CWGSAP

Collaborative Working Group on Sustainable Animal Production

Survey and Analysis

24.08.2015

Editorial

Animal production is one of humanity's oldest cultural achievements. Farm animals are kept to provide food such as meat, milk, eggs, honey and other products of animal origin such as wool, hides, skins, etc.

The opening of the European internal market in 1992 facilitated the trade in live animals and products of animal origin in the European Union. Since then, the global trade has increased, however, so has the risk of spreading infectious animal diseases.

Consumer demands of different consumer sections are changing and become more and more specific which results in different requirements for animal production and products of animal origin. Above all, consumers want high-quality but reasonably priced food. Thus process quality is affected, too. At the same time consumers in developed countries are increasingly questioning the ethical acceptability of some animal production systems and now include animal welfare as a benchmark for assessing standards and livestock farmers must increasingly take animal protection and animal welfare aspects into account

Animal production is not only impacted by changing environmental conditions but also has an impact on the environment in turn, notably through emissions, including odors, greenhouse gases, bioaerosols and particulate matter. International negotiations have resulted in the introduction of limitations for different areas with a view to curbing or reducing the rise in temperatures through climate change and the production of greenhouse gases. This also concerns the agricultural sector, and animal production in particular. These global challenges must be faced and for this reason, we must also reduce emissions from animal production such as nitrogen oxides or methane from cattle farming.

The European animal production sector is very diverse, especially for ruminants, e.g. milk and beef cattle production. On one end of the rang are very intensive systems with confined animals where the mainstream commodity system favour work productivity as an essential criteria of competitiveness. On the other end of the range are extensive grassland based systems which are of particular importance for less-favoured areas which are not able to compete with more favourable regions/systems. In these regions approaches are founded on marketing high quality or the origin of the product supported by a list of specifications or simply on the benefits of inhabiting such less favoured areas that depend on livestock farm activities. There is a necessity to tackle this diversity of systems because the response to global challenges might differ but also to explore positive externalities of the more extensive and natural resources based systems.

Livestock farmers must take these challenges into account but also ensure the general well-being of their animals in terms of e.g. health, welfare, protection and nutrition and it can thus be concluded that animal husbandry is directly linked with a wide range of different areas and constantly changing conditions.

With a view to secure the future of animal production in the European Union, the appropriate conditions for all these aspects must be brought into line. Against this backdrop, the European Commission saw a significant need for research and took this into account in its "Horizon 2020" research and innovation programme. In consultation with the Member States, the Commission has taken a comprehensive approach and launched a call for a European Research Area Network (ERA-NET) on sustainable animal production. The targeted network building of research funders in Europe will improve the effectiveness of research funding by bringing European research project partners together and foster multidisciplinary research approaches which are needed to tackle the sustainability challenges in transnational projects.

The Standing Committee on Agricultural Research (SCAR) therefore set up a Collaborative Working Group on Sustainable Animal Production (CWG-SAP) which was to lay the foundations for this ERA-NET.

A total of 18 countries are currently represented in the CWG-SAP. Though Member State driven, CWG-SAP invited observers from relevant private initiatives such as the Animal Task Force (ATF) which represents key stakeholders from industry, farmers and research from across Europe and already took up the issue of further developing a sustainable and competitive livestock sector in Europe in its White Paper. Representatives from other public partnerships such as the SCAR CWG on Animal Health and Welfare, ERA-NETs on animal health and welfare, but also from the Joint Programming Initiative on Agriculture, Food Security and Climate Change to foster exchange on environmental or, specifically, on emissions issues are included in CWG-SAP as well.

Specific aspects with regard to the general definition of the three pillars of sustainability – society, environment, economy – were determined right at the start of the CWG-SAP:

» societal aspects, also including consumer expectations and animal welfare,
» environmental aspects – e.g. emission reduction, and
» economic aspects.

In a first step, all members of the CWG-SAP gave an overview on animal production in their countries in order to provide a basis for outlining its importance and key issues for future development. This was also useful when it came to setting the necessary priorities among upcoming research questions.

The reports, which are all included in this document, show that farm animal production remains an important economic factor in Europe which adds value along the whole production chain and last but not least provides employment in rural regions. Sustainability in this context means also to ensure that animal production will be possible in Europe and in the Member States.

In a second step, the members of CWG-SAP outlined the relevant national research framework for animal production and identified open national research questions. The following topics and questions were identified:

» Research on Animal Production Systems
» Improvement of Animal Production Systems
» Animal Health
» Animal Welfare
» Mitigation and adaptation to Climate Change
» Feeding / Nutrition
» Breeding / Genetics
» Reproduction
» Biotechnology
» Information and Communication Technologies (ICT) / Precision Livestock Farming (PLF)
» Economy / Competitiveness / Trade
» Social Acceptance (incl. farmers working conditions)
» Food Production
» Bees
» Knowledge exchange: reaching the producers and all other actors in the livestock sector
» Other topics.

The different research areas were subsequently summarised and evaluated by topic groups. The major challenge was then to find a balance between the sustainability approach, the different research questions and national research priorities.

The scope has been developed during several meetings in 2014 and 2015 and is now presented in this CWG-SAP final report “Survey & Analysis”. It lays the foundation for an evaluation of farm animal production in Europe and thus also for the development of proposals for the legislation at EU level (COM Directorate General for Agriculture and Directorate General for Health).

As previously mentioned, it also provided the basis for developing the scientific scope and research framework for a comprehensive multidimensional approach of the ERA-NET on sustainable animal production.

The aspect of sustainability is a great challenge but will also distinguish the ERA-NET on sustainable animal production from other ERA-NETs. Due to the tight timeframe of the "Horizon 2020" framework programme for research, relevant proposals had to be prepared by June 2015. The necessary work therefore had to be organised in a very efficient and structured manner. The proposal for an ERA-NET on "European Research Area on Sustainable Animal Production Systems – SusAn" was submitted on 11th June 2015.

At this point, I would like to thank Susana Astiz, former Co-Chair from the National Institute for Agriculture and Food Research and Technology, Spain, and Babette Breuer, representing the Head Office for CWG-SAP at the Federal Office for Agriculture and Food, most cordially for their great commitment. They have supported the CWG-SAP and the preparation of the ERA-NET proposal in a very dedicated and competent way. My thanks also go to all members of the CWG-SAP who have contributed through their reports on animal production and research in their countries with great energy. And I would also like to thank Jean-Louis Peyraud from the National Institute for Agricultural Research, France and everybody else most cordially for all the expert input, and last but not least Pinder Gill from the Department for Environment Food & Rural Affairs UK for adding expertise along with highly valued linguistic text revisions.

Bernhard Polten

Chair

Content

1 Introduction

1.1 Rationale for the Collaborative Working Group on Sustainable Animal Production

The Standing Committee on Agricultural Research (SCAR) is committed to contribute to the development of the European bioeconomy. Since the renewal of the SCAR in 2005, many Collaborative Working Groups have been initiated to this aim, many finished in an ERA-Net, some others continue on-going even though an ERA-Net has been developed.

The livestock sector forms an important part of Europe's (agricultural) economy and plays an essential role in the provision of Europe`s citizens with sufficient, healthy and safe food. The Communication of the EC on Innovating for Sustainable Growth: A Bioeconomy for Europe states the Food demand is expected to increase by 70% by 2050 and many of today's food production systems already compromise the capacity of the planet to produce sufficient future food supplies. Meat consumption, for example, in both the developed and developing world, is projected to double from the 229 million tonnes produced worldwide in 1999/2001 to 465 million tonnes in 2050. In the future, livestock production will increasingly be affected by competition for natural resources particularly land and water, by the need to reduce fossil energy dependency and environmental impact, and by societal concerns concerning animal welfare.

The challenges sustainable animal production is facing, can only be tackled by a holistic approach. The Livestock sector is considered to be broader than the Animal Health and Welfare aspects, not only because of the interaction with human health, but also because of horizontal issues that are of extreme importance for the sector. .

The EC Bioeconomy Strategy Communication also states that Developments in breeding, nutrition, and animal health will contribute to increasing potential production and further efficiency and genetic gains. In this respect the tools of molecular genetics could have considerable impact, in particular marker assisted selection for traits that are difficult to measure, such as meat quality and disease resistance. The holistic approach in order to improve sustainable animal production is shared with the Animal Task Force initiative that integrates the main EU Research and Knowledge providers on animal production issues and all the TPs dealing with livestock production. The COPA-COGECA as the farmers and cooperatives representative organization at EU level is also supporting this initiative.

1.2 Scope and overall objective

In this situation it is considered that even Research and Innovation has made Europe's livestock sector as competitive and efficient as it is today. This investment in Research, Development & Innovation must continue in the future. Creating a supportive environment for research and innovation in the livestock sector can lead to ways of production that ensure the supply of safe and healthy food, reduce the emissions of greenhouse gases, are acceptable to society, contribute to a viable economy, and will be an example for the world.

An increasing awareness exists about the importance of creating a more efficient framework for the livestock sector's R+D+I in Europe, so a better coordination of national and regional efforts at this regard will contribute for the development of the ERA in order to have a more competitive and sustainable animal production sector in Europe.

The goal of the proposed SCAR CWG on Sustainable Animal Production is to provide shared tools based on standardized data to improve the coordination and collaboration on research prioritization and procurement, with an holistic approach, creating the necessary critical mass and focus to deliver the sustainable animal production research needs of the funding agencies and policy makers and the European livestock industry, in close collaboration with the CWG on Animal Health.

