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Annex 7: Research and Innovation

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List of abbreviations

AKIS	Agricultural Knowledge and Innovation System
CAP	Common Agricultural Policy
EIP-A	European Innovation Partnership in Agriculture
ENRD	European Network for Rural Development
ETP	European Technology Platform
EU	European Union
FAS	Farm Advisory System
FP 7	Seventh Framework Programme for Research and Development
GAEC	Good Agricultural and Environmental Conditions
GDP	Gross Domestic Product
ICT	Information and Communication Technologies
mio	Million
NGO	Non-Governmental Group
PO	Producer Organisation
SCAR	Standing Committee on Agricultural Research
sCMO	Single Common Market Organisation
SMR	Statutory Management Requirements

1. STATE OF PLAY OF RESEARCH AND INNOVATION IN THE EU

1.1. The importance of research and innovation in the agricultural sector

The significant role that research plays in agricultural development has been highlighted in various publications. There is a large body of evidence which shows that a substantial part of agricultural productivity growth which took place in the last 50 years was generated by investments in agricultural research and development (e.g. IFPRI, 2000; Alston, 2010).

Research is only one part of what is currently called the **Agricultural Knowledge and Innovation System** (AKIS). The AKIS encompasses the education, the advisory services and the farmers and more and more other stakeholders are considered as part of it as well including the upstream and downstream industry, cooperatives and farmer organisations and NGOs. Among all these actors, the advisory services play an important role in influencing farmers' behaviour and are an important interface for transferring research knowledge to the farm sector. Advisory services have been reformed in many EU Member States in the course of the last two decades with most often a reduced public involvement and budgetary support, leading to the emergence of new actors (e.g. through privatisation). This restructuring has sometimes led to a fragmentation of advisory services through the multiplication of service providers with various ambitions.

1.2. Agricultural research in the EU and in the Member States and coordination with Member States

1.2.1. EU support to research in agriculture under FP 7

The CAP does not finance research programmes. EU scientific research is supported through the Seventh Framework Programme for Research and Development (often referred to as FP 7). Agriculture is covered within FP 7 through the "Food, agriculture and biotechnology" thematic priority, specifically devoted to the technological challenges facing European agriculture. It concerns farm-management policies, food safety and rural development with the following three main activities:

- Sustainable production and management of biological resources from land, forest and aquatic environments
- Food (including seafood), health and well being
- Life Sciences, biotechnology and biochemistry for non-food products & processes

For the whole duration of FP 7, €1.9 bio is earmarked to the "food, agriculture and biotechnology" thematic priority (of which 10% is spent on fisheries/oceans).

With the evolution of cross-cutting issues within research policy, agriculture and rural development finds a growing relation to other programmes of FP7, notably:

- Environment (and Climate Change) for agri-environmental & sustainability issues
- Socio-economic Sciences and Humanities for broader rural development issues
- Energy for bio-fuel issues
- Information and Communication Technologies for rural ICT issues

- Nanotechnologies and New Technologies for agricultural and food applications

European technology platforms (ETPs) were set up in 2004 as industry-led stakeholder forums with the aim of defining medium to long-term research and technological objectives and developing roadmaps to achieve them. Several technology platforms have been established in the framework of FP 7 in the area of agriculture and forestry:

- Agriculture Engineering and Technologies ManuFuture subplatform
- ETPGAH: ETP for global animal health
- European bio-fuels technology platform
- European Technology Platform for sustainable chemistry
- FABRE: sustainable farm animal breeding and reproduction technology platform
- Plants for the future
- Food for life
- Forest based sector technology platform
- There is also TPOrganics, which is a technology platform for organic research, although it is not yet recognised formally as an ETP.

In 2006-2008 (2009 for TPOrganics) these technology platforms have delivered strategic research agendas towards 2025 and also published detailed action plans for research programmes in the first years of implementation. These strategic documents have been utilised in the programming of FP 7 research in agriculture and food and have an important role to play in the programming of the forthcoming Common Strategic Framework for Research and Innovation in their specific technical areas.

1.2.2. Agricultural research in EU Member States

Research and development in agriculture takes place in most Member States. It is financed from public and private sources. However, it is not possible to draw a complete picture of the overall effort since there are no data on private investments. Eurostat provides data only for public spending¹ on research and development. According to those data, in the EU Member States public spending in research and development in the agriculture sector has been increasing in the last years, from €2.8 billion in 2005 in the EU-27 to an estimated €3.3 billion in 2008, it would have declined however in 2009 to reach an estimated €3.1 billion², a decrease probably due to the economic crisis. Six Member States (France, Germany, Italy, the Netherlands, Spain and the United Kingdom) provide 77% of the research effort in the period 2007-2009. Most of the investments take place in the EU-15: out of the EU-27 average of €3.2 billion in 2007-2009, the EU-15 achieved €3.0 billion and the EU-12 €0.2 billion.

