Prospects for Farmers' Support: Advisory Services in European AKIS
WP 4 – AKIS ON THE GROUND: FOCUSING KNOWLEDGE FLOWS SYSTEM | Topic 3
Final Synthesis Report

Designing, implementing and maintaining agricultural/rural networks to enhance farmers' ability to innovate in cooperation with other rural actors

Lívia Madureira (Coord.)
Timothy Koehnen
Dora Ferreira
Miguel Pires
Artur Cristóvão
Alberto Baptista

With the collaboration of: Annie McKee, Katrin Prager, Rachel Creaney, Monica Caggiano, Kinga Boenning, Andrea Knierim

Centre for Transdisciplinary Development Studies
University of Trás-os-Montes e Alto Douro

Portugal

May, 2015

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement nº 311994

Please reference this report as follows:

Madureira, L., Koehnen, T., Ferreira, D., Pires, M., Cristovão, A., Baptista, (2015). Designing, implementing and maintaining agricultural/rural networks to enhance farmers' ability to innovate in cooperation with other rural actors. Final Synthesis Report for AKIS on the ground: focusing knowledge flow systems (WP4) of the PRO AKIS. May 2015. Online resource: www.proakis.eu/publicationsandevents/pubs

Content

List of figures

List of tables

List of acronyms

AAS	Agricultural Advisory Service
AKIS	Agricultural Knowledge, Information and Innovation System
CSF	Cluster of Small Fruits
DE	Germany
DSM	Drosophila Suzukii Monitoring
EIP-AGRI	European Innovation Partnerships: Agriculture and Innovation
EU	European Union
FAS	Farm Advisory Service
FBO	Farmer Based Organisation
ICT	Information and communications technologies
INKA BB	Innovation Network of Climate Change Adaptation Brandenburg Berlin
IT	Italy
NCO	New Organized Cooperation (Nuova Cooperazione Organizzata)
NGO	Non-Governmental Organisation
PRO AKIS	Prospects for Farmers' Support: Advisory Services in the European Agricultural Knowledge and Information Systems'
PT	Portugal
R&D	Research and Development
RDP	Rural Development Programme
SCAR	Standing Committee on Agricultural Research
UK	United Kingdom
WP	Work Package

Executive Summary

This synthesis report is one deliverable of the European project PRO AKIS (Prospects for Farmer's Support: Advisory Services in European AKIS). The project focus was to investigate the agricultural advisory services across Europe within the context of Agricultural Knowledge and Information Systems (AKIS). One of the project components (Work Package 4) was to explore and describe selected forms of advisory services and agriculture knowledge flows in Europe within the broader context of AKIS by focusing three major themes (Topics 1, 2 and 3) through a case study approach. Topic 1 investigated the effectiveness of advisory services to respond small-scale farmer's needs and demands; Topic 2 the capability of AS to bridge research and knowledge needs of farmers; Topic 3 analysed how rural/agricultural networks enhance farmer's ability to innovate in cooperation with other rural actors. Research in each topic was based on a set of four case studies, and a total of 12 case studies were conducted in different European countries, including both cases with regional and national scope. The selected case studies provide an overview of the diversity of situations across the European Union (EU) respecting the strengths and gaps of AS for each of the research topics covered by the analysis. Each case study was reported by the respective responsible team through a 'country report'. A total of 12 'country reports' were elaborated. The synthesis reports summarise in a comparative way the main findings for each of the three research topics, based on the country reports and including the contributions of stakeholders that have participated in the respective topic seminar. Three synthesis seminars have been organised, each one corresponding to a different research topic, and finally three synthesis reports were elaborated.

The report here presented synthesises the research conducted under the PRO AKIS project for the topic 3: Designing, implementing and maintaining agricultural/rural networks to enhance farmers' ability to innovate in cooperation with other rural actors. It includes a brief description of the five case studies undertook under this research topic, which were: 1) policy-induced agricultural innovation network in Brandenburg, Germany ('Adapting seeds to climate change'); 2) the 'Anti-Mafia innovation network: from land to fork' (abbreviated as 'Anti-Mafia'), a rural network situated in the Northern part of the Campania region in Southern Italy; 3) the 'Cluster of Small Fruits' (CSF), a sectoral and nationwide Portuguese network; 4) a berry pest-monitoring local network, situated in the Central-North of Portugal; and 5) the 'Monitor Farms' which are farmer-driven networks set-up by the Scottish Monitor Programme implemented by the Scottish government with delivery partners including levy bodies such as Quality Meat Scotland.

The case studies selected evidenced that the agricultural and rural innovation networks' configuration and dynamic exhibited a high degree of heterogeneity. This is largely explained by the diversity of problems and solutions they addressed, whereas being as well a result of other factors, namely: 1) the presence of substantial differences in the national and regional AKIS across Europe; 2) different funding opportunities; 3) the diversity of the socio-economic and cultural contexts where they were established. Notwithstanding the heterogeneity displayed, all the selected networks played a role in the local or regional, or even national AKIS, by filling gaps or complementing the functions of other players. All the studied networks can be evaluated as best-fit cases of advisory models by themselves. However their success regarding this advice function is heavily depending on the quality of the supporting services from the existent knowledge and advisory infrastructure. In addition, in most of the cases, the networks are temporary and for that reason they shouldn't be envisaged as an alternative to conventional advisory models.

All the selected networks underpin well-performing knowledge flows namely respecting the exchange of knowledge, information and experiences. These are a result and at the same time an input of the co-creation of knowledge and innovation processes taking place within the networks. The interactive collective learning processes stimulated by the networks enhance farmer's ability to co-create knowledge and innovations by sharing common problems and looking collectively for solutions

(problem-solving focused innovation) and also by discovering new ways of doing things and thinking as a result of exchanging ideas, information and experiences with different actors within different contexts. Hence, these innovation networks leverage most notably small-scale and incremental innovations, non-tech innovations, such as organizational, behavioural or social innovations, and innovation with low R&D incorporation, which produce small and cumulative changes and improvements that often go unnoticed.

The networks ability to induce well-performing knowledge flows respecting the co-creation of knowledge and innovation along with the exchange (and the storage in same cases) of data and information enable them to fill gaps in the conventional linkages of the research sector both, with the advisory services, and with the farmers knowledge needs. In addition, the networks might show a useful model to generate technical locally-specific knowledge and the adaptation of scientific and synthetized knowledge to the local specific contexts (which are fundamental aspects of an AKIS enabling to overcome the productivity and sustainability challenges of EU agriculture).

The effectiveness demonstrated by the networks to enhance the processes of co-creation and knowledge exchange and of co-innovation are largely a result of three main features: 1) the multiple actor's dimension, by joining together actors from the various areas of the AKIS, which are often apart, in particular researchers, farmers and advisors; 2) the horizontal and multi-directional social interactions between individual and grouped actors within the network, which also bring-in to the network the knowledge, skills and information the actors get from their connections outside the network; 3) supporting multiple formats and methods of interaction, since formal talks, workshops, field trials, farm visits and in-farm experiences, to ICT communication and demonstration activities, which extent largely the scope, duration and the intensity of the interactions between the actors.

The network features which show decisive data to encourage the farmer's adherence encompass: 1) offering effective opportunities to meet and interact with diverse actors, in particular researchers, experienced technicians, leader (or 'good', or' pioneer') farmers, and other advisors (e.g., from whom they can get advice on legislation or business management aspects); 2) addressing topics which are relevant for farmers, in particular when addressed in a practical manner (e.g., on-farm demonstrations, or involving farmers in problem-solving); 3) facilitating the enter/exit of the network and the absence of fees attached to the participation(in addition to the costs the farmers show willing to bear, related with time, traveling and also their own land for experiment and trials); 4) the previous inter-personal and/or professional interactions, along with the opportunity of socialising and creating and/or enlarging own personal and professional social networks.

The conclusions of the case studies together with the stakeholder's contributions suggested a number of leading recommendations, from which are stated:

- *Do not overlook the need to account for the diversity of eventually supported networks, diversity in structure, contents and dynamics.*
- *Target diversity, i.e., small, simple, easily manageable solutions versus complex, more fuzzy solutions, also with a broader variety of actors, which might have more transformative potential.*
- *Support innovative, 'strong' actors, which can provide more resources and have an advantage specifically in the field of new technologies and supporting a variety of socio-economic groups, which will develop innovations fitting their specific needs.*
- *Acknowledge and support small-scale and incremental cumulative innovation patterns as well as smart mixes of technical, social, organisational and institutional innovation.*
- *Account for farmer's innovation as main drivers, which comprise productivity and sustainability, but also profitability and other social gains.*
- *Do not underestimate the farmers' role as co-creators and converters of knowledge as well as innovators.*
- *Try to find a good balance between flexibility and stability of supported networks.*

1. Introduction

This synthesis report is a deliverable of the European project PRO AKIS (Prospects for Farmer's Support: Advisory Services in European AKIS). The project's focus is to investigate the agricultural advisory services across Europe within the context of Agricultural Knowledge, Information and Innovation Systems (AKIS). One of the project components (Work Package 4) was to explore and describe selected forms of advisory services and agriculture knowledge flows in Europe within the broader context of AKIS (described previously by the PRO AKIS project at the individual country level), accounting for the diversity and demand conditions across different countries/regions and diverse types of farmers. Within this overall goal, Topic 3 focussed on exploring and identifying the possibilities, conditions and requirements of rural innovation networks that constitute examples for the 'European Innovation Partnership' by increasing farmers' capacities to create, test, implement and evaluate innovations in cooperation with other rural actors, through in-depth case study analysis.

The case studies investigated networks that were innovative and focussed on innovation in an agricultural or broader rural development context (in which agriculture played a part). In the remainder of the report we refer to networks, innovation networks, and agricultural/rural networks interchangeably.

The topic 3 goals were broken down to several research questions. In order to design and maintain innovation networks that enhance farmers' ability to innovate in cooperation with other rural actors, we needed to understand farmers' motivations for enrolling in these networks (influencing factors). Another core question was how to evaluate the knowledge flows (both formal and informal) and the success of the innovation network (including the degree to which it promoted best-fit practices). The key research question was:

- Which features of the agricultural/rural networks enhance farmers' ability to innovate in cooperation with other actors?

This was supported by the following sub-questions:

- How do the selected agricultural/ rural networks link to the existing knowledge infrastructure and advisory services?
- Which factors influence the stability of the network over time?
- Do these networks contribute to the productivity and sustainability of agriculture and rural areas through innovation as expected by EIP-AGRI, and if so, how?