The CWG on Sustainable Animal Production should consider all sectorial aspects of the animal production like economics and data recording, animal feeding, animal reproduction, animal genetics, and animal husbandry regarding the horizontal aspects like, animal facilities, resource efficiency, GHG emissions (Carbon and water footprint), animal waste management, animal welfare, animal health and other socio-economic aspects that will lead to a more sustainable animal production sector in the EU.

The interactions of the different disciplines related to the livestock sector must be regarded in a holistic way. An improvement in one discipline always affects other aspects of livestock production. For instance improvements in productivity without outstanding knowledge about the changes in management that should be implemented simultaneously, can have negative effects on animal welfare or the environmental footprint.

Therefore, the whole spectrum of production systems, from the extensive, low input, organic ones to the intensive indoor systems will equally require attention.

1.3 Structure and interlinkages

The holistic approach of the CWG on Sustainable Animal Production leads to the need for a close collaboration with the CWG on Animal Health and Welfare. The coordination between both CWGs should be managed by following measures:

- each coordinator participates in the other group
- the CWG meetings should be held back to back
- joint subgroups between both CWG SAP and CWG AH&W should be established for horizontal and cross cutting issues in order to avoid overlapping and strengthen the Livestock research coordination in the EU. Once a year an inter-Group meeting (plenary) will be organized where representatives from both CWGs will discuss about the main outcomes and future activities for the development of the coordination activities. It is foreseen the participation of the sector in the different meetings (COPA-COGECA, ETPs, ATF) as observers.

It is considered the opportunity to continue with a separate CWG on Animal Health & Welfare, because the European Commission has recently adopted a package of measures to strengthen the enforcement of health and safety standards for the whole agri-food chain. This package of measures provide a modernized and simplified, more risked-based approach to the protection of health and more efficient control tools to ensure the effective application of the rules guiding the operation of the food chain that is foreseen to entry in force in 2016.

Beside the CWG on Animal Health, the proposed CWG SAP should consider the different EU wide initiatives that are working on livestock production or do have interfaces to the topic, e.g. the Animal Task Force, COPA-COGECA, Technology Platforms and the FACCE JPI.

The CWG-SAP intends to collect information about the existing activities in the field of animal production in Europe. To identify possibilities for future joint activities the CWG-SAP will work in collaboration with the CWG on Animal Health and Welfare as well as with other EU initiatives on livestock production. The goal is to prepare a common ERA-Net proposal under the headline “Sustainable Animal Production” (pre- announcement 1st AP under Horizon 2020).

The CWG-SAP intends to publish a report on its activities and make recommendations for a new ERA-Net.

Due to the extreme broadness of the livestock research with the high number of horizontal issues, in the first phase a pilot action should be developed in order to map the research areas and prioritize the research areas to work on. For this pilot action it will take advantage of different results from other mapping activities already conducted within other initiatives like FACCE CSA and other on-going initiatives.

Based on this results the structure of subgroups, the collaboration with CWG on AH&W and future activities are developed.

As a consequence of the coordination activities conducted within the CWG and depending on the results and Member States commitment, the development of an ERA-Net that should integrate both CWG issues can follow as the existing ERA-Net on Animal Health and Welfare (ANIHWA) will end by December 2015.

1.4 Progress

1.4.1 Establishment

Following a joint proposal by Germany (BMEL) and Spain in the 18th SCAR Plenary the SCAR members supported the establishment of a new CWG on Sustainable Animal Production under the SCAR during the 19th Plenary. Member States nominated their representatives.

The list of members can be found in the annex.

1.4.2 Meetings

The Kick-Off meeting was hosted by BMEL Germany in Bonn from 29th – 30th January 2014 with the following results:

- definition of sustainability
- discussion of relevant topics in the context of sustainable animal production
- national priorities
- options for collaboration with CWG-AHW
- timeline with regard to the ERA-Net Cofund proposal.

Members agreed to prepare a status quo report on the national livestock production.

The 2nd meeting was hosted by INIA Spain and was held in Madrid from 5th – 6th May 2014 with the following results:

- status quo reports on national livestock production
- draft framework for the ERA-Net Cofund proposal
- discussion of the thematic scope (research topics)

The 3rd meeting was hosted by INRA France and was held in Paris in from 25th – 26th September 2014 with the following results:

- ...

2 Animal Production

2.1 Agriculture and livestock production

The study of production trends in livestock production is the indicator of a changing society, which moves from its own rural economy of a developing country to a developed urban economy in a globalized environment. The development of intensive livestock production accompanies rural depopulation and urbanization typical of several countries, mainly in the early 50s.
In the evolution of these quantities certain circumstances have motivated in certain regions in the world, an apparent exponential growth in animal production, and defined the outer orientation of a suitable intensive sector to supply the world population with the needed commodities.
In general, the production and consumption of meat is also associated with income level, and explains key productive economic fluctuations of certain meats, such as poultry and beef.

2.2 What are we looking at

Animal production includes several species and a wide range of systems. Species integrated in production are swine, cattle, small ruminants (sheep and goats), other ruminants (buffle), poultry, other avian species, rabbits, and other minor species (rendeer, fur species…).

The systems in which the animals are kept in order to produce commodities for the human population (mainly meat, milk and eggs) vary depending on a wide range of factors and circumstances in the world: environment, legislation, socio-economic level, traditions, level of supply and demand….

In general, we observe traditional, low input systems, integrated in the landscapes and based on the leveraging of local resources. And on the other hand, we can observe high intensified, high in-put, animal production systems, with a high level of use of technology, high demands of energy, and raw materials, as well as a higher impact on the local environmental situations.

2.3 Worldwide

2.3.1 Agriculture as an important part of the bioeconomy

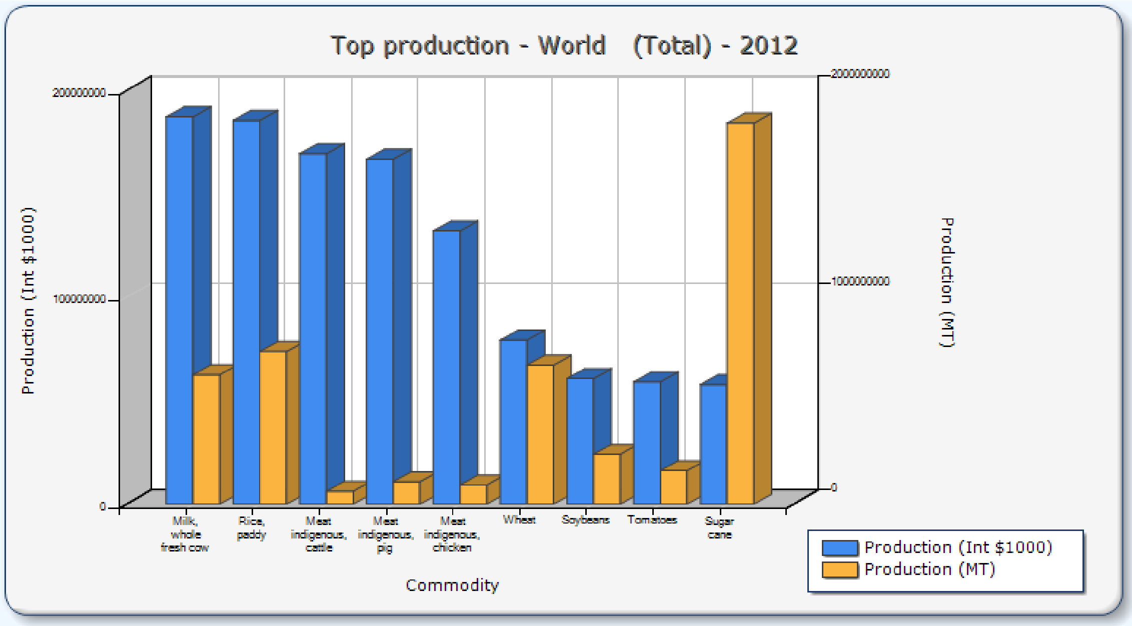
Agriculture has a central role in tackling major issues related to the bioeconomy concept in the long run. It has to ensure the production of sufficient food, but also feed, fuel and fibre by managing the land and preserving a resilient and continuously productive environment. Innovation, both technical and societal, is essential for success. Agriculture is a global issue in an increasingly interdependent world and its transition towards bioeconomy will further enforce its role already in the medium term.

The production of animal-source food is at the heart of world agriculture today. A quarter of the earth's terrestrial surface is used for ruminant grazing, and a third of global arable land is used to grow feed for livestock, accounting for 40 percent of total cereal production (FAO, 2012), with animal agriculture using far more land resources than any other human activity.

While rice is mainly for human consumption, much soybean and maize production serves to feed animals.

The whole production and ranking of each basic nutritional product can be observed in table and figure 1, such that the production of the EU can be placed in a global frame.

Table and Figure 1: total production of commodities in the world; Year 2012.