On average in 2007-2009, Member State public expenses on agricultural research amount to 2.3% of the gross value added (GVA, an economic aggregate close to the

¹ Government Budget Appropriations on Research and Development (GBAORD), these data refer to budget provisions not actual expenses. Data include both current and capital expenditures and cover not only government-financed research and development performed in Government establishments, but also government-financed R&D in the private sector.

² AGRI estimates for 2008 and 2009 as data are missing for several Member States.

GDP) of the agricultural sector for the EU-27, with 2.5% in the case of the EU-15 and 1.0% for the EU-12.

1.2.3. Coordination with Member States in developing the European Research Area

Coordination of Member State agricultural research is of major importance since more than 90% of research spending is managed by the Member States³. Currently, this is assured by the Standing Committee on Agricultural Research (SCAR), mostly composed of Member State agriculture ministries⁴. The SCAR has played in recent years an outstanding role in the efforts of coordination of Member State agricultural research and in tackling important issues in the field of agricultural research and related areas (such as the functioning of AKIS). As a complement to the SCAR, the European Initiative for Agricultural Research for Development (EIARD)⁵ aims at coordinating the investments of the European Communities and of the Member States in the specific field of Agricultural Research for Development (i.e. agricultural research meant to assist less advanced countries in achieving the Millenium Development Goals).

There have been a number of SCAR initiatives and working groups that have made SCAR a reference point in agricultural research and a governance model often referred to in broader research circles.

These include:

- The Joint Programming Initiative (JPI): the joint programming of research activities between Member States is a major recent instrument in the European Research Area (ERA) policy. Two of the first initiatives relate directly to agriculture: "Agriculture, food security and climate change"; and "A Healthy Diet for a Healthy Life". The Commission has adopted recommendations for Member States to pursue these initiatives, which will become the object of significant collaborative agricultural research efforts in the EU;
- ERA-NET actions, which provide a framework for actors implementing public research programmes to coordinate their activities, in areas such as rural development, ICT, research in the organic sector, animal health, etc.;
- "Foresight" and "Horizon Scanning" exercises on agricultural issues, which provide a broader and longer-term outlook on the challenges facing the EU agricultural sector⁶.

³ The EU budget allocated to research projects in the field of agriculture represents 5.5% of public outlays of Member States in 2009. Yet, Member State support includes infrastructure and running expenses. If one would take only research projects budget in consideration, the significance of EU contribution would appear larger.

⁴ The legal basis of SCAR is the Council Regulation (EEC) 1728/74 regarding the coordination of agricultural research (OJCE L74 of 5 July 1974, p. 1).

⁵ See COM(1997)126 "The European Initiative for Agricultural Research for Development (EIARD)"

⁶ The third foresight exercise was presented in Budapest in May 2011 and the main conclusions for agricultural research were highlighted in the so-called 'Budapest Declaration' which was endorsed by Member States at the SCAR Plenary meeting of June 2011.

- A SCAR collaborative work on AKIS set up in early 2010.

1.3. Current policy measures of the Common Agricultural Policy influencing research and innovation in agriculture

Although the CAP does not deal directly with agricultural research issues several elements of the policy affect some parts of the AKIS. This concerns in particular the Farm Advisory System (FAS) and several rural development measures on knowledge and information dissemination and on cooperation for innovation. This annex does not provide an analysis of the impact of measures such as investment or business development of Rural Development which may have an impact on innovation processes as well.

The CAP does not support directly research projects with however a notable exception in the fruit and vegetable sector: in the single Common Market Organisation (sCMO), the so-called Producer Organisations (POs) can have research projects co-financed by the CAP within the so-called Operational Programmes⁷.

Article 68 of Council Regulation 73/2009 on direct payments allows Member States to provide support to farmers for specific purposes, including: improving the quality of agricultural products, improving the marketing of agricultural products, practicing enhanced animal welfare standards and specific agricultural activities entailing additional agri-environmental benefits. Several Member States have utilised the possibilities under Article 68 to support innovative practices at farm level (e.g. on precision farming).

Before entering into specific policy measures it is important not to overlook the overall impact of the CAP on innovation. Indeed, some measures have a direct impact on AKIS and on innovation, but other measures influence indirectly the capacity of operators to innovate. Research suggests that the CAP as a whole would have a positive effect on the adoption of new technologies by farmers (see in particular CAP-IRE⁸ Policy Brief and Bartolini et al. 2011).

1.3.1. Farm Advisory System

The Farm Advisory System (FAS) was set up as a component of the CAP reform of 2003. Its main purpose was to help farmers comply with cross-compliance requirements via the provision of technical advice. The establishment and use of the FAS is supported by the Rural Development Policy (see below). The advisory activity covers at least the Statutory Management Requirements (SMR) and the Good Agricultural and Environmental Conditions (GAEC). The deadline for setting up a national FAS was 1 January 2007, the start-up period lasted until 2009 due to time necessary for practical implementation of the national legal FAS provisions, e.g. the procedure for certifying

⁷ See Article 21(f)(4) and Annex VIII(1) of Commission Regulation 1580/2007. There is no overview of the use of this possibility as a comprehensive reporting from all Member States, including on this aspect, is in place only as from 2009, for which data are not yet available.

