

Deliverable 3.1 – AKIS report



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About Dairy4Future

Funded by the Interreg Atlantic Area Program, the Dairy-4-Future project aims to increase the competitiveness, sustainability and resilience of dairy farms in the Atlantic area. Its objective is to identify, evaluate and then widely propagate innovative practices to European dairy technicians and breeders, through transnational seminars or farm open days and technical tools.

Dairy-4-Future focusses on four key issues: analysing strengths and weaknesses of the dairy sector in Atlantic Area, fostering dairy sector economic resilience, improving resource use efficiency, and determining sustainable dairy systems for the future.

The project puts innovative farmers at the centre of practice-based research work, and combine several methods (SWOT analysis, research activities, economic simulations) to adapt and develop scientific knowledge, which will lead on technical solutions and recommendations to be shared across the network.

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Document Abstract

The Dairy-4-Future AKIS report aims at describing the AKIS (Agriculture Knowledge and Innovation Systems) in the Atlantic Area.

The evolution of agriculture has always been accompanied by innovation which has made it possible to meet increasing demands.

The AKIS have developed differently across the Atlantic area, as each country has been subject to particular historical events which that shaped the development of the agricultural and other sector. In some countries, the AKIS have always been integrated, whilst in others it is characterised by a higher degree of fragmentation. Despite these differences, it is clear that the AKIS throughout the AA have continuously adapted to the challenges faced by agriculture and livestock farming.

A diverse number of people and organisations (AKIS actors) are involved in generating, delivering and adopting knowledge and innovation in the agricultural sector in the Atlantic Area. While farmers are still the end users of this knowledge, they are increasingly involved in its generation and dissemination. In order to maximise the uptake of innovation, it is critical for the AKIS actors to consider some aspects characterising the end user, such as age, education and plans for the future, but also the external barriers that may prevent the adoption of innovation.

A SWOT (Strengths - Weaknesses – Opportunities – Threats) analysis of the AKIS in the Atlantic Area has been carried out, with many common themes identified across regions and countries. Main strengths were identified in the wide range of the AKIS actors and their increasing focus on innovation, while fragmentation and insufficient funding are considered the main common weaknesses. Further reductions in funding and changes in the farming industry were commonly identified threats, while new delivery technologies, new generations and consumers' demands are seen as opportunities.

Finally, the report presents some suggestions to deliver innovation to the dairy farming industry in a more efficient and effective way. Some examples are: stronger links between research and practice, stronger collaboration among AKIS actors at local, national and international level, more support to digital transition, and increased focus on training.

This report only reflects the views of the author(s).

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List of Acronyms and websites

General		
AA	Atlantic Area	
AKIS	Agriculture Knowledge and Innovation Systems	
BC	Basque Country	
BPS	Basic Payment Scheme	
CAP	Common Agricultural Policy	
EAFRD	European Agricultural Fund for Rural Development	
EEC	European Economic Community	
EU	European Union	
EN	England	
ES	Spain	
FADN	Farm Accountancy Data Network	
FAS	Farm Advisory System (EU)	
FR	France	
GA	Galicia	
GAEC	Good Agricultural and Environmental Conditions	
GB	Great Britain	
GDP	Gross Domestic Product	
GHG	Greenhouse Gas	
IRE	Republic of Ireland	
K&I	Knowledge and Innovation	
KE	Knowledge Exchange	
KT	Knowledge Transfer	
LINSA	Learning and Innovation Networks for Sustainable Agriculture	
MOOC	Massive Open Online Course	
NGO	Non-Government Organisation	
NI	Northern Ireland	
PT	Portugal	
R&D	Research and Development	
RDP	Rural Development Program	
SC	Scotland	
SCAR	Standing Committee on Agricultural Research	
SME	Small and Medium Enterprises	
SMR	Statutory Management Requirement	
UK	United Kingdom	
WA	Wales	
Republic of Ireland		

ACOT	An Chomhairle Oiliúna Talmhaíochta (National advisory and training body)	
AFT	An Foras Taluntais (Institute for Agricultural Research)	
AGRI-I	Agricultural greenhouse Gas Research Initiative for Ireland	https://agri-i.ie/
ASSAP	Agricultural Sustainability Support and Advice Programme	https://www.teagasc.ie/publications/2020/agricultural-sustainability-support-and-advisory-programme-assap.php
DAFM	Department of Agriculture, Food and Marine	https://www.agriculture.gov.ie/
FRS	Farm Relief Services	
GLAS	Green, Low-Carbon, Agri-Environment Scheme	https://www.teagasc.ie/environment/schemes--regulations/glas/
REPS	Rural Environment Protection Scheme	https://www.teagasc.ie/environment/biodiversity--countryside/schemes/
United Kingdom		
AIC	Agricultural Industries Confederation	https://www.agindustries.org.uk/home/
ADAS	Agricultural Development and Advisory Services	https://www.adas.uk/
AFBI	Agri-Food and Biosciences Institute	https://www.afbini.gov.uk/
AHDB	Agriculture and Horticulture Development Board	https://ahdb.org.uk/
AHVLA	Animal Health and Veterinary Laboratories Agency (old)	
APHA	Animal and Plant Health Agency	https://www.gov.uk/government/organisations/animal-and-plant-health-agency
BBSRC	Biotechnology and Biological Sciences Research Council	https://bbsrc.ukri.org/
BDG	Business Development Groups	https://www.cafre.ac.uk/business-support/rural-development-programmes/business-development-groups/
BEIS	Department for Business, Energy and Industrial Strategy	https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy
bTB	Bovine tuberculosis	
CAFRE	College of Agriculture, Food and Rural Enterprise	https://www.cafre.ac.uk/
CPD	Continuing Professional Development	https://cpduk.co.uk/
DAERA	Department of Agriculture, Environment and Rural Affairs	https://www.daera-ni.gov.uk/
DANI	Department of Agriculture for Northern Ireland (old)	
DARD	Department of Agriculture and Rural Development (old)	
Defra	Department for Environment, Food and Rural Affairs	https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy
FAR	Feed Advisers Register	https://www.agindustries.org.uk/feed-adviser-register.html
FAS	Farm Advisory Service (Scotland)	https://www.fas.scot/
FAS	Farming Advice Service (England)	https://www.gov.uk/government/groups/farming-advice-service
FERA	Food and Environment Research Agency – Now FERA Science	https://www.fera.co.uk/
FSA	Food Standards Agency	https://www.food.gov.uk/

GCSE	General Certificate of Secondary Education	
GHGAP	Greenhouse Gas Action Plan	https://www.gov.uk/government/publications/greenhouse-gas-action-plan-ghgap-2016-review
HFCF	Helping Farmers Comply Forum	
HSE	Health and Safety Executive	https://www.hse.gov.uk/
KAS	Knowledge Advisory Service	https://www.daera-ni.gov.uk/news/daera-launches-new-knowledge-advisory-service
MAFF	Ministry of Agriculture, Fisheries and Food (old)	
NAAS	National Agricultural Advisory Service (old)	
NFU	National Farmers Union (NFUS in Scotland and NFU Cymru in Wales)	Scotland - https://www.nfus.org.uk/
QUB	Queen's University Belfast	https://www.qub.ac.uk/
RPA	Rural Payments Agency	https://www.gov.uk/government/organisations/rural-payments-agency
SAC	Scottish Agricultural College (old)	
SRDP	Scottish Rural Development Programme	https://www.ruralpayments.org/publicsite/futures/topics/customer-services/common-agricultural-policy/scottish-rural-development-programme/
SRUC	Scotland's Rural College	https://www1.sruc.ac.uk/
VMD	Veterinary Medicine Directorate	https://www.gov.uk/government/organisations/veterinary-medicines-directorate
WSAC	West of Scotland Agricultural College (old)	
France		
ANDA	Association Nationale pour le Développement Agricole (old) (Association for Agricultural Development)	
APCA	Assemblée Permanente des Chambres d'Agriculture (Permanent assembly of Agricultural Chambers)	https://chambres-agriculture.fr/
ANR	Agence Nationale de la Recherche (National Research Agency)	https://anr.fr/fr/
CASDAR	Compte d'affection Spécial au Développement Agricole et Rural (Special Account for Agricultural and Rural Development)	https://agriculture.gouv.fr/developpement-agricole-et-rural-casdar
CEMAGREF	Centre national du machinisme agricole, du génie rural, des eaux et des forêts (old) (National Centre for Agricultural Machinery, Rural Engineering, Lakes and Forestry)	
CNRS	Centre national de la recherche scientifique (National centre for the scientific research)	http://www.cnrs.fr/
CR	Coordination Rurale (Rural Coordination)	https://www.coordinationrurale.fr/
CP	Confédération Paysanne (Peasant Confederation)	https://www.confederationpaysanne.fr/
CUMA	Coopératives d'Utilisation du Matériel Agricole	http://www.cuma.fr/content/les-cuma-quoi-ca-sert-et-comment-ca-marche

DGER	Direction générale de l'enseignement et de la recherche (General Directorate for Studies and Research)	
DGPAAT	Direction Générale des Politiques Agricole, Agroalimentaire et des Territoires (General Directorate for Agriculture, Agrifood and Territory Policy) (old)	
FBO	Farmers' Based Organisations	
FCEL	France Conseil Elevage	https://www.france-conseil-elevage.fr/
FNA	Fédération du Négoce Agricole (Federation of Input Traders)	http://www.negoce-village.com/
FNDA	Fonds National de Développement Agricole (National Fund for Agricultural Development)	
FNSEA	Fédération nationale des syndicats d'exploitants agricoles (National Federation of Agricultural Holders' Unions)	https://www.fnsea.fr/
GAB	Groupements d'Agriculture Biologique (Organic Agriculture Groups)	
GDS	Groupements de Défense Sanitaire	
GIS	Groupes d'Intérêt Scientifique (Groups of Scientific Interest)	
IDELE	Institut de l'Elevage (French Livestock Institute)	http://idele.fr/
INRA	Institut national de la recherche agronomique (old) (National Institute for Agricultural Research)	https://www.enseignementsup-recherche.gouv.fr/cid51595/institut-national-de-la-recherche-agronomique-inra.html
INRAE	Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (National Research Institute for Agriculture, Food and Environment)	https://www.inrae.fr/en/about-us
IRSTEA	Institut national de recherche en sciences et technologies pour l'environnement et l'agriculture (old) (National Research Institute of Science and Technology for the Environment and Agriculture)	https://www.enseignementsup-recherche.gouv.fr/cid49674/irstea.html
ITA	Instituts techniques agricoles (Technical Agricultural institutes)	
ITAB	Institut Technique de l'Agriculture Biologique (Technical Institute on Organic Research)	http://itab.asso.fr/
JA	Jeunes Agriculteurs (Young Farmers)	https://www.jeunes-agriculteurs.fr/
ONVAR	Organismes Nationaux à Vocation Agricole et Rurale (National Organizations with Agricultural and Rural Vocation)	
PCIA	Pôle du conseil Indépendant en Agriculture (Pole of independent consultancy in Agriculture)	https://www.pcia.fr/

RIEL	Recherche et Ingénierie en Élevage Laitier (Dairy Farm Research and Engineering Unit)	https://www6.inrae.fr/umt-riel/L-UMT-RIEL
RMT	Réseau Mixte Technologique (Joint Technological Networks)	https://agriculture.gouv.fr/developpement-agricole-et-rural-reseaux-et-unites-mixtes-technologiques
UMR	Unité Mixte de Recherche (Mixed Research Unit)	
UMT	Unités Mixtes Technologiques (Mixed Technological Units)	https://agriculture.gouv.fr/developpement-agricole-et-rural-reseaux-et-unites-mixtes-technologiques
Spain		
AGACAL	Agencia Gallega de Calidad Alimentaria (Galician Agency for Food quality)	https://mediorural.xunta.gal/gl/conselleria/organismos-adscritos/axencia-galega-da-calidade-alimentariam
CIAM	Centro de Investigaciones Agrarias de Mabegondo (Centre of Agricultural Research of Mabegondo)	http://www.ciam.gal/sp/index/?r=portada.index
CSIC	Consejo Superior de Investigaciones Científicas/ Scientific Research Superior Board	https://www.csic.es/en
INIA	Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria/ National Institute of Agriculture Research and Technology	http://www.inia.es/inia/
NEIKER	Nekazaritza Ikerketa eta Garapenerako Euskal Erakundea/Basque Institute for Agricultural Research and Development	https://neiker.eus/es/
OAC	Oficina Agraria Comarcal /County Agriculture Office	https://web.bizkaia.eus/es/-/oficinas-comarcales-agrarias
OPA	Organización Profesional Agraria/Professional agrarian organisation	https://www.upa.es/upa/que-es-upa
PT	Plataforma tecnologica (Techonology platforms)	http://www.idi-a.es/plataforma-tecnologica
Portugal		
ABLN	Associação para o apoio à Bovinicultura Leiteira do Norte (Association to support the North Dairy cattle farming)	http://www.abln.pt/
ALIP	Associação Inerprofissional do Leite e Lactícínios (Interprofessional Association of Milk and Dairy)	http://www.alip.pt/index.html#
CAP	Confederação dos Agricultores de Portugal (Portuguese Farmers Confederation)	https://www.cap.pt/
CNA	Confederação Nacional da Agricultura (National Farmers Confederation)	https://www.cna.pt/
CONFAGRI	Confederação Nacional das Cooperativas Agrícolas e do Crédito Agrícola de Portugal (National Confederation of Agricultural Cooperatives and Agricultural Credit of Portugal)	https://www.confagri.pt/
CoLAB	Laboratório Colaborativo (Collaborative Laboratories)	https://www.fct.pt/apoios/CoLAB/index.phtml.en
DGADR	Direção Geral de Agricultura e Desenvolvimento Rural (Directorate General for Agriculture and Rural Development)	https://www.dgadr.gov.pt/

EABL	Associação para o Desenvolvimento da Bovinicultura Leiteira (Association for the Development of Dairy Cattle)	http://www.eabl.pt/
FENALAC	Federação Nacional das Cooperativas de Produtores de Leite (National Federation of Dairy Producers Cooperatives)	https://www.confagri.pt/associadas/fenalac/
ISA	Istituto Superior de Agronomia (High Agricultural School)	https://www.isa.ulisboa.pt/en
PROAGRI	Programa de Apoio ao Reforço das Organizações de Agricultores (Program to Support the Strengthening of Farmers' Organizations)	https://dre.pt/pesquisa-avancada/-/asearch/566190/details/maximized?perPage=100&anoDR=1990&types=SERIEI&search=Pesquisar
SIRCA	Sistema de Recolha de Cadáveres de Animais Mortos na Exploração (Collection System for Dead Animals on the Farm)	http://www.dgv.min-agricultura.pt/portal/page/portal/DGV/genericos?actualmenu=1579556&generico=2460806&cboui=2460806
UTAD	University of Trás-os-Montes and Alto Douro	https://www.utad.pt/

1. The report

1.1 Purpose

The purpose of this report is to describe the AKIS (Agriculture Knowledge and Innovation Systems) in the Atlantic Area regions in terms of their development and evolution, structure, functions, strengths and weaknesses. This analysis will also help to potentially identify the most effective ways to foster innovation in the Atlantic Area based on the current AKIS. The report will not propose any change to the AKIS structure.

1.2 Methodology

Each Dairy-4-Future regional partner appointed an AKIS expert who collected information regarding AKIS and dairy farming in their respective regions. Where dairy-specific or regional data were not available, livestock or agricultural and national data were used and indicated as such. After receipt of the initial information, a second request was made for data clarification or any missing information. Unavailable data were simply noted as N/A. The gathered data were organised in an Excel spreadsheet to aid information collation and analysis. The main findings have been collated and contextualised with relevant available literature (reports, scientific articles, reviews).

2. AKIS and innovation

The next 30 years will pose significant pressures on the agricultural sector. Feeding a growing population, predicted to reach nearly 10 billion people by 2050, in a sustainable way and in the context of climate change will be challenging and require innovative solutions to guarantee food safety and security.

The AKIS concept describes a “system of innovation, with emphasis on the organisations involved, the links and interactions between them, the institutional infrastructure with its incentives and budget mechanisms” (1). The AKIS provide farmers with relevant knowledge and offers useful networks around agriculture (2).

Traditionally, institutional agricultural knowledge systems were built upon a linear research model. A clear institutional delimitation was set between universities and research centres (dedicated to research and education), extension services (dedicated to training, advice and general communication), and farmers (as end users) (3). In the last decade, in the European Union (EU), as it became more and more clear that the linear research model was failing, the concept of Agricultural Knowledge and Innovations Systems (AKIS) evolved from a primarily academic concept to a broader approach for agricultural knowledge, policy and sectors (4). According to this new concept, farmers were not considered only end users anymore but active AKIS actors, playing a critical role in the generation and exchange of knowledge and innovation (i.e. through informal on-farm experiments and/or practice adoption) and in the co-production of schemes and support. The gradual reshaping of agricultural knowledge systems reflects the change in the vision of agricultural knowledge, with abandonment of the traditional linear approach to knowledge transfer, once limited to agricultural knowledge institutes, and introduction of innovation in a broader sense and a more intricate pattern of knowledge exchange relationships amongst AKIS actors.

The evolution of the agricultural sector has always been accompanied by innovation, which has made it possible to meet increasing demands. The new concept of AKIS as an interactive, rather than linear, approach is key to deliver and foster innovation. Innovation is a bottom-up process, which often requires the inputs of different partners from both public and private sectors to generate ideas, put them into practice and test

them, facilitate their diffusion, implementation and uptake. This is the core of the EIP-AGRI interactive innovation model (5), which promotes collaboration amongst actors and uses complementary knowledge types to develop co-owned projects with highly impactful positive outcomes for the end-user.

Therefore, to successfully generate knowledge and innovation and translate it into practice, the collaboration among the AKIS actors throughout the process is critical.

Many attempts to graphically describe AKIS models have been made in past years. Figure 1 shows a simplified view of the AKIS, where the connections between producer (farmer) and the three basic institutional components are highlighted. However, in this simplified model, many other relevant AKIS players are missing, such as government, the private sector, public society, support systems (i.e. inputs, credit, and farmers' associations), markets etc. Figure 2 shows a more comprehensive AKIS model, where the support system component and non-system components (policy, institutional commitment, communication systems and physical and human resources) are included. This model, where the four components act upon the knowledge of farmers and generate innovations in response to problems and opportunities, desired outcomes, system drivers and regulative policies and institutions, gives a better idea of the complexity of the AKIS. Figure 3 gives a broader view of the different active frames, with the issues addressed by the AKIS.