Rank	Commodity	Production (Int $1000)	Flag	Production (MT)	Flag
1	Milk, whole fresh cow	187277186	*	625753801	A
3	Meat indigenous, cattle	169476916	*	62737255	A
4	Meat indigenous, pig	166801086	*	108506790	A
5	Meat indigenous, chicken	132085858	*	92730419	A
10	Eggs, hen, in shell	54987685	*	66372549	A
15	Milk, whole fresh buffalo	38303165	*	97417135	A

* : Unofficial figure

A : Aggregate, may include official, semi-official or estimated data

Data from FAOSTAT (http://faostat.fao.org/site/339/default.aspx)

Most of the value of livestock production is from ruminants and mainly comprises meat and milk. The rest comprises pig, poultry meat and eggs, and buffalo milk in that declining order of importance (table 1). Moreover animal-source foods play an important role in global food security, nutritional well-being and health.

Aquaculture is a relatively new and fast-growing activity. Aquaculture products currently account for nearly 50 percent of seafood consumed globally. The sector is characterized by a high number of stakeholders along the supply chain from breed improvement to the sale of live fish. The players range from smallholder producers to large-scale commercial companies. Because aquaculture is a recently developed activity, two parallel approaches are taken to satisfying consumer demand and increasing food fish supply: domestication of new species and further genetic improvement of species that are already produced commercially. The domestication of new species depends on the capacity to close the whole life cycle in captive conditions. Over the last three decades, the number of taxa – families, species/species groups –being farmed has greatly increased.

2.3.2 Description of livestock sector

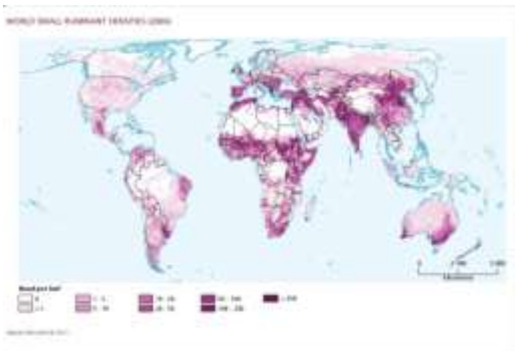
About 40 animal species have been domesticated for use in food production and agriculture. Five species – cattle, sheep, chickens, goats and pigs – dominate in terms of numbers and distribution. Cattle, sheep and chickens are widely found across all regions of the world, whereas goats and pigs are less uniformly distributed. Goats are found in greatest numbers in developing regions and pigs are relatively uncommon in countries that are predominantly Muslim.

Chicken breeds make up a large majority of the total number of avian breeds in the world. Cattle are important in all regions and have a global population of over 1.3 billion animals, or about one for every five people on the planet. Asia and Latin America have 32 percent and 28 percent of the global herd, respectively, with Brazil, India and China accounting for particularly large proportions. Large cattle populations are also found in Africa (particularly Sudan and Ethiopia), and Europe and the Caucasus, with the largest numbers in the Russian Federation and France. Cattle breeds contribute 22 percent of the world's total number of recorded mammalian livestock breeds.

The world's sheep population is just over 1 billion. About half are found in Asia and the Near and Middle East. China, India and the Islamic Republic of Iran have the largest national populations. Africa, Europe and the Caucasus, and the Southwest Pacific have around 15 percent each; and 8 percent are found in Latin America and the Caribbean. Sheep are the species with the highest number of recorded breeds (contributing 25 percent of the global total for mammals)

[Data from http://www.magrama.gob.es/es/ganaderia/temas/zootecnia/razas-ganaderas/publicaciones-interes/Guia_Conservacion_In_vivo_recursos_geneticos_animales_tcm7-306074.pdf]

The main regions in the world breeding the most important species of animal production are depicted in the following figures:



Source: World Livestock 2013. Changing disease landscapes. FAO 2013

2.3.3 System classification

Solely Livestock Systems (L): Livestock systems in which more than 90 percent of dry matter fed to animals comes from rangelands, pastures, annual forages and purchased feeds **and** less than 10 percent of the total value of production comes from non-livestock farming activities.

Landless Livestock Production Systems (LL): A subset of the solely livestock systems in which less than 10 percent of the dry matter fed to animals is farm produced and in which annual average stocking rates are above ten livestock units (LU) per hectare of agricultural land. The following additional differentiation is made:

Landless monogastric systems (LLM): A subset of LL in which the value of production of the pig/poultry enterprise is higher than that of the ruminant enterprises.

Landless ruminant systems (LLR): A subset of LL in which the value of production of the ruminant enterprises is higher than that of the pig/poultry enterprise.

Grassland Based Systems (LG): A subset of solely livestock systems in which more than 10 percent of the dry matter fed to animals is farm produced **and** in which annual average stocking rates are less than ten LU per hectare of agricultural land.

Temperate and tropical highland (LGT)

Humid/sub-humid tropics and sub-tropics (LGH)

Arid/semi-arid tropics and sub-tropics (LGA)

Mixed Farming Systems (M): Livestock systems in which more than 10 percent of the dry matter fed to animals comes from crop by-products, stubble **or** more than 10 percent of the total value of production comes from non-livestock farming activities.

Rainfed Mixed Farming Systems (MR): A subset of the mixed systems in which more than 90 percent of the value of non-livestock farm production comes from rainfed land use, including the following classes.

Temperate and tropical highland (MRT)

Humid/sub-humid tropics and sub-tropics (MRH)

Arid/semi-arid tropics and sub-tropics (MRA)

Irrigated Mixed Farming Systems (MI): A subset of the mixed systems in which more than 10 percent of the value of non-livestock farm production comes from irrigated land use, including

Temperate and tropical highland (MIT)

Humid/sub-humid tropics and sub-tropics (MIH)

Arid/semi-arid tropics and sub-tropics (MIA)

2.3.4 Main topics / problems with regard to sustainable animal production

Livestock production occupies 70% of all land used for agriculture, or 30% of the land surface of the planet. It is an important source of greenhouse gases (indeed if not the largest one). It also generates 64% of the ammonia emission. Livestock expansion is cited as a key factor driving deforestation. Through deforestation and land degradation, livestock is also driving reductions in biodiversity.

The rapid growth in livestock production and supply chains is creating public health threats associated with an animal-to-human pathogen shift, which implies pandemic risks, food safety hazards and high burdens of zoonotic diseases, depending on the agro-ecological and socio- economic development context Livestock production and supply practices are part of a complex of global factors that drive disease emergence, spread and persistence.

In modern intensive husbandry, systems often restrict farm animal behaviour. Behavioral needs will be generated by external stimuli such as stressors deriving from environmental factors or the method of animal care, or some internal factor in farm animals. This means that behavioral restriction would induce maladaptation to stressors or chronic stress. Such a risk of behavioral restriction degrades an animal's physical and mental health and leads to economic loss at a farm. Methods to reduce the risk of behavioral restrictions are to ameliorate the source of a stressor through adequate animal management or to carry out environmental enrichment (Ninomiya S., 2014)

With land pressure being critically high in Asia and growing fast in Africa, the challenge is to arrive at sustainable resource-use practices.

Sustainability has many dimensions, involving socio-economic objectives and resource management processes that need to mitigate issues such as deforestation, biodiversity loss, climate change, water stress, land erosion and dis- ease dynamics, including the evolution of new pathogens. Disease dynamics are of immediate concern to the health of humans, livestock and wildlife, and provide an indicator of increased vulnerabilities associated with ever-closer inter- faces among human living environments, farming landscapes and natural ecosystems.

Regarding the animal production breeds, more than 70% of the production is originated by less than 10% of the animal breeds, with two animal breeds getting extinted every week. Historically, Animal Genetic Resources have been widely exchanged throughout the world and many of the most commonly used breeds are of mixed ancestry. Livestock keepers and breeders in many parts of the world have contributed to the development of these breeds, and today livestock production in most regions depends on the genetic resources that originated or were developed elsewhere. Currently, major flows of germplasm in the commercially most relevant species take place between developed countries or from developed to developing countries. In contrast to the commercially more relevant breeds that are widely exchanged, many breeds are used rather locally and are not strongly involved in international exchange. This may change in the future, as many of the traits needed to respond to the effects of climate change may be found in locally adapted breeds.

Animal biotechnology has been practiced in one form or another since the beginning of the domestication of animals. Many of the previously used tools of animal breeding, genetics, and nutrition have played and will continue to play an important role in the selection, propagation, and management of desirable and economically important characteristics in livestock. In the future, livestock production will rely even more heavily on existing and emerging biotechnological advances to produce our food. Yet, improvements are still needed in product composition and production efficiency, especially in growth, disease resistance, and reproduction. Genetically modified (transgenic) livestock, stem cells, and other emerging biotechnologies will have important roles in producing more and higher quality food derived from livestock (Wheeler MB, 2013).

2.4 Europe

2.4.1 Background, history and traditional knowledge

The origin of livestock production dates back about 11,000 years ago when man started to domesticate sheep. With the domestication of animals and the cultivation of plants a fundamental change in the development of humanity happened. Animal farming did not change very much since the beginning until the 17th century. Its development was always closely related to the progress and productivity of plants production. The transformation of animal farming towards higher productivity happened only when crop rotation was introduced in agriculture, starting first in England. Depending on the farm management and the quality of the land; animals could be kept indoors or on specially prepared pastures in summer.

The introduction of modern science in agriculture began in the 18th century, when scientists started to systematically explore opportunities for increases in both plant and animal production. This was necessary because of the increasing demand for food for an increasingly urbanised European population. The number of livestock rose continuously. In 1800 about 10 million cattle were counted in the area of Germany. This number rose in 1913 to nearly 21 million, and the pig population increased from 3.8 to 25 million during this period. In the following years livestock production fundamentally changed with the intensification.