The networks investigated included a: (1) policy-induced agricultural innovation network in Brandenburg, Germany ('Adapting seeds to climate change'); (2) the 'Anti-Mafia innovation network: from land to fork' (abbreviated as 'Anti-Mafia'), a rural network situated in the Northern part of the Campania region in Southern Italy; (3) the 'Cluster of Small Fruits' (CSF), a sectoral and nationwide Portuguese network; (4) a berry pest-monitoring local network, situated in the Central-North of Portugal; and (5) the 'Monitor Farms' which are farmer-driven networks set-up by the Scottish Monitor Programme implemented by the Scottish government with delivery partners including levy bodies such as Quality Meat Scotland.

These case studies highlight a diverse range of agricultural and rural innovation networks with regard to their structure, content and dynamics. Learning networks in particular were also addressed by the

European research project SOLINSA[1]. The selected case studies address the overall goals of topic 3 and were developed to answer the aforementioned research questions. The case studies were developed through a qualitative approach including in-depth interviews, participatory network mapping, document analysis and literature reviews, and in some cases social network analysis.

This final synthesis report is a comparison and synthesis built on the country reports elaborated by the teams responsible for each case study that was enriched with the stakeholder's contributions at the learning seminar "Enhancing Services for Rural Innovation Networks" that took place at Vila Real (Portugal), in February 2015.

The report has been structured in order to introduce each of the WP4 case studies and describe the networks investigated. Next a short comparison of the five networks is presented. The findings are presented in three sections (4, 5 and 6). A final section is devoted to the discussion of key insights and to present some policy recommendations based on the cross-comparison of the case studies analysis and the insights from the participants at the Seminar held in Portugal.

2. Introduction to case studies

This section presents a brief description of each of the individual networks studied, for which their locations are highlighted in Figure 1. The final part of the section is devoted to a cross-network comparison highlighting their similarities and dissimilarities, and the reasons that underpin these findings.

Figure 1*: Location of cases studies by country*

[1] http://www.solinsa.org/

2.1 Policy-induced agricultural innovation network in Brandenburg, Germany

This network was situated in Brandenburg and involved scientists, farmers, associations and a public authority. It was set up in the context of a project, funded by the German Ministry of Education and Research, and focussed on developing innovative strategies for adoption of practices to counter climate change. Concretely, the studied project and network aimed to test and evaluate crop seed varieties under different climatic conditions. The planned activities were carried out on time, and the project can be considered successful in terms of its realised activities and goals. After a stable working phase of five years, despite an interest in its continuation by a majority of its members, the network dissolved in 2014 due to a lack of available funds for any follow-up network.

The network was established and ran within a period of public service downsizing in related fields and with a complete lack of public advisory services. The analysis showed that the project – funded under an initiative of the German Ministry of Education and Research – filled in several of the gaps that were generated by the weak public structure. Prominently, it brought scientists and practitioners together. Also, due to cooperation between a number of associations and the University chair, as well as previous cooperation with practitioners, the project initiators were able to define the topic in such a way that was interesting to both the practitioners and the scientists in the project.

This network was established as one of several networks within the government-funded project known as the "Innovation Network of Climate Change Adaptation Brandenburg Berlin (INKA BB)". Apart from this umbrella-project INKA BB and its funding source, the network is located in Brandenburg, with its regional AKIS and advisory services. In Brandenburg – opposed to the majority of German states ('Länder') – there are no official, publicly funded general advisory services for farmers. Therefore, farmers rely on private advisory services when/if they can afford these services. Additional features of the AKIS include the strength of research institutes in dealing with agricultural topics, such as landscape and climate change. In addition, the proximity to the national capital Berlin, with its various public authorities, international conferences, events such as the 'Green Week', and more universities (one of which has an agricultural department with a long tradition), is another important factor. Like other German states, Brandenburg has its' own Ministry for Rural Development, Environment and Agriculture, as well as a Ministry for Infrastructure and Regional (Land use) Planning, each with subordinate authorities. In the context of the specific topic, it is important to mention that, Brandenburg – like other German – states, had and partly has a public seed trial system, which was responsible for testing seed varieties under controlled conditions and regularly supplying farmers in the state of Brandenburg with neutral, science-based recommendations on specific seed varieties. Due to a lack of funds, and a shift in political priorities, this system is currently being dismantled.

In terms of agricultural production, a structure of big farms is characteristic for Brandenburg, as a result of the history of collectivised farming. In 2010, the average farm size in Brandenburg was 240 ha (compared to an average of 56 ha in Germany as a whole) (Boenning and Knierim, 2014). The four participating farms collectively operate over 1000 ha, with the largest farm operating over approximately 500 ha. With this, they all fall into the biggest 6.4% of farms in Brandenburg. They fit the characteristics of bigger and more innovative farms that represent the dominant type of farms involved in INKA BB (Bundschuh and Knierim, 2013). The management is led by people who, in most cases, have received a Master degree at one of Berlin's Universities.

More detailed information on this case study can be obtained in the respective country report (Boenning and Knierim, 2014).

2.2 Anti-Mafia Innovation network: from land to fork! Italy

The Italian case study focusses on the emerging rural innovation network in the so-called *Land of Fires*, an area in the Northern Campania region (Southern Italy) that is infamous for the socio-economic and environmental impacts of more than two decades of waste crisis. The network involves cooperatives who work on land which has been confiscated by the Mafia, environmental activists, associations, public and private actors (citizens and companies) fighting against dispossession and contamination of territories, and against Mafia culture.

The study analysed the "economic heart" of this emerging network which is also a smaller formal network: the consortium of social cooperatives called NCO (Nuova Cooperazione Organizzata, New Organized Cooperation). To confront the current crisis of the European welfare state, the NCO cooperatives advance social inclusion, through the agricultural work of disadvantaged people (mentally ill people, former prisoners, immigrants and unemployed people), with the ambition of becoming sources of “ethic economic wealth”. The NCO is a consortium, founded in 2012, involving five ‘social cooperatives’ which share common interests, principles and have the same vision of their community. Formally, only four cooperatives joined the Consortium (Al di là dei sogni, Eureka, Agropoli, Millepiedi), but for the purposes of this case study the cooperative of Resistenza who are very cohesive, was also included.

NCO cooperatives are the key actors in the *core network* and are formally linked to the Consortium. It ironically takes the acronym of the *Nuova Camorra Organizzata* (New Organized Camorra known as NCO), which was a powerful mafia organisation founded in the late 1970s by Raffaele Cutolo to renew the old rural Camorra and create a real business organisation. The vision of the Consortium emphasises that it is necessary to organise people and to establish networks to join forces to fight against the Mafia whilst also struggling with the prejudices associated with disadvantaged people. In the Land of Fires, which is marked by unemployment and by irregular and exploitive working conditions, especially within the agricultural sector, the cooperatives promote fair and horizontal work relations, even with marginalised people. They practice mostly organic agriculture, avoiding pesticides and inorganic fertilisers, adopting crop rotation systems to replace nutrients in the soil. They minimize and recycle the farm waste making compost for fertiliser. The cooperative also tries to regenerate and use local seeds and plants, sometimes in cooperation with a regional research institute, becoming both users and custodians of biodiversity in connection with local knowledge and the farming communities. This innovative *land use* involves a cognitive and cultural re-orientation that assumes a purely non-instrumental relationship with the environmental and territorial resources, the labour force and with consumers. This agricultural value is not only measured in economic terms but also in social values provided *for and with the community* (Caggiano, 2014).

Following the general decentralisation of Italian AKIS, Campania region has a peculiar AKIS in which the public component plays, a crucial role, directly and indirectly, although its role has decreased in recent years. The Agricultural Advisory Services (AAS) provides important technical support services (such as agrometeorological and plant protection services), manages the applied and experimental research programmes, agriculture databases, variety improvement programmes, quality of agricultural production, promotion of local products, etc. In addition, AAS also provides the

administrative management of the Rural Development Programme (RDP) measures. This system has an active role in supporting the agri-food sector of Campania and its innovation processes. Over the years, the role and the objectives of the regional AAS are changing following the general change in direction of the European Union (EU) agricultural and rural policies, with the main objectives focussed on integrated rural development together with sectoral competitiveness. However, nowadays, advisors are engaged more and more in bureaucratic and administrative tasks and are thus losing contact with the farmers in the field. Other important services providers in the regional AAS are the local units of the Italian Farmers Unions, the Regional Breeders Association of Campania, the sixteen local fruit and vegetable producer organisations, the downstream and upstream industries (especially seed, fertiliser and pesticide providers) and the private professional advisors (there are actually sixteen advisory bodies accredited for the FAS measures of RDP).

However, the network lacks specialised technical advice and extension services for organic farms, which the cooperatives mainly access through external sources and informal channels (other cooperative and farmers). Other relevant sources for knowledge and information are downstream firms and organisations, such as plant and seed suppliers and private control bodies for organic certification.

More detailed information on this case study can be obtained in the respective country report (Caggiano, 2014).

2.3 The berry networks in Portugal

The selected Portuguese case studies were: (1) the *Cluster of Small Fruit* (CSF) and (2) the *Drosophila Suzukii Monitoring* (DSM). The first is a horizontal nationwide sectoral network established in 2014; its coordination structure comprises the main facilitators of knowledge sharing and diffusion processes. It is composed of both experienced and inexperienced producers and a diversified set of other actors, such as: private agricultural advice companies, independent consultants, several FBOs (cooperatives, farmers' groups and associations) and up and downstream industry firms, amongst others. The DSM established in 2014 is a regionally located, hierarchical but informal network led by a coordinating body (Regional agency of the Ministry of Agriculture) which also involves farmers and facilitators (FBOs).

The CSF network involves the full range of actors in the berry production sector (blueberries, raspberries, strawberries, gooseberries, for example) and is itself instrumental in organising the sector, specifically the knowledge and information supply to meet to the current heavy demands of farmers and their organisations. It may be considered a relevant case study in the Portuguese AKIS context, not only because of its national and sectoral importance, but also due to its unique position: on the one hand it shows how FBO and private advice can organise themselves in order to meet farmers' needs and demands and, on the other hand, it identifies these organisations' limitations in providing quality support to a novel and knowledge-intensive sector.