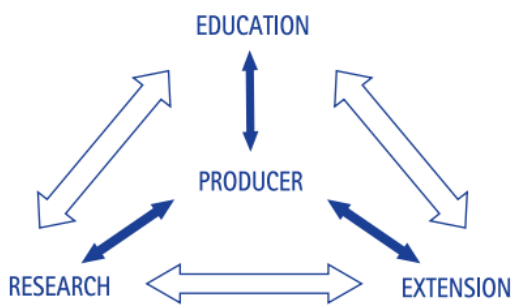


Figure 1. Simplified AKIS diagram (6)

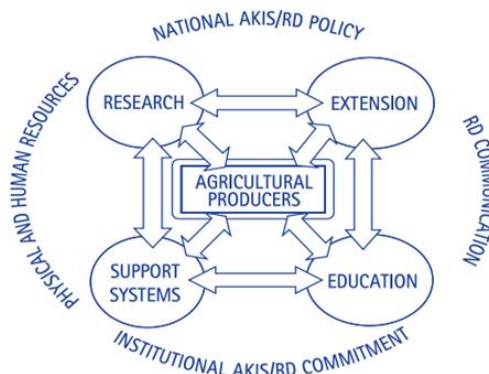


Figure 2. A more comprehensive AKIS/RD model (6)

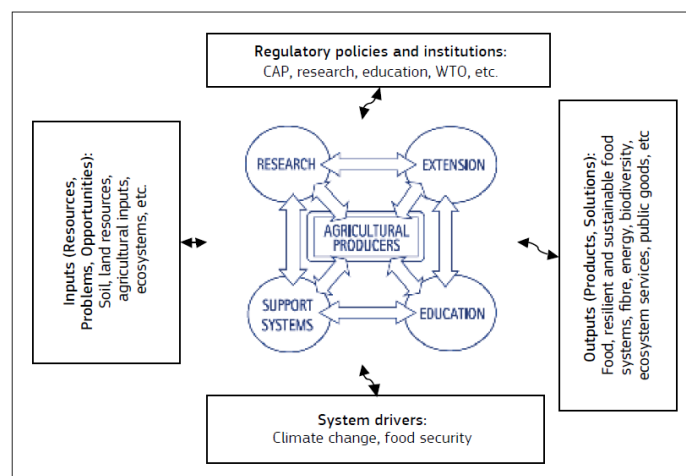


Figure 3. A model of an Agricultural Knowledge and Innovation System undergoing transformation (1)

3. Regional framework: how history shaped the AKIS in the countries and regions in the Atlantic Area

3.1 General overview

The Knowledge and innovation systems have developed differently, historically, across the Atlantic Area (AA), as each country has been subject to particular historical events which have shaped the development of the agricultural and other sectors. Additionally, the AKIS has always been very integrated in some countries, whilst in others it has been characterised by a high degree of fragmentation.

Despite these differences, though, it is clear that the AKIS throughout the AA had to adapt to the different challenges faced by agriculture and livestock farming.

In the post-Second World War Europe, agriculture was a key sector and its objective was to increase the food supply to the population and to secure income for farmers. During this time, the AKIS were structured to provide research and advice, mainly aimed at increasing production. In the majority of the Atlantic Area, the state played an important role in the coordination of the AKIS, in particularly the extension services. Modernisation and intensification were important enablers of this strategy of increased productivity.

During the 1990s, the research and advice provision began to shift from the strong production-based model to an agriculture increasingly focused on sustainability, with the environment and animal welfare as emerging drivers. In addition, emerging technologies and development of information and communication systems contributed to a new *status quo*. These changes are reflected in the historical developments of the Common Agricultural Policy (CAP). In recent years, there has been a general reorientation of agricultural policies according to the three pillars of sustainability - economic, environmental and social - with an increasing importance of the consumer in shaping this approach.

For each country or region, the main historical events that led to the current AKIS structure are summarised in the paragraphs below.

3.2 Republic of Ireland

The AKIS in Ireland have a long history. Since the early 1910s, the need for a technical instruction to young farmers was recognised: the DAFM (Department of Agriculture, Food and Marine), established in 1919, was originally responsible for this action and encouraged programmes of basic agricultural education throughout the national school system. At the same time, the local authorities were given the power to levy rates on agricultural land to finance county committees of agriculture, which, in turn, were obliged to provide technical instruction to young farmers and to stimulate rural industry (7).

With this structure, it was difficult to ensure consistent and high-quality advice aligned to national policies throughout Ireland. The idea of a state-supported agency to ensure the adoption of new methods by farmers was widely accepted (8)(9) and in 1980 a semi-state institution named ACOT (An Chomhairle Oiliúna Talmhaíochta/The national Advisory and Training Body) was founded. ACOT provided training and advisory services for all farmers and took over the functions and personnel of the five state colleges previously operated by the DAFM, and responsibility for the state funding of the private colleges (9).

In 1981, a comprehensive training programme for young entrants to farming, the Certificate in Farming (now replaced by the “Green Cert”) was initiated.

On the research side, in 1958, An Foras Talúntais (AFT, Institute for Agricultural Research), the forerunner to Teagasc, was founded and it was the first time the country had its own national agriculture research organisation (10). In that time of economic gloom and crisis in Ireland, An Foras Talúntais provided solutions to farming problems around the country.

In 1988, The Agriculture (Research, Training and Advice) bill made the provision for setting up a unified body called Teagasc¹, the Agriculture and Food Development Authority. This national agency subsumed the training functions of ACOT and the research activity of An Foras Talúntais. The rationale for this was that considerable benefit could be derived from the co-ordination and integration of the training service with the research and advisory services (9) (10).

The education and training system success faced some fluctuations through the years. Even in recent years the applications for land sector higher education courses have faced volatility, possibly indicative of some shrinkage in overall demand against a background of an increasing number of higher education providers and the potential over-provision of higher education courses (11).

The extension service as well had to face some changes to get to the current situation. In 1987, a basic charge for a standard annual advisory contract was introduced (all advice was previously free), with a variety of advisory packages offered with different levels of service (9). However, the introduction of charges resulted in a focus on those farmers who could pay, namely the more commercially-oriented farmers (12). The late 1980s were also characterised by funding cuts and consequent fall in advisor numbers, which recovered throughout the 1990s thanks to additional funding to support the delivery of the Rural Environment Protection Scheme (REPS).

An important milestone that marked the AKIS recent history in Ireland is the abolition of milk quota in 2015. When quotas were introduced in 1984, milk processors and ACOT (and subsequently Teagasc) advisers and specialist interacted very strongly to figure out best farming practice under this new constraint. In the early 1990s, a number of Joint Programmes with milk processor partners were initiated (many still operating today), building on the close working relationships established. The focus of these Joint Programmes were various, from improving product quality to grassland management practices, with the common aim of lifting dairy farm incomes in a quota environment (13).

In preparation for milk quota removal, the Irish extension services began to actively promote low-cost, sustainable milk production through expansion of the dairy herd, increased specialisation in dairying and encouraging farmers to intensify dairy production in an otherwise land constrained environment: the emphasis was continuously put on the longstanding three core technologies of grassland management, breeding and cost control (14). The success of this strategy is recognised: Ireland has moved from being the poorest country in the European Economic Community (EEC) at the time the of milk quota introduction to being one of the most affluent in the EU today (13).

3.3 United Kingdom

Agriculture and education have been devolved matters in the UK since the end of the '90s, meaning that the regional administrations of England, Wales, Scotland and Northern Ireland have decision making powers for their territory and there may be different policies and arrangements in place. In this section, we summarise the wider United Kingdom AKIS history as described in the PRO AKIS project report (2), highlighting some of the relevant historical events at each administration level.

¹ Teagasc pronounced "Chawg-ask" means 'instruction' or 'doctrine' in the Irish Gaelic language,

Until the late 1980s, the extension service in the UK, at the time publicly funded, focussed primarily on increasing food production. Scientific information generated in universities and research stations was used for education and training, through universities and colleges and by the state advisory organisation (ADAS).

The most relevant milestone to highlight is the privatisation of the ADAS, which occurred in 1997. The PROAKIS report (2) identified several steps in the development of the UK AKIS:

- Increased focus of strategic, public good research work in the late 1980s, with less funding available to near market applied research (which became a remit of the industry)
- Increased commercial research activity of the ADAS in the early 1990s with final privatisation in 1997
- Creation of Defra in 2001, with more focus on environmental sustainability and less on food production

In addition, between the 1980s and the early 2000s, several colleges, research stations and universities either merged or closed. In 1994, the Agricultural Training Board, established in 1966 to provide appropriate training in conservation, environment improvement, basic agricultural skills and other aspects of rural life, was dismantled.

The dairy levy board for Great Britain, the Milk Development Council, was established in 1995 and was replaced in 2008 by DairyCo (now AHDB Dairy) a subsidiary company of the Agriculture and Horticulture Development Board (AHDB).

These historical events lead to a fragmentation of the AKIS in Great Britain, particularly England, with a disjuncture between market-based advisory services and the increasingly pressing policy-driven need for non-market advice and knowledge on the environment (15). This “laissez faire” approach allowed for a large number of, often unregulated, advisory services, contributing to the decrease in trust between farmers and the government, already triggered by the loss of the connection with the state advisors (15).

On the research side, many institutions have adapted activities successfully in accordance to the changing needs of agriculture, and dairy farming in particular, throughout the years. The Hannah Dairy Research Foundation (Box 1) is a good example of flexibility and adaptation. Scotland, where many of these research centres are located, has a long history of high quality and world leading research into animal and human health, including nutrition:

- The Rowett institute was founded in 1913 to provide knowledge on vitamin and mineral nutrition in farm animals and continues to research nutrition and human health with a significant impact on animal health and human nutrition, both in Scotland and globally.
- In 1993, the Roslin Institute was established as an independent institute of the BBSRC (Biotechnology and Biological Sciences Research Council) with a focus on genetics and breeding. Since then, it has made many contributions to animal sciences, especially through quantitative genetics to improve livestock and welfare. The principal objectives of Roslin remain to enhance animal health and welfare; enhance sustainability and productivity of livestock systems and food supply chains; enhance food safety; enhance human health; identify new and emerging zoonoses and to enhance quality of life for animals.
- Other research institutes, though not initially intended to advance dairying research, have since become important sources of research and knowledge for all Scottish agriculture, including dairying. The Moredun Research Institute was established in 1920 by a group of Scottish farmers with the aim of improving the health of livestock, particularly sheep. Over the decades, the focus of this research has broadened and now covers cows, goats, horses and other wildlife.

Box 1. Adapting to the needs of industry and society: the case of Hannah Dairy Research Foundation – Scotland

*One example of how research adapted to the needs of dairy farming to provide real solutions is the **Hannah Dairy Research Foundation**. Established in 1928 as Hannah Dairy Research Institute, it focussed originally on issues such as bovine tuberculosis (bTB), milk fever and physiology of milk secretion. Thanks to its activity, in the mid-1930s, the county of Ayr in Scotland was declared the first bovine TB-free area in Scotland, following collaboration between scientists from the Hannah and local authority veterinary staff educating and helping to provide knowledge to local farmers. Over the next 20 years, the whole of Scotland became TB-free following introduction of a plan based on the Hannah principles. The Hannah continued to provide knowledge that improved productivity on Scottish farms and further afield, whilst studies, including the production and utilisation of grass, contributed to an 80% increase in productivity of British grassland from the 1930s.*

During the Second World War, from 1940, farm self-sufficiency became key and the institute focussed on investigating and providing information on protein substitutes for dairy cows, bovine mastitis and the preparation and storage of dried milk. Research at the Hannah continued post-war, investigating animal nutrition and production, the chemistry and physics of milk, lipid biochemistry and enzymology, milk utilisation and mammary physiology. In 2002, the institute's scientific focus shifted to improvements of both Scotland's and world health, by exploring and explaining emerging links between lifestyle and lifelong health and well-being.

<https://www.hannahdairyresearch.org.uk/>

A similar historical pattern of the AKIS developing according to the needs of the dairy farming industry was seen in Northern Ireland. In the late 1980s, previously generalist advisers started to specialise in the different agricultural enterprises, including dairying. An Agricultural Technology Branch was established at Greenmount in 1996 to back up the new specialist advisory services. The remit of this branch was to apply research findings within commercial farming systems and demonstrate the application of these systems of production and management through the DANI (Department of Agriculture for Northern Ireland) College farms to commercial farmers and growers in Northern Ireland. Since 1996, the Agricultural Technology Branch has expanded into the CAFRE (College of Agriculture, Food and Rural Enterprise) Knowledge Advisory Service (KAS)².

During 1988, in line with the introduction of charging for government advisory systems by ADAS in England and Wales, charging for advisory services was introduced.

In 1997, the election of the new Labour government, with a strong emphasis on education, stimulated a review of DANI strategic priorities identifying as new priorities with a market-led culture, reducing costs of production through improved business and technical competence, adoption of appropriate technologies and management practices, improved collaboration and integration across supply chains, best practice in environmental management, animal welfare and public health. The charge for advisory services was

² The CAFRE KAS consists now of 4 branches including the Intensive Livestock and Crops Development Branch with responsibility for both application of research within the CAFRE Dairy Herd and for CAFRE Dairying Development Advisers working with dairy farmers through Business Development Groups and delivering FAS to dairy farmers.

subsequently removed³. In 1998 the new Agri-Food Development Service (responsible for farm advisory services within DANI) was established to lead the change in DANI policy in moving away from charging for reactive advice to focus on proactive people development through education and training courses to improve business management, promote the adoption of technology and exploit market opportunities.

Agricultural education and farmer training development was made the responsibility of the single DARD (Department of Agriculture and Rural Development) College CAFRE, from the amalgamation of three previously separate DARD colleges, Greenmount, Loughry and Enniskillen.

To assist farmers with business management, in 1999 CAFRE Dairy Benchmarking was created, establishing a system where dairy farmers could compare their farm financial performance with a benchmarking database to establish strengths and weaknesses of the business. Associated with CAFRE Dairy Benchmarking was the establishment of a system of farm development planning; setting out an individualised roadmap for the farm in terms of priorities for developing the business through investment, technology adoption, training and skills development. In the same year, DANI was renamed as DARD, which was then renamed as DAERA (Department of Agriculture, Environment and Rural Affairs) in 2016.

To proactively develop people and businesses, a series of independently accredited vocational training courses for farmers named 'Challenges' were developed, with Grass, Business, Fertility and Animal Health Challenges specific for dairy farmers. For many farmers, these were the first educational certificates earned.

In 2001, the Vision Report for the future of the agri-food sector in Northern Ireland identified several challenges with a strategy aimed at tackling them: the sterling – euro exchange rate; the reform of the common Agricultural Policy (CAP); globalisation; changing consumer tastes and preferences; food safety and pressures to farm in an environmentally friendly and welfare conscious way.

In 2002, the non-departmental government body AFBI (Agri-Food and Biosciences Institute) was founded, with responsibility for agricultural and food research in Northern Ireland.

Overall, there has been an organisational evolution towards the privatisation and commercialisation of knowledge production and transfer, especially in England. Non-Government Organisations (NGOs), public and private actors compete for the provision of agricultural advice (2).

3.4 France

After the Second World War, the French agricultural world formed a sort of citadel, apart from the rest of society, with its own structures (health, teaching, banking establishments, etc.), its own norms, and its own unified research and professional organisation. The latter was influential, co-managed the entire system of supervision of state support and acted as the interface with the outside world. Apart from the implicit consensus that agriculture aimed to feed people, non-agricultural society was scarcely concerned by the way farmers organised themselves in order to produce.

Non-agricultural society was absent from the choices made in farming, in particular regarding the use of technical progress. Recent use of the National Research Agency, development of clusters and networks between institutions modified this situation. After the Second World War, agriculture was an important economic and strategic sector where productivity was to be strongly improved. The sector was also

³ A 2001/02 survey (43) highlighted the relatively low level of education level of farmers and farm families in Northern Ireland. 45% of farmers were found to have a general qualification of GCSE or equivalent level, while only 13% of farmers had agricultural qualifications. The findings of this study provided strong supporting evidence for the removal of charging for advisory services.

composed of very small tenures that could not afford alone the cost of a research and development system. Consequently it had to be, and still is, organized more collectively, and more independently, than in the other productive sectors.

The evolution of the financing and management of advisory services in France is embedded in the history of the relationship between the state and farmers' unions (16). The development of professional organizations at the local, regional and national levels was a major aim of modernization policies during the '60s and '70s. The French innovation, training and extension system has been since then collectively funded by the farmers, with an increasing control of the state and more and more orientations towards public expectations and goods.

From the 1960s to the 1980s, the main objective of the innovation system in France was the improvement of production and productivity. The process of intensification was maintained by the productivity gains thus generated and was sustained by collective action and public policies. The period of modernization that started in the 1960s, was characterized by an increase in the budget dedicated to agronomic research, by a development of professional networks, and of technical consulting services provided to farmers.

The government funded and governed a national research institute (INRA - Institut national de la recherche agronomique) and a national applied research institute (CEMAGREF - Centre national du machinisme agricole, du génie rural, des eaux et des forêts). The farmers, through specific taxes funded sector applied research institutes, agricultural chambers and many local extension and genetics services. Globally the system was considered as a "top-down" one, from public research to the farmers through extension services. In fact the functioning of the system was already more complex.

As described by Labarthe (16), from 1960 to 2006, farmers paid a levy ("para-fiscal" tax, consisting of a percentage taken on the first trades on agricultural commodities) to the FNDA (Fonds National de Développement Agricole - National Fund for Agricultural Development): the state (ministry of Agriculture) and farmers' unions, mainly the FNSEA (National Federation of Agricultural Holders' Unions), equally represented within the ANDA (Association for Agricultural Development) negotiated the allocation of this fund, which was mainly used by applied research institutes and the chambers of agriculture. The training of farmers and the individual advice was mainly free of charges. By the same time, the private firms and the cooperatives also advised the farmers. After years of criticism regarding lack of effectiveness and transparency, in 2006 the ANDA was finally dismantled: the FNDA was replaced by the current account, called CASDAR, under the control of the Ministry of Agriculture, and the funding system remained based on a levy, on the farmers' gross income (16). This reform, which diversified the beneficiaries of the funding in favour of alternative approaches to rural development, has significantly transformed the AKIS actors. The chambers of agriculture reoriented their mission towards new themes such as environment, local development, territorial issues, with less advice on technical or economic issues. Also, a set of non-profit organisations, defined as ONVAR (Organismes Nationaux à Vocation Agricole et Rurale) emerged as key AKIS actors. Most of the other extension services which benefited from the former levy system became financially independent, funded directly by farmers, through direct services.

Summarising, while during the 1980s the objective was the reduction of production costs (cost of mechanisation, fertilisation...), since the 1990s the main objectives of the extension and knowledge system have progressively changed. Environment, quality of products, animal welfare and sustainable development are getting more important in the governance of the system, even if productivity and moreover production costs are still present and important.

3.5 Spain: Basque Country and Galicia

The political and territorial organization of Spain is based on decentralization, in which the regions have much of the responsibilities and decision-making power. The decentralization of competences and responsibilities to the regions occurred during the end of 70s and early 80s after a period of negotiations between the new regional governments and the central government. In this system, the central government defines the basic national objectives and guidelines of the policy of agricultural research, the overall coordination of the projects collected in national programmes of agricultural research and international scientific relations in the field. The National Institute for Agricultural and Food Research and Technology (INIA) established by the Government in 1971 was the national public agency responsible for the above- mentioned functions. The Statutes of Autonomy of the regions establishes that regions have competence in agriculture: therefore, each region independently designs and develops its own agricultural research, with different models of management and different philosophy and in accordance with their own agenda and objectives, following their own stated needs.

As described in the PRO AKIS report (17), the Spanish advisory services to farmers emerged in the mid-1950s; it was known as Agricultural Extension Service (AES) and was led by the central government. The AES remit was knowledge transfer and farmers' training to farmers, implemented through County Agricultural Offices (OACs). At the end of the 70's (1978), the AES began to be transferred to the recently created regional governments. During this time, in preparation to join the EU in 1986, the government moved its strategy away from a social focus on rural agriculture and focussed on the technical and economic aspects of agriculture towards modernisation. In 1987, to manage coordination and cooperation between regional and central government, the Agriculture Research Committee, chaired by INIA and ministries, was created. In 1991, the AES disappears as autonomous body, and only the OACs remained operational: the OACs progressively lost the role of advisers and became focused on administrative tasks, such for example the management of grants to farmers from CAP. The technical advisory functions were taken over by the OPAs (Professional Farmer's Organisations).

In the specific case of the Basque Autonomous Community (Euskadi), the competences are shared between the governing bodies of the three provinces (Bizkaia, Gipuzkoa and Álava) and the Autonomous Government. The Autonomous Government is responsible for the planning, research and inter-institutional coordination, and the Provincial Government is responsible for the execution of the policies related to agricultural production (health, aid implantation, irrigation,...). To facilitate relations with farmers, the councils created the County Agricultural Offices (OACs).