⁸ CAP-IRE research project (supported by FP 7), "Assessing the multiple Impacts of the Common Agricultural Policies (CAP) on Rural Economies", <http://www.cap-ire.eu>.

advisory bodies and mobilising rural development support. The European Commission reported on the implementation of the FAS in the Member States in November 2010⁹.

1.3.2. Rural development measures promoting knowledge and innovation

Several measures of the Rural Development policy provide support to knowledge, advisory services and innovation, directly or indirectly: this concerns especially measures of Axis 1 and also Leader and the European Network for Rural Development (ENRD).

Axis 1 measures:

- Measure 111 on vocational training and information actions.
- Measure 114 on the use of advisory services by farmers and forest holders. The support is provided in order to help farmers to meet costs arising from the use of advisory services for the improvement of the overall performance of their holding. As a minimum the advisory service should cover the SMR and GAEC of cross-compliance and occupational safety standards based on Community legislation. Support is limited to 80% of eligible cost per advisory service with a maximum eligible amount of €1 500 per complete advisory service.
- Measure 115 on the setting up of farm management, farm relief and farm advisory services, as well as of forestry advisory services. Support is provided to cover the costs of setting up and is degressive over a maximum period of five years from setting up.
- Measure 124 on cooperation for the development of new products, processes and technologies in the agriculture and food sector and in the forestry sector. The support is provided to promote cooperation between primary producers in agriculture and forestry, the processing industry and/or third parties. The cooperation has to involve at least two actors of which at least one is either a primary producer or belongs to the processing industry.

Whereas measure 111 on vocational training existed already before the current programming period, the other three measures were created more recently: measure 114 for the use of advisory services has been implemented with the CAP reform of 2003¹⁰, whereas the other two measures were introduced as from 2007.

⁹ Report from the Commission to the European Parliament and the Council on the application of the Farm Advisory System as defined in Article 12 and 13 of Council Regulation (EC) N° 73/2009 (COM(2010) 665 final)

¹⁰ This measure was implemented with Council Regulation EC 1783/2003 amending Regulation (EC) No 1257/1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF).

Leader

Leader (Axis four of the rural development policy) and the European Network for Rural Development (ENRD) are also included in the analysis: Leader contributes to the emergence of innovations, in particular social innovation, at the local level. The ENRD facilitates the flow of information and knowledge.

Leader started as a Community initiative about 20 years ago and was integrated in the Rural Development policy in the current programming period. Leader works in a bottom-up approach and supports local and integrated development strategies.

European Network for Rural Development

The ENRD was established in the current programming period to create a network among EU rural development actors. The objectives are to disseminate information and good practices on various aspects of rural development. The ENRD has established thematic working groups (e.g. linkages between agriculture and the wider rural economy; public goods and public intervention) and has established a sub-committee targeting Leader. The ENRD also provides analysis of Rural Development programmes and organises events and seminars on specific issues of relevance for the development and implementation of the rural development policy.

1.4. Current links between the CAP and the EU research policy implemented within the Seventh Framework Programme for Research (FP 7)

There are currently no formal links between the implementation of the CAP and the implementation of agricultural research within FP 7. Agricultural research used to be managed under the CAP until 1999. The European Commission was assisted in this activity by the Standing Committee on Agricultural Research (SCAR). In 2000 agricultural research was transferred into the umbrella of the Framework Research Programme (FP 6). Secretariat and management of SCAR was maintained in the CAP administration although the Committee no longer played the role of a Programme Committee. It was decided in 2004 to bring SCAR under the management of the Research Programme as from 2005. Although Commission services dealing with the CAP have no longer had responsibility on agricultural research from 2000, links have been maintained with research. An important tool of research programming and follow up is the AGRI-RTD research network, an informal inter-service group composed of DG AGRI staff with research needs for policy development and DG RTD staff of project officers responsible for agricultural research. It serves to submit project proposals submitted to the annual work programmes and to organise the involvement of DG AGRI in ongoing projects. Yet, these informal annual inputs are far from constituting a consolidated and comprehensive approach to research from the side of the CAP.

2. ACHIEVEMENTS AND CHALLENGES

2.1. Delivery of current CAP instruments

2.1.1. Implementation of the Farm Advisory System (FAS)

As the FAS was established quite recently and became fully operational in most Member States in 2008 only, it is still too early to draw definitive conclusions on its implementation. In these early years, the number of farmers having received FAS advice is rather limited in the EU as a whole: 4.8% of farmers receiving direct payments were given one-to-one advice in 2008 in the 20 Member States where information was available. In the Member States / regions where the FAS has been implemented since 2007 or earlier, the outreach stood at around 5-10% with a maximum rate of 20% in some Member States where the FAS is implemented since 2005. The main beneficiaries of the FAS have been large farms¹¹, already familiar with using advisory services. Obviously, the outreach of the FAS will grow with the number of years of implementation and the coverage should reach higher levels.