The second network, DSM, presents a model designed to create and store knowledge that is fundamental both at the regional/local and sectoral levels, when dealing with crop pest-monitoring, and one that engages farmers in the process of co-creating knowledge. The DSM is geographically a well-defined network, located in the central-northern region. The network is co-ordinated by a public regional agency of the Agriculture Ministry and the members are farmers, mostly inexperienced berry producers, who were selected by the FBOs and private firms that they (the producers) are

linked to. As regards to these organisations, the private firms act as facilitators, identifying the farms which are suitably located for field experiments and the farmers who are actively exchanging knowledge as well as having the ability to implement and maintain the scientific experimental tests designed to detect the Drosophila Suzukii, the insect pest responsible for devastating this crop and to store and report the data collected.

More detailed information on this case study can be obtained in the respective country report (Madureira *et al.*, 2014).

2.4 Monitor Farms in Scotland, UK

In the Scottish case study 'monitor farms' were investigated as an example of agricultural/ rural innovation networks. The Scottish Monitor Farms Programme is delivered by Scottish Government in collaboration with delivery partners. Delivery partners include levy bodies (Quality Meat Scotland, DairyCo, Home Grown Cereal Authority), National Farmers Unions Scotland and the Scottish Organic Producers Association. Between 2009 and 2013, 18 Monitor Farms were established by the Scottish Government and the Delivery Partners. To date a total of 40 monitor farms have been initiated in Scotland, funded mainly through the Scottish Government's Rural Development Programme Skills Development Scheme.

The Scottish Monitor Farms Programme is co-ordinated by the Monitor Farms Development Group, made up of funders, project managers, the Scottish Government and a Facilitator representative. The MFDG approves the Monitor Farms Programme strategy (Creaney *et al*., 2014). The strategy called for closer co-operation between funders, greater emphasis on the collection and use of baseline data, greater support for farmers and facilitators and closer links with industry and research bodies. The Monitor Farm strategy stated that improvements to knowledge transfer to the Scottish agricultural industry lay at the heart of the Programme.

Two of the selected monitor farms – Hartbush and Arnprior – were investigated in detail via interviews and participant observation, with findings from observations and informal talks at the third farm – Savock – used to complement these results. Different farmer types participate in the monitor farm network, representing the range of enterprises in the geographical area of the monitor farm, as well as young farmers and new-entrant farmers. Many participants were known to each other prior to the initiation of the network, from other groups or memberships, or from farming in the same area. The selection of topics covered in the Monitor farm meetings is relatively farmer-led as they are determined by the management group made up of 5-8 participating farmers that want to become more involved. Around six meetings are held on the monitor farm per year, comprising visits to different areas of the farm to discuss current/relevant issues, and often incorporating a visiting external speaker or specialist. Meeting attendance is influenced by weather, the perceived relevance of the meeting topic, members' personal connections with the monitor farmer, and the timing of meetings close to other events and in relation to important periods in the farming calendar.

There are many links between the monitor farm programme and existing knowledge and advisory services, not least due to the role of the programme facilitators, many of whom are agricultural advisors, and through the wider network including invited specialists, industry representatives and student/researcher attendees. As this investigation into the monitor farm programme reveals, the network provides an opportunity to bridge gaps in advisory services, for example, providing practical on-farm demonstrations. As the objective of the monitor farm network is to develop best practice

through on-farm changes, the processes and dynamics developed to generate and exchange knowledge for co-innovation focus on communication, knowledge exchange and co-creation, for example through the informal discussion and sharing of ideas and experience between monitor farm participants.

More detailed information on this case study can be obtained in the respective country report (Creaney *et al*., 2014).

3. Cross-country comparison of the cases studies

A common denominator across the networks studied, with the exception of the Italian case study, is that they all filled gaps in the Agricultural Knowledge, Information and Innovation System (AKIS) in the regions and/or sectors in which they are situated. The network studied in the Italian case also filled a gap in the regional/local AKIS (advice for organic farms), although the reasons for the establishment of this network were rather different and broader in comparison with the other case studies. The four cases illustrated quite diverse network models reflecting the agricultural/rural diversity across Europe, the different AKIS at regional/national level, and as well as the diversity of problems and potential solutions that the innovation agricultural/rural networks can address.

All the networks involved the cooperation of a varied range of actor's, providing examples of multi-actor networks which enhance the farmer's innovation capacity in cooperation with other rural (and non-rural) actors through social interaction and collective learning. The studied networks were all, with the exception of the Italian case, focused on the agricultural sector. The 'Anti-Mafia' was a rural network involving and integrating a diversity of sectors, including social and health care, agriculture and ecological restoration. The Monitor Farms (Scotland/UK) and the Cluster of Small Fruits (PT) configure broad networks in terms of scope and/or number and diversity of actors involved, and might be envisioned at some extent as rural networks.

It should be noted that none of the selected networks has received support from the respective country's Rural Development Programmes (RDPs). The innovation network for developing climate change adapted seeds (in Germany) and the Monitor Farms in Scotland were funded through national funds. The Portuguese 'Cluster of Small Fruits' (CSF) network was funded by EU structural funds. The NCO cooperatives that constitute the core of the Anti-Mafia innovation network decided to invest in agriculture as way to give economic sustainability to the network, by reducing its dependency on public funds for health and social services that are often delayed and discontinued. The *Drosophila Suzukii Monitoring* (DSM) network case in PT was not funded, not by public or private funds, and depended on the voluntary time and work contributions of the involved actors (researchers, technicians, facilitators and farmers).

Regarding innovation, the German case study typifies a policy-funded innovation network in the sense of a network established to develop or rather test a particular innovation, in this case to enable the farmers to select the crops adapted to climate change, by involving scientists and farmers. The success of this collaborative innovation process appears to have been made possible by a number of factors, including: (1) available long-term public funding (5-years); (2) the development of a R&D-based innovation of direct and 'immediate' interest for farmers (continuously important decision to select the right seeds); (3) the familiarity (geographic and cognitive proximity) between farmers and scientists derived from the fact that the farmers involved had received advanced academic training in

the higher education institution leading the network, enabling them to understand the specificities of the scientific research more easily. While the planned activities were carried out professionally and led to both published results and some learning by the participants, the actual uptake of the potential innovation by the farmers is doubtful.

The Monitor Farms were not explicitly focussed on innovation. They were funded for shorter periods (3-years) in comparison to the German case (5-years), and intended to promote improvements in the profitability, productivity and sustainability of the farms. However, they are an innovative model for providing advice and extension in a holistic and transversal way (including regarding production, business development and other aspects simultaneously). In that sense they overcome a limitation which is commonly highlighted in advisory systems/services with regards to their difficulty to adequately respond to the diverse needs and demands of farmers. These networks enhanced farmer's incremental innovation in farming practices and processes, as well as in business development, through collective learning processes which were leveraged by the effect of demonstration, produced by the Monitor Farm to show the results of changes to the farm practices which were introduced at different levels: production, management, business development amongst others.

Similarly, the Portuguese network 'Cluster of Small Fruit' cannot be considered a 'typical' innovation network. Their concerns were similar to those of the Monitor Farm programme, given its main goals are to enhance the competitiveness and sustainability of the small fruit sector in Portugal. The two networks differed regarding the scale at which they promoted these goals: (1) at the farm level, in the case of the Monitor Farm programme; (2) at the sectoral level in the CSF network. Nonetheless, the CSF was also an innovative platform for delivering advisory and extension services at a sectoral scale. In comparison to the Monitor Farms, the major concern of the CSF was to guarantee the availability of quality farming advice for a large number of newly-established and inexperienced farmers. Therefore, the network primarily addressed the knowledge absorbers and innovation adapters. It also involved mature producers, which improved the network by exchanging their knowledge and experience, and which resulted, to a large extent, in innovative behaviour through network members' continuous attempts to improve the productivity and sustainability of their orchards along with their business profitability. In addition, it is expected that in the upcoming years the currently inexperienced producers will obtain more of a capacity for innovation building and less as passive absorbers of knowledge, as most are highly educated people, hoping to be successful in their farming activities.

Both networks, Monitor Farms and 'Cluster of Small Fruits', joined together farmers, advisers (FBO, public and private), researchers, experts, down and upstream industry and other actors (e.g. accounting, certification consultants and project developers). These networks enabled the interaction among the entire range of actors involved in the respective farming activities and for that reason they were platforms to enhance knowledge exchange. However, the Monitor Farms appeared to be far more powerful in that respect, in comparison to CSF, given that they offer farmers and other actors a holistic and repeated opportunity to experience and observe farm improvement (or not) as a result of changes (innovation processes), i.e., a way of participating more or less actively in the actual innovation processes taking place at the Monitor Farm. These experiences were expected to develop innovative behaviour amongst the participating farmers through mimicking, experimenting, testing and evaluating innovation adoption processes anchored in their enhanced

innovative capacities, on their farms. On the other hand, the CSF network included more farmers than the model of a Monitor Farm could cater for.

The Portuguese network *Drosophila Suzukii Monitoring* (DSM) illustrates a case of cooperation between technical-scientific actors and farmers with the support of a group of facilitators (FBO and private producer groups to whom farmers are formally linked to). This network does not directly address innovation, instead comprising a learning network. However it demonstrated the potential to enhance co-innovation among farmers derived from enhancing their innovative capacity and stimulation to participate in social networks.

The 'Anti-Mafia' network was an excellent case of social innovation undertaken by a rural network that has been created to address a social problem through collective action involving different actors from different sectors. This network used agriculture as a foundation to promote smart, inclusive and sustainable growth as stated by the European Agenda 2020. Organic farming was promoted in association with a number of marketing and organisational innovations, including the creation of a collective brand, adopting fair trade and exploring the proximity to the consumer through short food chains. Their approach was to employ staff from socially-marginalised groups of society, such as the disabled, unemployed, and immigrants. Thus, the network aimed to develop innovative patterns of employment alongside social innovation. In addition, by adopting organic farming, the network progresses the environmental sustainability of the degraded soils and landscapes.

The 'Anti-Mafia' case study illustrates how helpful social innovation can be to unlock growth potential in rural areas. It showed that social innovation must be placed on the EIP-AGRI agenda as well as on the rural innovation agenda in general.

The comparison of case studies highlighted that multi-actors networks are actually able to deliver advisory services within innovative formats that overcome some of the limitations of the conventional advisory systems. They enable multi-topical advice, enhance the farmers' role as creators, co-creators and converters of knowledge, and reduce the distances (geographical and cognitive) between farmers and other actors, such as researchers and experts.