In spite of shrinking farm numbers in Europe, the number of farm animals reached a new world wide high with 68.8 billion poultry, 11.8 billion ruminants (cattle, sheep, goats) and 1.5 billion pigs in 2010. [*Hartung J. A short history of livestock production. In: A. Aland and T. Banhazi (eds.) Livestock housing: modern management to ensure optimal health and welfare of farm animals DOI 10.3920/978-90-8686-771-4_01, © Wageningen Academic Publishers 2013*].

2.4.2 Short overview

The European Union includes countries that are very different in the way the produce livestock, and with very marked traditions and consumer behavior rules.

The Statistical Office of the European Union (EUROSTAT), publish yearly data identifying the different countries through their website. The methodology used to calculate the macromagnitudes applies equally across the European Union: Regulation (EC) No 138/2004 of the European Parliament and of the Council of 5 December 2003 on the accounts economic agriculture.

The EU showed data from Gross Domestic Product (GDP) in the Agrarian Sector, 2011 (with updated data from January 2013) of 11.650 x103 mill€ with a variation 2012/2011 of +4,.3%. The work factor expressed as Agricultural Work Unit (AWU) was determined by 5,133 x103.

The Production of the Agrarian Sector consists of the sum of the value of production of agricultural products (vegetables, livestock meat and animal products, ie, milk and eggs) and the goods and services generated within the non-agricultural secondary activities.

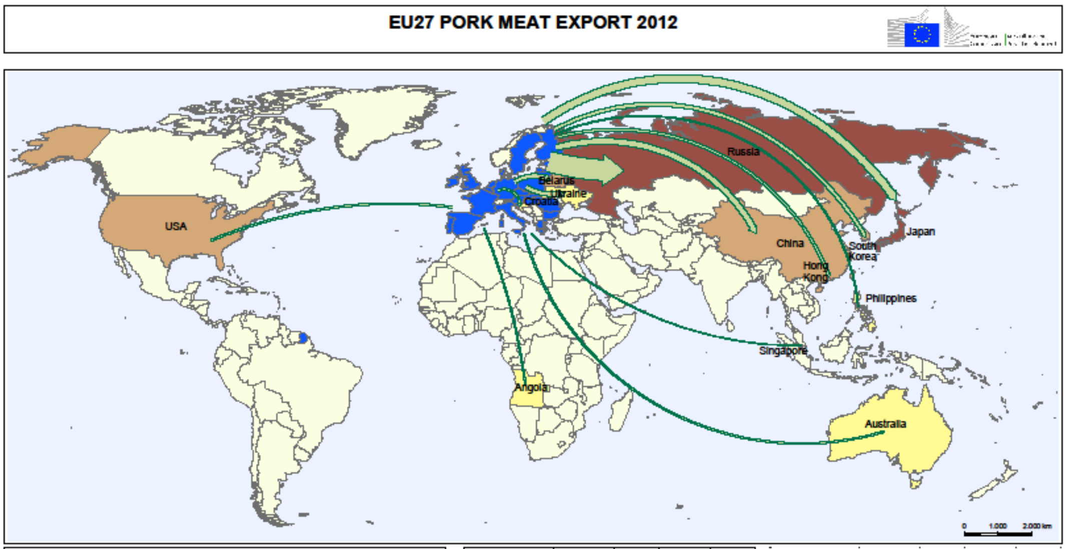
The evolution of the macromagnitudes in this sector of farming in the whole EU in 2011 compared to 2010 has been positive since the GAV (Gross Added Value) gained 3.1% and 3.2% the Agricultural Income reaching the latter at € 115,148,000 with Germany, Italy and France having obtained more positive than average results.

Finally, the productivity per unit of agricultural labor, obtained as GAV / AWU, was 25,066€ / UTA. Both France and Germany show higher than the EU. On the other hand, productivity per hectare of agricultural area (UAA) is in the EU, 1,044€ / ha..

2.4.3 Agriculture as an important part of the bioeconomy

The livestock sector is an important sector for realising a bio-economy in Europe. Supplying safe and healthy food, reducing the emission of greenhouse gases, improving use of resources, meeting needs of consumers in societal appreciated ways are keystones for contributing to a viable economy. And all of these aspects are included in livestock and livestock Research and Innovation needs.

Indeed, export of agrarian products is a relevant part of the bioeconomy in Europe (figure), with several regions depending on this economic inputs, and on the competitiveness of the EU agrarian products in a globalized world.



Countries representing 80% of the total quantity of EU exports (minimum 1%)
50 Ktons
150 Ktons
600 Ktons

Value of EU exports for countries
> 750 M€
250 - 750 M€
≤ 250 M€
Not included

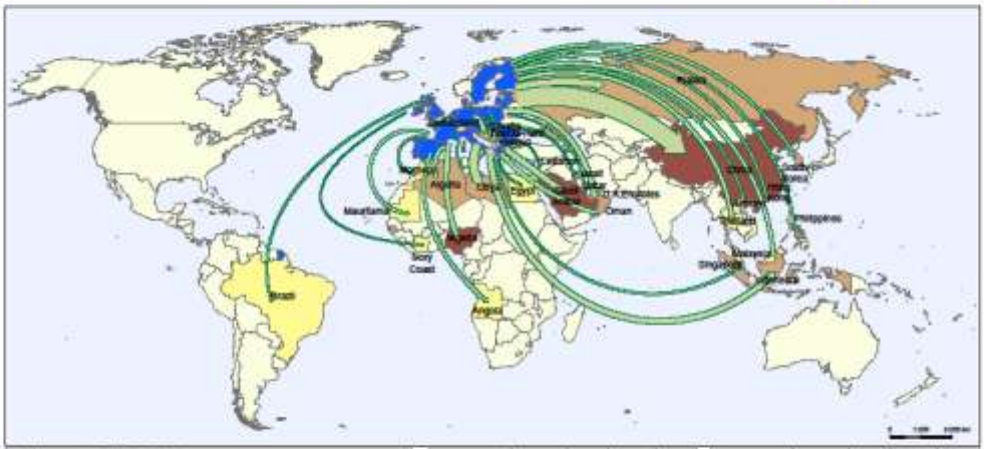
Source: Eurostat - COMEXT
Cartography: DG AGRI GIS-Team 10/2013

Map Projection World: Eckert III - Map Scale 1:110.000.000

© EuroGeographics Association for the Administrative Boundaries
Note : The borders of the map does not necessarily represent the official position of the EU. The map has only a statistical value.

Exports to	Qty (Ktons)	Qty (%)	Val (M€)	Val (%)
Russia	681.97	29.8	1223.75	24.5
Japan	265.43	11.6	864.55	17.31
China	203.61	8.9	325.71	6.52
Ukraine	145.25	6.35	225.74	4.52
Belarus	138.33	6.04	256.63	5.14
South Korea	131.25	5.74	314.05	6.29
Hong Kong	89.2	3.9	134.42	2.69
Croatia	69.63	3.04	153.85	3.08
USA	63.18	2.76	269.61	5.4
Australia	57.6	2.52	153.0	3.06
Angola	47.95	2.1	114.82	2.3
Philippines	40.62	1.77	55.21	1.11
Singapore	27.78	1.21	67.32	1.35

EU27 MILK AND MILK PRODUCTS EXPORT 2012



Countries representing 80% of the total quantity of EU exports (minimum 1%)

50 Ktons
100 Ktons
200 Ktons

Value of EU exports for countries

> 150 M€
50 - 150 M€
≤ 50 M€
Not included

Source: Eurostat - COMEXT
Cartography: DG AGRI GIS-Team 10/2013

Map Projection World: Eckert III - Map Scale 1:110.000.000

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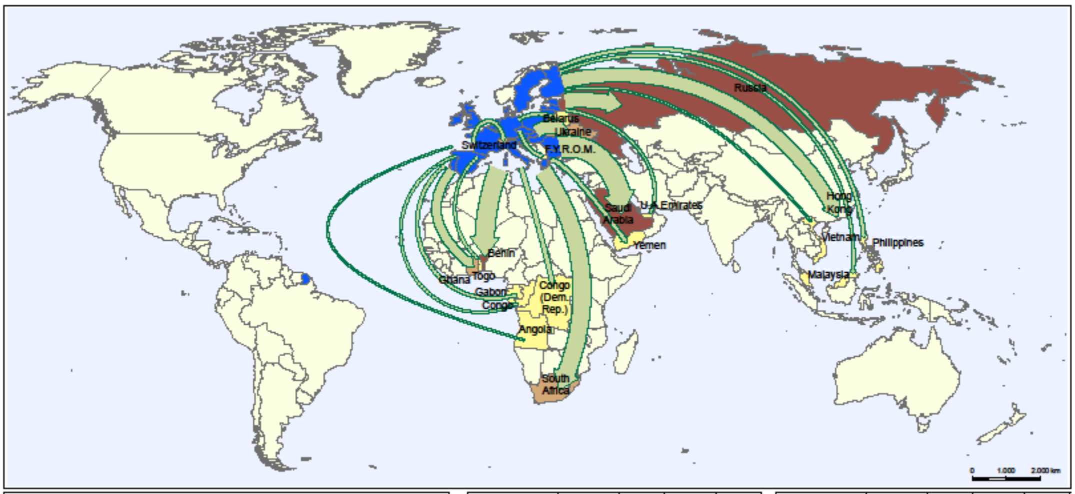
Note : The borders of the map does not necessarily represent the official position of the EU. The map has only a statistical value.