In 14 Member States, the FAS focused strictly on cross-compliance whereas in the remaining Member States the advice embraces broader issues, such as the competitiveness of the holding, the environmental impact of farming practices and support for the implementation of rural development measures (e.g. agri-environmental measures). Yet, it is difficult at this stage to assess the role that FAS may have played in these areas going beyond cross-compliance. In some Member States, the existing advisory services have been used for this purpose. In this case, a broader approach has been applied, including the economic performance of the holdings.

For a large number of Member States, the FAS does not address comprehensively the various needs of farmers, except cross-compliance. Most often, these needs are covered by the existing advisory services. Yet, the FAS can be used in a much wider perspective than just taking care of cross-compliance as the example of Flanders in Belgium shows where a 'whole farm' advice system approach was adopted.

In any case, it seems that for a number of Member States, the setting up of the FAS has prompted some Member States to rethink the functioning of the AKIS and its delivery to farmers. Within this, the potential role of FAS advisors as interface between the agricultural and research sectors could be significant. Yet as indicated in ADE et al. 2009, it remains mostly untapped. ADE et al. 2009 makes a series of recommendations, of which a) target FAS activities in other areas than cross-compliance, thereby ensuring broader advisory services in Member States where they are lacking; b) better integrate the FAS in networks involving research activities and other advisory services; c) enhance access of small farms to the FAS. In the conclusions of the report on the application of the Farm Advisory System¹², the Commission also highlighted that the FAS should cover issues going beyond cross-compliance.

¹¹ Council Regulation (EC) 1782/2009 introduced a priority for farms receiving more than €15 000 of direct payments. This priority was abolished with the Health Check (Council Regulation (EC) 73/2009).

¹² Report from the Commission to the European Parliament and the Council on the application of the Farm Advisory System as defined in Article 12 and 13 of Council Regulation (EC) 73/2009 (COM(2010) 665 final)

In order to establish exchanges on technical aspects between Member States on these issues, the Joint Research Centre¹³ has organised several workshops with national experts from the Member States. The last one took place in Warsaw in February 2011 with 116 delegates from 19 Member States.

2.1.2. Implementation of Rural Development measures focussing on knowledge and innovation

Among Axis 1 measures (vocational training and information; use of advisory services; cooperation for the development of new products), it is **measure 111** on vocational training and information actions which bears the largest outreach, with 233 000 trained participants in the period 2007-2009, with a total public support (EU and Member States) of €142.3 mio. Most active Member States are Lithuania (approximately 79 000 farmers trained), Belgium (48 000 farmers trained), France (26 000), Finland (21 000), the Czech Republic (16 700) and Germany and Spain (both at about 14 500). However, at the level of the EU and of most Member States, the outreach represents a marginal share of the total number of producers.

The **measure 114** on the use of advisory services was planned in 20 Member States, covering 1.1 mio farmers for a total budget of €870.5 mio for 2007-2013. Yet only 1.9% (€16.9 mio) have been spent in 2007-2009 with an outreach of 32 200 farmers supported: Hungary (around 11 200 producers), Spain (8 200), Italy (5 700), Germany (4 000), the Czech Republic (1 100) and the Netherlands (900).

The **measure 115** supporting the setting up of management, relief and advisory services was planned by seven Member States, with four Member States (Italy, Malta, Portugal and Spain) clearly focusing on the FAS. In the period 2007-2009, only 205 projects have been supported, of which 176 concerning the setting up of advisory services to agriculture or forestry (of which 146 in Spain) for a total public support of €2.5 mio. A total amount of €172.9 mio was earmarked for this measure for 2007-2013, which means that only 1.4% has been spent in the first three years.

In summary, until 2009 measures 114 and 115 have been utilised to a rather limited extent for the provision of knowledge to producers. Measure 111 has the largest outreach, yet it still concerns a minority of producers. Forest-related actions are present in 69 national programmes. It has been pointed out (e.g. University of Gloucestershire, Countryside and Community Research Group, 2008) that the measures are overlapping between each other and that they would need to be integrated within an overall approach for the Member States regarding advisory services to farmers. It has been advocated that, for a more coherent approach and better results, these measures should be merged into a single measure dealing with the provision of knowledge and advice.

The **measure 124** (cooperation for the development of new products) is programmed in 14 Member States with a total allocated budget for 2007-2013 of €349.2 mio. This measure has provided support to 356 projects during 2007-2009 (of which 44% implemented in Austria) for a total public support of €17.7 mio (average public support per project: €49 700), i.e. 5% of the foreseen budget. This slow uptake, with a clear exception in few Member States, stems probably partly from the fact that this measure

¹³ Institute for Environment and Sustainability, unit on "monitoring of agricultural resources" (MARS).

was new for rural development programmes¹⁴. This is a potentially very useful measure for the adoption of innovations in agriculture and rural areas as it takes account of the collective dimension which is often necessary to the innovative process. The potential effectiveness of this measure is high whereas its implementation costs are relatively low. It was recommended (University of Gloucestershire, Countryside and Community Research Group, 2008) that this measure should be best developed as part of an overall development strategy of research and innovation. Measure 124 containing forestry-related actions has also been programmed in 41 national or regional programmes.