It also showed that somewhat different network arrangements are possible to address similar problems/solutions. This diversity is due to contextual differences and the available options (e.g. with regards to funding).

4. Network features and main knowledge flows involved

4.1. The features of the network: comparative analysis

Table 1 presents a comparative description regarding the main features defining the structure of the five studied networks. It illustrates their diversity with regard to the contexts of their origins and its establishment. It is noteworthy that even in those cases where the initiative for the network creation was top-down these tend to function through a bottom-up approach with a prevalence of horizontal and a mix of formal and informal interactions (as shown in Table 2). Most of the networks are individual, one-off or even ad hoc initiatives, with the exception of the Monitor Farms programme in Scotland. This suggests that networks are still not regarded as essential collective learning, advisory

and co-innovation tools for agriculture and rural development, or, that the official frames within which they sit do not fit the needs of the actors in the ground.

Table 1: *Networks structure*

	'Adapting seeds to climate change', DE	'Anti-Mafia', IT	'Cluster of Small Fruits', PT	'Berry pest monitoring', PT	'Monitor Farms', Scotland
Context for network(s) establishment	Research Programme	Collective action	Sectoral initiative	Institutional but 'ad hoc' initiative	National Programme
Initiator	National research founder	Local care cooperatives	Local authority	Government department	Government
Geographical scope	Regional	Local	National	Local	Local
Temporal scale (duration in years)	2009-2014	Established 2012	Established 2012	2013 - 2015	2011 - 2014
Scope/field	Specific problem oriented – agricultural	Territorial oriented- multi-sectoral	Sector oriented – agricultural	Specific problem oriented – agricultural	Sector oriented – agricultural
Leadership	Science-led network	Cooperative-led network	Farmers-led network	Government-led network	Farmer and facilitator-led network
Funding	Public (national research funding)	Self-funded (social / health funding)	Public (EU structural funds)	Self-funded	Public with industry contributions

Table 2 emphasises the multi-actor character of the networks, the prevalence of the horizontal multi-directional interactions, and the importance of informal interactions, which are fundamental reasons for the success of the networks. The network configuration, as well as the actors involved and the way they interact, reflect the AKIS structure and capacities in the different countries to a large extent.

Table 2: *Network's main actors and interactions*

	'Adapting seeds to climate change', DE	'Anti-Mafia', IT	'Cluster of Small Fruits', PT	'Berry pest monitoring', PT	'Monitor Farms', Scotland
Main actors and their roles	**Research and higher education (scientists):** Project co-ordinator, innovation evaluators. **Farmers:** Innovation testers and evaluators. **FBO**: producer's representatives. **Public sector**: Choosing/suggesting crop seed varieties for testing.	**Cooperatives**: consortium coordination and core network. **Regional and local authorities of healthcare and social systems**: legal compliance, collaboration, funding. **Social Farming National Forum**: knowledge exchange. **Public sector (AAS and research:** knowledge exchange and advice in no-production topics. **Organic farming accredited certification bodies**: technical and compliance advice.	**FBOs:** Coordinator, facilitators. **Farmers:** knowledge and advice suppliers and demanders. **Public sector (advisory, local governments):** Enablers, facilitators, knowledge exchanger. **Research and education (public and private):** Knowledge creator/exchanger. **Private Sector (up and downstream firms and companies, consultants):** knowledge and advice exchangers	**Public sector (regional agricultural technical services)**: Coordinator, facilitators. **FBOs and private producer groups**: facilitators **Farmers:** co-creators of knowledge.	**Public sector:** provide funding and high level coordination. **Private advisory sector**: Co-funding and facilitators **Up and down-stream industry:** Technical advice and co-funding **Research and education:** Technical support and advice (limited); **Farmers**: co-creators of knowledge and innovation.
Int	Horizontal, vertical and formal	Horizontal, formal and informal	Horizontal, formal and informal	Vertical and informal	Horizontal, formal and informal

Table 3 describes the specific goals and main drivers of the various networks. The different goals and drivers of the networks explain their structure and governance heterogeneity to some extent, whilst, as already said, this heterogeneity is also due to the contextual and funding opportunities available across the countries.

Table 3: *Network's goals* and drivers

	'Adapting seeds to climate change'	'Anti-Mafia'	'Cluster of Small Fruits',	'Berry pest monitoring',	'Monitor Farms'
Specific goals	Developing, testing, implementing and evaluating innovative adaptation strategies in agriculture in the context of climate change	Link agricultural practices and care services and to implement different social farming activities	Enhancing the knowledge and expertise in the field of orchard planting and cultivation; collecting and storing information on markets and prices, promoting the sector	Prevention and control of crop pests	To develop best practice through on-farm changes; To develop the processes and dynamics to generate and exchange knowledge for co-innovation.
Mina drivers	Developing, testing and evaluation of innovations, with regard to selected seed varieties	Promoting social farming as a practice that uses agricultural resources to provide rehabilitation, social or educational care services for vulnerable groups of people	Enhancing the competitiveness and sustainability of the berry sector	Making available local synthesised knowledge on pest crops prevention and control	Improving the profitability, productivity and sustainability of Scottish farmers by discussing and demonstrating business improvement.

Regarding the dynamics of the various studied networks, it is important to underline four aspects:

- Firstly, the networks were studied in **different phases of their life-cycle**: the Portuguese cases were studied during the initiation phase, whereas the German case studied a network that had finished. More mature networks, whilst still in their developing phases, were studied in the Italian and the Scottish case.
- A second related aspect is the **dependence on public funding** of most of the networks. All three networks directly addressed structural gaps in the country's AKIS, but do not seem to be able to be self-sustaining. 'Anti-Mafia' rural network is driven by being self-sustainable, however funding to initiate it was also needed. The 'berry pest monitoring' was a singular experience; its model replication and systematisation would certainly require public funding.
- A third aspect, which relates to and explains the networks' public dependence, is that a **determinant of the farmer' enrolment is the absence of fees**. We noted that farmers are generally willing to bear travelling expenses and time opportunity costs, and appear to be satisfied with the gains of their participation, namely in the cases of Monitor Farms and CSF. This suggests that the costs of funding innovation networks might be considered more cost-effective in comparison with other advisory options. The German case is different in this regard, as it involves explicitly economically strong farms, which are able to 'invest' into the project with small areas of their ground and with labour provided by their firm. This does not contradict the overall conclusion, but rather points to the fact that the financial conditions of the networks might have a strong impact on the types and groups of farmers participating.

- Fourth, **previous informal relational capital and trust** may be determinant for farmers to enrol and participate in the network.

The importance of previous relationships and informal contacts to the social cohesiveness of networks is highlighted in all the cases.

A key factor for the stability of the 'Adapting seeds to climate change' network was, as emphasised in the respective country report (Boenning and Knierim, 2014), the previous inter-personal and professional relationships and mutual understanding between the farmers and the scientists involved. This was because many of the farmers were former students and alumni of the research and higher education institution leading the project. The small number of actors involved (only eight organizations in total with four farmers) has also probably supported the network stability throughout its life-cycle of five years. Professional management and a good choice of topic at the outset can also be assumed to be important factors.

In the case of the 'Anti-Mafia' network in Italy, previous contacts, interactions and inter-personal relationships between the founder cooperatives have also shown to be helpful in building the trust needed to establish the consortium. This allowed for the establishment of strong ties that support effective communication and knowledge sharing, and the innovation capacity of both consortium and individual co-operatives. In the broader network, led by the consortium, stability comes from shared values derived from anti-mafia attitudes and belief in a social alternative economic model to the sustainable development of the region of the 'Land of Fires'.

The 'Cluster of Small Fruits' in Portugal showed social cohesion amongst the mature producers, mostly situated in the South, again to a large extent derived from long-term inter-personal and professional relationships, in addition to contact between farmers and other professionals, such as researchers and traders. In the North-Central region, where most of the inexperienced and small-scale producers were located, the social cohesion of the network was more unstable. This reflects the immaturity of the network alongside with the youth of the sector, and the prevalence of newly-established farmers who are just beginning to create their own social and professional networks. A dispute regarding the fruit production of the small-scale producers raised by assemblers and traders has been a factor of sector fragmentation in this sub-region that contributed to some mistrust and limited cohesion within the network. The maturation of the new-entrants producers in the sector will be important in the future in overcoming the challenge of cohesiveness faced by this network.

The stability evidenced by the 'berry pest monitoring' network (PT) shows that newly-established farmers are eager to work together and cooperate more. They are achieving this though building their own micro social and professional networks, as a way to learn through sharing knowledge, information and experiences.

The 'Monitor Farm' networks in Scotland also provide evidence regarding how farmers value informal and neighbourhood connections. Previous personal and professional relationships and contacts enhance the adherence of farmers to the Monitor Farm (and respective farmer). The social aspects of participation appear to be of special value in this case, where the 'free meal' and opportunity to socialise with friends and acquaintances, as well as to enhance personal social networks, act as a determining enrolment factor.

The value that farmers assign to previous informal relationships and to the opportunity of socialising with peers and other professionals experienced provided by the networks should to be highlighted

given that it can show a determinant feature to the success and effectiveness of learning and innovation within agricultural and rural networks.

A further important aspect related to the networks' dynamics in terms of their social cohesiveness is how they address tensions, namely respecting cooperation versus competition, when the members (i.e. farmers) are competitors. In this case, previous relational and trust capital showed to be a decisive factor, although this tension can be surmounted by identifying/and focussing on shared goals.

In the case of the 'adapting seeds to climate change' network in Germany, longer-term inter-personal and professional relationships arguably contributed to the high level of trust and cooperation in the network. The tensions in the 'Anti-Mafia' network are more likely to be related to diverse and often divergent interests and opinions, given the multi-sectoral nature of the network. Therefore, it is unsurprising that the adhesion to common and clearly-stated anti-Mafia values is demonstrated as a crucial element to binding actors together, creating a clear identity that enables cooperation and innovation.

The 'Cluster of Small Fruits' network in Portugal constitutes a network of competitors and tensions that are mainly due to fragmentation caused by the myriad of organizations competing with each other to engage newly-established and small-scale farmers, causing mistrust among the players and instability in the sector. Mature producers act as a cohesiveness factor given that they are aware (and some of them willing to contribute as knowledge suppliers) of the importance of quality advice in the sector to ensure the quality of the production, which in turn is critical to ensure the international reputation of Portuguese berries. The founders and other actors involved in the CSF also focus on this cohesiveness factor, by enhancing the sharing and cultivating of the concern with the international reputation of the berries, which is fundamental to maintaining and expanding the external markets where the fruits are currently placed.