Exports to	Qty (Ktons)	Qty (%)	Val (M€)	Val (%)
China	234.1	11.86	384.12	11.34
Libya	106.8	5.37	132.67	3.91
Russia	88.33	4.46	116.54	3.45
Saudi Arabia	81.17	4.11	182.34	5.38
Indonesia	76.61	3.87	115.75	3.42
U.A.Emirates	65.72	3.33	122.56	3.63
Nigeria	61.89	3.13	160.66	4.74
Croatia	58.61	3.07	34.11	1.01
Thailand	54.13	2.74	70.54	2.08
Oman	53.54	2.71	134.29	3.97
Algeria	51.35	2.6	142.86	4.22
Malaysia	50.81	2.57	66.29	1.96
Angola	43.56	2.21	69.56	2.04
Mauritania	39.74	2.01	37.31	1.1
South Korea	39.53	2.0	84.43	2.49

Exports to	Qty (Ktons)	Qty (%)	Val (M€)	Val (%)
Switzerland	34.14	1.73	34.99	1.03
Hong Kong	33.83	1.71	84.35	2.49
Philippines	33.79	1.71	52.74	1.56
Vietnam	32.10	1.63	26.28	1.07
Singapore	30.81	1.62	60.11	1.48
Morocco	28.04	1.42	31.08	0.92
Brazil	27.54	1.4	33.01	0.97
Kosovo	27.41	1.39	16.88	0.49
Kuwait	22.93	1.16	67.58	2.0
Egypt	22.58	1.14	51.0	1.51
MELILLA	21.31	1.08	18.2	0.55
Qatar	20.41	1.03	56.18	1.64
Lebanon	20.23	1.02	58.18	1.72
Ivory Coast	20.09	1.02	40.4	1.34
Bosnia-Herz.	20.0	1.01	12.59	0.37

EU27 POULTRY MEAT EXPORT 2012



Countries representing 80% of the total quantity of EU exports (minimum 1%)

50 Ktons
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150 Ktons

Value of EU exports for countries

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Source: Eurostat - COMEXT
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Map Projection World: Eckert III - Map Scale 1:110.000.000

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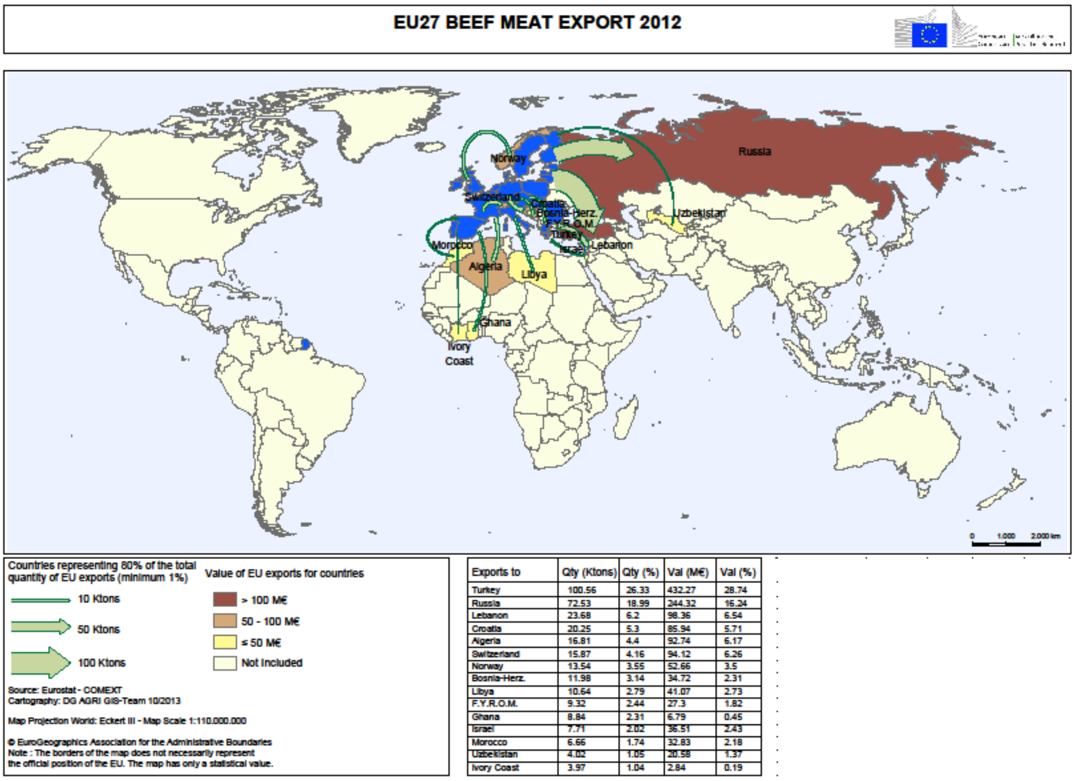
Exports to	Qty (Ktons)	Qty (%)	Val (M€)	Val (%)
Saudi Arabia	149.26	11.24	231.45	11.94
Benin	137.02	10.32	185.76	9.58
South Africa	125.33	9.44	145.98	7.53
Russia	106.63	8.03	166.47	8.59
Hong Kong	99.19	7.47	120.85	6.23
Ukraine	89.98	6.78	92.89	4.79
Ghana	67.58	5.09	53.64	2.77
Yemen	34.48	2.6	45.22	2.33
Congo (Dem. Rep.)	33.66	2.53	35.47	1.83
Philippines	29.28	2.2	20.26	1.05
F.Y.R.O.M.	29.16	2.2	29.9	1.54
Switzerland	27.82	2.09	126.79	6.54
Belarus	25.16	1.89	25.64	1.32
Gabon	24.99	1.88	27.84	1.44
U.A.Emirates	22.66	1.71	34.96	1.8

Exports to	Qty (Ktons)	Qty (%)	Val (M€)	Val (%)
Malaysia	22.52	1.7	38.35	1.98
Togo	19.61	1.48	21.8	1.12
Congo	17.93	1.35	20.17	1.04
Vietnam	14.91	1.12	9.81	0.51
Angola	14.63	1.1	20.32	1.05



Exports to	Qty (Ktons)	Qty (%)	Val (M€)	Val (%)
Turkey	100.56	26.33	432.27	28.74
Russia	72.53	18.99	244.32	16.24
Lebanon	23.68	6.2	98.36	6.54
Croatia	20.25	5.3	85.94	5.71
Algeria	16.81	4.4	92.74	6.17
Switzerland	15.87	4.16	94.12	6.26
Norway	13.54	3.55	52.66	3.5
Bosnia-Herz.	11.98	3.14	34.72	2.31
Libya	10.64	2.79	41.07	2.73
F.Y.R.O.M.	9.32	2.44	27.3	1.82
Ghana	8.84	2.31	6.79	0.45
Israel	7.71	2.02	36.51	2.43
Morocco	6.66	1.74	32.83	2.18
Uzbekistan	4.02	1.05	20.58	1.37
Ivory Coast	3.97	1.04	2.84	0.19

2.4.4 Regional distinctions

The most important species, number of heads and mean production, in general, and per country in the EU, can be observed in table 2 (source: FAOSTAT, last data available 2012; http://faostat.fao.org/site/569/DesktopDefault.aspx?PageID=569#ancor).

Table 2: production level of Europe in livestock sector and compared to the data of the EU-27 (data Faostat, 2012)

Area	item	element	Amount	UNIT
EU-27	Eggs, hen, in shell	Production (tonnes)	13195162	tonnes
Europe	Eggs, hen, in shell	Production (tonnes)	10578737	tonnes
EU-27	Meat, cattle	Producing Animals/Slaughtered (Head)	27178070	Head
Europe	Meat, cattle	Producing Animals/Slaughtered (Head)	42156404	Head
EU-27	Meat, cattle	Production (tonnes)	7667618	tonnes
Europe	Meat, cattle	Production (tonnes)	10404369	tonnes
EU-27	Meat, chicken	Producing Animals/Slaughtered (1000 Head)	6472923	1000 Head
Europe	Meat, chicken	Producing Animals/Slaughtered (1000 Head)	9649114	1000 Head
EU-27	Meat, chicken	Production (tonnes)	10232427	tonnes
Europe	Meat, chicken	Production (tonnes)	15320775	tonnes
EU-27	Meat, goat	Producing Animals/Slaughtered (Head)	8889023	Head
Europe	Meat, goat	Producing Animals/Slaughtered (Head)	11099220	Head
EU-27	Meat, goat	Production (tonnes)	84811	tonnes
Europe	Meat, goat	Production (tonnes)	117744	tonnes
EU-27	Meat, horse	Producing Animals/Slaughtered (Head)	314420	Head
Europe	Meat, horse	Producing Animals/Slaughtered (Head)	654705	Head
EU-27	Meat, horse	Production (tonnes)	73114	tonnes
Europe	Meat, horse	Production (tonnes)	136890	tonnes
EU-27	Meat, pig	Producing Animals/Slaughtered (Head)	253150256	Head
Europe	Meat, pig	Producing Animals/Slaughtered (Head)	308757252	Head
EU-27	Meat, pig	Production (tonnes)	23325386	tonnes
Europe	Meat, pig	Production (tonnes)	27226500	tonnes
EU-27	Meat, rabbit	Producing Animals/Slaughtered (1000 Head)	331549	1000 Head
Europe	Meat, rabbit	Producing Animals/Slaughtered (1000 Head)	348116	1000 Head
EU-27	Meat, rabbit	Production (tonnes)	488758	tonnes
Europe	Meat, rabbit	Production (tonnes)	521876	tonnes
EU-27	Meat, sheep	Producing Animals/Slaughtered (Head)	59484697	Head
Europe	Meat, sheep	Producing Animals/Slaughtered (Head)	75217957	Head
EU-27	Meat, sheep	Production (tonnes)	876630	tonnes
Europe	Meat, sheep	Production (tonnes)	1150961	tonnes
EU-27	Milk, whole fresh cow	Milk Animals (Head)	23162414	Head
Europe	Milk, whole fresh cow	Milk Animals (Head)	37693129	Head
EU-27	Milk, whole fresh cow	Production (tonnes)	149971879	tonnes
Europe	Milk, whole fresh cow	Production (tonnes)	210336776	tonnes
EU-27	Milk, whole fresh goat	Milk Animals (Head)	6964466	Head
Europe	Milk, whole fresh goat	Milk Animals (Head)	9091253	Head
EU-27	Milk, whole fresh goat	Production (tonnes)	1902032	tonnes
Europe	Milk, whole fresh goat	Production (tonnes)	2536773	tonnes
EU-217	Milk, whole fresh sheep	Milk Animals (Head)	27226976	Head
Europe	Milk, whole fresh sheep	Milk Animals (Head)	31049557	Head
EU-27	Milk, whole fresh sheep	Production (tonnes)	2775815	tonnes
Europe	Milk, whole fresh sheep	Production (tonnes)	3015062	tonnes