To provide themselves with financial and technical expertise, the farmers set up cooperatives (the first, LURGINTZA, was founded in 1971), leading to the Management Centers: LORRA, in the province of Bizkaia, ABELUR and LURGINTZA, in the province of Gipuzkoa and ABERE, in the province of Álava. These non-profit cooperatives are responsible for assisting farmers on administrative, economic and technical issues. In 2007, the Management Centres have been recognized as Consulting Organizations. From a research perspective, in 1996 the public society NEIKER (Institute for Agricultural Research and Development) was constituted and assumed the management of the activities carried out until then by other research centres.

In Galicia, an important historical trend is the development of the agricultural organizations (OPAs) and cooperatives during the 90s, as a response to the insufficient training activity of the research centres. They were emerging and consolidating themselves as non-formal advisory services while traditional extension service functions were disappearing. From the point of view of their activities, the last two decades have been defined by an important process of modernization and improvement of their service delivery capacity.

Therefore, the regions have taken over large number of competences since the early 80s, including those referring to the traditional public agricultural extension services, which is not offered anymore as before. The change was not just related to competences, but also to the conception of the service itself: from a focus on the development and demonstration of agronomic innovations to the farmers, the services became more oriented to the fulfilment of official requirements from the CAP (17).

3.6 Portugal

The PRO AKIS report (18) describes the public agricultural extension service activity in Portugal as sporadic and mostly disorganised. Until the mid-1970s, the messages delivered on technology and the information and demonstration campaign were not adapted to the local social and economic circumstances: moreover, the technical assistance service reached few farmers, lacked consistency and continuity, was very centralised and the advice provided was based on central policy problems rather than on actual issues identified by farmers.

From 1930 to the early 1980s, Portugal was a closed economy and Portuguese agriculture evolved due to a national policy, which marked it deeply. During this period, the Portuguese agricultural sector served mainly as a support for the industrial development model chosen for the country by the New State (Estado Novo) regime, food production decisions were made centrally, rural areas were neglected and suffered massive emigration to main cities and central European countries. At the same time, per capita income in agriculture grew at much lower levels than in the services and industry sectors (19).

A first important change in direction came with the Revolution of April in 1974 and the new democratic orientation of the State: new laws introduced regionalization, through the creation of Regional Agricultural Services, and an extension service (Rural Extension Services). At a central level, the General Directorate of Rural Extension was created to support the rural extension services, at the regional and local levels, in the organisation, planning, training, and evaluation tasks. It took many years for the extension service to become effective: the first organised extension programmes started in the late 70s but were only implemented in some regions of Portugal and the tentative to link research and extension with the creation in 1982 of the National Institute for Agricultural Research & Extension was short-lived. It was in the late 80s/early 90s that the qualifications of public extension staff were upgraded and the specific competences identified for the training with a strong role of the Universities and Polytechnic Agricultural Institutes.

Until middle 1980s, the Portuguese AKIS was mainly supported by public organizations responsible for research and extension services. In 1986, Portugal became a EU member and after 1990 there was a marked change. Public services were mainly providing information on CAP measures and policies, and taking care of administrative tasks. Technical support for agricultural development became a function of many institutions and services, especially cooperatives and farmers' associations, in a more or less fragmented and dispersed fashion. This change was difficult and require many years to become efficient.

In 1990 a major programme - PROAGRI - was launched, with the objective, in a privatisation view, of strengthening the capabilities of farmers' organisations in the areas of management and technical support to members and non-members. Cooperatives and farmers' associations were frequently weak, in both organisational and financial terms and on the other hand, the transfer of functions to such organisations was not accompanied by changes in extension practices, therefore the top-down and linear perspectives of the State services remained dominant.

After PROAGRI, in the mid-1990s the government created 300 new "Agricultural Zones" and the so called "family technicians": each municipality corresponded to an "Agricultural Zone", and each "Zone" had a team of agents, of whom a number of farm families was assigned, in order to allow a more personalized contact. The emphasis was placed on information, particularly on Common Agricultural Policy measures and policies, and practices tended to be quite bureaucratic. Agricultural zones have progressively tended to perform bureaucratic administrative functions, controlling CAP subsidies, inspection and related issues. After this period, technical support to agricultural development became a function of many institutions and services, especially cooperatives and farmers' associations, in a more or less fragmented and dispersed fashion.

In the last 2 decades and especially in the last one, the agricultural sector and the dairy sector in particular have sought support from universities and their associated research centres, but also from private



companies, to address the major challenges facing the sector, including environmental impacts, food safety, animal feed and animal welfare. This approach was based on the need to get answers to the low price of milk, but also the growing social and regulatory demands on sustainability and well-being. In parallel to the cooperation for research and innovation, there have been many training courses for farmers and technicians.

4. Main AKIS players in the Atlantic Area

4.1 Overview

A diverse number of people and organisations are involved in generating, delivering and adopting knowledge and innovation in the agricultural sector in the Atlantic Area (Figure 4 and Figure 5). The players involved in the linear transmission of knowledge to farmers (Research - Education – Extension) still have an important role in this broader and more articulated AKIS structure. However, many other actors not belonging to this process (vets, commercial advisors, supply chain, banks, NGOs...) are now considered a relevant part of the AKIS and in many cases have a much stronger impact on the farmer.

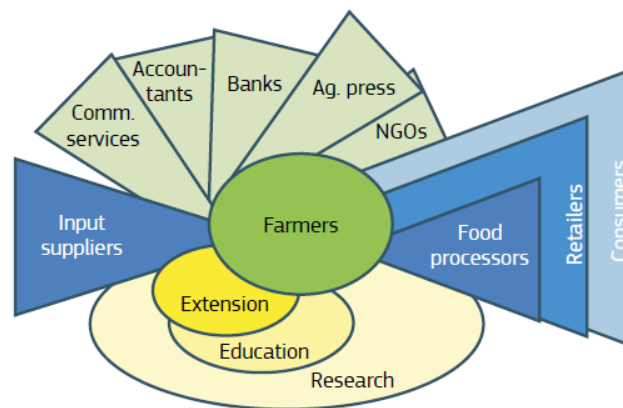


Figure 4. Actors in the AKIS directly relevant for agricultural innovation in the food chain (1)

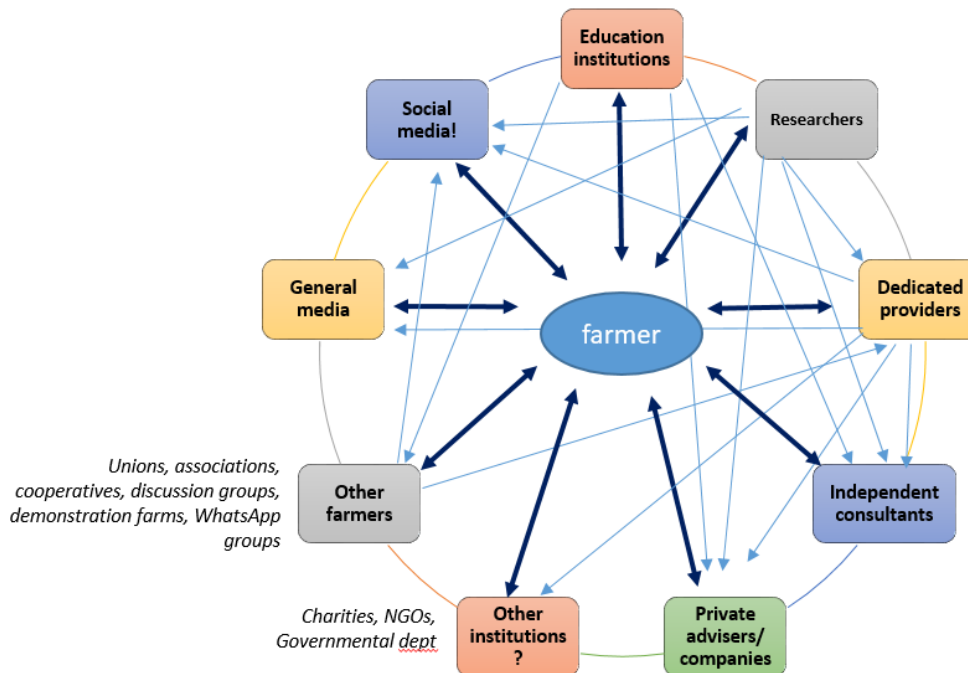


Figure 5. Relationships among the main AKIS players in dairy farming (source: this document)

The farmer is still at the centre of the system, as traditional “end user”: he/she is in fact the one who will eventually introduce innovation in the farm and/or utilise the knowledge to improve farming activities. However, farmers are also increasingly involved in the generation of knowledge and innovation and through various channels such as discussion groups, online forums or social media, can deliver it successfully to other farmers. Chapter 5 provides a more detailed description of the dairy farmer’s characteristics in the Atlantic Area regions.

An interesting aspect of the relationships between the farmer and the other AKIS is the existence of a “ring of confidence”, where different players are positioned according to the level of trust that the farmer places in them (Figure 6 - (20)). Trust forms the basis of an effective relation between farmer and adviser: according to this model, a farmer’s receptiveness to advice depends on the level of confidence they have in the advice source and reliability of the advisory recommendations they are given (21). This is a general description and at an individual level this may of course be different.

In the inner circle, an important role is played by family members, as decision-making is often a family matter, as well as other farmers. Farmers often prefer to receive information from friends and family or from peers where they can see the outcomes of the decision themselves. Whilst in this model the commercial advisers are in the inner ring, it is worth mentioning that in some cases the advice from sales representatives is perceived as biased by the need to push sales and may therefore be not as independent as other sources. The success of the knowledge and innovation transfer in the inner ring is related to the possibility to tailor the message and the advice to the specific situation, making it more practical, effective and adaptable to change to specific circumstances. This mutual trust leads to better two-way discussions, increasing further the dissemination of new knowledge and innovations.

The advisers in the outer ring are generally less successful in influencing decision-making - unless related to specific regulations - as the advice they provide is generic and sometimes conflicting with actual farm practice and management. Again, at an individual level this may be different with some outer-ring advisers moving to the inner ring, if trust is built between them and the farmer.

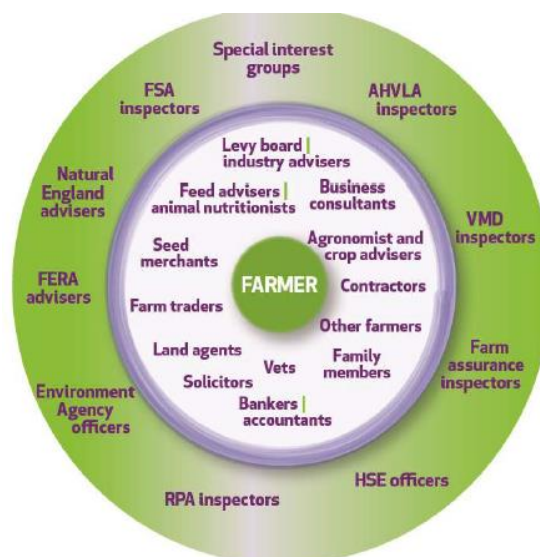


Figure 6. AIC Ring of Confidence in England (20) ⁴

⁴ For acronyms explanation, see Page 4

4.2 Country/region-specific AKIS

The AKIS in Europe, and in the AA in particular, is very diverse. This diversity mainly derives from the adoption, in each country/region, of a system that applies to the specific situation in terms of farming characteristics, issues and needs of the different actors involved. At a higher level, the different culture and traditions can also affect the AKIS structure and its development. The historical events described in Chapter 3 are an example of how different the AKIS evolution was in each country, even in the presence of a general common change from a production-based to a sustainability-based agricultural concept. For this reason, the AKIS in the AA countries are not easily comparable.

Knierim and Prager (22) plotted the European AKIS according to their strength (involvement of influential actors and resource allocation) and level of integration (formal links between the AKIS actors which define the level of coordination, collaboration and competition among them). As shown in Figure 7, the AA countries (circled in red) have very diverse AKIS in terms of strength and integration. Note that whilst this matrix includes the whole agricultural sector, the dairy AKIS present similar characteristics.

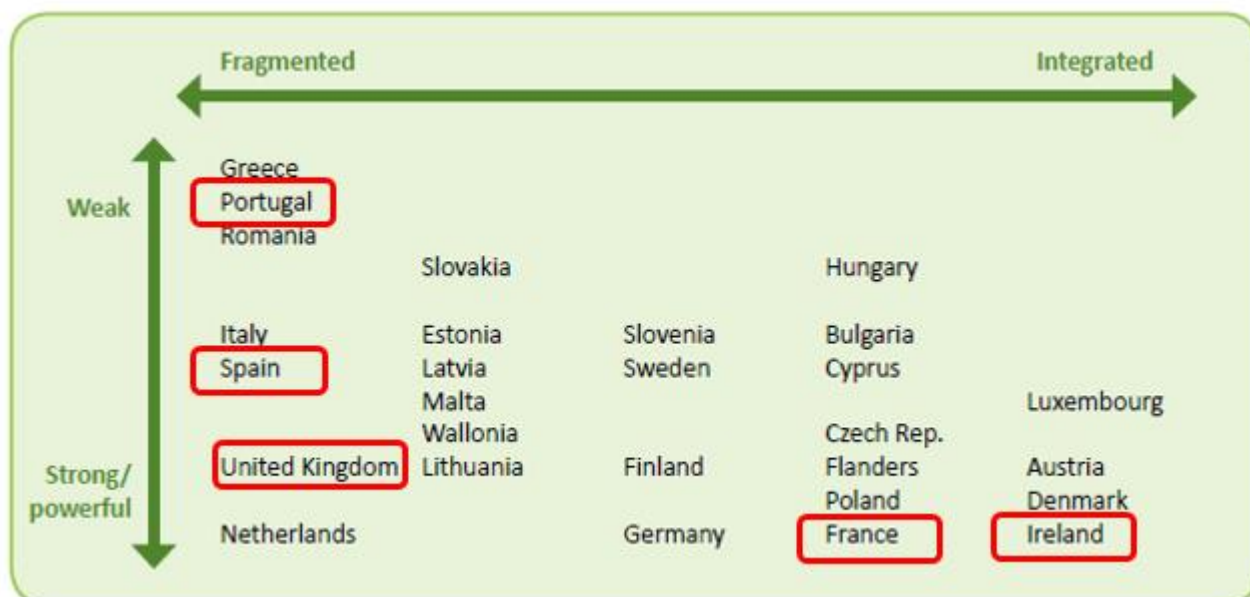


Figure 7. Overview of the European AKIS according to their level of fragmentation/integration and weakness/power where those circled in red represent countries in the Atlantic Area. (22)

4.2.1 Republic of Ireland

- Ireland is unique in having a substantial component of its AKIS within a single organisation (Teagasc, the Agriculture and Food Development Authority) (9) and being thus classified as one of the most integrated and powerful AKIS systems in the EU (Figure 7). The Irish AKIS map (Figure 8) shows the strength of links between the different AKIS players: there are strong linkages between the Teagasc Research arm and external research organisations (mainly universities), and between Teagasc Advisory and stakeholders (farmers etc.). There are also substantial links between these two Teagasc arms, and between external research and external education organisations (universities and colleges). There are weaker links between stakeholders and external advisory organisations (reflecting the dominance of Teagasc in this respect) and between stakeholders and Teagasc Education, while other linkages are weak or virtually non-existent (9) (23).

- Teagasc covers many elements of AKIS, providing extension services, education, and support structures, but also undertaking a large number of research activities (ca 300 research projects) on different themes (Animal and Grassland, Crops, Environment and Land use, Food, Rural Economy and Development).
- The 2018 Teagasc Education Vision (11) deliberations on future education and qualification needs centred around three core farm occupational roles (or equivalent occupational role types in other areas of the land sector): Farm manager (level 7), farm technician (level 6), and farm operative (level 5).
- From an advisory perspective, Teagasc knowledge transfer section, known as advisory, assists farmers in understanding the strengths and weaknesses of their farms and helps farmers make better decisions. Teagasc clients now have access to many services within the organisation, some of which include: an advisor with full access to specialist and research backup, business and financial planning including annual basic BPS (Basic Payment Scheme) applications, farm management advice, access to farm walks, demonstrations and public events, and independent and confidential advisory service.
- As reported in the ProAKIS report (9), the state largely finances agricultural advisory services in the form of a subsidy to the cost of advice. Around 75% of Teagasc's yearly budget comes from the Irish exchequer and EU funding, with the balance generated from earned income. Some 40% of the budget is devoted to research, with the remainder split half and half between advisory and education services. There is a recognition that Government no longer needs to provide the sole source of finance for all of the services offered by a public advisory service, but it does need to support the provision of public goods which otherwise would not be provided due to market failures, e.g. advice in remote areas, or to small enterprises.

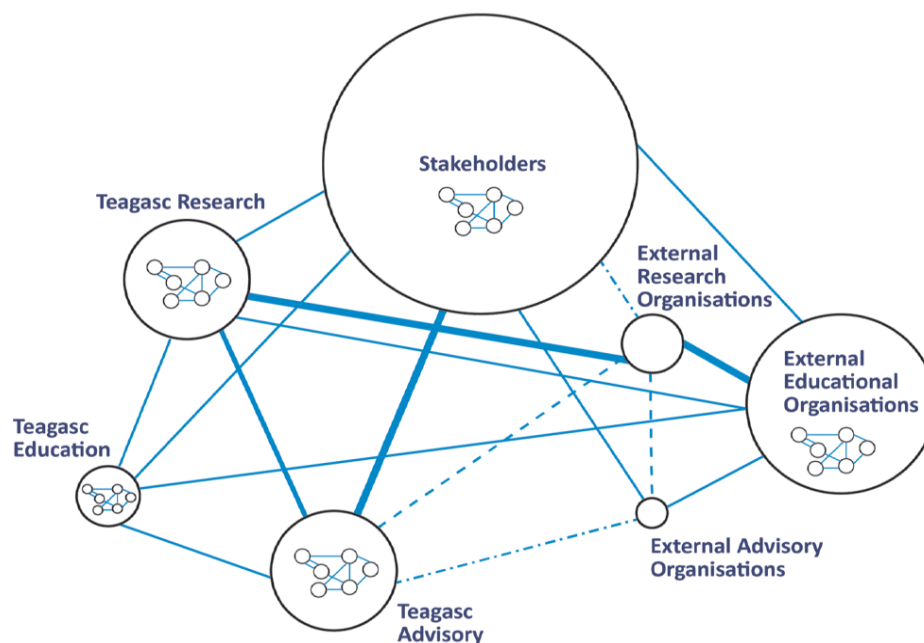


Figure 8. AKIS map in the Republic of Ireland (from (9))

- In 2018, Teagasc had 240 advisors (a 55% decrease from 2007): this reduction in advisor numbers has led to alternative forms of advisory that still provide technical and economic advice such as

discussion groups. However, the high level of satisfaction and low number of formal complaints indicate the high efficiency of the advisory service even in challenging situations.