'Monitor Farms' in Scotland also represent a 'competitors network', but the value perceived by farmers for learning from each other, providing support through sharing ideas and solutions to common problems, as well as the socialising opportunities, surmount competitive tensions. There can be competitive tensions in the Monitor Farm selection if there is more than one farm nominated in the catchment area. Nevertheless, Monitor Farms represent best practice in terms of networking through farmer' cooperation, in particular given that the farmer responsible for the Monitor Farm has to disclose the results (including financial) of the changes introduced in the course of the innovative processes undertaken on their farm.

4.2. Main knowledge flows underpinning the networks

Table 4 summarises the main knowledge processes taking place within the networks, including the description of the main methods applied and the involved actors. Despite the diversity of the networks with regard to structure and content, they all encompass the major knowledge processes in the AKIS. In addition to the exchange (or sharing) and conversion of knowledge, which are anticipated in networks, the importance of co-creation highlights the role of these networks as tool to enhance co-innovation. While the different networks enhance diverse innovation patterns, as shown in Figure 2, they all represent innovation processes based on collective, interactive, learning involving multiple actors, as acknowledged by the EIP framework (EU SCAR, 2013).

Given that the terminology respecting the knowledge processes is often fuzzy due to the use of a significant number of different terms to identify the same processes, whereas the opposite is also frequent, i.e., the use of the same term to designated different knowledge processes, the terminology here adopted is briefly introduced. Co-creation is defined as the joint creation of knowledge build on communication processes which take place within a shared practice by different actors (e.g., Regeer and Bunder, 2009). Although, the concept of co-creation is more commonly associated to the joint creation of knowledge involving scientists and non-academics, in this case farmers and R&D actors (Schneider et al., 2012), it is also used to describe the joint creation of practical knowledge by farmers, in general involving also other actors (Mauser et al., 2013). The knowledge exchange within the networks context entails mainly the share of messages, experiences, and information. There was also, in all the cases, exchange of knowledge and information from and to the outside of the network, involving processes of dissemination or diffusion of information (respecting the processes of transmission, exchange, dissemination and/or diffusion of converted knowledge and information, see e.g. OECD, 2012). Another relevant knowledge process for most of the networks is the storage (and/or accumulation and retrieval) of data and information. This is an important process to support innovation and to enhance the knowledge generation and dissemination

Table 4: *Knowledge processes: methods and actors involved*

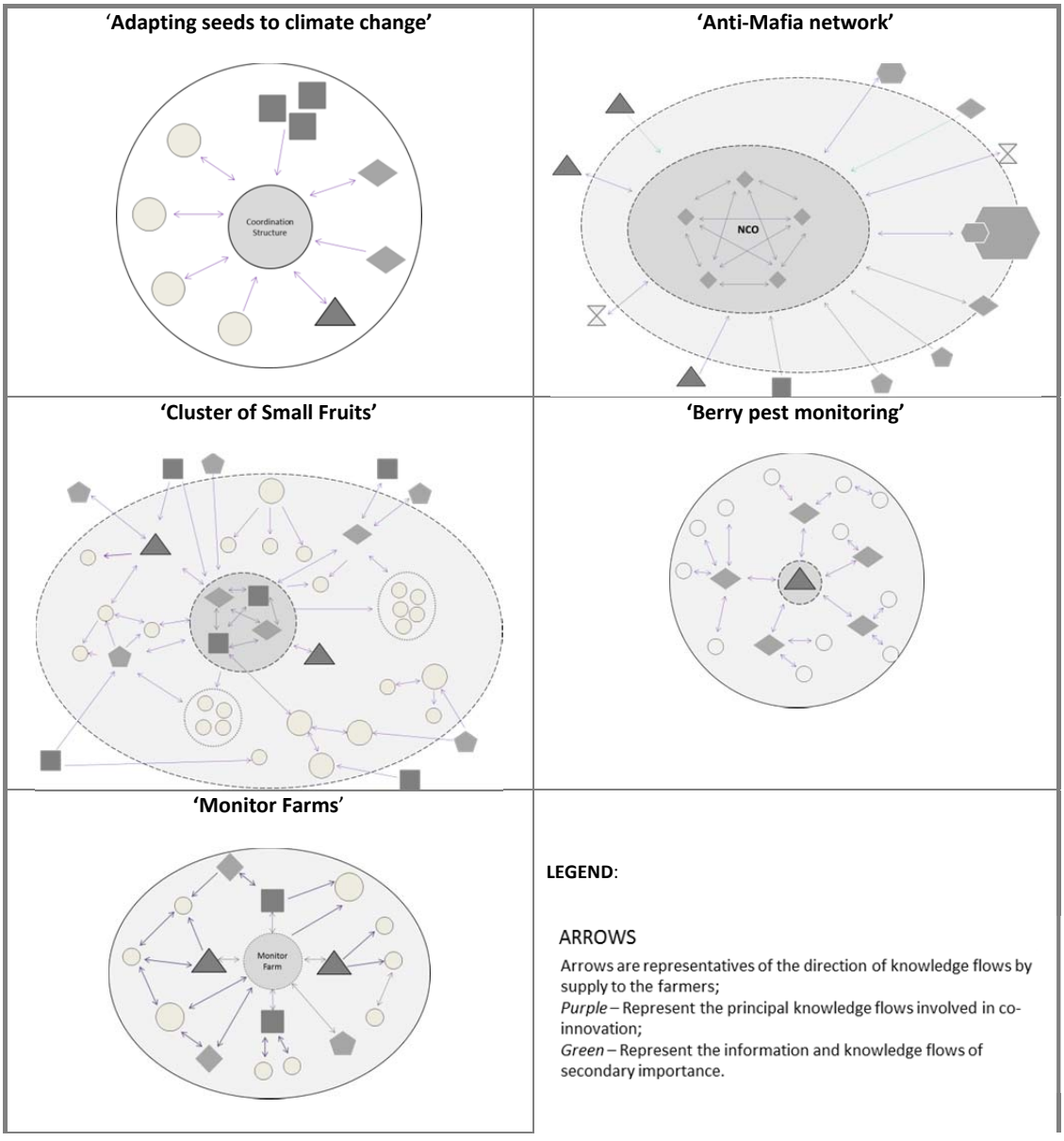
	'Adapting seeds to climate change', DE	'Anti-Mafia', IT	'Cluster of Small Fruits', PT	'Berry pest monitoring', PT	'Monitor Farms', Scotland
Co-creation of knowledge and innovation	Experimental field trials and discussions in meetings where the main actors involved area the scientists and the farmers.	Experimental field, meetings, fairs and other bottom up learning processes, involving many actors and local institutions, in particular, NGOs, health and social services, public research institutes.	Co-creation of codified knowledge through the elaboration of technical handbooks, done in collaboration involving the R&D, sectoral association and experienced producers.	Experimental field trials, involving technical-scientific staff from regional public advice services and producers.	Discussions in management group meetings; trials on the monitor farm, involving all monitor farm network participants, facilitators, visiting speakers.
Knowledge and information exchange	Within the network in the project meetings; external to the network in events such as the 'Farm Field Days', public conferences and Fairs - All actors involved.	With local and external actors (Libera, National Forum of Social Farming) through participation and organization of conferences, guided tours, work camps.	Presentation by invited speakers and experts, field visits and training courses; social networks, face-to-face informal contacts, by all network actors.	Workshops and producer meetings, social networks, face-to-face informal contacts by all network actors.	Presentations by invited speakers during monitor farm meetings and opportunity for questions from Monitor Farm participants.
Knowledge storage	Databases and publications. Led by the scientists but involving also the public authority representative and the farmers.	Through the consolidation of the practices inside the network.	Technical handbooks; minutes, presentations of technical-scientific events and other technical publication.	Databases collected by farmers and processed and stored by the technicians and scientists.	Reporting of the monitor farm meetings (minutes, fact sheets) done mainly by the facilitators.

In addition, in some of the networks, e.g. in the case of the PT networks and the Monitor Farms, were observed vivid processes of conversion and integration of knowledge through the knowledge and information application in the agricultural practice by the farmers, namely in interaction with their peers by communicating informally with neighbours and other farmers through social networks

and in informal contacts in the course of the formal meetings, technical visits and training courses arranged by the networks.

The analysis of knowledge flows, by observing the processes, methods and actors involved, shows that the selected innovation networks might be a complementary approach (or in specific cases even an alternative) to conventional advisory services, in particular by filling structural gaps in national or regional AKIS. The networks facilitate the interaction of different actors and roles, engage farmers actively in the knowledge processes, and are able to integrate the entire knowledge chain (creation, conversion, storage and use). Thus, as mentioned, their potential as a multi-topic advisory alternative should be studied in-depth, including their potential cost-effectiveness regarding conventional systems that are increasingly being dismantled across Europe, due to their costs to public budgets.

Figure 2 depicts, in a simplified way, the respective interaction of the main actors in the knowledge flows, underpinning the various networks.



