo.cuoco@ifoam-eu.org
Bram Moeskop (TP Organics)	bram.moeskops@tporganics.eu
Michael Kuegler (Chambres d'Agriculture EU Platform Brussels office, Belgium)	m.kuegler@vlk-agrar.de
Karin Ellermann-Kuegler (Chambres d'Agriculture EU Platform Brussels office, Belgium)	k.ellermann-kuegler@vlk-agrar.de
Lena Lind (Sweden)	Lena.lind@gov.se
Hans Rolandsson (Sweden)	Hans.rolandsson@gove.se
Egizio Valeceschini (France)	Egizio.valceschini@pario.inra.fr
Hans Joerg Lutzeyer (European Commission DG Research)	Hans-Joerg.Lutzeyer@ec.europa.eu
Marc Duponcel (European Commission DG Agri)	Marc.DUPONCEL@ec.europa.eu
Inge Van Oost (European Commission DG Agri)	Inge.VAN-OOST@ec.europa.eu

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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. SCAR set up a Strategic Working Group (SWG) of civil servants from the European Commission and the EU Member States to reflect on Agricultural Knowledge and Innovation Systems (AKIS). Innovation is an important challenge for European agriculture. This report gathers experiences from different countries and regions. The report especially reflects on how innovation could be organised in the European research and innovation policy, using the framework of the European Innovation Partnership for Agricultural Productivity and Sustainability, and how this could be connected to agricultural policy and the Horizon 2020 research framework programme. Special attention is paid to the role of ICT, that could support social innovation processes and to incentives for research to collaborate in innovation processes.

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