- The Irish AKIS (9) also includes private actors (consultants, veterinarians, food processing companies and cooperatives, input supply and service companies e.g. accounting and software), universities and Institutes of Technology, the Department of Agriculture, Food and the Marine (DAFM) and other government departments, public agencies such as Bord Bia, the Irish Cattle Breeding Federation, Animal Health Ireland, the Environment Protection Agency, and the agricultural media which is particularly strong in Ireland. A number of agencies and other bodies are involved in specific aspects of the AKIS.
- During the milk quota regime, the Teagasc Dairy Advisory Programme has been built around three core technologies: grassland management, breeding/ herd fertility and cost control. Research and the development of appropriate, farmer-friendly support tools have enabled Teagasc dairy advisers to lead the dissemination and adoption of these three technologies during this period. The Dairy Expansion service for example, was a concentrated effort in the form of discussion groups to help farmers transition into a post-quota frame of mind, emphasizing expansion, intensification and enterprise specialisation, with a 291 more discussion/project groups in 2012 than in 2009.
- The Advisory Service has now returned to a milk production environment without milk quotas, working with other industry stakeholders in supporting Irish dairy farmers to sustainably expand their dairy businesses. The focus will then be on increased milk production and the challenge for the next few years may very well be to influence dairy farmers to adopt innovative grassland management, breeding and cost control technologies that will underpin sustainable milk production.
- In November 2017, the Agricultural sustainability support and advisory programme (ASSAP) commenced: is an initiative aims to encourage behavioural change, facilitate knowledge transfer and achieve better on-farm environmental outcomes and water quality requirements, by providing a free, one-to-one advisory service. This will be run by Agricultural Sustainability Advisors, some belonging to Teagasc and some others, who have undergone the same programme of training, operating in the dairy processing side The Programme will be jointly funded by both Departments, Teagasc, local authorities and the Dairy Co-ops on a trial basis for four years to 2021.

Box 2. A successful knowledge transfer campaign – Grass10

Grass10 is a 4-year campaign (2017-2020) to increase grass utilisation on Irish livestock farms (dairy, beef and sheep), with the objective of achieving 10t grass dry matter (DM)/ha/year utilised and 10 grazings/paddock/year.

This campaign aims at tackling the low optimisation of grass production and utilisation in Irish livestock farms: Teagasc research indicates that the current levels of grass grown (and utilised) on dairy, beef and sheep farms can be increased significantly. Closing the gap between current levels of grass utilised and the Grass10 target of 10t DM/ha/year utilised, will support significant increases in milk and meat production. Achieving this will require changes in farm practices associated with both grass production and utilisation, including soil fertility, sward composition, grassland measurement and grazing infrastructure.

The campaign has produced a large amount of KE material, such as wall charts and guides, and training courses aiming at improving grazing management to reach the goals. Grass10 produces also a weekly newsletter reporting the Pasturebase performance and providing further advice.

<https://www.teagasc.ie/crops/grassland/grass10/>

FAS – Farm Advisory System in Republic of Ireland

In Ireland there is a strong involvement of the private advisory sector in the FAS delivery, resulting in a mixed set-up of public and private bodies. The FAS integrates the pre-existing network of private advisors built in 1994 to deliver specialised advice on the Rural Environment Protection Scheme (REPS): these advisors now compete with but also complement advice provided by Teagasc. The ProAKIS report (9) provides an exhaustive description with some points summarised below.

- The FAS is coordinated by the Department for Agriculture, Food and the Marine.
- The Minister for Agriculture and Food has designated “Planning Agencies” as approved Single Payment Scheme Farm Advisory Agencies after specific training. In 2013 the list comprised of a total of 572 entries, 224 of which were working in Teagasc (9). Recently, Teagasc has instigated the sub-contracting of ‘non-core’ work to the private sector on a regional advisory basis and has established a Strategic Alliance with Farm Relief Services (FRS) to assist with delivery of the GLAS (Green, Low-Carbon, Agri-Environment Scheme).
- The FAS covers various subjects: Herd and flock management, Business and financial planning, Farm management, Grassland management planning, Breeding, Nutrition and ration formulation, Buildings and paddock layout, Assistance with DAFM schemes, Options for planning for the future, alternative enterprise development, Joint programmes with industry, Young farmer discussion groups, Farm partnership services, Teagasc Cost Control Planner, Teagasc Profit Monitor, Environment advice and planning, Soil and grass analysis, BETTER farm programmes, Access to adult farmer education courses and programmes, Research updates.
- FAS advisors employ a range of methods from one-to-one on/outside the farm, small group advice, discussion groups, a telephone helpdesk, a newsletter and online resources. Teagasc holds farm walks on demonstration farms to discuss and highlight cross compliance issues, in particular concerning SMRs (Statutory Management Requirements) and GAEC (Good Agriculture and Environmental Conditions). Also, Teagasc and some private FAS bodies provide public meetings or seminars on all SMRs and GAEC.
- The link between support payments and attendance at training events leads to a very high coverage of FAS.
- The main weaknesses identified in the Irish FAS are:
 - an apparent disadvantage for the farmers using the private advisory services, not only in terms of funding, but also in the disproportionate access to the valuable research done by Teagasc (24)
 - There are still many farmers not using the extension services, and advisors from the private sector are more likely to engage with smaller and more vulnerable farmers (25).

4.2.2 United Kingdom

The current advisory system in the UK is characterised by diverse (and increasingly separated) arrangements in the four UK countries, e.g. for setting SMRs and GAEC, education and training, rural development, and much research (2). As reported for the UK by (26) “England has a fully privately-driven extension approach, whereas Wales uses a strong publicly-driven approach supported by various private advisory networks, and Scotland and Northern Ireland operate through a fully publicly-managed system, though some of their services are outsourced to advisers accredited according to subject”. The ProAKIS report (2) provides an exhaustive description with some points summarised below.

Great Britain

- The delivery of advice involves many different providers (Figure 9) and delivery routes, with: also, there is significant diversity in the involvement of the state.

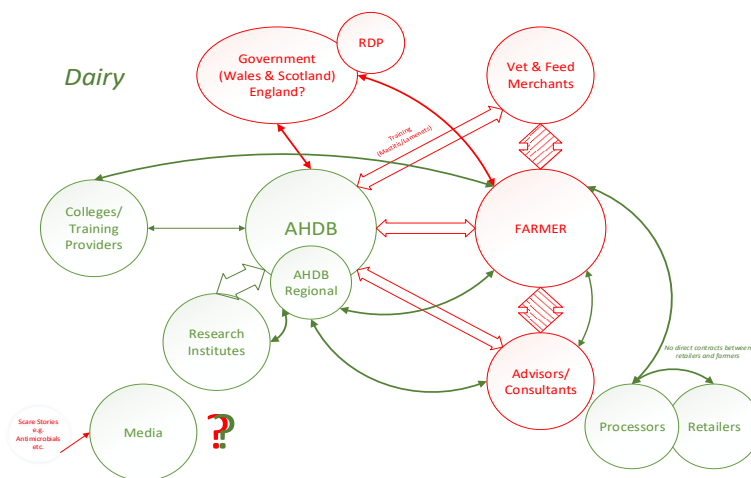


Figure 9. AKIS map in Great Britain (AHDB, unpublished)

- The levy sector is an important actor in the GB AKIS. The levy from dairy farmers in England, Scotland and Wales is collected by AHDB Dairy (The Agriculture and Horticulture Development Board dairy levy board). AHDB, which covers many sectors, is the statutory levy body and is officially an executive Defra-sponsored non-departmental public body.
- The role of AHDB is to provide to levy payers with information regarding performance and markets, but also to fund independent research, aimed at investigating issues critical to dairy farming. An important activity of AHDB is knowledge exchange. The activities carried out by AHDB are approved by a board of members and outlined in the corporate strategy.
- Technical (crop, livestock, soil) and business advice on farming is also offered by private consultants (individuals and small companies, usually regional) as well as by some college and institute staff. NGOs are also involved in providing agri-environmental advice or advice related to conservation, wildlife and habitat management on farms, and also in influencing aspects related to animal welfare.
- Private advisors, including commercial advisors (feed, semen, agronomy etc.) and the milk supply chain, are also important in the GB AKIS and have strong, direct contact with farmers.
- A further source of information and knowledge relevant to dairy farmers is the Agricultural Industry Confederation (AIC), a trade association representing several sectors within the agri-supply industry. The AIC manages the Feed Adviser Register (FAR), a voluntary initiative set up by AIC and the feed sector, in response to the Governments' commitment to the industry and customer demands to reduce emissions from farmed livestock. To be a member of the Register, feed advisers must demonstrate their knowledge in areas of animal nutrition, welfare, feed efficiency and animal health and will receive training on environmental policy along with practical ways to mitigate emissions on farm.
- There are several farmers based associations, generally funded by membership or sponsors which provide lobbying at a political level, as well as specific advice. The NFU, National Farmers' Union, in England and Wales (known as NFU Cymru), and NFUS in Scotland, are the largest representative body for agriculture and horticulture, with members covering two-thirds of the agricultural land.
- The education and research sector is very well represented across GB with international renowned institutions. In 2014 (2), across the UK there were around 15 university faculties or university-linked colleges with varying degrees of involvement in production agriculture, veterinary courses, farm business management and other agriculture-related courses. Research centres are also numerous

and, whilst they cover different topics, they generally focus on a specific area of expertise. Research activity is supported by mixed (private and public) sources of funding.

- Agri-Tech centres are a unique collaboration between government, academia and industry to drive greater efficiency, resilience and wealth across the agri-food sector. The objective of these centres is to turn agricultural innovation into commercial opportunities. These centres were funded as part of the Agri-Tech Strategy launched in 2013, as part of a £150 million commitment to UK Agriculture by the Department of Business, Energy and Industrial Strategy (BEIS). The Agri-Tech centres are a typical example of collaborative research.
- As the advisers in GB are a diverse group, the associated advisory methods utilised are broad; ranging from one-to-one or group advice, both on and off farm, meetings and online portals, webinars and newsletters. Farm walks and visits, demonstration farms and strategic dairy farms are quite common and much appreciated by the farming community. Specialised press is also commonly utilised by farmers to get information.
- A novel and increasingly common way of sharing information is social media and online forums, though these are considered less relevant in terms of generating knowledge and innovation. Online, farmers share ideas, discuss pressing issues, debate current topics or simply connect and exchange knowledge with people who they may not otherwise meet. Social media are increasingly used by farmers and knowledge networks will help farmers rapidly and broadly connect with peers (27).

Example of a successful knowledge transfer activity – the Strategic Dairy Farm Programme (Great Britain)

The programme aims to improve business resilience and performance through increased uptake of business management skills, tools and information. Demonstrating how technical performance can be improved through the adoption of best practice using an evidence-based approach and the latest research outcomes is core to this programme.

Strategic dairy farms provide a platform for farmer-to-farmer learning, accelerate the uptake of knowledge and showcase best practice. They act as a focal point for regional and national discussions, openly sharing performance data and the impact of changes to farming or business practices. This happens by hosting regular on-farm meetings and openly sharing their figures against AHDB's key performance indicators to show what can be achieved. In combination with the on-farm activities, the platform delivers several webinars as well.

The farms reflect one of two production systems - all-year-round or block calving (spring or autumn) - demonstrating what is possible through both systems and publishing key performance indicators so others can benchmark their own business performance.

Strategic dairy farmers are top operators in their production system who have a clear strategy with defined goals and measurable targets. They are willing to disclose information, open up their business to scrutiny and share decision making with other farmers. They will be open minded, receptive to new ideas and willing to embrace change.

The Strategic Farms are part of AHDB's wider Farm Excellence Platform, which inspires industry to improve performance and succeed through knowledge exchange.

<https://ahdb.org.uk/farm-excellence>

Northern Ireland

- The AKIS for dairy farmers in Northern Ireland is dominated by government and government agencies (Figure 10)

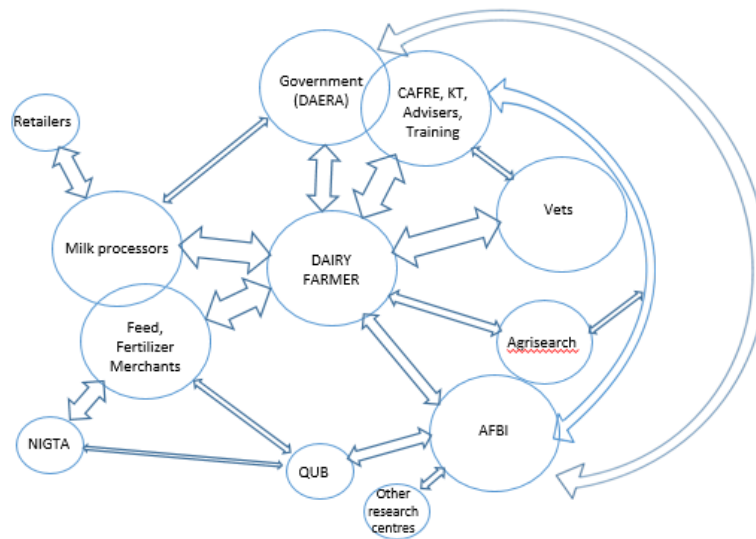


Figure 10. AKIS map in Northern Ireland

- Dairy research is largely carried out by a non-departmental government agency, the Agri-Food and Biosciences Institute (AFBI).
- The College of Agriculture, Food and Rural Enterprise (CAFRE) is an integral part of the Department of Agriculture, Environment and Rural Affairs (DAERA) which provides full and part-time education courses for young people entering the dairy farming industry. CAFRE also provides training and development services for dairy farmers working in the industry through Business Development Groups.
- The levy sector has a role in AKIS in Northern Ireland. There is one voluntary levy body, Agrisearch, which collects a producer levy from dairy farmers through milk processors at a flat rate per litre of milk production. The levy funds are used to commission near market research through AFBI, usually match funded by DAERA. The Agriculture and Development Board (AHDB) does not collect a levy from NI milk producers and do not have a formal presence in Northern Ireland. However, AHDB contributes to AKIS in NI through the analysis of milk records to generate breeding records for dairy cattle.
- DAERA funded research initiatives undertaken by AFBI are required to have an accompanying knowledge transfer programme. This usually involves a partnership approach with CAFRE to deliver new knowledge through existing channels such as CAFRE Business Development Groups (BDG).
- Advisory methods used range from one-to-one or group advice both on and off farm, to online decision support tools and newsletters. Farm walks / visits, demonstration farms, conferences and seminars are ongoing advisory methods.
- The branch of CAFRE responsible for dairy farm development has a total of approximately 25 technical staff working with the dairy sector. The animal feed industry in Northern Ireland and independent nutritionists are estimated to number over 60 individuals who largely work with dairy farmers on a one-to-one basis.
- There are estimated to be 80 veterinary practices employing approximately 300 large animal vets who provide animal health related advice to farmers mainly on a one-to-one basis but also through occasional practice organised technical meetings.
- The demand for agricultural knowledge is constrained by farmer demand, much of which is interested in income and profit, rather than in the environment or social objectives.
- Two kinds of advice can be distinguished:

- market-oriented advice concerning increased production (and to some extent improved marketing for higher prices and added value) and greater efficiency (cost savings); this type of advice is more likely to be provided by commercial organisations and vets
- environment-oriented advice concerning public goods, such as anti-pollution methods, landscape and wildlife (biodiversity), covered by CAFRE through dairy farmer BDGs, and FAS as indicated in Table 1 below.

Table 1. Advisory topics delivered by organisations in Northern Ireland

Advisory topics	CAFRE	Commercial Organisations	Veterinary Practices
Agri-environment programmes, Bookkeeping, taxation etc., Building design, Business management, Cross-compliance, Environment (water, biodiversity, climate change, soil), Renewable energy and energy efficiency	✓		
Animal health	✓	✓	✓
Forage production and utilization, Livestock husbandry Machinery operation and maintenance	✓	✓	

- In Northern Ireland (2006), the most popular sources of dairy information were CAFRE Advisers, Popular Press and vets, while the least used sources of dairy information were demonstration farms, discussion groups and retailers (28). There is a wide variation in the farmers' opinion on the AKIS, from excellent to poor.
- The 2013, a report by the Agri-Food Strategy Board in Northern Ireland (29) proposed a vision including, among many other recommendations, a higher focus on innovation, research and development through a collaboration across the industry and in partnership with Government and academia.
- The core AKIS programmes which CAFRE delivers to people within the agri-food industry are: industry training, knowledge and Technology Transfer, Benchmarking, Business Development Planning, DAERA Online Support (series of online tools from nutrient management planning to the single application form, slurry exports, cattle births deaths and movements).
- Analysis of CAFRE AKIS expenditure in 2015/16 shows that Industry Training accounted for 44% (2014/15 - 47%), Knowledge and Technology Transfer 31% (2014/15 - 29%), Benchmarking 11% (2014/15 - 9%) and Business Development Planning 11% (2014/15 - 8%) of the total costs.
- Changes in the CAP, environmental legislation, increasing consumer awareness and the sustainability agenda is driving other AKIS actors to take a more active role in dairy farming AKIS in Northern Ireland. Private consultants, milk processors and vets are increasingly playing a role in AKIS delivering new services and training to dairy farmers.

Box 3. Example of a successful knowledge transfer activity – the Business Development Groups

Knowledge transfer through Business Development Groups (BDG) is a scheme which is part funded by the EU through the 2014-2020 Rural Development Programme. The scheme uses a group approach to improve the technical efficiency of farm businesses and will also offer participants the opportunity to gain a Level 3 qualification.

The Business Development Groups scheme was launched in November 2015 and today there are over 140 groups in operation. Each BDG will comprise of around 20 like-minded farmers who will meet six times a year to focus on the topics agreed by the group. The discussion groups are managed by a dedicated facilitator and activities include on-farm meetings, demonstrations and skills training.

Farmers participating in the scheme benefit from benchmarking their business to identify areas that have the potential to be improved. A business development plan helps identify the actions to be taken to improve the technical efficiency of the business and improve the sustainability of the farm.

As participants work to improve the efficiency of their businesses, they will be awarded credits that will build towards gaining a Level 3 qualification.

The benefits for the farmers are:

- ☐ A clear development plan for the business
- ☐ Improve profitability
- ☐ Keep up to date with the latest technologies
- ☐ Access to a CAFRE Development Adviser
- ☐ Option to gain a qualification
- ☐ Meet with like-minded individual

<https://www.cafre.ac.uk/industry-support/business-development-groups/>

<https://cafrestag.do-ttl-stage.com/business-support/rural-development-programmes/business-development-groups/>

FAS in the United Kingdom

Great Britain

- The UK belongs to the group of EU Member States where the advisory activities organised under the mandatory FAS have tended to focus strictly on the statutory management requirements (SMRs) and the good agricultural and environmental conditions (GAECs) included in the scope of cross-compliance.
- In Scotland and Wales, agriculture is a responsibility of the respective government (Scottish Government/Welsh Government). In England, SMR and GAEC obligations are set by Defra. The actual implementation and agricultural extension services are either managed by government or devolved to a government agency or to an agricultural college.
- Under the Scottish Rural Development Programme (SRDP), the Scottish Government co-funds, together with the EU, the Farm Advisory Service (FAS). FAS provides free integrated advice, information and resources (grants, events, subscriptions, articles and publications) aimed at increasing the profitability and sustainability of farms and crofts. All these activities are delivered on behalf of the Scottish Government by SAC Consulting (part of Scotland's Rural College) and Ricardo Energy and Environment under contractual arrangements. Through FAS, dairy farmers receive the

newsletters Milk Manager News, Animal Welfare and Agribusiness News. FAS currently provides free access to knowledge to everyone in Scotland through SAC Consulting and online resources, along with their dedicated phone line.

- In England, the FAS as Farming Advice Service is funded by Defra to provide free, confidential advice to farmers and farming industry advisers to help them understand and meet requirements for cross compliance, “greening” (green direct payments), water protection and the sustainable use of pesticides. FAS is coordinated by Ricardo Energy and Environment and is carried out by a national network of qualified, independent advisers under contract to Defra from agricultural consultancies and research organisations throughout England. FAS experts provide information through organised events such as farm walks, workshops and drop-in clinics and articles in the farming press. The FAS in England produces newsletters and technical resources available online.
- In Wales, the FAS delivery is part of Farming Connect’s activity. Farming Connect is a programme funded by the Welsh Government Rural Communities – Rural Development Programme (RDP) 2014-2020 and supports the development of a more professional, profitable and resilient land based sector. It is mainly delivered by Menter a Busnes and comprises an integrated programme of knowledge transfer, training, innovation and advisory services designed to deliver greater sustainability, improved competitiveness and improved environmental performance. The focus areas of Farming Connect are climate change, biodiversity, forestry, red meat, dairy, grassland, arable, horticulture, organic production, pigs and poultry.