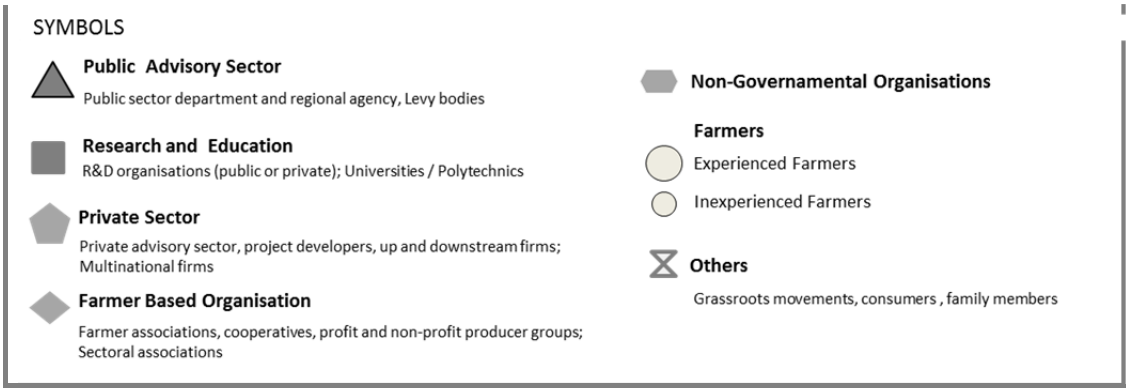


Figure 2: *Knowledge flows in innovation networks*

Figure 2 highlights the diversity of knowledge flows associated to the various networks. The policy-induced innovation agricultural network in Brandenburg ('Adapting seeds to climate change') has well-defined boundaries due to its formality as a result of being a research-project based network, led by scientists and involving a lower number of participants. In contrast, the 'Anti-Mafia innovation network' is not a clearly bounded network, involving a multitude of actors, both in type and number, that interact in a multi-directional way through formal and informal communication channels. The stability of the network is assured by the well-defined leadership structure defined by the cooperatives consortium that acts as the turntable of the multiple and diverse knowledge flows underlying the broader network. The main knowledge flows in the 'Cluster of Small Fruits' underline the presence and role of small-scale and inexperienced farmers. These farmers demand knowledge and information from the interaction opportunities provided by the network, either in an isolated manner or jointly with private and farmer-based producer groups, both formally and informally. This is not a bounded network but involves knowledge flows into and out of the network, namely involving mature farmers that demand knowledge from outside the cluster, e.g. from R&D institutions with ICT resources. In this case, a core structure is fundamental to ensure the functioning and stability of the network, composed of four diverse but complementary actors: a sectoral farmer-based organisation, two R&D entities (one of them a specialised private R&D organisation), and an internationalisation facilitator organisation. The knowledge flows underlying the 'Berry pest monitoring' shape clearly this network. This is not surprising giving that the main goal of this network is the co-creation and storage of explicit knowledge. The overall picture of knowledge flows in the 'Monitor Farm' networks relies on a diverse group of farmers and other actors gathering around the 'monitor farm/farmer'.

The importance of the national/regional knowledge infrastructures within their diverse missions and functions, knowledge creation, conversion, exchange and storage, along with the advisory systems and services is evident in the various networks, despite their weakness in several of the cases. The **linkages exhibited by the networks with the available knowledge and advisory infrastructure in the regions** are summarised in Table 5.

Table 5: *Links between networks and knowledge and advisory infrastructure*

Networks	Knowledge and advisory infrastructure				
	Public Advisory Sector	Research and Education	Private Advisory sector	FBOs	NGO
'Adapting seeds to climate change', DE	○	◉		○	
'Anti-Mafia', IT	○	◉	◉	○	◉
'Cluster of Small Fruits', PT	○	○	○	◉	
'Berry pest monitoring', PT	◉	○	○	◉	
'Monitor Farms', Scotland	◉	○	◉	○	

Legend:

○ Links

◉ Main links

The links identified in Table 5 underline the networks ability to mobilise and to integrate this infrastructure (knowledge and advisory sector) in two ways: (1) benefiting from it in situation where advisory services are present, as is the case with the Monitor Farms in Scotland, and (2) benefiting advisory services by filling gaps resulting from the weakness or even absence of advisory infrastructures due to public services downsizing policies.

The **role of place-based innovation networks for the creation of local knowledge** (scientific and synthesised) is underlined by the cases of 'Adapting seeds to climate change' in Brandenburg region, the 'Berry pest monitoring' in the Centre-North of Portugal and the 'Monitor Farms' in Scotland.

The 'Anti-Mafia' rural network is a (best-fit) example of how smart, inclusive and sustainable growth can be implemented at a territorial level, building on collectively shared values. The multi-sectoral and multifunctional character of this network explains its ability to mobilise the different sectors of the regional (and national) AKIS, and as well as how sectoral boundaries in policies, regulations and incentives can be overcome through an integrative and alternative concept of development.

The 'Anti-Mafia' rural network is also an interesting case to highlight the diversity of innovation patterns and dynamics that must be considered by the policies and programmes addressing innovation. There are different types and combination of innovations: (i) product, process, marketing and organisational innovation; (ii) innovation drivers: social, commercial, environmental, and mixed; (iii) innovation scales: market or societal, adoption in-farm, incremental; and (iv) temporal dynamics: continuous and cumulative, disruptive or occasional. Whilst they are all important, it is essential to identify the relevant patterns in each case to enhance productivity, sustainability and profitability, as well as other goals (such as for inclusiveness or quality), for agriculture.

The case studies show a diversity of innovation patterns and the aforementioned aspects (types, drivers, scales, temporal). We recognise a gradient starting with the formal collaborative innovation involving R&D partners and the development of R&D based innovations, to the informal interaction arrangements supporting incremental and other small-scale co-innovation processes. The importance of the latter, the incremental, small-scale and low-tech innovation, is evidenced by the network concentration around them, building on informal and multi-actor co-innovation.

Therefore, the potential of these diverse networks to enhance innovation in agriculture and rural areas needs to be taken into account by innovation policies and agendas. These networks are able to

enhance innovation among small-scale farmers even in contexts where farmers lack formal education, access to advisory services, and innovative capacities. What is important is to place in the scientific and political agendas that we need to know more about small-scale innovation and its cumulative effects in the productivity, sustainability and profitability of agriculture, as well as its impact at the territorial level, in particular in peripheral and less favoured rural areas.

5. Performance of knowledge flows and best-fit practices for advisory services

5.1. Performance of knowledge flows underpinning the innovation networks

The assessment of performance of knowledge flows in the networks was one of the aims of WP4 of PRO AKIS project. Therefore, a brief summary of the country reports is presented for each of the networks.

- Policy-induced agricultural innovation network in Brandenburg ('Adapting seeds to climate change')
  Co-innovation enabled by this network, between farmers and scientists, generated relevant and usable knowledge regarding the stability and yield of specific seed varieties under specific conditions. The network also contributed to strengthening already existing ties between scientists and farmers and it can be assumed that those contacts might also be used in future for exchange and joint initiatives.

- The Anti-Mafia innovation network: from land to fork ('Anti-Mafia')
  The openness and inclusiveness of this network magnified the opportunities for knowledge co-creation and exchange involving a great diversity of actors that enhanced co-innovation at different levels. The innovations carried out contributed to the profitability and sustainability of the organic farming activities managed by the cooperatives of the consortium, which resulted in multiple economic and social benefits. These include getting fair market prices for their products, access to new markets, strong customer loyalty, increased employment opportunities; strengthening of the community bonds, and promoting the economic and social development of the community.

- The 'Cluster of Small Fruits' network in Portugal
  The multi-actors platform enhancing the share knowledge and information created by the CFS network originated effective opportunities for farmers to learn from others, scientists, experts, technicians, other farmers, through intense formal and informal information and experiences exchange. It also enhanced the farmer's ability to cooperate for learning and innovating, as shown by observed examples of farmer-driven innovation. The elaboration of technical handbooks by converting scientific knowledge and adapting it to local-specific conditions, done in cooperation by scientists, technicians and mature producers is another example of good performance of knowledge flows triggered by the CSF network.

- The 'Berry pest crop monitoring' network in Central-North of Portugal
  Producers' networking assisted by producer groups made it possible to co-generate synthesised knowledge at local level, through a trial undertaken by the farmers, with voluntary participation

and without public financial support, illustrating a good example of interaction between farmers and scientists.

- Monitor Farms (Scotland, UK)
  Knowledge flows led to an increase in monitoring and recording of farm performance. Insights from a wide range of trials conducted on the monitor farms were demonstrated to the wider Monitor Farm groups. Positive effects on productivity, delivering cost-savings, increasing turnover, increasing profit and financial performance were more pronounced among the host Monitor Farmers and management group than other participating farmers.

5.2. Best-fit practices for advisory services

The identification of best-fit practices for advisory services was also one of the aims of the WP4 of the PRO AKIS project. Here, best-fit practices are identified in the context of the selected networks: the identified subject might be the networks themselves and/or the way conventional advisory services link with them.

- In the case of the policy-induced agricultural innovation network in Brandenburg ('Adapting seeds to climate change') the network is itself an example of best-fit practice for advisory services. It filled a gap in the weak advisory system of the Brandenburg region, by engaging farmers directly with scientists in the co-creation and exchange of relevant and useful knowledge for farmers. The development of field trials to seed testing and evaluation in the farmers own land also covered, while only temporarily and for a specific subject, a gap in the regional public applied research component of the region AKIS that is abandoning this field trial activity.
- The innovation rural network 'Anti-Mafia' (IT) can also be envisaged in itself as an example of best-fit practice for advisory, giving it engaged a diversity of actors in a process of revitalization and co-production of *place*, according to the vision of territory as a set of relationships, a relational space, instead of a mere physical space or geographical area. The multi-actors feature combined with the large scope of interactions comprised by this network was decisive to fill the existent structural gap in the regional advisory system regarding the organic agriculture. This gap has been addressed with the use of informal channels and practices of self-experimentation, whilst the future availability of advisory services is important in promoting a qualitative leap in the development of this network.
- The 'Cluster of Small Fruits' (PT) is another case where the network itself as an example of temporarily best-fit practice for advisory by filling a structural gap in quality advice for inexperienced farmers in Portugal, in particular when dealing with novel crops, such as is the case with the soft fruits. The formal network were able to induce dynamic interactions among producers and between them and other actors, which has stimulated a myriad of informal and diverse cooperation in micro-networks that resulted in a helpful (self-) advisory resource for both experienced and inexperienced producers. However, there is a significant difference between the micro-networks of each producer group. Experienced producers connect to each other and to researchers, quality advisory technicians and clients (often through their international traders). They are able to use the networking as an effective advisory support due to their experience, skills and relational capital, whilst also being producers and suppliers of

advice to others. Reciprocity, giving and receiving, seems to be a key factor for the cohesion of producer networks, along with trust in each-other's know-how and skills. Inexperienced producers tend to connect to and support each other in the FBO and private producer groups they are linked to. In every case, ICT are intensively used to support communication flows. Producers' networking has shown to be fundamental in the case of the Portuguese soft fruit sector to overcome knowledge and advisory gaps and induce innovation. However, the temporary nature of the network doesn't configure it as a solution to structurally fill the structural gaps in the Portuguese AKIS.