Regarding the size of the livestock farms in the EU, the mean numbers are summarized in table 3.

Table 1: *Data of LSU in the European Union (data 2007) [LSU: For each of the 23 categories of livestock surveyed in the FSS, a specific coefficient is established initially on the basis of the nutritional or feed requirement of each type of animal which converts the number of heads to an LSU number (1 LSU corresponds to 1 dairy cow or 10 sheep). For more information see: http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Livestock_unit_(LSU)]*

Countries	Average LSU		LSU/1000 ha	
	Smaller farms	Larger farms	Small farms	Large farms
BE	76	164	3171	1094
BG	2	134	500	43
CZ	42	2009	587	568
DK	86	681	1752	1597
DE	45	609	1218	438
EE	10	818	329	410
IE	40	161	1492	1179
EL	3	28	696	437
ES	13	189	679	174
FR	40	113	923	411
IT	5	172	843	511
CY	6	95	1951	645
LV	4	157	297	185
LT	4	293	407	317
LU	60	245	1248	1152
HU	3	1351	606	427
MT	4	24	5157	3402
NL	81	146	3920	1077
AT	15	15	956	52
PL	4	126	771	506
PT	7	280	674	227
RO	1	111	534	62
SI	6	56	1175	962
SK	8	1651	378	418
FI	14	74	502	506
SE	21	190	593	488
UK	45	290	1051	120
NO	23	61	1343	768
CH	26	65	1792	1204

Source: Eurostat — FSS

Some important data are that the percentage of LSU (livestock Units) in larger farms is 20% or more of the total LSU in Finland, Slovakia and Estonia. The larger farms in Austria occupy only 1% of the total LSU. Similar to the situation in the United Kingdom, the larger farms in Austria are made up of rough grazing with a very low livestock density. This is also the case in Bulgaria and Romania, where despite the higher average of LSU in the larger farms, their livestock per hectare (LSU/ha) is very low. The larger farms of all EU 27 Member States have 10% of the total LSU in the European Union. The number of LSU per hectare is greater in smaller farms in most of the countries, with the exception of Estonia, Slovakia and Finland. In Belgium, Malta and the Netherlands there is over 3000 LSU per 1000 hectare in the small farms, the value in Malta being the highest at 5157 LSU/1000 ha. The larger farms are predominantly less intensive regarding livestock density. In Bulgaria, Austria and Romania the LSU/1000 ha is under 100.

Even with the decrease of the number of LSU in the EU (from 136.4 million in 2003 to 132.6 million in 2007) the average number of LSU per holding has increased from 17.2 in 2003 to 18.1 in 2007. With the exception of Romania, this reduction of LSU per holding occurred in the countries where it was lower (Greece, Slovenia Malta and Cyprus) and also in the Czech Republic and Slovakia where privatisation process in the agricultural sector is reducing the numbers of livestock per farm. The four countries that contribute most to the total amount of EU-27 livestock are France (17%), Germany (13.5%), Spain (11%), and the United Kingdom (10.5%). These four Member States represent more than half (52%) of the livestock of the EU-27. In the last 10 years there has been a slight increase of the pig livestock, and a small decrease of the poultry and rabbits.

Some tendencies can be perceived: the importance of cattle in the percentage of livestock has reduced in the "old" Member States. In Denmark, Finland, and the Netherlands the percentage of cattle in the total amount of LSU has reduced by more than 2 percentual points. Norway also reduced the percentage of cattle from 52.9 to 50.2% from 2003 to 2007. On the contrary, the new MS have increased the share of cattle. An increase of 2 percentage points or more of the share of cattle was observed for Bulgaria, Romania, Slovakia, Lithuania, Poland and Slovenia. Portugal with an increase of 3.7 percentage points, and Estonia with a decrease of 2.3 percentage points are the exceptions to the rule. In Luxembourg and Ireland more than 80% of the total LSU belongs to the cattle category.

More than half (57.4%) of the livestock of Greece are sheep and goats. In this category, there has been a great increase in Romania from 13% to 19.8% from 2003 to 2007 and in Cyprus the sheep and goats have dropped from 24.3 to 21.3% in the share of total livestock.

[Information from Martins C, and TosstorfG. Eurostata Statistic in focus 18/2011; [http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Farm_structure_evolution]

Livestock, despite being very relevant to EU- bioeconomy and essential for the most basic food supply to the European and to the World population, does face a range of challenges.

Eutrophication of the soil and aquatic ecosystems is an issue. Agriculture in general accounts for 70% of withdrawals of freshwater resources. Agriculture is facing the challenge of producing more food for the world's growing population with reduced water resources. On the other hand, agricultural water usage can also cause major environmental problems, including the destruction of natural wetlands, the spread of water-borne diseases, and land.

Some indications have been given above of the increasing pressures on natural resources such as land; the increasing demand for livestock products will give rise to considerable competition for land between food and feed production…

The effective sustainability of the farms depends on the control, reduction and solution of all these issues.

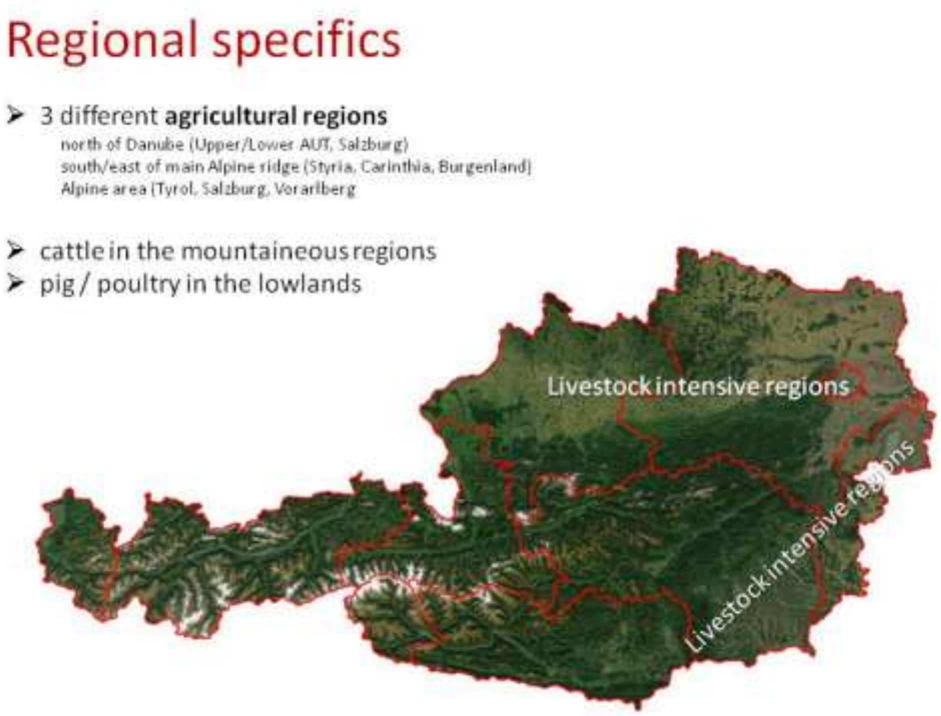
On the other hand, the management of natural resources in the EU's rural areas represents a platform for economic diversification in rural communities because they offer real opportunities in terms of potential for growth in new sectors, provision of rural amenities and tourism, attractiveness as a place to live and work and reservoir of natural resources and highly valued landscapes. Nevertheless, 57 % of the overall utilized agricultural area in the EU is classified as less favoured area, since agricultural production or activity is more difficult because of natural handicaps, difficult climatic conditions, steep slopes in mountain areas, or low soil productivity. This situation leads to significant risk of agricultural land abandonment, with consequent possibility of loss of biodiversity, desertification and forest fires and loss of highly valuable rural landscape. Rural development policy regulation for 2007 to 2013 concerns three themes ("thematic axes") focused to improve the competitiveness of the agricultural and forestry sector, the environment and the countryside, the quality of life in rural areas and encouraging diversification of the rural economy. In this contest, pastoralism in now acknowledged as essential for conserving biodiversity and retaining the attraction of cultural landscapes, with low-intensity farming systems having proved of significant importance for nature conservation in some marginal regions.