The rather low level of use of measures 114, 115 and 124 could be partly attributed to the fact that they are recent measures in the rural development policy. In addition, it is not sure that they have been granted important visibility in the Member States. The fact that Austria was able to have the measure 124 implemented in a sizeable number of projects reflects that implementation is also conditional upon co-financing budgets and the interest displayed by the Member States, influencing the role granted to the measure in the rural development programmes.

2.1.3. Implementation of Leader

An assessment of Leader is provided in the annex dealing with Rural Development to which the reader is referred. Only specific aspects are discussed here. The Leader approach has long proven its high value for delivering local development strategies. Its inclusion in Rural Development programmes as from 2007, often referred as "mainstreaming" has allowed it to extend further (more than doubling the number of local action groups in comparison with Leader + of the period 2000-2006). Yet, the mainstreaming has also led in some Member States to a reduced flexibility for implementation by the Local Action Groups (LAGs). This often perceived too strong interference of Member State bureaucracy is reported to have hindered the bottom-up approach and would have reduced the innovative capacity of the projects.

2.1.4. The European Network for Rural Development

The implementation of the network is supported by rural networks set up at national level and by the European Network for Rural Development at the EU level. These networks gather organisations and administrations for the purpose of exchanging information and experiences, to stimulate joint analysis and cooperation between the actors of the policy. Since 2008 the ENRD has carried out a large number of activities such as stakeholder groups to analyse specific policy implementation issues, information dissemination to the broader public, organisation of events on specific issues. An evaluation expert network has also been set up to bring methodological support to the evaluation of programmes.

2.2. Challenges ahead regarding research and innovation

There is a large body of publications which calls for a **renewed impetus for research in agriculture** in order to make the sector better able to cope with long-term challenges¹⁵.

¹⁴ This measure was previously implemented under the research programme "Multiregional Operational Programme in Objective 1 Regions 1994-1999: Services to the farm sector" (see University of Gloucestershire, Countryside and Community Research Group, 2008)

¹⁵ Among the most recent documents, see in particular the third SCAR foresight exercise "sustainable food production and consumption in a resource constrained world") or the Foresight report of the United

These challenges include catering at world level for the food needs of a growing population, with more resource-efficient and environmentally sustainable practices imposed by the increase in resource scarcities (water, energy, soil depletion, etc.), taking into account the needs to mitigate and adapt to climate change. These challenges are fully reflected in the Europe 2020 strategy for smart, sustainable and inclusive growth¹⁶ which lists among major challenges climate change, resource efficiency and environmentally-friendly production methods and land management. It is among the objectives of the flagship initiative Innovation Union¹⁷ to foster innovation in order to better grasp these challenges.

The scope of necessary research for agriculture and forestry to meet these challenges in the long term is fundamentally different from the one that was developed to support the so-called Green Revolution. It is indeed no longer sufficient to focus on productivity increase. Research has now to address a much broader range of issues. The necessity to cope with complex issues such as maintaining or increasing the productivity and, at the same time, maintaining eco-system services delivery (such as biodiversity), implies to support pluralistic scientific approaches reflecting this complexity. No single avenue will be sufficient. Hence, required innovations will not just be technological, they will also have to be non-technological (e.g. agro-ecological innovations), social and organisational. These innovations will have to respond simultaneously to several objectives (e.g. food security, biomass production, environment preservation) and should help to minimize the trade-offs between reaching these objectives.

Innovations are often defined as the successful implementation of new ideas. Hence, it is not only the scientific research area which is involved, it is the whole complex of interactions between science, knowledge systems (including advisory services), producers and other stakeholders (e.g. NGOs) and markets which is at stake. Evaluations of research programmes in agriculture often report that the research sphere is not sufficiently connected to the implementation level. Therefore, interesting research results do not always find their way to potential users and the users face sometimes difficulties to have new challenges grasped by the research community.

It has to be acknowledged that the interface between research and potential users, among which regional agricultural research institutions and especially the **advisory services to agriculture and forestry**, has been quite neglected in the last decades in most countries in the world, including the EU. Restructuring and privatisation under public budget constraints have profoundly changed the landscape of advisory services in many EU Member States leading to a fragmentation of advisory services with the multiplication of extension organisations.

Kingdom Government Office for Science "The future of food and farming: challenges and choices for global sustainability".

¹⁶ Communication from the Commission, Europe 2020 a strategy for smart, sustainable and inclusive growth (COM(2010) 2020 final).

¹⁷ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Europe 2020 Flagship Initiative Innovation Union (COM(2010) 546 final).

In some instances, this has limited their capacity to deliver to the whole range of commercial farms, including the small ones (Labarthe, Laurent, 2009), or their capacity to deliver advice on public goods such as agri-environment (see Nigel et al. 2002; University of Gloucestershire, Countryside and Community Research Group (2008), Klerkx et al. 2006) and their involvement in back-office activities (construction of knowledge, e.g. field experiments, etc.). It appears that, at a time when farmers are faced with multiple challenges (environmental norms, increased technicality of production processes, necessity to cope with climate change, business management, etc.) which require large amounts of knowledge, they sometimes have access to a more narrow scope of knowledge of sometimes lower quality¹⁸ (see in particular Labarthe, Laurent, 2006). In the absence of a comprehensive approach regarding the role and the objectives of advisory services to agriculture, there is a risk that the trade-offs between various objectives (e.g. maintain or increasing productivity together with eco-system services) and time horizons (short-term objectives regarding income and longer-term objectives regarding sustainability) will not be properly taken care of by the advisory services.