- The 'Berry pest crop monitoring' network, in Central-North of Portugal, is also another case of advisory best-fit practice in itself, with the temporal limitations also encountered in the previous cases. It allowed farmers to create and to use knowledge respecting the prevention of an important pest crop. However, this is an one-off experience that was only possible due to the remains of former best-fit practice in the Portuguese AKIS, regarding the linkage between the applied research and the regional public advisory services. The innovation here was to include the farmers directly in field trial. Nonetheless, replicating this case will entail the involvement of applied research and experienced advisors.
- Monitor Farms (Scotland, UK). The social nature of the meetings has contributed to participants becoming more likely to engage in networks, having taken up leadership or representative roles, becoming more confident at speaking in public, being more willing to adopt new farming methods, and being more willing to share learning, information and practices with others. Two key social outputs noted were the new connections between farmers in a local area and the development of industry networks, which may be defined as 'innovative'. Monitor farms are themselves an example of good-fit advisory model by allowing the delivering of pluralist advice in a holistic way, leveraged by the on-field demonstration of the results of changes in farming and business management practices. However, as shown by the previous cases, the success of these networks advisory function is heavily depending on the quality of the pre-existing knowledge and advisory infrastructure. Their potential as a complementary successful advisory model is proportional to the performance of the latter (pre-existing knowledge and advisory infrastructure).

6. key features of the networks to enhance co-innovation

This section presents the main findings from the presented the case-studies, with respect to the addressed research questions, which were the following:

- Which features of the agricultural/rural networks enhance farmers' ability to co-innovate in cooperation with other actors?
- Which factors influence and encourage farmers to enrol in these types of networks?
- How do the selected agricultural/ rural networks link to existing knowledge infrastructures and advisory services?
- Which factors influence the network's stability over time?
- Do these networks contribute to agricultural productivity and sustainability through innovation as expected by EIP-AGRI, and if so, how?

6.1. Features of the networks enhancing the farmers' ability to co-innovate in cooperation with other actors

Table 6 summarises the main features, as identified in the different case studies (reported in the respective country reports) that appear to enhance the farmer's ability to co-innovate with other rural actors.

Table 6: *Network features enhancing farmer's ability to innovate in cooperation with other actors*

Network features	'Adapting seeds to climate change'	'Anti-Mafia'	'Cluster of Small Fruits'	'Berry pest monitoring'	'Monitor Farms'
Structure	Well-bounded, comprising a limited number of actors.	Broad rural network, managed by a core group of actors.	Multi-actors platform, managed by a core group of sectoral FBO and R&D actors.	Well-bounded, comprising a limited number of actors.	Monitor farm network surround by funding structure by sector.
Actors	Scientists and farmers were the main players; farms big in size and professionally managed.	Cooperatives of consortium are the core, which support formal and informal horizontal interaction of a large number and diverse actors.	Comprising all players involved in the sector of soft fruit, including applied research actors, plus other rural actors, such as local governments.	Farmers are linked with actors from applied research sector; a key role is played by public advisors and facilitators (private, profit and non-profit)	Diverse actors; farmers from a clearly defined monitor farm "catchment" area
Goals & contents	Clearly defined in advance and closely related to the daily work of all involved network members	Clear strategy and objectives	Clearly defined to solve concrete problems	Clearly defined to solve concrete problems	Implementing various measures to enhance productivity and efficiency of farms
Network dynamics	Managed effectively; pre-project bilateral contacts supported trust and cohesion, as did face-to-face meetings	Core network has a very high connectivity, based in interpersonal and professional relationships, together with commonality and trust	Gathering farmers around solving problems; informal co-innovation processes prevail and are mostly based on cooperation led by experienced producers	Gathering farmers around co-creation of needed local-specific knowledge and that is usable by farmers	Open-minded participation with a willingness to be challenged
Elements of the regional AKIS	University education, different major actors, well-connected to others; public advisory services do not exist.	Lack of specialised technical advisory services for organic farming.	Presence and participation of applied research and advisory services has shown fundamental, while limited due to its scarcity.	Pro-active role of technical-scientific staff of the public advisory system at regional level.	Network provides an opportunity to bridge gaps in advisory services, for example, providing practical on-farm demonstrations.

Network features	'Adapting seeds to climate change'	'Anti-Mafia'	'Cluster of Small Fruits'	'Berry pest monitoring'	'Monitor Farms'
Knowledge flows:	Centralized; within the whole group in yearly project meetings; bilateral working meetings; bilateral non-related project contacts Dominant type of interaction was face-to-face meetings	Synergetic effect between formal and informal links, formal/informal and tacit and explicit knowledge sources	The novelty of the small fruit sector and its dependency on locally crop-specific knowledge strengthened the need for the creation and exchange of synthesised and experimental knowledge	Need for locally crop-specific co-creation a and storage of knowledge	Knowledge flows within the group of monitor farm participants; a holistic learning experience coupled with succinct and continuous delivery of information
Key feature	Policy-induced network	Socially-induced network	Experienced farmer-led network	Technical-scientific staff-led network	Constructive communication network

6.2. Factors which encourage farmers to enrol the networks

The aspects of the networks that appear to enhance farmers' ability to join and to co-innovate (assuming the diversity of innovation patterns already presented) in cooperation with other farmers and other actors, relate to their structure, content and dynamic. These aspects are highlighted, in relation with the networks they revealed to be more relevant, in the following bullets.

- The ability of the network to provide opportunities for farmers to learn and build innovative capacity through multi-actors interactions, namely the opportunity to learn interactively through on-farm demonstrations, trials and visits, and as well with the engagement in solving practical problems. This is a key factor for farmer's enrolment in all the studied networks, with a particular emphasis on the Portuguese cases and the Monitor Farms.
- The network ability to offer opportunities for delivering cross-cutting and multi-topical knowledge and information appeared as a decisive factor for farmer's enrolment in the cases of the Cluster of Small Fruits (PT) and the Monitor Farms.
- The addressing of issues and topics relevant to the farmers was a determinant factor for the farmer's engagement in all the selected networks, with a particular prominence in the case of 'Adapting seeds to climate change' Brandenburg network.
- The freedom to enter/exit the networks without complications and the absence of fees attached to the participation are also key factors to enhance the farmer's enrolment in the networks. This is true in all case studies. Nonetheless farmers are willing to bear costs, including time expenditure, travelling expenses and the use of own land for the trials when involved in the network content, since networks provide them opportunities to learn and to acquire relevant information, experience and knowledge according to their judgment.
- Another factor encouraging the farmers to enrol the networks is the existence of previous inter-personal and/or professional relationships, connections, and contacts with other actors in the network and mutual trust (previous relational capital and trust often work as 'seed capital' for network establishment). This is applicable to all the selected networks, whereas it emerges as

more decisive in the cases of 'Adapting seeds to climate change' Brandenburg network and the 'Anti-Mafia' rural network.

- In some cases the networks are also very much valued by farmers by the opportunities they offer them to create and engage on other informal networks. This factor is emphasised in the PT networks, in particular in the case of the CFS, given the informal networking shows determinant to enhance small and micro-scale innovation focused on solving practical problems (e.g., downsizing technologies for small-scale orchards).
- Another important factor for farmers (and other actors) enrolment in the networks is the presence of shared values, such as the ethical livelihoods and lifestyles in the 'Anti-Mafia' case, or the existence of shared goals, despite potentially diverse or even conflicting interests, that happens in the Portuguese CFS network (the international of PT berries reputation).

6.3. Linkages between the networks and the existing knowledge infrastructures and advisory services

An important finding in this regard is that networks often fill structural gaps in the regional (or national) AKIS derived from the weakness of applied research and/or quality advisory, which are a result of the public divestment trend observed for some years in various European countries, as has been observed by the PRO AKIS (Kania et al., 2014). However, the case studies findings also highlight that the networks are not in general able to perform an advisory role permanently, given they are one-off and even ad-hoc initiatives, depending on short-term funding. In addition, the networks performance, as advisory tool, appears to be directly related to the quality of the underlying knowledge and advisory existent infrastructure. The following bullets allow for highlighting these findings in relation with the particular networks.

- Networks that act as a multi-actors platforms delivering pluralist advice, such as the CSF (PT) and the Monitor Farms (UK) rely and depend on existing knowledge and advisory infrastructure, namely through the involvement of researchers, experts, experienced advisors and other technicians.
- In some cases the networks are themselves a tool to bridge directly the research with the farmer's needs, such as illustrated by the 'Adapting seeds to climate change' Brandenburg network, or more indirectly comprising the mediating role of advisors and other facilitators in the case of the Portuguese crop pest monitoring network; In the case of Monitor Farms (UK) the networks are a tool to bridge the research sector with the advisory services; The CSF network (PT) also covers gaps in the existing knowledge infrastructure by converting and exchanging scientific (and also synthetized) knowledge produced by international R&D institutions.
- The Portuguese network CSF encompasses explicitly a role of filling gaps in the national AKIS, in particular in advisory services and in bridging them with the research sector; The 'Anti-Mafia' rural network (IT) also addresses gaps in the regional advisory sector regarding organic farming by mobilising its interactive ability to gather knowledge and information from different sectors and actors.

6.4. Main factors influencing the networks' stability over the time

The factors influencing the networks stability tend to be transversal to all the studied networks, and comprise:

- Farmers and other actors' perception of gains through the participation in the network.
- The dependence on short-term funding or discontinued funding are instability factors.
- The ability of networks to respond to dynamic needs of knowledge and to problem-solving demands.
- Engaging in the networks leadership and governance those farmers, institutions and professionals that are recognized and trusted among the farming community.

6.5. The networks contribution to the agricultural productivity and sustainability through innovation

The EIP-AGRI (EU SCAR, 2013) relies on the innovation systems approach (Lundval, 1992; Cooke et al., 1997; Audretsch, 1998; Asheim, 1999), which envisages innovation as partly the result of interactive learning processes involving multiple actors. Within this approach, multi-actor knowledge networks are the basis for innovation processes taking place at the territorial level. Hence, the EIP focusses on the networking of producers and users of knowledge, which include farmers, advisors, researchers, business and other actors whose interaction generates 'new insights and ideas, and mobilises existing tacit knowledge into focused solutions' (EU SCAR, 2013: 25). Regarding the contribution of each of the studied networks to enhancing co-innovation focused on the productivity and sustainability goals, the findings suggest:

- The networks focused on the agricultural sector, all the selected networks with the exception of 'Anti-Mafia' rural network, enhance 'naturally' the co-innovation related with productivity and profitability goals, which are demanded by the farmers, and that depend on enhancing the sustainability of the farming systems and practices.
- However, the predominant innovation patterns in the agriculture-focused networks are small-scale and incremental innovations, building on a continuous marginal improvement in the farming systems, practices and business models, potentiated by the multi-actors interaction and the collective learning experiences, in particular when those take place on-farm.
- In addition, these incremental patterns of innovation are enhanced by mixing tacit and explicit knowledge sources and by informal inter-personal and professional relationships, connections and contacts among the actors network.