Finally, there is another more and more relevant challenge, that is the societal “sustainability”, that implies the acceptance by the society of the outputs of the livestock systems, as well as the acceptance of the “way of life” or “way of production”. Livestock production is likely to be increasingly affected by carbon constraints and environmental and animal welfare legislation. Demand for livestock products in the future could be heavily moderated by socio-economic factors such as human health concerns and changing socio-cultural values.

[Cited in Philip K. Thornton. Livestock production: recent trends, future prospects. Phil. Trans. R. Soc. B 2010 365, doi: 10.1098/rstb.2010.0134, published 16 August 2010]

2.5 Country reports (1): Status quo of national animal production

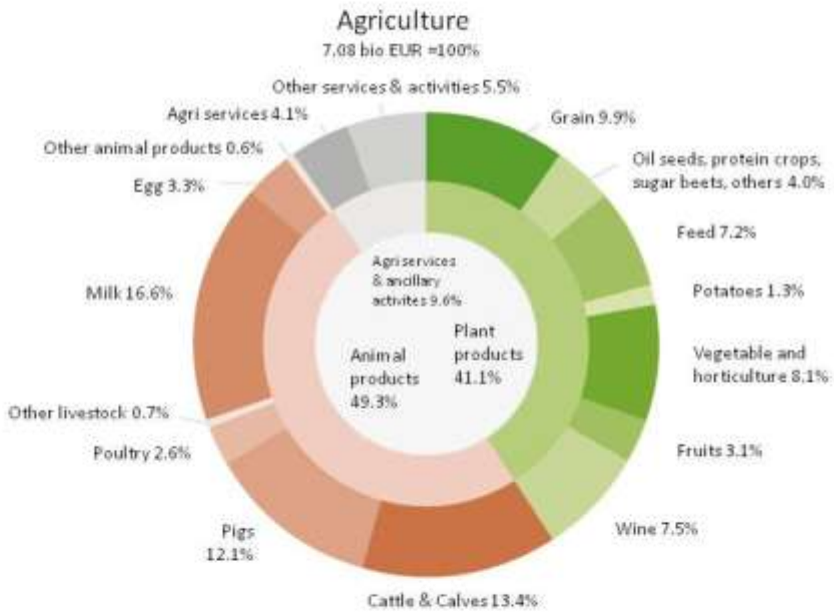
2.5.1 Austria



Agricultural sector in AUT

	2013	(1995)
➢ Total **production value** agriculture & forestry	EUR 8.74 billions	(6.84)
Agriculture	EUR 7.08 billions	(5.83)
Forestry	EUR 1.66 billions	(1.01)
➢ **Gross value added** by agriculture	1.5% GVA AUT	
➢ EU, federal and provincial **funds spent** for agriculture and forestry	EUR 2.076 billions	

Production value 2013



AUT agri sector structure

small units, traditional family farm operations

	1999	2013
➢ Total **number** agricultural and forestry holdings	217.508	166.317
Organic farms		21.810 (13%)
➢ Average **farm size**	34.6 ha	44.2 ha
➢ **Family** farms		92.4 %
Regular		37.3 %
Sideline		55.1 %
Cooperative		3.3 %
Corporate		4.4 %
➢ Average **labor force** per farm		1,37

AUT agri sector structure

small units, traditional family farm operations

	1999	2013
➢ Average **income** per farm		97.421 €
% contribution livestock		37 %
% subsidies		18 %
➢ Average **production costs** per farm		71.723 €
➢ Average **net income** per farm		25.698 €

AT production numbers 2013

➢ Slaughterings	#	meat [t]
cattle	623.000	222.000
calves	69.100	7.100
pigs	5.432.000	529.000
poultry	74.300.000	94.940
sheep	286.000	7.200
goats	54.400	710
horses	1.000	198
harvested fish		3.100

➢ Product	
milk - cattle	3.400.000 t
- sheep	11.000 t
- goat	21.000 t
eggs	107.000 t

AT self sufficiency / import / exports 2013

	Self-sufficiency rate	Import*	Export*
cattle (with calves)	146 %	71.000 t	140.000 t**
pigs	106 %	220.000 t	246.000 t
poultry	70 %	127.000 t	74.000 t
eggs	81 %	36.000 t	10.500 t
small ruminants	81 %	2.400 t	360 t
horses	249 %	85 t	490 t
fish	5 %	70.000 t	4.700t

- Σ Live and processed

** very volatile

Challenges

Challenge: structural change, ***concentration***

	Livestock			holdings		
	1995	**2013**		**1995**	**2013**	
cattle	2.300.000	2.000.000*	↓	117.000	66.000	↓↓
pigs	3.700.000	2.900.000	↓	112.000	27.000	↓↓
sheep	365.000	357.000	~	22.000	14.000	↓↓
goats	54.000	72.000	↑	15.000	10.000	↓↓
horses		120.000			-	
poultry		12.400.000			71.000	
bee hives		368.000			25.000	
fish/AQ		3.300 t			190	

Livestock numbers decrease moderately,
large numbers of farm operations drop out of business

Challenges

Challenge: structural change, ***concentration***

	Number of farms (* 1000)			**area** [ha * 1000]		
	1995	2013		1995	2013	
no area	2.4	0.5	↓↓	-	-	
< 5 ha	66	32	↓↓	180	97	↓↓
5 -10	44	30	↓↓	316	216	↓↓
10 – 20	49	32	↓↓	720	463	↓↓
20 – 30	31	22	↓	761	541	↓
30 – 40	27	25	~	1,035	959	~
50 – 100	12	16	↑	792	1,103	↑
100 –200	3.7	5.2	↑	515	700	↑
> 200	3.2	3.5	~	3,213	3,278	~

Small farms disappear, trend to larger units

Challenges

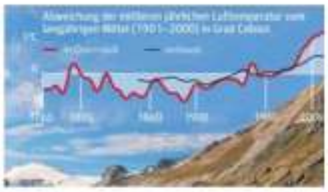
Challenge: structural change, ***loss of labour force***

	1995	2013	
Total work forcec in agri & forestry	593.000	414.000	↓↓
family		343.728	
hired (mainly harvesters)		70.682	

Challenge: large area of ***mountaineous/ disadvantaged*** *regions*

mainly grassland

Challenges



Challenge: ***climate change***

- Alpine space: **warmes up** disproportionally
  +2°C = 2x average global warming
  (2/3 of AUT lie in the Alpine area)
  glaciers/permafrost disappear, snow only in high altitudes

- **Weather extremes** more frequent, longer and more intensive (floods and seasonal/regional water scarcity)

  Reports of drought and flooding increased by 50% in 2013 compared to average number of reports of last 15yrs

  Total damage 2013: € 240 mio., 20.000 farms , 150.000 ha farm land affected

- Changed **vegetation** zones and soil **fertility** , changed **pathogen/vector patterns**, emerging diseases

2.5.2 Belgium - Wallonia

Report for the SCAR - Collaborative Working Group on Sustainable Animal Production: Focus on animal production in Belgium

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1/ Foreword

Belgium is a federal state since 1993 which includes three regions: the Walloon Region, the Flemish Region and the Brussels Region.

Following several phases of the State's reform, agricultural skills were regionalized. The law of 13 July 2001 gave Regions general competence in the field of agricultural policy, except skills always within the federal government (primarily the safety of the food chain, including the important area of health animal).

This summary provides an overview of the Belgian breeding emphasizing its regional specificities, particularly Walloon.

As matters relating to agriculture are managed separately to the north and south of the country so it's possible that more specific remarks made for Wallonia do not necessarily meet those of Flanders.

2/ Overview

The major feature of the Belgian agricultural sector is the structural decline in the number of farms resulting in the phenomenon of land concentration. In 30 years, from 1980 to 2010, the country has lost 63% of its farms. Over this period, the rate of disappearance was the same in Flanders and Wallonia (-3.4% per year on average). During the same period, the average area per farm has more than doubled. The workforce in agriculture has a parallel contraction in volume: the sector lost 45% of the workers employed in agricultural activities.

In Flanders, agriculture, primarily intensive type, is characterized by pig, poultry, dairy and meat farms and fruit crops, vegetables and horticulture.

In Wallonia, the focus is on field crops and a more extensive breeding. This is due to the fact that grasslands cover about 50% of the utilized agricultural area, nearly half of which are permanent grasslands. Livestock are very important for the agricultural economy of this region. Nearly 80% of Walloon farms have animals. Livestock products constitute the major part of agricultural production (± 60% of its value). Finally, enclosed breeding in Wallonia are poorly developed compared to Flanders.

3/ Importance of agriculture in Belgian economy

The contribution of agriculture in the Belgian economy is very low (figure 1). In 2010, this sector accounted for 0.65% of GDP against 1.13% in 1980. However, its relative part in exports is much higher. Indeed, the food represents 11.1% of Belgian exports, 5.8% for agriculture alone (animal products, animals and plants). Livestock production accounts for 55% of the value of total agricultural production.