Northern Ireland

- The Farm Advisory System (FAS) was established within CAFRE in 2015 to provide advice to farmers on how to comply with the Nitrates and Phosphorus regulations and to meet the EU requirement to provide farm environmental advice.
- The focus is on the statutory management requirements (SMRs) and the good agricultural and environmental conditions (GAECs) included in the scope of cross-compliance.
- The SMR and GAEC obligations are set by the Department of Agriculture. Northern Ireland has set up a central committee entitled the Helping Farmers Comply Forum (HFCF) which co-ordinates the delivery of FAS and brings together staff involved in all aspects of DAERA work on cross-compliance and ensures that the advisory message addresses issues that arise from control (inspection) activities. There is no specific co-ordination or interactions other than the standard interaction within the agriculture department providing backstopping and info-research data to advisers.
- The FAS is an integral part of the existing advisory framework and provides free advice on environmental compliance advice to dairy farmers through CAFRE dairying development advisers.
- All CAFRE Development Advisers involved in delivering FAS to dairy farmers have a minimum qualification to degree level in an agricultural discipline. Facilitation skills training has been provided to all CAFRE Development Advisers. Regular technical training updates are centrally organised and a formal continuing professional development (CPD) process aligned with professional body membership is under development.
- Both one-to-one and one-to-group advice approaches through existing CAFRE Business Development Group structures are utilised. A biannual publication, FAS News is also mailed to all farm businesses in Northern Ireland.

4.2.3 France

- The AKIS in France has a long history of institutional arrangements between the state and farmers' associations (16). It is characterized by public investments at a national scale in various research and education organizations, and by arrangements and contracting with farmers' associations, non-profit organizations and private actors for advisory services and applied research.
- AKIS investments and activities aim at supporting the performance of the sector, at tackling the challenges associated to the reduction of its environmental and sanitary impact and at dealing with issues associated to rural development, such as the maintenance of landscape, and the contribution to services and social cohesion in rural areas (16).
- Advisory services are provided to farmers by a diversity of organisations: chambers of agriculture, farmers' associations, farmers' cooperatives, private consulting companies, inputs providers (seed, fertilisers, feed...) and processors. Figure 11 and Figure 12 illustrate the links between the various AKIS components in France.
- The ProAKIS report (16) provides an exhaustive description of the main French AKIS, summarised for the dairy sector in the points below.
 - Organisations in direct contact with farmers through input supply or purchase of agricultural commodities.
 - farmers' cooperatives.
 - private traders (represented by the FNA – Federation of Input Traders).

Even if it is not easy to evaluate these AKIS actors, due to their fast reorganization and to the commercial aspect of advice provision, they have an important role as farmers' initial partners for accessing technical information. Advice appears to be an important dimension of their economic activity and of their relations with farmers. These services are partly charged separately from the commercial transactions of inputs or outputs. Some of these cooperatives are grouped under an umbrella organisation, INVIVO, which is a major player within agricultural R&D nowadays.
 - downstream industries can also be key actors of advisory services (agro-food industries), even though there are strong differences between sectors, and a clear lack of information about the development of such services. In certain supply chains with high levels of vertical integration such as milk, some firms have created important advisory service departments.
 - Chambers of agriculture. The chambers are consular organisations, chaired by a president (farmer) and a board of farmers' representatives belonging to different unions, who nominates the chamber's director. They are endorsed with public missions and are mainly supported by public funds (local taxes, CASDAR fund, contracts with local authorities) and purchase of services by farmers. The domains of intervention are: individual business advice for farmers (farm settlement, commercial strategy, organisations, and investment in equipment), agronomic and environmental advice, territorial and local development, compliance with regulations (standards, subsidies, application forms...), quality of products (standards...), and the monitoring of intangible resources and databases. Some of these services are mandatory missions associated with the delegation of service from the Ministry.
 - Various farmers' associations that provide services to their farmers
 - Organismes Nationaux à Vocation Agricole et Rurale (ONVAR), more oriented towards rural development. The ONVAR are national umbrella organisations of local non-profit organisations and/or provincial federations of farmers and workers. They are often grounded in collective and participatory approaches so as to promote alternative farming practices or models of farm management. They are mixing

different sources of funding: public subsidies (including CASDAR), farmers' contributions, projects, and purchase of service by clients (training, advice...). Among the ONVAR are the Coopératives d'Utilisation du Matériel Agricole (CUMA), whose aim is to organise a collective and shared utilisation of agricultural machinery among farmers. These cooperatives offer services such as individual and group advice, experiments, demonstrations (trials with constructors...), training and methodology.

- Federations of non-profit organisations (not subsidised by CASDAR) that play a key role in the provision of services for farmers, in the field of advice related to the technical and economic performance of farms:
 - CERFrance, a network of 70 farmers' associations providing bookkeeping services and advice. They are independent organisations, funded by members' contributions, and from the sales of services. CERFrance produces ad-hoc data bases for the Ministry in charge of agriculture, mainly about farms' economic performance indicators (CERFrance is also a key actor of the FADN system in France). Despite the decrease in the number of farms, the activity (both in terms of employees and gross income) is still increasing, due to a diversification of services for farmers (i.e agronomic advice);
 - France Conseil Elevage (FCEL) is a historical network of farmers' associations whose former aim was measuring and monitoring of the performance of animal production to support genetic selection. Today, they provide advice on animal feed, milk quality, reproduction, economic performance, fodder production and even fertilization. The associations are financed by farmers' contributions that cover basic services. This federation is also involved in research projects and in the maintenance (with applied research institute and the Ministry in charge of agriculture) of a data base on milk production that supports the national system and procedures of genetic selection for animal production;
 - A last group of actors are private advisory companies, including private bookkeepers, software providers etc.
 - Health sector is taken in charge by two types of veterinarians: private vets, who takes care of animal care. In addition to this private activity, some of them also carry out missions for the State, directly commissioned by the Ministry of Agriculture to carry out compulsory prophylactic actions. . These last actors are involved in the Groupe de Défense Sanitaire (GDS), which are non profit organizations like FCEL but have a mission delegated by the state to manage health risk and "regulated" diseases. There is one GDS in each French department, with the aim of monitoring animal health and preventing sanitary risks thanks to advice provided by veterinarians on vaccination, hygiene, and practices.
- For the organic sector, other than the advice from the aforementioned sources, there is an applied research institute dedicated to the R&D on organic production (Technical Institute on Organic Research - ITAB), recently been acknowledged as one of the ITA (Technical Agricultural institutes), and receives subsidies from the CASDAR. There are also some associations of farmers (Groupements d'Agriculture Biologique - GAB) that support farmers with any aspect of the production (either technical or economical).

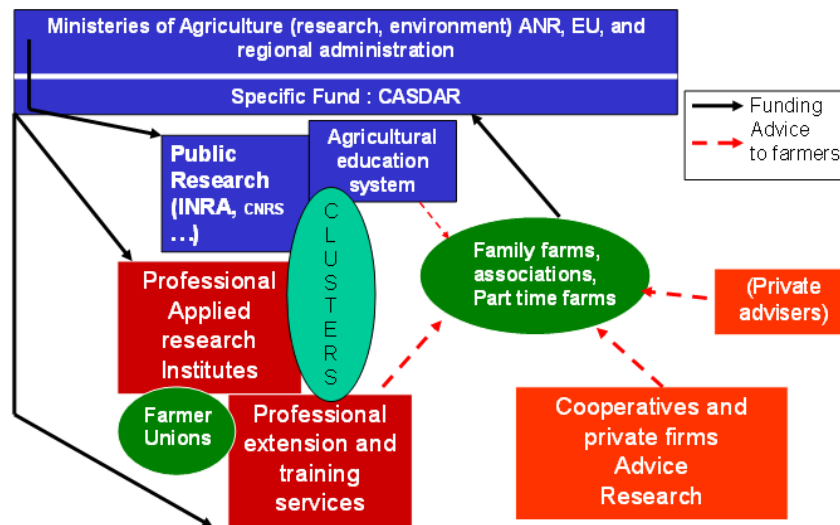


Figure 11. French organisation of AKIS

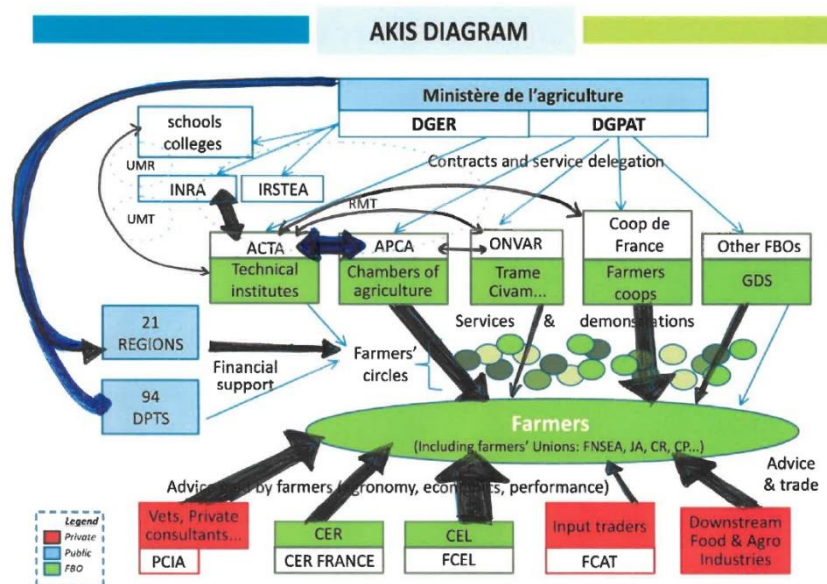


Figure 12. French AKIS Diagram (from (16) mod.)

- Public funding is slowly, but regularly decreasing. Co-management between the government and farmers' unions is less important as the weight of agriculture in economy is strongly decreasing (farmers' income is not a major collective objective) and as a greater number of decisions are taken at European level.
- The government now manages alone a specific fund for AKIS, based on taxes on farm incomes. Overall, as reported by (16), the funding of AKIS and agricultural advisory services combines different sources (regional and provincial funds, farmers' contributions) and forms. It includes calls that aim more and more at supporting innovations and at enhancing the connections between AKIS organisations, so they can be of benefit to the users.
- Historical public funding tends to decline for research and development organizations, forcing them to redirect some of their activities. New sources of funding are available from private or

interprofessional partners, especially regarding the following growing topics: animal welfare, soil and water protection, renewable energies etc. In this sense, the subjects dealt with by AKIS may evolve, but the structure of AKIS itself remains the same. However, there are developments in the involvement of certain territorial organisations that play an increasing role in supporting farmers, particularly on environmental issues (water quality in Brittany, for example). The trend is towards consolidation and simplification as well as a bottom-up approach.

- The relations within the AKIS are partly embedded in formal and informal partnerships that have been institutionalised for the long term between applied research institutes (ITAs) and advisory organisations or farmers' associations. These formal and informal interactions exist for each of the ITAs, even though they may take specific forms according to the organisations in the different sectors⁵.
- Since the 2000s, different institutional innovations have been created with the aim to generating partnerships that bridge research and practice. Advisory services are fully integrated in these institutional innovations that fulfil different functions within the French AKIS.
 - Some of them are directly aimed at supporting new partnerships between research and other actors so as to produce operational or finalized knowledge and methods for farmers:
 - 26 Joint Research units (Unités Mixtes Technologiques - UMT, created in 2005); they merge researchers from INRA and ITAs to produce knowledge and innovations on agriculture and agri-food for diverse productions or diverse topics.
 - 3 Agro-transfers (Picardie, Brittany and Poitou Charentes); they merge producers' organisations, ITAs, chambers of agriculture, local authorities, INRAE.... to propose applicable methods and practices (i.e. reduction of the use of input, soil management...). The idea is to bring researchers and engineers in a same geographical location and under a same management unit to enhance the knowledge exchanges.
 - Other institutions are more targeted at supporting network and project dynamics and fostering stakeholders in building consortium and apply to different national or EU call in the line with the objectives of the French rural and agricultural policy.
 - 27 Joint Technological Networks (RMT), created in 2007. The main aim of the RMTs is to gather all the relevant stakeholders and skills in order to tackle collectively the whole themes from agronomic content (fertilisation, weeds management), to R&D methods (modelling...), or social and economical issues (labour and supply chains in animal production). The RMTs produce reviews of academic literature, comparative analysis (about tools, data bases, models...), but also identify new areas for public research and to apply to new R&D projects to several calls (mainly from CASDAR). There are also objectives for knowledge transfer such as handbooks, tools for advisors, training programmes, and communication operations. Since their creation, the state has invested about 8 million Euros in RMTs .
 - Other institutions aim at facilitating the integration of stakeholders in the planning of agricultural research.
 - 15 Scientific interest groups (Groupes d'Intérêt Scientifique - GIS), where different organisations share e-sources for long-term conventions. GIS can be thematic (about agronomy, supply chains, soils, green biotechs...), or regional. Regional GIS

⁵ For instance, Idele strategic plan is decided by an executive board (composed of farmers, but also of representatives of other AKIS organisations such as chambers of agriculture or FCEL) that receives recommendations from a scientific committee and from committees representing supply chains (dairy, pork, meat...). A unique feature of the institute is that it may be less active in the dissemination of agronomic results from experimental stations, but more in partnerships with advisory service organisations (chambers of agriculture, FCEL, producers' associations) to develop new methods for advisory services with them (65). In that respect, IDELE plays the roles of facilitator, as well as brokering and organising many training activities.

- aims at producing knowledge about, and for, the different functions that agriculture plays at the crossroads of territorial and sectoral issues (i.e in mountainous areas).
- Other initiatives also involve exchanges of resources and competences between research institutes (i.e. INRAE) and advisory organisations.
- The extension system theoretically targets all the farmers. In fact the smallest farms, those involved in multifunctionality or diversification activities are often less involved in the extension system.
- Farmers get most of the advice from performance control, cooperative or dairy industry, veterinarian, chambers of agriculture.

The Atlantic Area of France is characterized by the important representation of dairy farming and has some specificities related to dairy activity.

- A higher level of support for the dairy farmers of the Atlantic Area, due to higher density of AKIS actors. Consequently they have on average a slightly better technical level than in the rest of France. However, whilst the Northern Atlantic Area (Normandy, Brittany, and Pays de la Loire) benefits from a very dynamic dairy activity, the South (Nouvelle Aquitaine) has to face livestock decline because of crop competition.
- Segmentation of dairy farmers support. Technical advice is provided by a wide diversity of structures. , Livestock consulting companies, are professional bodies that carry out performance monitoring and consulting on diverse topics. They are gathered into France Conseil Elevage. Other organisations also have advisory activity that often compete with Livestock consulting companies. For instance, advice on milk quality and production is carried out by dairy industries and livestock consulting companies, feed and nutrition by livestock consulting companies and feed companies, reproduction and AI by artificial insemination centres and selection enterprises, health advice by GDS, strategic support by the agricultural chambers and CERFrance, production costs by cooperatives, agricultural chambers and CERFrance, new installations advice for new entrants by agricultural chambers...
- A different technical support balance, with the large majority provided by livestock consulting companies. However, due to an increasing number of other private advisers in very specific areas and to other organisations developing a support activity (i.e. dairy industries), dairy farming consulting is totally diffuse and exploded, with no institutional links between the different companies. Agricultural Chambers are a bit less represented in the individual technical support than before, due to the growth of these other organisations.
- Emergence of new channels of advising. More and more bottom-up initiatives start to emerge in the agricultural landscape and West of France is particularly pioneer (Sustainable Agricultural Network, technical groups called “milk groups” (Groupes Lait, about 100) which gather farmers to discuss about technical issues, new approaches and encourage peer-to-peer sharing. Social networks are increasing but consist in an information source more than an advice one for the moment.
- A higher density of applied research. Thanks to the high density of dairy farms in this region, applied research is also well represented in the Atlantic area. INRAE, Idele and Agricultural chambers are strongly involved in it:
 - Experimentation, with 4 dairy experimental farms located in the Atlantic area and gathered in the Farm XP network, belonging usually to agricultural chambers and supported by Idele engineers. They conduct tests on various technical options and innovations and translate results into tools or methods to be widely spread on farms by the advising structures’ technicians.
 - Research, with 3 INRAE units located in the French Atlantic Area working on dairy production. UMR Pegase studies the efficiency of dairy systems at both herd and system levels, feed self-sufficiency and the reduction of environmental impacts with two

experimental farms located in Brittany and Normandy, whereas the experimental unit Ferlus located in Poitou-Charentes designs and assess agroecological dairy systems at the farm scale. They have strong relationships with many other AKIS actors.

- References: Inosys Réseaux d'Élevage is a partnership scheme involving volunteer farmers and engineers from IDELE and Chambers of Agriculture. The purpose of this platform is to produce references on herbivorous breeding systems for breeders and their advisors. This scheme exists across France but it is well represented in the West.
- Technological mixed Unit (Idele and INRAE): The work of the Dairy Farm Research and Engineering Unit (RIEL) focuses on the management of dairy systems, milk quality, information management on dairy farms and the environmental impact of dairy systems. Based in Rennes (Brittany), its aim is to improve the zootechnical efficiency of dairy farms, to provide milk adapted to consumer and processor demand (i.e. feeding practices to modulate milk quality parameters) and to reduce the environmental footprint of dairy production (management of carbon, nitrogen and phosphorus flows as well as the enhancement of local fodder resources).
- The education sector is well represented with three institutes of higher education in agronomics and veterinary science (AgroCampusOuest, Bordeaux Sciences Agro, ONIRIS)

Box 3. Example of a successful multipartner program – Reine Mathilde (Normandy, France)

Reine Mathilde is a multi-partner program whose objective is to develop the organic dairy sector in Normandy. Coordinated by Idele since it was launched, it was initiated in 2010 by Stonyfield France with funding from Danone's Ecosystem Fund. With the support of new funders (Normandy Region, Agence Bio, and 2 private dairies marketing under the Les 2 Vaches et Vrai brands), Reine Mathilde is now part of a real approach of a known and recognized sector in Normandy, with a national influence.

The Reine Mathilde programme is based on a diversified action plan aimed at a wide audience: organic and conventional livestock farmers, veterinarians, field advisors and teachers. The aim is to support conversions, to give technical and economic credibility and security to organic milk production, to provide farmers with the technical keys to gain autonomy, and to globally develop all the local consulting and support skills.

<http://idele.fr/reseaux-et-partenariats/reine-mathilde.html>

The FAS – Farm Advisory Service in France

- In France, there has been no specific implementation of FAS, as the existing AKIS system has been recognized as FAS Agricultural Advisory Service(s). All agricultural organizations are eligible to apply.
- The subjects covered by the FAS are cross compliance, modernization and competitiveness, climate change, biodiversity, water protection
- In 2014 (16), more than 100 networks were accredited by the 21 French regions. These networks represent more than three hundred organisations.
- According to (16), there are three dominant types of organisations in French FAS:
 - chambers of agriculture,
 - farmers' associations (mainly from the group CERFrance);
 - farmers' cooperatives (i.e. Coop de France), which also supply inputs to farmers.