There is a growing consensus that **innovation in agriculture encompasses a plurality of approaches**: the traditional linear process with knowledge flowing from research to farmers ('science push') through advisory services is no longer considered as the most appropriate approach although in some instances it bears fruit. Innovation is also more and more viewed as the outcome of collaborative networks where information is exchanged and a process of learning takes place (Knickel et al. 2008, results of FP 6 research project In-sight¹⁹). Hall (2007) supports that innovation is rarely triggered by agricultural research and, instead, is most often a response of entrepreneurs to new and changing market opportunities. In this context, **a critical role for public authorities is to support the emergence of a plurality of innovation systems and to provide a conducive environment and support to innovation networks and collective approaches** gathering producers and other stakeholders on specific issues requiring innovation. In this context, it is considered that the provision of research and agricultural advisory services should be pluralistic with mixed funding and undertaken by both public and private parties (Klerkx, Leeuwis, 2009). Public involvement and funding is particularly important in those areas (e.g. public goods) which do not attract the interest of the private sector.

The expenses in agricultural research of FP 7 represent less than 10% of the expenses of the Member States. Given the limitations of EU research budget, the question of the purposes and targeting of EU investments in research is a major one. The present impact assessment is not the place for a thorough analysis on this but one could well argue for a concentration around themes and targets which would maximise the capacity of EU research programmes to deliver on public goods.

¹⁸ E.g. quality of proof of a field experiment on pesticide testing carried out by a public research institute versus the proof provided by the cooperative or input company which sells the pesticide to the farmer.

¹⁹ Other research projects financed by the European Union under the Framework Programme for Research and Development investigate the role of networks in the innovation processes as part of their work programmes: the project DERREG (www.derreg.eu) looks at rural areas and globalisation and shows the importance of international networks for rural SMEs; the project NETGROW investigates the role of networks on SME innovativeness (www.netgrow.eu); the project SOLINSA elaborates on the very issue of learning and innovation networks for sustainable agriculture (www.solinsa.eu).

The necessity to rethink the whole complex of the AKIS has been embraced by the Standing Committee on Agricultural Research (SCAR) which set up in 2009 a collaborative working group on the issue. As part of this work, a review of national AKIS in Member States shows in particular that national AKIS are often fragmented and not sufficiently responsive towards changes and to new societal concerns and demands (Dockès et al., 2011). Moreover, many recent publications and reports insist on the importance for countries to invest in agricultural research but also in advisory services (see reports of the SCAR foresight or of the United Kingdom foresight).

In view of the fact that many of the norms and regulations that are implemented in the farm sector are generated by EU policies and that policies to better cope with the challenges the sector face (such as climate change) are also for most in the realm of EU policies, it would appear most effective that, although resting on approaches and tools decided at national level, the capacity of AKIS to deliver on EU priorities be supported and coordinated at the EU level. This would ensure that, with a variety of approaches, all farmers in the EU have access to adequate advisory services (in terms of issues covered, in terms of quality of the advice provided, etc.). An important aspect which should not be overlooked is also the technical capacity of the advisors who have to cover a larger array of issues than some decades ago (capacity to provide integrated advice solutions on cross-cutting issues, capacity on technical issues and on approaches, e.g. participatory approach).

3. HOW COULD THE CAP SUPPORT AGRICULTURAL KNOWLEDGE AND INNOVATION SYSTEMS IN THE EU?

The main policy scenarios used in other parts of this Impact Assessment have been designed with a view addressing primarily the major building blocks of policy intervention within the CAP. The policy options developed herebelow do not all strictly reflect the main policy scenarios. Yet, the policy option depicted under section 3.2 would qualify under the Integration Scenario, whereas the option presented in section 3.3 could be integrated either in the No Policy Scenario or in the Refocus Scenario.

The various options that are investigated below apply to the measures which have a direct impact on the AKIS and on innovation. The overall CAP and instruments like direct payments, which also influence the capacity of operators in the sector to innovate, are only marginally addressed.

The manner by which the challenges the agriculture sector faces currently and will face in the medium to long term will be taken up by the new research and innovation policies and programmes which will succeed to FP 7 is not discussed extensively in this document since it goes beyond the remit of the CAP. Yet some elements are presented under the scenario presented in section 4.2. If it is considered that research will play a more important role in the agriculture sector, partly through the establishment of an European Innovation Partnership "Agricultural Productivity and Sustainability" (EIP-A) aiming at fostering innovation, coherence of policies indeed calls for a coordination of the relevant research with the major objectives of the CAP and with the EIP-A.