7. Discussion and recommendations

The case studies selected evidenced that the agricultural and rural innovation networks' configuration and dynamic exhibited a high degree of heterogeneity. This is largely explained by the diversity of problems and solutions they address, whereas being as well a result of other factors, namely: (1) the presence of substantial differences in the national and regional AKIS across Europe;

(2) different funding opportunities; (3) the diversity of the socio-economic and cultural contexts where they were established. Notwithstanding the heterogeneity displayed, all the selected networks played a role in the local or regional, or even national AKIS, by filling gaps or complementing the functions of other players.

The case of Monitor Farms illustrates how innovation agricultural networks might be useful to complement conventional advisory models. By offering an opportunity to provide multi-topical advice through repeated holistic experiences taking place in-farm, this frame respond to some of the gaps commonly pointed to the conventional advisory models: the segmentation of advice by subjects and the cost of proving customised advice to different farmers. Thereafter, it highlights two important features that could be accomplished by network-based advisory models: the possibility of supplying pluralist advice to a large group of farmers simultaneously, allowing for scale and scope economies regarding the advisory provision.

Another interesting feature of the Monitor Farms is the fact of joining advice supply and demand at the local level. In fact, as shown by the Portuguese 'Cluster of Small Fruits' sectoral level network, whereas broad scale networks might be useful to join the different players within a sector, that don't exempt them from the necessity of a local level dimension regarding the effective matching the supply with the demand of advice.

The studied agricultural/rural innovations, in spite of its diversity, underline the capacity of the 'multi-actors network' frame to fill gaps in the conventional linkages of the research sector both, with the advisory services, and with the farmers knowledge needs. The case of the 'Adapting seeds to climate change' Brandenburg network, illustrates that in some contexts, e.g., large, professional and highly educated farmers, networks might effectively link directly the researchers with the farmers knowledge needs, without the need for mediators. Nonetheless, probably in most of the cases, in particular with small-scale farmers, the role of advisors and/or other facilitators might be decisive to link the research sector with the farmers, such as was exemplified by the Portuguese crop pest monitoring network (DSM network). The Monitor Farms, and at some extent the CFS (PT), also illustrate how networks might be effective in connecting the R&D sector with the advisory services, irrespective of whether they are public or private (for profit and/or non-profit).

In addition, the networks might show a useful model to generate technical locally-specific knowledge and the adaptation of scientific and synthetized knowledge to the local specific contexts (which are fundamental aspects of an AKIS enabling to overcome the productivity and sustainability challenges of EU agriculture).This type of knowledge is became increasingly scarce in most of the European AKIS due to the disinvestment on the national and/or regional applied research infrastructure, namely on the field trials, and the lack of interest from the universities and other research institutions with this type of research. Therefore, the networks by engaging the farmers in co-creation knowledge processes, together with researchers and technicians, might facilitate the implementation of innovative formats to generate this type of knowledge in a continuous and systematic manner.

The knowledge flows underpinning the networks, which were partially described in the case studies (see the respective country reports) and summarised by Figure 2 evidence their capability to enhance the farmers (and other actors, namely advisors) ability to learn and to innovate. Networks might act as platforms that support: (1) multiple actor's interaction, by joining together players from the various areas of the AKIS, which are often apart, in particular researchers, farmers and advisors; (2) horizontal and multi-directional social interactions between individual and grouped actors within the

network, which also bring-in to the network the knowledge, skills and information the actors get from their connections outside the network; (3) multiple formats and methods of interaction, since formal talks, workshops, field trials, farm visits and in-farm experiences, to ICT communication and demonstration activities, which extent largely the scope, duration and the intensity of the interactions between the actors.

Although most of the studied networks, such as the Portuguese Berry networks, the Monitor Farms, and the 'Anti-Mafia' rural networks, weren't typical innovation networks – differently from the Adapting seeds to climate change' (DE) – they all enhanced co-innovation processes amongst farmers and the cooperation with other actors within these processes. The interactive collective learning processes stimulated by the networks enhance farmer's ability to co-create knowledge and innovations by sharing common problems and looking collectively for solutions (problem-solving focused innovation) and also by discovering new ways of doing things and thinking as a result of exchanging ideas, information and experiences with different actors within different contexts. Hence, these 'not typical' innovation networks leverage most notably small-scale and incremental innovations, non-tech innovations, such as organizational, behavioural or social innovations, and innovation with low R&D incorporation, which produce small and cumulative changes and improvements that often go unnoticed.

The networks by promoting the development of best-fit local solutions to agricultural and rural problems, as well illustrated by all the networks, in particular by the 'Anti-Mafia' rural network, enhance the territorial cohesiveness and are a tool to promote smart, inclusive and sustainable development of European rural areas.

Recommendations

Based on the findings of the case studies, which key message was presented in the 'discussion' above presented in this section, and the insights of the stakeholder guests at the synthesis seminar in Portugal, some recommendations are drafted in the following bullets. These recommendations address mainly the stakeholders and politicians committed with the improvement of the AKIS performance and with the promotion of innovation in agricultural and rural areas.

- Be aware that the funding schemes will impact composition of actors and content, also beyond formally targeted groups and topics.
- Do not overlook the need to account for the diversity of eventually supported networks, diversity in structure, contents and dynamics.
- Target diversity, i.e., small, simple, easily manageable solutions versus complex, more fuzzy solutions, also with a broader variety of actors, which might have more transformative potential.
- Support innovative, 'strong' actors, which can provide more resources and have an advantage specifically in the field of new technologies and supporting a variety of socio-economic groups, which will develop innovations fitting their specific needs.
- Acknowledge and support small-scale and incremental cumulative innovation patterns as well as smart mixes of technical, social, organisational and institutional innovation.
- Enhance community self-organisation to sustain community empowerment.

- Account for farmer's innovation main drivers, which comprise productivity and sustainability, but also profitability and other.
- Do not underestimate the farmers' role as co-creators and converters of knowledge as well as innovators.
- Try to find a good balance between flexibility and stability of supported networks.
- Reconcile project-related procedures for accountability on the one side and flexibility for changes and surprises on the other side, especially with more ambitious innovations.

Although our findings have highlighted the huge potential of the innovation agricultural and rural networks when they are envisioned as a diversity of structures, driven by different goals, and resulting in many different innovation patterns, to effectively support them we need to learn more about them. So far research has focussed on typical innovation networks, which are technological-oriented or in other cases multi-institutional and organisational networks. More evidence is needed regarding on how to enhance small-scale, incremental and cumulate innovation through innovation processes and on how measure its impacts.

References

Asheim, B. (1999). Interactive learning and localised knowledge in globalising learning economies. Geo Journal 49: 345-352.

Audretsch, D. (1998). Agglomeration and the Location of Innovative Activity. Oxford Review of Economic Policy 14: 18-29.

Boenning, K., Knierim, A. (2014): Designing, implementing and maintaining (rural) innovation networks to enhance farmers' ability to innovate in cooperation with other rural actors. Case study report on a policy-induced agricultural innovation network in Brandenburg. Report for AKIS on the ground: focusing knowledge flow systems (WP4) of the PRO AKIS project. November 2014. Online resource: www.proakis.eu/publicationsandevents/pubs

Bundschuh, A., Knierim, A. (2013). Partizipation von Praxispartnern: Wer repräsentiert die Landwirtschaft in INKA BB?, in: Knierim, A., Baasch, S., Gottschick, M., (eds), Partizipation und Klimawandel: Ansprüche, Konzepte und Umsetzung, 103-120. München: oekom

Caggiano, M. (2014): Designing, implementing and maintaining (rural) innovation networks to enhance farmers' ability to innovate in cooperation with other rural actors. Anti-Mafia Innovation network: from land to fork! Report for AKIS on the ground: focusing knowledge flow systems (WP4) of the PRO AKIS project. November 2014. Online resource: www.proakis.eu/publicationsandevents/pubs

Cooke, P., Uranga, M., and Etxebarria, G. (1997). Regional Innovation Systems: Institutional and Organisational Dimension. Research Policy 26: 475-491.

Creaney, R.; McKee, A.; Prager, K. (2014): Designing, implementing and maintaining (rural) innovation networks to enhance farmers' ability to innovate in cooperation with other rural actors. Monitor Farms in Scotland, UK. Report for AKIS on the ground: focusing knowledge flow systems (WP4) of the PRO AKIS project. November 2014. Online resource: www.proakis.eu/publicationsandevents/pubs

EU SCAR (2013). Agricultural knowledge and innovation systems towards 2020 – an orientation paper on linking innovation and research. Brussels.

Kania, J., Vinohradnik, K., Knierm ,A. (Eds.) (2014). AKIS in the EU: The inventory – Final Report Vol. I (2014). PRO AKIS – Prospects for Farmers' Support: 'Advisory Services in the European AKIS. Krakow, Poland.

Lundvall, B. (1992). National Innovation Systems: A Comparative Analysis. Oxford: Oxford University Press.

Madureira, L., Ferreira, D., Pires, M. (2014): Designing, implementing and maintaining (rural) innovation networks to enhance farmers' ability to innovate in cooperation with other rural actors. The berry networks in Portugal. Report for AKIS on the ground: focusing knowledge flow systems (WP4) of the PRO AKIS project. December 2014. Online resource: www.proakis.eu/publicationsandevents/pubs.

Mauser, W., Klepper, G., Rice, M., Schmalzbauer, B. S., Hackmann, H., Leemans, R. Moore, H. (2013). Transdisciplinary global change research: the co-creation of knowledge for sustainability. Current Opinion in Environmental Sustainability 5: 420–431.

OECD (2012). Improving Agricultural Knowledge and Innovation Systems: OECD Conference Proceedings.

Regeer, B. J., and Bunders, J. F. G. (2008). Knowledge co-creation: Interaction between science and society. A transdisciplinary approach to complex societal issues. RMNO, 2008, Den Haag, The Netherlands.

Schneider, F., Steiger, D., Ledermann, T., Fry, P., Rist, S. (2012). No-tillage farming: Co-creation of innovation through network building. Land Degradation & Development 23: 242–255.