4.2.4 Spain: Basque Country and Galicia

The Spanish AKIS has a complex organization, as described in (17). As previously described, because of the decentralized administrative system the strategic decision-making and funding level is divided between the central and regional structures. Design and funding of national plans of research and technological development are decided at a central level: the two main centres are INIA and CSIC (National Research Council), funded by central government (but also attending calls for projects). The INIA system (including regional centres) is the traditional and main framework for agricultural research in Spain. The CSIC is the largest public institution dedicated to research in Spain and the third in Europe, and its agricultural branch is recognised internationally as a key reference centre. At a regional level, the governments have created their own research and development centres, but with a higher specialisation in subjects specific to their respective regions, and with greater attention to the training tasks (with some of them assuming formal training responsibilities).

As reported by (17), in terms of collaboration and knowledge exchange, there is a good number of collaboration between institutions and sectors, both private and public, working on joint research projects or on other types of joint activities. The Technology Platforms (PTs) are an example of sector-specific collaborations among associations, research centres, agricultural universities and OPAs aiming at identifying and prioritising the technology and innovation needs and to foster research, development and innovation. Other traditional means of scientific communication and knowledge exchange are congresses, conferences, seminars, workshops and other similar activities.

Basque Country

The AKIS structure in the Basque Country is described in Figure 13.

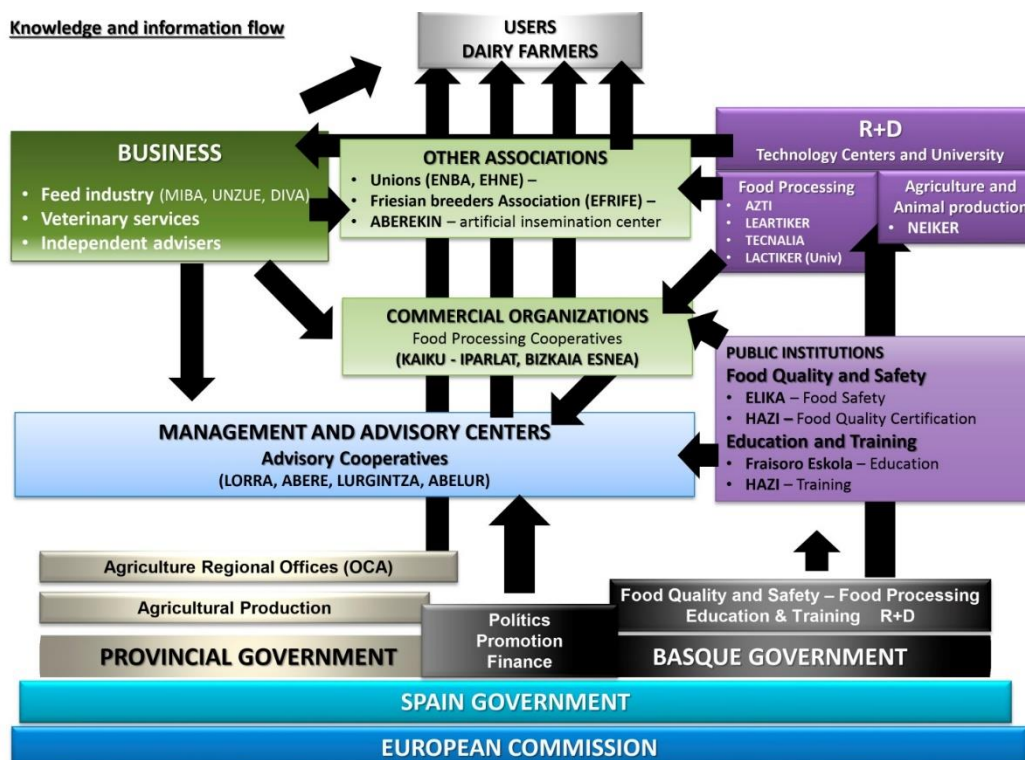


Figure 13. AKIS map in Basque Country

- The Management Centres (non-profit primary cooperatives) are the main consulting organization located in the various provinces of the region. Their members are legal entities such as Associations of Agricultural Producers and/or livestock farmers, agricultural cooperatives and other collaborating entities. They manage the technical-economic data of farmers to evaluate, only at individual farm level, the impact of innovation. They also guarantee the price stability for farmers and milk provision for the industry.
- From a research perspective, NEIKER is the Basque Institute for Agricultural Research and Development of the Basque Country. It develops knowledge and innovative and transferable solutions to add value to the agri-food sector and improve its competitiveness with criteria of respect for the environment, ensuring its current and future sustainability and actively contribute to the economic and social development of the environment, in line with the objectives of the Basque Government. In relation to dairy cattle, it works in:
 - Animal Health - Diagnosis and prevalence of the main diseases affecting dairy cattle. Optimized material handling to reduce the use of medicines.
 - Animal Production -Improved milk quality through optimal feeding. Pasture management
 - Environmental impact - Slurry management. Best practices for the reduction of greenhouse gas emissions.
- Farmers get most of their advice from management centers, cooperative and suppliers (i.e. feed, health products, semen, fertiliser,...)
- The research institutes are the AKIS actors most weakly linked with farmers
- The recent establishment of a new dairy factory (TGT) will introduce a new stakeholder within the existing AKIS, and therefore a new relationship or balance between the existing actors will have to be developed. In addition, there is an innovative project promoted by the Basque Government (Gaztaberri) to widen the diversity of cheese production (made only from local milk) within the Basque Country. Both factors may open new opportunities to local dairy farming. Another issue is the adoption of Welfare label for dairy sector, where new agents will be incorporated in the AKIS.

Box 4. Successful collaboration to produce a consulting and management tool – Basque Country, Spain

Computer tool for technical management and consulting to improve dairy cattle production processes

New management system for the dairy sector based on a collaborative and integrated platform in which all agents and actors with competence in the system will be able to participate.

The system manages the genealogical book, the milk control program and the productive, reproductive and health factors. It has been designed in collaboration with the different agents that interact in the consulting work of the farmers, so that now everyone can use the same tool.

<https://www.hazi.eus/es/proyectoshazi/8949-proyecto-de-colaboracion-para-modernizar-los-sistemas-de-informacion-del-sector-vacuno-de-leche.html>

Galicia

The AKIS structure in Galicia is described in Figure 14.

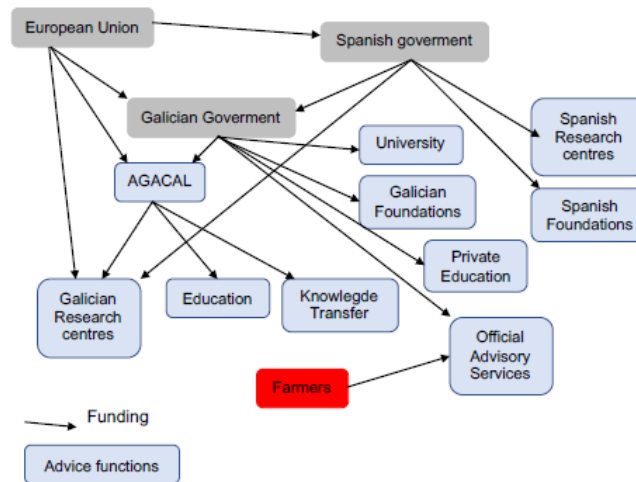


Figure 14. AKIS map in Galicia

- The OPAs cooperatives are the most important part of the current advisory system in Galicia, and probably they cope more than 90% of the services. They are very close to farmers and farmers trust in them, but the quality of the advice could be improved
- Private commercial advisers in seed, fertilizers, facilities...are always linked to trade firms and often the same happens with vets. Some, very few so far, new independent advisers are coming. Advisers with an holistic vision of farm are lacking and so are advisers on global strategies
- It is possible that the Galician AKIS will develop toward a deeper implication of private companies on it, in particular advising companies. Private organizations are growing despite competing with large and experienced structures, often offering specialised services and expertise otherwise not available for farmers
- Overall spending in all sectors on Research + Development in Galicia is around 0.9% of the Gross Domestic Product (GDP), whereas in Spain around 1.3% and in Europe 2%. The structures are maintained with regional funds in Galician AKIS and national in Spanish AKIS, but the new projects are funded mainly through the European Agricultural Fund for Rural Development (EAFRD), with the rural development program (RDP) for Galicia or in some cases the national rural development program or European projects
- Farmers get most of the advice from private adviser, social media and AGACAL
- The least utilized source of information is the CSIC, as the basic research produced by it is very far away from farmers' needs

Box 5. Example of an innovative platform to help with precision fertilization with slurry – Galicia, Spain

This online platform provides recommendations for the use of slurry as fertiliser in different situation: forage sorghum, pasture and their establishment and winter forages.

The application, produced by the CIAM, is free to use and comes with a detailed user's manual for a correct data input. It is a good example of online provision of a service through an easy and precise tool

This program was created with a very close cooperation of farmers and co-operatives with Mabegondo Research Centre (CIAM) in the frame of collaborative projects funded by EAFRD, in the first project approaches to crops necessities, weather conditions and characteristics of slurry were studied and established and with a second project these information was harmonized and a website was created.

The first step was made with a database built up after analysing soil and slurry composition for several years in hundreds of dairy farms in Galicia.

<http://ciam.gal/sp/index/?r=aplicacions.index>

The FAS – Farm Advisory Service in Spain.

Due to the administrative structure, each region has its own Rural Development Programme, which establishes the framework in which to develop its respective FAS.

Basque Country

- The Basque Country FAS is coordinated by LURSAIL, a coordination entity owned by the Management Centres (ABELUR, ABERE, AGA, LORRA, LURGINTZA) and the HAZI Foundation; the aim of this society is to find solutions for the various problems arising in the Basque agrarian sector.
- The subjects covered are socioeconomics, administrative issues, access to funding, subsidies, etc , as well as dairy farming management technical aspects: waste management, fertilization, nutrition...
- The FAS is delivered by a robust institutions supervising technical and economic aspects; however the high administrative burden for technicians limits the time available to devote to the promotion of innovation activities.

Galicia

- AGACAL coordinates the activities of the FAS in Galicia
- The covered subjects are mainly subsidies, animal nutrition and reproductive programs
- The main strength of the FAS in Galicia is the closeness to farmers; however many FAS deliverers are very close linked with sales of drugs, feed, fertilizers

4.2.5 Portugal

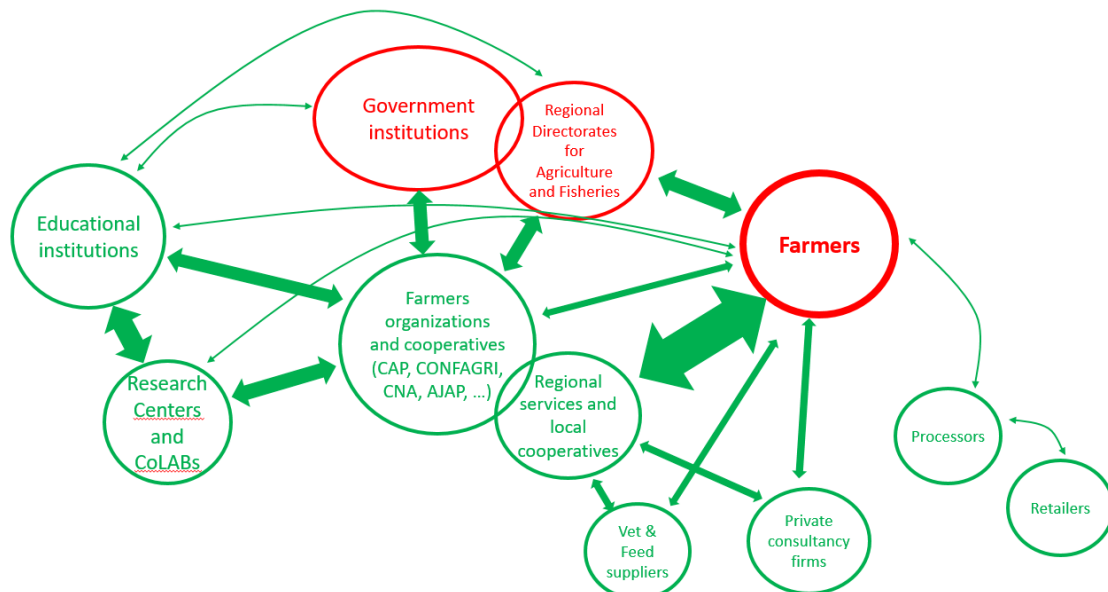


Figure 15. AKIS in Portugal

- Portugal has a very fragmented AKIS, constituted by many and diverse players not very integrated or coordinated in their activity.
- The advisory services are mainly provided by many farmer-based organisations and first level cooperatives, but also by a large number of private providers.
- In terms of funding, for recent year, there are no official values on applied funding on agricultural advisory services. According to (18) this funding is from mixed sources; each organization involved as a provider of agricultural advisor service develops efforts to attract funding through contracts with the government, training programmes supported by public money or charging for service delivery. In 2019, the government open a call for Advisory services for the value of 2.75 million euros.
- The CoLABs (Collaborative Laboratories) are fairly new structures in the Portuguese AKIS: their goal is to create skilled and scientific jobs in Portugal, both directly and indirectly, by implementing research and innovation agendas geared at creating economic and social value. CoLABs must meet the challenge of enhancing the density of knowledge-based activities in the country by fostering the consolidation of collaborative practices between scientific, technological or higher education institutions and the social and economic fabric.
- Farmers get the majority of the advice from farmers' cooperatives, producer organisations and private companies, while the public advisory service is the least used.
- The perception of the farmers is that the national Knowledge exchange/advisory systems is not working effectively. The more negative situation is the absence of connection between Universities/research centres and the productive dairy sector. In operations like milk processing, research is almost nil.

Box 6. Example of a collaboration among AKIS in creating innovation – the Operational Group GOEfluentes – Livestock Effluents - Portugal

This EIP-AGRI project promotes an integrated approach to reducing and valorising the nutrient flows generated within intensive animal production systems. Several organizations including farmers, farmers organizations, coops, private companies, research centers and universities are involved in the initiative. Considering the economic and environmental importance of the agricultural sector, and the challenges it faces, this project will create concrete solutions that increase the efficiency of water and nutrient utilization, reduce the environmental impact of farming and add value to that which was, until recently, considered as waste.

Outcomes of the project:

- ☐ *Production of the BATFARM software, which simplifies the procedures associated with the valorisation of livestock effluents to facilitates compliance. The software will also help the systematization of information and database building*
- ☐ *Development of an inventory of solutions concerning the management of livestock effluent and adaptable to region and farm characteristics*
- ☐ *Innovative ways of treating effluents (e.g. Black Soldier Fly larvae, biogas production or composting of slurry solid fraction) to valorise them*

An important main objective of the GOEfluentes initiative is the dissemination of information to farmers and government agricultural planning offices. This type of projects could allow further joint action between the project partners relating to the agricultural valorisation of effluents, which until now was unlikely, with benefits for all parties.

https://enrd.ec.europa.eu/greening-rural-economy/bioeconomy/rural-bioeconomy-portal/get-inspired_en

The FAS – Farm Advisory Service in Portugal.

- The FAS in Portugal is coordinated by the DGADR (Direção Geral de Agricultura e Desenvolvimento Rural - Directorate General for Agriculture and Rural Development)
- The subjects covered are conditionality, safety at work, climate and environmentally beneficial farming practices (Greening), agricultural surface maintenance, water quality protection measures, sustainable use of plant protection products, measures at farm or forest level, first installation of young farmers, minimum requirements for agri-environment measures, forest management plan, forest defence, forest certification, nature conservation (Habitat and Birds Directives).
- The FAS coordinated by DGADR is essentially an administrative tool/work to assess the compliance of the farmers with the rules established for each of the subjects to receive the subsidies and apply to new aids.
- In addition, there are other advisory and training services which are conducted by the farmers based organizations. The five Regional Directorates for Agriculture and Fisheries belong to the Ministry of Agriculture are still providing some training to technicians belonging to the farmers organizations but these actions are progressively decreasing since the Regional Directorates are increasingly lacking in human resources.

- The interaction between the farmers and the farmer advisory service (FAS) is strong and its role is very relevant (18). The utility and importance of such a service is unanimously recognized. However, some weak points are heavy bureaucracy, lots of work for the field technicians and little benefit for the involved organizations, bias towards medium-large sized farms, short period of intervention, reimbursement delays, weak links with research and in general limited dialogue with other AKIS (18).

5. Characteristics of the dairy farmer, succession plans and new entrants in the AA regions

Farmers are traditionally considered the end users of the knowledge and innovation (K&I) generated and disseminated by other AKIS actors. The effective uptake and utilisation of this K&I will play a key role in helping dairy farmers stay competitive, resilient and sustainable, as well as successfully meeting current and future challenges. As mentioned previously, farmers are not just passive end users but, in several cases, they are also generators and disseminators of knowledge and innovation themselves.

Being aware of the characteristics of the end user is an important factor when evaluating the best routes to deliver knowledge and to enhance innovation uptake. The innovation culture and attitude amongst farmers is varied and currently suffers from its demographic context (i.e. ageing farmers, missing handover to the next generation)(4). Typically, larger farm businesses, younger farmers, farmers with higher levels of education, farmers who are willing to take risks, farmers with access to own funds or credit and farmers with greater networks and networking capacity (including social networks) are more likely to engage in innovative practices (30). In addition, there could be a bias of the advisors towards specific categories (i.e more specialised) and this means that there may not be equal access to innovation-based advice for all farmers (1).

In the questionnaire given to partners and experts, we asked questions regarding some characteristics of the dairy farming population such as age and education level of the dairy farmers in each region or country. These characteristics have been widely recognised as important non-economic factors influencing the uptake of innovation. We also asked questions on the generational turnover of the dairy farming industry, mainly related to succession and to new entrants. It is not possible to directly compare the data from different regions and countries due to differences in how information was sourced and collected (i.e. different ways of asking the questions, years in which the survey was done and sample size).

5.1 Age distribution and education level of dairy farmers in the AA

In Figure 16, the average age and distribution (where available) of dairy farmers in the different regions of the AA are shown.

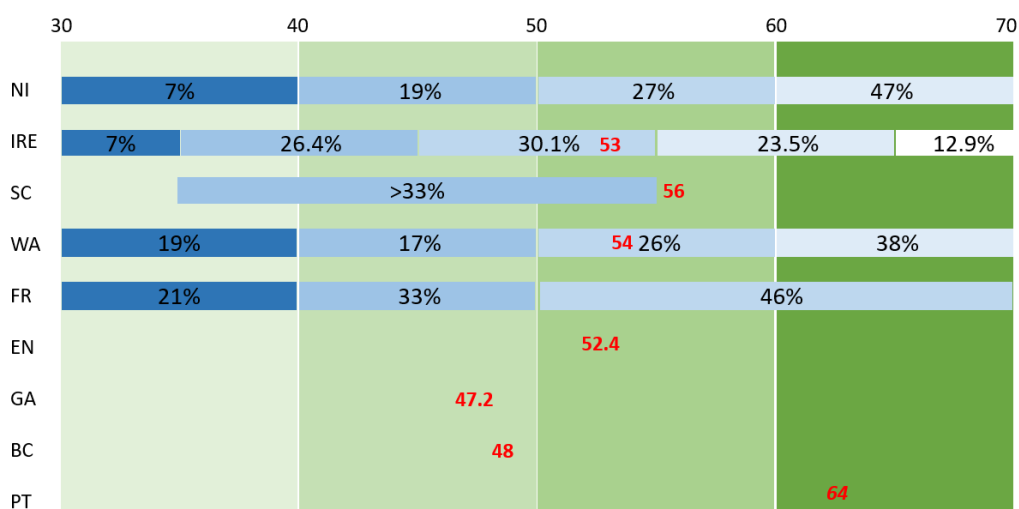


Figure 16. Age distribution of dairy farmers in the AA. Numbers in red indicate the average age (not available for Northern Ireland (NI)). For England (EN), Galicia (GA), Basque Country (BC) and Portugal (PT) only average age was available: the figure for Portugal reflects the average age of farmers in all sectors, not just dairy. References: NI (31), IRE (Republic of Ireland) (32)

and (33), SC (Scotland, unpublished data), WA (Wales) (34), FR (France) (35), EN (36), GA (37), BC (NEIKER, personal communication), PT (38)

The literature has reported that increasing age in farmers reduces the likelihood of taking risks and adopting innovations (30) (39). A Galician survey (37) showed that the dairy farmers involved in organic production at pasture are, on average, younger than those operating on conventional systems, particularly those based on maize and grass silage.