3.1. Status quo scenario

3.1.1. Policy measures

Under this scenario no additional initiative for enhancing innovation is taken at the EU level. The existing FAS instrument and current measures under Rural Development are kept unchanged. Advisory services through the FAS still focus on cross-compliance issues and do not take on board other EU objectives (actions targeted towards innovation, biodiversity, etc.).

3.1.2. Potential impact

Given that the obligation to establish a national FAS is recent and the related advisory bodies have only been certified in the last years, the outreach of the FAS would certainly increase, though to perhaps modest levels. In any case, results in terms of knowledge dissemination and innovation adoption would most certainly fall far short of the challenges if not just for lack of a coherent framework for the use of available measures. Farmers would lack knowledge and research support to cope with the new challenges. Post FP 7 European research programming would not be connected to the problems of the farmers and rural entrepreneurs to the necessary extent. Moreover, in the absence of an emphasis on innovation-related measures and on the promotion of higher use, the effective impact of these measures would remain low. The support under rural development for the use of advisory services by farmers and for the delivery of the AKIS across Member States would be maintained, thus affecting the capacity of the agriculture sector to cope with the new challenges.

3.2. EU incentives enhancing actions targeted towards innovation and agricultural knowledge exchange in the agri-food sector and reinforced links with the Framework Research and Innovation Programme

3.2.1. Policy measures

The FAS is reinforced to extend its minimum scope beyond cross-compliance and targets all farmers. Rural development measures supporting knowledge and advisory services are streamlined and strengthened. Innovation is embedded in the CAP through a European Innovation Partnership in agriculture which aims at enhancing innovation in priority areas. Key acting entities would be Operational Groups bringing together farmers, advisors, researchers and enterprises. Furthermore, a specific European Innovation Partnership Network would be established to facilitate communication and the exchange of information.

The Farm Advisory System

The FAS is reinforced from an advisory tool focusing on helping farmers receiving CAP payments to fulfil cross-compliance requirements to an advisory system covering a broader range of issues, linked to innovation and the environment, which is made available to all farmers. Among other issues, the FAS would provide useful inputs to farmers on the potential implementation of a greening of the first pillar. The reinforced FAS ensures that farmers have at their disposal advice reflecting the specific situation of the farm. The minimum scope of the FAS is enlarged to climate change mitigation and adaptation, biodiversity, the protection of water and actions targeted towards **innovation**. Rural development measures supporting the FAS are strengthened (see below). The FAS

also provides information to farmers on the European Innovation Partnership and contributes to disseminate at the farm level innovations developed within the EIP.

A coordination of FAS is established at the EU level, with in particular the view to gain at EU level from the strengths and positive experiences of the different Member States: a regular exchange of experiences and best practices in the Member States related to organisation, certification, monitoring and evaluation of advisory services is organised. The FAS advisory bodies are linked with the whole AKIS system, including other advisory bodies, and research and education institutions, both at national and EU level. In particular, discussion on the improvement of the organisation of advice provision and the availability of adequate advisory tools in the Member States is promoted, e.g. concerning minimum qualification and regular training of advisors, the organisation of regular feedback provision from farming practice to researchers and authorities and vice versa. This regular discussion should cover the implementation of the FAS and the relation of the FAS to the whole AKIS. This coordination may lead when needs arise to suggestions for amendments to the EU legislation (FAS, Rural Development programmes, etc.).

Agriculture European Innovation Partnership

In view of closing the gap between the vast range of innovative research results, on the one side, and the availability of innovative approaches applicable to farming practice, on the other, an European Innovation Partnership Agriculture "Agricultural Productivity and Sustainability" (EIP-A) is set up aiming at an EU agricultural sector that 'produces more with less', thereby overcoming the existing development path of enhancing productivity at the expense of the environment and natural resources. Currently new approaches take too long to reach the ground and the practical needs on the ground are not sufficiently communicated to the scientific community. This EIP-A will ensure a faster exchange of knowledge from research to "practical" farming and provide feedback on practical needs to science via operational groups.

In view of facilitating the information flow between research and practice, **an EIP Network** is created. Via the EIP Network, key actors (farmers, advisors, researchers, enterprises, administrations) in operational groups will share experience, communicate good practice, and give advice at different geographical levels. The EIP Network will also engage in animating the establishment of 'Operational Groups' on the ground. The work of the EIP requires a solid underpinning by national networks as well as networking at regional level. With respect to the latter, farm advisory services and the FAS could play an important role. Furthermore, the EIP Network requires a good interface to facilities existing on the research side. Close interactions with the Standing Committee on Agricultural Research (SCAR) will be necessary.

In order to reach the objectives of the EIP, measures fostering innovation in agriculture are reviewed and strengthened. The new Rural Development framework includes adapted and streamlined measures covering (among other things) cooperation, pilot and demonstration projects, knowledge transfer, innovative investments and the establishment and use of farm advisory systems.