In addition, there were some noteworthy associations between farmer's age and farm characteristics. Figure 17 shows the relationship found in a Welsh survey between age and herd size (34). As the herd size increases, the average age of proprietor (horizontal axis) decreases (from nearly 60 y/o in very small herds to 51 y/o in very large herds).

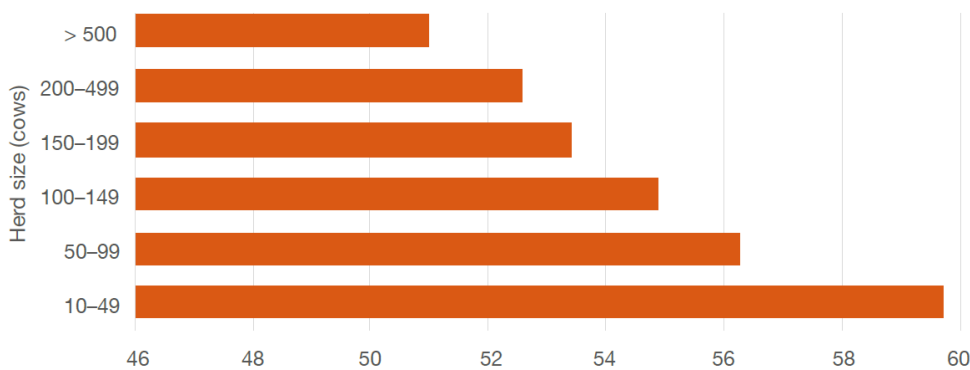


Figure 17. Average proprietor's age by herd size in Wales in a 2018 survey (3)

Education level is another aspect that has been reported as an important factor affecting the uptake of innovation and new knowledge. According to the data provided by the partners, only a small percentage of dairy farmers has a higher level education with a larger share of farmers having only a basic level. In most regions where dairy-specific data are available a high proportion of farmer holds some kind of certificate or professional training in agriculture:

- England: 65% of dairy farm businesses have an individual with a college/national diploma/certificate in agriculture (40)
- Scotland: 50% educated to college level and 12% holding university degrees (2018, unpublished result)
- Republic of Ireland: 52 % have a full time 3rd level qualification (further education, college and University), 26% certificate in farming or farm apprenticeship (32)
- Galicia: 20.1% have a professional training and 23.5% have university degrees (37)

In Northern Ireland, according to a survey (28), more than 50% of dairy farmers had no formal training. Interestingly, training had a significant impact on the attitude of farmers to learning and the questions asked when adopting new research findings: in addition, farmers who indicated some degree of formal education were twice as likely to place importance on being innovative compared with farmers who received no formal education (28).

Box 7. Access to education programmes and resources – Teagasc ConnectED, Republic of Ireland

Teagasc ‘ConnectED’ was launched in 2015 with the aim of providing professionals working within the agrifood sector structured access to high quality education programmes and Teagasc resources. The Teagasc ConnectED programme was born from the need to enhance knowledge resources to services and professionals that support the agri-food sector. “The dissemination, and importantly the application, of knowledge at all levels within the agri-food sector will be crucial if we are to achieve the targets set out in the FoodWise 2025 strategy” Gerry Boyle, director of Teagasc. Total ConnectEd industry membership rose to 520 in 2018, encompassing 276 companies. By embracing new ways of working, sub-contracting, the establishment of strategic alliances, reaching out to other rural professionals that support the agricultural sector, referral to other providers and continuous improvement in service delivery, etc., Teagasc will be able to service government and EU schemes more effectively.

<https://www.teagasc.ie/about/our-organisation/connected/get-connected/>

5.2 Succession plans

Succession is necessary to ensure the continuity of a business and has been identified as a strong determinant factor in the decision-making process when it comes to investing in the business and the uptake of innovations or new practices. Despite this importance, succession is still generally considered an issue throughout the Atlantic Area with few farmers having succession plans in place.

- **Republic of Ireland.** According to a recent survey (41), only 14% of the farmers (not only dairy) have a clear succession plan in place. Traditionally in Ireland family farms have been passed onto the next generation on death. In recent times social and economic changes have resulted in more transfers taking place during the owner’s lifetime. The large proportion of successors to Irish family farms tend to be young (under 35), male and approximately half of the farmers identified the successor as having an agricultural qualification (42). According to the survey (41), there are a number of key issues pertaining to succession in Ireland:
 - The current farm owner does not believe that the farm is a viable business so new generations are not encouraged
 - No thought given to succession
 - No interest in from next generation/ no clear successor in the family
 - Too sensitive a topic

It is reported (42) that there is generally a lack of information and understanding around the availability of succession options for the family farm. Partnerships and share farming are a relatively new concept in Ireland, but is a viable option for those farm owners who do not have a successor.

- **Northern Ireland.** Succession is generally considered an issue, but quantifiable data is difficult to come by. An AFBI survey (43) found that approximately half of all farm operators had identified a successor with the majority of the successors identified as sons. Two thirds of the designated successors in the AFBI survey did not have an agricultural qualification. Of those survey respondents identifying a successor without an agricultural qualification, just over two thirds of these successors were reported to have no plans to undertake an agricultural qualification.
- **Scotland.** According to an SRUC survey (44) , two thirds of those surveyed had inherited the business and 50% had identified a successor. An increase from 1990 in the reluctance of farmers to retire has also been seen in the wider UK farming according to a 2003 survey (45). Whilst there are differences

in each respondent's own definitions of 'retirement', the results indicated a strong reluctance for Scottish farmers to retire completely with 33% of Scottish farmers planning never to retire, in comparison to a 27% UK average. Respondents were also asked whether their plans varied from their wishes and in Scotland, of those 33% of all decision-makers not planning to retire, almost 87% stated they did not want to (45).

- **Wales.** In 2018, 55 % of dairy farmers had made a succession plan, where the successor is almost always a farmer's relative. It is unclear whether these are formal legal succession agreements or 'understandings' (34).
- **England.** In 2013/14, approximately 48% of the Farm Business Survey respondents had a successor nominated within the family (46), this percentage increased to 56% in the 2018/19 survey (47).
- **France.** The handing over is mainly carried out in the family context. No figures are available on the share of farmers with a designated successor.
- **Basque Country.** The likely successor is a male or a female younger than 40 (28 y/o), medium level of education (35% with basic education and the remaining with professional training), with shared ownership. In 2014, among dairy farms in which the owner was over 55 years old or had plans to abandon milk production, 39% of them declared to have the succession insured, while 57% had no successor and the remaining 4% did not know for sure (48).
- **Galicia.** In 2016, among dairy farms in which the owner was over 55 years old or had plans to abandon milk production, 50% of them declared to have the succession insured, while 36% had no successor and the remaining 14% did not know for sure (37): in a previous survey carried out in 2014, these figures were 24.5, 52.8 and 22.7 % respectively (48). In the 2014 survey, in farms with succession, the average age of the successor is 33.5 years, with around 52% of them having basic formation, 17% professional training, 11% secondary and 21% university studies.
- **Portugal.** In general, dairy farms succession occurs from father to sons. The successor is mainly male and has higher education or at least a secondary education specific on agriculture. No figures are available on the share of farmers with a designated successor.

5.3 Implications

Many factors can enable or limit the uptake of innovation. A survey conducted in 2012/13 in England (30) on a sample of farmers in various sectors showed, unsurprisingly, that economic factors such as financial benefits, access to funds and cost-effectiveness are very strong enablers or constraints to innovation uptake. This is more evident when the innovation is an expensive technology. However, other non-economic aspects such as education level, training and access to information, age and presence/absence of farmer networks are reported to be moderate to strong factors when it comes to innovation uptake.

According to the literature, younger individuals and farmers with higher level of formal education are generally more willing to take risks and are more likely to adopt a new innovation or practices and to invest in the business and expand it (36) (49) (50) (51). The relationship found in the Welsh example (Figure 17) suggests that either a farmer is likely to reduce numbers of cows with time, or, more likely, as older farmers retire from farming and leave a younger generations to carry the farm on, the overall average herd size was likely to continue rising (34

). The introduction in the dairy farming sector of younger individuals with higher education levels represents an important enabler for innovation uptake, providing the innovation is economically viable. It is important, however, not to generalise: there is considerable heterogeneity within the young farmer population in terms of practice adoption, and this heterogeneity can be better understood by considering young farmers' goals and objectives when designing future extension and education services delivery (39).

The generational turn-over in the dairy farm industry is represented by the successors in existing farms, the most common form of intergenerational renewal, and by new entrants.

Succession has been identified as an issue by nearly all regions in the AA. On average, less than half of the farmers have identified a successor. The reason is not known for those who haven't; it is suggested to be due to either a lack of family or natural successors or the lack of willing from these successors to take over the business.

In Portugal, for example, young people seem not attracted by the dairy farming way of life due to the high commitment in terms of work- life balance and the low profitability. In other cases, such as Scotland, a reluctance to retire has been noticed which could be due to lack of succession or to other reasons. In any case, the lack of succession and the reluctance to retire are important barriers to the generational renewal of dairy farming.

Succession planning is a very personal decision and every family has a different set of circumstances. Therefore, an important role of the AKIS should be to provide dedicated support to farmers for an easier and more comfortable succession planning for their farm. This kind of support should cover a broad range of aspects, such as legal, financial, practical and psychological advice for both parties. Teagasc, for example, have identified issues with passing on the family farm, such as the number of family members involved in the farm and separation of the family home from the farm and have set up clinics with Teagasc advisors and experts in the field (e.g. accountants, solicitors, social welfare advisers) to help aid the process. Farming Connect in Wales also provides surgeries on succession.

On the other hand, new entrants generally have a different profile than successors. There is less available information on the numbers or characteristics of new entrants. According to the EIP AGRI Report on New Entrants in Farming (52), new entrants tend to be younger, operate smaller farms, are more highly educated and are more likely to be female than is characteristic of mainstream farming, although women still represent a minority. In Ireland, in 2013, the average new entrant in dairy was 36 years of age (ranging from 21 to 62 years) with nearly 26% of new entrants in dairy under 30 (53). New entrants are more likely to be involved in alternative agricultural systems (organic farming, short food supply chains, back to the land movements) and unlike with successors, they are motivated by the farming lifestyle (52). The stimulated interest coming from these new entrants generally brings in new knowledge and techniques with new business and organisational models and a stronger focus on sustainability, with a stronger interaction and networking in the community.

New entrants however, face several barriers when deciding to start dairy farming (52), such as access to land (high capital value and low availability), economic factors (high start-up costs, low profitability of farming), high bureaucracy and limited access to information (more in some EU countries than others). In many regions/countries, new entrants may access specific grants or subsidies to help start their business. However, specific support is needed to accompany new farmers into the business and help them deal with the legal, financial, practical and technical aspects of farming. In Ireland, to comply with schemes (i.e Young Farm Scheme) and for inheritance purposes, there has been a large increase in the numbers of people (1,420 people in 2017) completing the Green Cert (Vocational FETAC Certificate in Agriculture). The Green Cert places emphasis on the development of business and management skills and in developing proficiency in dairy, grazing beef and sheep or crop production. Since its initiation over 11,000 young people have completed the programme, of these, 72% are in full-time farming and a further 20% are in part-time farming and the majority of the remainder are in agriculture-related employment.

Box 7. GAZTENEK programme, Basque Country

GazteNEK arises to promote the incorporation and maintenance of young farmers in the Basque agricultural sector. The programme also aims to support the maintenance of the agricultural activity of young people already settled in the area. All of this is carried out with the perspective of developing the activity and living conditions of the agricultural community to those that are comparable to the rest of Basque society.

<https://www.hazi.eus/es/emprendimiento/251-gaztenek.html>

Box 8. VENTURE, Wales

Venture is designed to match farmers and landowners who are looking to step back from the industry with new entrants looking for a way into farming. It guides people on both sides through the key steps required to find a potential business partner. An integrated package of training, mentoring, specialist advice and business support will equip participants with the skills, knowledge and confidence needed to help them achieve their goals.

https://businesswales.gov.wales/farmingconnect/sites/farmingconnect/files/documents/cff_venturebooklet.pdf

An important role of the AKIS should therefore also be to focus on providing advice and support to the new generations, on practical matters, such as legal advice, and technical training and qualifications. In a non-dairy specific survey (30), 75% of the respondent farmers had a positive or proactive response to the need for training and qualifications and some older respondents recognised the need for younger family members or their staff to attend training courses. In order to be effective, it is important that education providers tailor training and education programmes to the actual needs of the younger generations, who are quite heterogeneous in their ideas of innovation. Consideration needs to be made to aspects such as the money and time required to attend courses. Content wise, new challenges that agriculture will face in the future will also require new knowledge and areas of expertise, such as resource efficiency and environmental and social sustainability. Low cost online courses that can be taken on demand (i.e. MOOCs) and monothematic webinars could be an option to effectively deliver messages on specific themes or issues.

Apprenticeship is another effective way to introduce aspiring farmers to their career path and make sure they are properly prepared on what to expect from their future job. An example would be the “pre-apprenticeship program” run throughout Scotland. This pilot scheme is run by agricultural machinery rings in Aberdeenshire, Dumfries and Galloway and the Scottish Borders, with support from Borders College, Lantra, the Scottish Funding Council, the Scottish Government, Skills Development Scotland and SRUC. During a 26-week paid work placement, the participants, from a range of agricultural and non-agricultural backgrounds, will gain technical skills and work with mentors (typically farmers) to receive practical experience and achieve a Certificate of Work Readiness. It is thought that 50% of the current 29 (2020) pre-apprentices will progress onto Modern Apprenticeships, with the rest moving onto full-time places at college or work.

In relation to motivations, a recent study (54) revealed that young farmers’ motivations are positively influenced by involvement in progression and a sense of control over the farm. Increasing the involvement

with farm activities and decision making and having more control over the farm positively impacts young farmers' enjoyment at work and allows them to obtain recognition and status. Finally, a farmer who is more motivated in terms of enjoyment and status is less willing to leave the farm, which may explain the negative correlation between a young farmers' motivation and their intention to leave. Motivation is also an influential trait of creativity, which can be found behind all type of innovations (55). Agricultural policy and associated rules and regulations can also limit risk taking, experimentation and collaboration, with negative impacts on the establishment of innovation partnerships (55). Increasing application of emerging technologies for precision dairy farming (i.e. sensors) for farm control and animal monitoring may contribute to improve the attractiveness of the activity in young people and at the same time enhance the uptake and development of these innovations.

From a research perspective, when planning their activity, researchers should apply a similar thought process. Investments in practical research should include projects on innovations aimed at delivering what is needed by the next generation of farmers to improve competitiveness and sustainability. However, research also depends on the organisation funding the research and the outcomes they have requested. Practical research should have both an innovative and productive outcome, along with knowledge exchange opportunities. For instance, researchers have a critical role to play in giving key facts about the new challenges that agriculture will have to face, and key knowledge to overcome them. It is important to produce knowledge also at the farm level through multidisciplinary studies on interactions between different processes (e.g. GHG emissions and water pollution), different components (e.g. N fluxes between crop and animal components), and their impacts on the three pillars of sustainability (e.g. impact of forage crops diversity on environment, profitability and labour load).

It should be noted that, regardless of age or education level, in many cases the decision-making process is to some extent driven by emotions and personal values (culture, identity, and lifestyle). These can be very dominant in the farming sector, especially in certain communities, and can be difficult to investigate or change (56). This can be seen particularly clearly in the role of the family in decision making. The most common type of dairy farm in the AA is the family farm and therefore the family dynamics may play a larger than expected role in the uptake of innovations and farm practices.

Whilst there is a role of the AKIS actors in facilitating and motivating new entrants in dairy farming (see Table 2), they play a more limited role in limiting the number of exits from dairy farming, as the reasons for leaving the industry are usually related to the absence of a successor, low motivation due to high workloads, and low profitability of the business. In the cases of early exits of younger farmers, usually for financial reasons, the role of AKIS could be the prevention of these by helping to limit these issues in advance, allowing them to be tackled before the situation becomes irreversible. Innovation uptake is probably not the main priority in these cases, especially if it implies a financial commitment, but it can become important once succession has occurred and/or the farm becomes more financially stable. Advisors may also play an important role in helping the exiting farmer finding a successor outside the family.

Table 2. Role of the AKIS in supporting new entrants in dairy farming: partners' and experts' suggestions

Region/Country	Suggestions on the role of AKIS to facilitate/motivate new entrants in dairy farming
IRE	Qualifications in agriculture, include practical farming experience – a lot of people who participate in agricultural studies enter the agri-food industry rather than take on practical dairy farming work. Clear pathways for progression.
NI	Specific new entrant training and mentoring is provided through the Business Development Groups structure.

SC	More knowledge at a younger age (schools of agriculture); explore different ways of being involved in dairy, also for non-ag background people (apprenticeship).
WA	Education and training Involvement in programs such as Venture.
EN	Education and training in both technical and non-technical issues (transversal skills) Farmer-to-farmer training, apprenticeships (using Strategic Dairy Farms).
FR	The profession, aware of the challenge of generational renewal, is working on this issue. It has just published a white paper on the subject (57), in which it formalises actions that would facilitate the settlement of young people: <ul style="list-style-type: none"> - improving initial and professional training - facilitating access to and financing of means of production (land, buildings, equipment, livestock): political, fiscal and regulatory measures, but also measures to adapt the conditions for taking over farms and financing the installation to the new structural and economic context of livestock farming - communicating to improve the image of the business, social issues and human relations.
BC	Introduce or test innovation in particular farming management practices or new food products (not just technical innovation or equipment).
GA	Education: most people involved in agricultural student programs remain in agriculture.
PT	At secondary and higher education degrees there is the opportunity to turn education less formal and try to improve technical and practical contact with dairy. Linked to a more technical/digital/precision dairy. New technologies are very attractive for young people.

6. SWOT analysis of the dairy AKIS systems in the Atlantic Area

The partners and experts were asked to prepare a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of the AKIS in their region or country. The answers for each category have been collated and grouped into common themes to create a SWOT analysis for the AA. The themes that were considered common had inputs from at least 3 regions/countries, although for completeness, the non-common themes mentioned by 1 or 2 countries and regions are also included.

6.1 Strengths

- Dairy farmers have been identified as generally focused on the future and open minded, forward thinking, capable of asking for advice and interested in innovation and new technologies. A strength of French farmers was identified in the strong banking and insurance systems for farmers, which could enable the uptake of innovation and technologies.
- Advisors are recognised as numerous, diverse and motivated, providing a wide range of advice and expertise in technical and non-technical (i.e. business management) aspects of the whole value chain. Other identified strengths were the independence of public advice, the possibility to get free access to information but also paid-for advice, both independent and commercial.
- AKIS have been acknowledged to focus on innovation and modernisation in both R&D and KT/KE, with innovative practices, networks and tech centres increasingly valued as important.
- AKIS and advice providers were described as embedded in the territory, close to farmers, widely present, with sometimes dense networks, but still able to provide bespoke research and advice.