Rural development measures supporting knowledge transfer, advisory services, cooperation for innovation

Measures related to knowledge transfer and advisory services are made more coherent and visible. In addition, measures are granted a larger scope. The new measure on knowledge transfer and vocational training covers courses, seminars, information sessions or workshops and technical, economic or research dissemination. **Support to exchange programmes for farmers and to demonstration projects is introduced.**

In the case of support for advisory services, the scope goes beyond cross-compliance issues and is aligned to the areas foreseen in the minimum scope of the FAS, however with enough flexibility for the farmer to decide on his exact need for advice. Other matters of relevance to the farm which contribute to achieving EU priorities, such as economic profitability, business development, environmental aspects, etc. can be advised upon. In order to contribute to increase the outreach, support covers 100% of the cost (up to the ceiling of €1 500 per advice). Support is also provided for the **training of advisors.**

The measure on cooperation for the development of innovative products, processes and technologies, which has great potential in steering collective actions towards innovation, is reinforced considerably taking on board, for instance, support to pilot projects and support to the **creation of cooperation networks and clusters and for the establishment of their activities.**

The measures are meant to finance the use of advisory services for various purposes (FAS or other types of uses) and to finance some of the activities to be carried out as part of the European Innovation Partnership in agriculture (see 3.2.4 below).

Leader

Leader programmes recover enough flexibility so as to be able to implement better innovative strategies. Whilst the aforementioned EIP has its primary focus on innovation along the supply chain, Leader addresses the wider context of local development strategies.

European Network for Rural Development (ENRD)

The ENRD and the National Rural Networks are strengthened to further reinforce links between administrations and stakeholders, to ensure the appropriate information support for beneficiaries and managers and to boost exchanges between the actors of the policy. Bearing a special focus on innovation along the supply chain, the aforementioned EIP Network will complement the efforts made under the ENRD.

Reinforced links with the EU Common Strategic Framework for Research and Innovation Horizon 2020

Although reinforcing the links with the EU Common Strategic Framework for Research and Innovation Horizon 2020 goes obviously beyond the remit of the CAP, it is worth addressing it for the sake of consistency and coherence with in particular the implementation of the EIP-A. The capacity of the agriculture sector to cope with challenges and the proper implementation of the EIP-A within the CAP obviously depends on a stream of research results originating from the Research Programme. In this

view a coordinated approach is necessary with the EU Common Strategic Framework for Research and Innovation Horizon 2020: 1) appropriate coordination on research programming and priority establishment in the areas of agriculture, forestry, food and the broader bio-economy area; and 2) development of tools better tailored for innovation in agriculture (e.g. flexible research projects; support to innovation brokers / innovation centres).

3.2.2. Potential impact

Reinforcement of the FAS and of the support to farmers for the use of advice increases significantly the number of producers taking advantage of advisory services on a broad range of issues. The setting up of the European Innovation Partnership fosters the involvement of stakeholders (researchers, advisors, agri-business and farmers) in innovation processes contributing to achieving EU goals of sustainable agricultural production. In particular, farmers would be in a better position to adopt intelligent solutions which are generated by research (for instance the European Joint Programming initiative on "Food, Agriculture and Climate Change". The streamlining of Rural Development measures dealing with the AKIS, their enlarged scope and increased visibility within a coherent policy towards innovation lead towards a much higher uptake of the various measures in comparison with what has taken place in the 2007-2013 financial perspectives.

The Agriculture EIP and the creation of an innovation network ensure better flows of information between the stakeholders increasing not only the use of research results by producers but also allowing research programmes to better take the needs of the stakeholders into consideration. The EIP network and the inclusion of actions targeted towards innovation among the services to be provided by the FAS ensure that Member States and concerned national institutions adopt a proactive approach towards innovation. Hence the risk that the EIP gains ground primarily in those Member States and regions where network-based AKIS are already established and producers and other stakeholders are the most proactive (e.g. more organised sector, etc.) is minimised. Exchange of experiences and good practices among Member States promote better delivery of the AKIS in the various Member States on EU priorities.

3.3. The CAP does not cover farm advice and innovation

3.3.1. Policy measures

Under this scenario, no specific initiative for enhancing innovation is taken at the EU level, nor have Member States any obligation to set up a FAS. The supporting measures under Rural Development are abolished.

3.3.2. Potential impact

Without FAS obligations at the EU level, Member States can decide not to organise any coordinated advisory system and leave the provision of advice to farmers completely to the initiative of the private sector. A minimum offer of advice for farmers on the basic cross-compliance rules is not guaranteed. The capacity of producers to improve their competitiveness, to comply with environmental standards and to adapt to climate change is reduced. This translates in an agricultural sector which cannot contribute to a full extent to solving the important challenges of restoring biodiversity or adaptation / mitigation of climate change as the initiatives and supply of AKIS services from the

private sector will most likely fall short of the farm sector demand for the provision of public goods. In particular, the farming sector of Member States where the development of the AKIS is not a priority, or is strictly resource-constrained, is at a strong disadvantage in comparison with other Member States.

Recently completed research (see the Policy Brief of the research project CAP-IRE) indicates that a more radical scenario of abolition of the CAP would entail a lower number of farms adopting innovation.

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