6.2 Weaknesses

- The low spending in R&D and innovation and insufficient resources have led to a lack of stable funding and more precarious work, insufficient size of groups and research centres and insufficient allocation of people and funds to collaborate in innovation projects. Lack of sufficient funding also creates financial constraints to delivering K&I in more remote areas.
- In traditional research, the production of results, dissemination and final uptake by the majority of farmers takes too much time.
- High diversity of dairy farmers and farming systems, including farmers living in remote areas with poor connections who could otherwise benefit the most from accessing information, lack of generational change, low education level, lack of farmers' involvement in defining how the AKIS should work.
- Fragmented and "siloes" (i.e. non holistic) advice, biased towards specific types of farms and excluding others, an "old school" focus on production models, rather than efficiency and sustainability; coming from the same education systems, same training, same type of approach in KT (i.e. too many meetings, which can lead to meeting fatigue and low attendance).
- Even if some regions have a more integrated AKIS, nearly all regions have identified the fragmentation and lack of connections as a weakness. A commonly mentioned weak point is the lack of shared needs and clear definitions, mission and directions. This derives from a lack of effective connections among the AKIS actors, which, as they are diverse, may compete rather than collaborate (mainly in the absence of a strong public KT system). In some areas, the AKIS is felt as not sufficiently organised to foster innovative networks and, for some, is considered burdened by too much bureaucracy.

6.3 Opportunities

- Increasing availability of different delivery methods for transfer knowledge. These include online hubs, online meetings, new technology, social media and exploiting the “circle of trust” as an effective route to delivery.
- Young generations of farmers and advisers who will need in future a higher rate of agricultural education uptake to ensure a capable and adaptive workforce.
- Increasing focus on sustainability and environment.
- Evolving requests from consumers.
- Political opportunities such as the new CAP, the consistent interest of the EU in the AKIS systems and, limited to some regions, the post Brexit scenario.

6.4 Threats

- Reduction of public funding or funding redirected to different areas of research which could make the AKIS less stable, with less resources and increased competition for money
- Risk of too much administration activity at the expense of technical advice
- Research not focusing enough on end-user needs
- Reduction in quality of the AKIS KT activity or loss of independence
- Increase in private advice and biased KT
- Risk of duplication/overlapping of activities
- Loss of confidence in the main AKIS
- Low numbers of new entrants and ageing farmers
- Change in the farming industry (i.e. shortage of skilled labour)
- Rise of other unpredicted barriers to innovation uptake
- Requirements from consumers that may make sustainable milk production more difficult
- Political uncertainties such as the new CAP, the post Brexit scenario and international competition

6.5 Implications deriving from the SWOT analysis

The current situation of the AKIS in the AA is defined by a series of strengths and weaknesses. The farmers’ community is described as innovative, future-focused and open minded, but at the same time it is very diverse, with many farmers still lacking the training and education needed to understand, uptake and exploit new knowledge and innovation. The implications of this and of the lack of new entrants has been described in 5.3.

In terms of advisers and type of advice provided, the main strengths are related to the broad competence and expertise and to the link with the desire to deliver more effective and bespoke advice. However, it is felt that broadness and diversity are often associated with an excessive fragmentation of advice, a lack of an integrated approach (“silo advice”) and, in some cases, with a stagnant way of delivering the knowledge. More broadly, a commonly mentioned weakness is the disconnection among the different AKIS players; an absence of common missions and goals and an increasing environment of competitiveness. Consequently, farmers receive mixed and disconnected messages (i.e. without considering trade-offs and unintended consequences of the advice given), leading to a loss of trust in the AKIS (identified as a threat) and failure to uptake innovation and technology, due to lack of confidence. The lack of consistent recommendations has been highlighted (58) in relation to the advice provided to reduce diffuse water pollution from agriculture in the United Kingdom.

The general focus on innovation, especially in R&D and the consequent KT, is certainly a strength to highlight, as it shows the general motivation of the AKIS to show new ways of farming to increase competitiveness, resilience and sustainability. However, this is not always easy to achieve, as in many cases funds and resources are limiting factors to the type of activity that can be conducted.

The majority of future challenges that the AKIS will face and that will likely shape their structure has been identified in the opportunities and threats sections of the SWOT analysis. Some of them are internal to the dairy farming industry (related to farmers, advisors and advice), other are external, such as changes in future funding, in consumer requests and in the political horizon at different levels.

A definite key opportunity to exploit is the upcoming new generations of farmers, advisers and consumers, whose attitudes, preferences, requests and skills can be integrated to create a more sustainable system from all perspectives. The increasing demand for more sustainable agriculture also represents an opportunity to introduce innovation aimed at producing food for an increasing number of people in a sustainable manner. For example, while it is accepted that agricultural GHG emissions are difficult to reduce, knowledge transfer campaigns can play a part in educating farmers around this issue. Teagasc and NEIKER research (BATFARM project) has shown that farmers who adopt a number of key practices and technologies can significantly improve efficiency, improve profitability and lower GHG emissions (59). Collaborative initiatives can also be beneficial to support this new way of farming; for example the Agricultural Greenhouse Gas Research Initiative for Ireland (AGRI-I) and the Greenhouse gas Action Plan in the UK (GHGAP).

Possible reduction in future funding, especially public funding, is a real threat that in many cases is not under the control of the AKIS. This lack of control is also true for the consumers' perspective of dairying and political uncertainties.

The innovation focus, the AKIS competence and expertise, and the new generations' needs and requests however can be key in mitigating some other listed threats, such as the production of impractical or low-quality knowledge and the fragmentation and duplication of activities.

6.6 The impact of Brexit on the AKIS structure in the AA

On January 31st 2020, the United Kingdom officially left the European Union after the results of the referendum held in 2016. Negotiations with the EU will begin to define, among others, the nature of the future EU-UK trade relationships.

The exit of the UK from the EU (Brexit) will certainly have an impact on both UK and Irish agriculture and the agri-food sector but the extent will be determined by the outcome of the negotiations by the end of 2020. It is clear that agricultural production should be the focus of policy makers as it will be one of the most likely impacted sectors.

As stated in the Amaeth Cymru report (60), Brexit for Welsh agriculture is both an opportunity and a threat. There is an opportunity to develop an agricultural policy for Wales with potential for import substitution in all of Wales' key agricultural sectors. Additionally, new trading opportunities can arise, so long as the markets remain open and a competitive currency provides good market conditions for exports and displacements of imports – if this is sustained in the long run. The threats can however be significant and could include the introduction of tariff and non-tariff barriers, a cheap food policy with increased risk of competition from low cost-low quality imported products, increased costs of production in case of a weak pound, and the uncertainty on future regulations and support regimes.

The AHDB publication "Brexit scenarios: An impact assessment" (61) aims at helping farmers and growers understand the potential impact of Brexit on their sector. This publication has been followed by the AHDB Horizon document "Preparing for change: The characteristics of top performing farms" (62), a guide published as a reference point for farmers seeking to improve their own performance, whatever their sector or current level of performance. The rationale is that while there are scenarios where farming could become more profitable after Brexit, farming cannot depend on these outcomes and most farms will need to work to become more competitive to retain a viable long-term and sustainable business. The section on Brexit on the



AHDB website provides a number of publications, media and online tools that farmers can use to prepare their business to different scenarios.

The AKIS in the UK will have to show a great degree of efficiency and flexibility to adapt to the new structure of agriculture, to facilitate the uptake of the right degree of innovation and make dairy farming competitive, profitable and at the same time sustainable.

The impact on Irish agriculture and the wider Irish agri-food sector of the UK exit from the EU (Brexit) will likely be negative. Teagasc is undertaking research and providing analysis on an on-going basis to the Irish Government and the wider Irish agri-food sector on the impact of Brexit on Irish agriculture and farm incomes.

7. Suggestions for a more efficient and effective deliver of innovation to the dairy farming industry in the AA

The SWOT analysis presented in Chapter 7 has clearly identified the weaknesses in the current AKIS in the AA. The disconnection and fragmentation mentioned in many regions makes it difficult to generate, disseminate and exploit knowledge and innovation effectively to meet future challenges. The available knowledge and innovation, significant in the agricultural sector, is often under-applied in practice. Therefore, it is important to identify the best routes to utilise within the AKIS to effectively connect science and practice and to foster innovation, without duplication of activities and in a cost-effective manner.

The 2019 EU SCAR Report “Preparing for Future AKIS in Europe” (4) has identified four main actions for successful AKIS strategies:

1. **Enhancing knowledge flows and strengthening links between research and practice.** One of the issues of AKIS identified by the SCAR Strategic Working Group is the increasing privatisation of knowledge and dependency of farmers on commercial solutions (4). It is vital for independent advice to be accessible to all and to reach this goal it is critical to achieve a good level of collaboration amongst AKIS actor. In addition, to support this, researchers need to be motivated to work in a more interactive and less traditionally linear way, with closer collaboration with other non-research AKIS actors. Some suggested ways (4) (63) to strengthen the research-practice links are:
 - a. Incentivise and reward researchers for their impact on agricultural practice, to be promoted as an additional asset for their careers;
 - b. Request researchers to produce specific outputs that are easy understandable for the end user;
 - c. Help them to get inspired through supporting them to join regular meetings with farmers on various agricultural (thematic) events;
 - d. Make use of on-farm demonstrations where researchers could present their results and exchange informally to learn about farmers' needs;
 - e. Organise specific training on the interactive approach.

The need for a more collaborative and integrated approach from research to practice has been mentioned by many partners and experts in the AA area. This suggests more attention is required for knowledge development and transfer, accompanied by a need for expanding interaction and cooperation with research and education centres. Another suggestion coming from the project is to co-design innovative systems experimented at farm level to test their feasibility and assess their sustainability, resilience and efficiency.

2. **Strengthening all farm advisory services and fostering their interconnection within the AKIS.** Collaboration and integration are needed within the advisory sector as well, who, by the nature of their job, are generally the closest to the farmer. It is important that advisors have access to the latest research, knowledge and innovation and are able to transfer it properly to the farmers. Strengthening the links with the other AKIS players will make this process more effective. Additionally, involving advisors in designing projects or other initiatives will help shape them around the actual needs and demands from farmers. This is a daily component for the advisor but in some cases may not be that evident to the researcher or the academic. Their involvement will also aid the design of appropriate actions to identify, analyse and communicate innovations.
3. **Enhancing cross-thematic and cross-border interactive innovation.** Inter-regional cooperation helps to develop new ideas and innovations. European (inter-regional) projects such as Green Dairy (2003-

7) and Eurodairy (2016-9) were conducted in close collaboration with several AKIS actors (universities, cooperatives and farmers organizations) and provided opportunities to change farmers' mind-set, stimulating them to adopt of new ideas and techniques. The inter-regional cooperation provided opportunities for training courses and workshops to deliver knowledge to technicians and advisors. The inter-regional dimension can push some farmers or technicians to participate more easily in exchanges, and thus increase the impact of a project. Inter-regional cooperation creates the opportunity to take a step back from current practices, to look for good ideas (i.e. see how other countries are tackling some issues, from an educational perspective but also in policy-making) and to allow exchanges. Benchmarking on transfer methods that work well can be evaluated such as discussion groups, webinars, social network and open-field days.

4. **Supporting the digital transition in agriculture.** This will mean accompanying and supporting the farmers by motivation through the digital process, as they may not have the time or the desire to learn modern technologies and use smart devices for their business management. One of the key challenges for a successful digitalisation is the improvement of mobile and internet connectivity, which is still an issue in many rural areas.

Additional suggestions include:

- Identify the knowledge and innovation to deliver; prioritise what has the least unintended negative consequences, especially economic, and maintain the flexibility to adapt to a change in circumstances. Where possible, include consumers' requests to find a compromise and increase social acceptance and permission to consume.
- Provide effective training of farmers and technicians to ensure a capable and adaptive work force:
 - Include those groups of farmers who don't have much motivation to learn but could significantly improve their performance if they acquire a positive attitude towards innovation through training.
 - Provide a more individualized advisory system, with particular focus on the goals and objectives of young farmers, and use up-to-date decision support tools and technology.
 - Create learning networks such as LINSAs (Learning and Innovation Networks for Sustainable Agriculture) and connect them with the AKIS. LINSAs are defined as networks of producers, consumers, experts, NGOs, SMEs, local administrations as well as official researchers and extension officers, that are mutually engaged with common goals for sustainable agriculture and rural development - cooperating, sharing resources and co-producing new knowledge by creating conditions for communication (64).
 - Include transferable skills in addition to technical skills.
- Work in partnership with other AKIS actors (included the media) to share resources, maximize effort and build trust. This would increase the profile of farmers as inventors and owners of "tacit knowledge" which is worth being disseminated further.
- Exploit the circle of trust ("influencing the influencer") to enhance the effectiveness of message delivery and uptake.
- Identify "flagship" farms (i.e. Strategic Dairy Farms) to showcase best practice and innovation
- Make use of online tools and learning methods. This may include the creation of forums where farmers and the other AKIS actors can interact
- Promote cross-region exchange visits among farmers including technicians and, if possible, policy makers
- Use a variety of media to disseminate knowledge, from field activity (i.e demonstration farms, open days on pilot farms), TV and specialized press to digital and online tools (i.e. social media such as forums where farmers can interact with other actors).

Appendix 1. Examples of costs of knowledge and innovation for a typical dairy farm

The following tables show some examples of K&I costs for a typical dairy farmer in the Atlantic Area (excluded Basque Country for which data were not easily available). These include both statutory and voluntary costs: the voluntary costs only give a very broad idea of the actual costs as not all farms will choose to pay for these services and the costs can be highly variable.

Country/region	Levies collected	Use	Status	Governance	Cost for a typical dairy farm (herd size: 83 cows, milk sold: 448,200lt)	
					€/farm	€/litre
Republic of Ireland	Dairy levy	Agricultural and food research	Obligatory	Stakeholder board	1613.5	0.0036
	Irish Cattle Breeders Federation (ICBF)	Genetics and Breeding	Voluntary	Stakeholder board	€100 per farm + €0.50 per cow 141.5	
	Animal Identification Tag Levy	ICBF	Obligatory	Stakeholder board	€0.38 per tag 32	
	Milk recording		Private - voluntary	COOP sponsored	€8.50 per cow per year 705.5	
	Bovine Disease Levy	Disease monitoring	Public-Obligatory	Ministry of Agriculture	269	0.0006
	Dairy Inspection Levy	Inspection of milking facilities	Public-Obligatory	Ministry of Agriculture	448	0.001
	Slaughter levy		Public-Obligatory	Ministry of Agriculture	€3 per head 60	
	Dead animal collection levy		Public-Obligatory	Ministry of Agriculture	€3 per head 12	
	Total				3281.5	0.73

Country/region	Levies collected	Use	Status	Governance	Cost for a typical dairy farm (herd size: 92 cows, milk sold 683,961 lt/yr)	
					€/farm (€/farm)	ppl (cnts €/litre)
Northern Ireland	Agrisearch - Dairy Levy	Applied Research	Charity ⁶	Farmers, Industry, Government	137 (156)	0.02 (0.022)
	Agrisearch - Beef Levy	Applied Research	Charity ⁶	Farmers, Industry, Government	11 (12.4)	0.002 (0.002)
	AFBI Research - mainly funded by Government	Research	Public	Board of Trustees (Government, Farmers and Industry)	0	0
	CAFRE, Integral part of DAERA	Knowledge Transfer	Public	Government	0	0
	Total				147 (166)	0.022 (0.024)

Country/region	Levies collected	Use	Status	Governance	Cost for a typical dairy farm (herd size: 150 cows, milk sold: 1,173,750 lt)	
					€/farm (€/farm)	ppl (cnts €/litre)
Great Britain	Milk levy (AHDB)	Applied research, KE, market intelligence	Public-obligatory	AHDB	700 (780)	0.06 (0.07)
	Beef levy (AHDB) – cull cows sent to abattoir	Applied research, KE, market intelligence	Public-obligatory	AHDB	162 (180)	0.01 (0.011)
	NFU membership	Lobbying with policy makers and other stakeholders, promotion, support in research	Private- voluntary	NFU	500 (555)	0.04 (0.05)
	DairyPro (AHDB) – yearly fee	Training	Public-voluntary	AHDB	24 (27)	0.002 (0.0023)
	Milk recording	Milk analysis and reports	Private- voluntary	Milk company	2400 (2667)	0.2 (0.23)
		Total				3786 (4206)

⁶ Principal funding sources are terms-of-trade levies collected on a voluntary basis by Northern Ireland processors of dairy, beef and sheep.

Country/region	Levies collected	Use	Status	Governance	Cost for a typical dairy farm (herd size: 70 cows, milk sold: 520,000 l)	
					€/farm	cts €/litre
France/West	CAS DAR : 90 €/farm and x 0,19% on turnover	Applied research, extension	Public	Government and farmers	515	0,09904
	Cniel/Dairy board : 1,22 €/1000 l	Dairy products promoting, studies for dairy chain, applied research	Private	Dairy board	634	0,12192
	Interbev/Beef board : 0,01 €/kg carcass	Beef products promoting, studies for dairy chain, applied research	Private	Beef board	68	0,01308
	Breeding national fund (CNE) 0,005/kg carcass	Genetics, studies	Private	Farmers	34	0,00654
	Chamber of agriculture : 10 €/ha AA	Extension, education, applied research	Public	Farmers	810	0,15577
	Beef carcass grading (Normabev) : 0,4 €/head	Carcass classification	Private	Beef chain	8	0,00154
	Dead animal collection levy (ATM) : 1,35 €/LSU	Dead animal collection	Private	Government and farmers	134	0,02577
	National Health Fund (FMSE) : 0,1 €/head	Mutual fund for health risks of cattle	Private	Government and farmers	13	0,00250
	Milk recording and consulting : 50 €/cow	Milk recording, consulting	Private	Farmers	3 500	0,67308
	Accounting: 40 €/AA	Accounting and first management consulting	Private	Farmers	3 240	0,62308
	Total				8 956	1,72231

Country/region	Levies collected	Use	Status	Governance	Cost for a typical dairy farm (500.000 litre/year)	
					€/farm year	€/litre
Galicia	Inlac (Dairy Board)	Dairy products promoting, studies for dairy chain, applied research	Private-obligatory	Industry and farmers	78	0.017
	Ligal (Galician Interprofessional Laboratory)	Analyses for milk payment	Private-obligatory	Dairy board	162.96	0.03134
	Milk recording	Milk analysis and reports	Private-voluntary	Farmers Association	600	0.12
	Total				841	0.168

Country/region	Levies collected	Use	Status	Governance	Cost for a typical dairy farm (herd size: 80 cows, milk sold: 400,350 lt)	
					€/farm	€/litre
Portugal	Registration in a cooperative	-Accounting -Veterinary services -Acquisition of resources -Dairy services	Private Optional	Farmers (board elected)	550	
	CONFAGRI / CAP / CNA	Lobbying with policy makers and other stakeholders, promotion, support in research	Private Optional	Farmers - Board elected by coops representatives	1	
	FENALAC	Lobbying with policy makers and other stakeholders, promotion, support in research	Private Optional	Dependent on CONFAGRI board		0.0002
	ALIP	Milk analysis	Private Obligatory	Farmers	210	
	ABLN/AEBL	Cows performance and genetic improvement	Private Optional	Farmers	1200	
	Animal movement registration fee	To sell or move animals between farms	Private Optional	Farmers	113.75	
	Blood sampling	Disease surveillance	Private Obligatory	Farmers	505	

	SNIRA	Animal registration and identification system	Private Obligatory	Farmers	200	
	SIRCA	Dead animal collection levy	Public-Obligatory	Government	107.50	
	Total				2887.25	0.0002

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