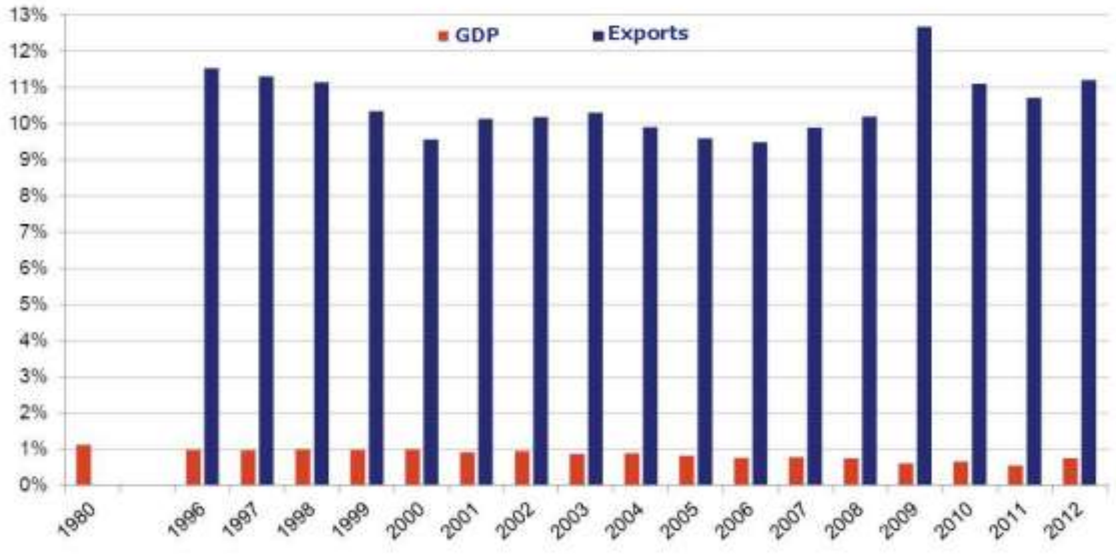


Figure 1 : Part of food in exports (1980 and 1996-2012)

4/ Means of production

The number of farms is decreasing every year (Table 1). However, the total area of all farms fell slightly, so we observe a concentration's phenomenon of the means of production. In thirty years, the average farm size has more than doubled in Flanders (8.4 ha in 1980 to 21.8 ha in 2010) and Wallonia (20.8 ha to 51.1 ha).

44% of the Belgian territory is devoted to agriculture. UAA in Wallonia is characterized by a preponderance of permanent grassland for extensive farming (Table 2).

In Belgium, only a small percentage of the population works in agriculture. Regarding workforce, two developments in the Belgian farms for three decades can be observed: on the one hand a very slight increase in the number of farm workers (1.6 workers in 1980 to 1.95 workers in 2012), but also a proportion increasingly important non-family workforce (rising from 3.9% in 1980 to over 20% in 2012).

Table 1: Number of farms, Utilized agricultural area and workforce (1980, 1990, 2000, 2010-2012)

Belgium	1980	1990	2000	2010	2011	2012
Number of farms	113.883	87.180	61.926	42.854	39.528	38.559
Utilized agricultural area (ha)	1.418.121	1.357.366	1.394.083	1.358.019	1.337.303	1.333.913
Workforce (number)	185.134	142.272	107.399	80.944	74.399	75.589
Workforce (AWU)*	-	-	-	61.881	57.415	58.337
Workforce / farm	1,63	1,63	1,73	1,89	1,88	1,96
Flanders	**1980**	**1990**	**2000**	**2010**	**2011**	**2012**
Number of farms	75.898	57.934	41.047	28.331	25.982	25.217
Utilized agricultural area (ha)	634.397	603.896	636.876	616.866	613.860	618.183
Workforce (number)	124.658	96.015	74.695	56.575	51.796	52.302
Workforce (AWU)*	-	-	-	44.058	40.653	41.249
Workforce / farm	1,64	1,66	1,82	2,00	1,99	2,07
Wallonia	**1980**	**1990**	**2000**	**2010**	**2011**	**2012**
Number of farms	37.843	29.178	20.843	14.502	13.521	13.301
Utilized agricultural area (ha)	783.165	752.743	756.725	740.885	722.652	713.812
Workforce (number)	60.141	46.076	32.614	24.315	22.566	23.214
Workforce (AWU)*	-	-	-	17.778	16.740	17.045
Workforce / farm	1,59	1,58	1,56	1,68	1,67	1,75

*AWU : Annual Work Unit

Table 2: Utilized agricultural area, grassland and forage crops (2011)

	Flanders	Wallonia
Total area (ha)	1.352.200	1.684.430
Utilized agricultural area (UAA – ha)	613.860	722.652
Grassland and forage crops, which :	338.620	419.373
Permanent grassland*	157.867	330.850
Temporary grassland	54.555	25.742
Forage crops	180.753	88.523

*=46% of wallonia UAA and 26% of flanders UAA

5/ Animal production

The main livestock production in Belgium are: cattle, pigs and poultry (Table 3). Small ruminants (sheep and goats) are marginal because of the lack of tradition in this type of breeding. There is a decline in the number of animals since 2000, which tends to stabilize from 2008. The monogastric livestock (pigs and poultry) is mainly concentrated in Flanders (Table 4) while the cattle is distributed equally between the two regions. However, specificities exist: Wallonia is considered a region of calf and Flanders as a region of feeders. The proportion of suckler cows is also higher in Wallonia. Among cattle farms, 60% are meat and 40% milk (Table 5). With 88% of the herd, the Belgian Blue is the first meat breed (Table 6) and Holstein the first dairy breed (94% of the herd – Table 7).

Wallonia is a region-oriented breeding. Indeed, 74% of farms are specialized in breeding: 46% of suckler farms ; 27% of dairy farms and 7% of mixed breeding-polyculture farms.

Table 3: Evolution of livestock animals in Belgium (2000, 2008-2012)

Animals (x1.000)	2000	2008	2009	2010	2011	2012
Cattle number	3.042	2.606	2.600	2.593	2.560	2.484
Dairy cattle	594	495	504	500	488	485
Suckler cattle	509	480	479	476	469	469
Pigs	7.369	6.262	6.321	6.430	6.521	6.634
Fattening pigs >50 kg	2.749	2.789	2.799	2.882	2.955	3.051
Breeding pigs >50 kg	734	548	544	532	523	500
Sheep	160	132	126	120	114	119
Goat	16	31	23	22	36	36
Poultry	40.637	32.493	33.240	34.375	36.442	35.618
Hens and chickens	15.232	11.493	11.828	11.595	12.292	11.984
Broilers	24.498	20.116	20.659	21.899	23.084	22.705

Table 4: Livestock animals in Belgium, Flanders and Wallonia (2013)

	Belgium	Flanders	Wallonia
Cattle number	2.454.704	1.265.811	1.188.893
Dairy cattle	487.373	284.689	202.684
Suckler cattle	460.307	172.507	287.800
Pigs	6.592.978	6.192.100	400.878
Fattening pigs >50 kg	3.112.512	2.857.365	255.147
Breeding pigs >50 kg	495.374	477.805	17.569
Sheep	114.407	66.476	47.931
Goat	40.473	29.807	10.666
Poultry	37.043.039	31.488.754	5.554.285
Hens and chickens	12.534.618	10.783.310	1.751.308

Broilers	23.665.542	19.961.203	3.704.339

Table 5: Number of farms by animal speculation (2013)

	Belgium	Flanders	Wallonia
Cattle farms*	22.075	12.873	9.202
Pig farm	5.180	4.508	672
Sheep farm	3.097	1.889	1.208
Goat farm	944	545	399
Poultry farm	3.292	1.702	1.590

*which 60% meat farms and 40% dairy farms

Table 6: Number of meat breeds present in Belgium (2011)

	Belgium	Flanders	Wallonia
Belgian-Blue (BBB)	489.639	202.887	286.716
Blonde d'Aquitaine	16.316	6.634	9.682
Charolais	5.148	309	4.839
Limousin	21.963	1.468	20.495
Other breeds and crosses for meat	25.138	6.144	18.994
Total	558.204	217.442	340.726

Table 7: Number of dairy breeds present in Belgium (2011)

	Belgium	Flanders	Wallonia
Holstein	330.595	187.447	143.104
Red Holstein	109.800	72.638	37.162
Blanc-rouge de Flandre orientale	9.322	8.268	1.054
Rouges de Flandre occidentale	3.101	2.372	729
Other breeds and crosses for milk	17.757	5.780	11.977
Total	470.575	276.505	194.026

6/ Animal products

The number of cattle slaughtered is relatively stable over the past 10 years with, however, the proportion of cows that increases (Table 8). The average weight of slaughtered cattle increases steadily year by year. The Belgian –Blue (BBB) represents the bulk of domestic demand (93% of the consumption of beef). Young bulls BBB represent 85% of the volume marketed beef in supermarkets. The Belgian market for beef is almost self-sufficient by its specific supply and its demand. Slaughter of pigs, meanwhile, remained very stable between 2000 and 2012.

Milk collection is fairly constant over the last 12 years (Table 9), Belgium rarely exceeding its quota. In 2011, 20% of farms have a higher quota of 500,000 liters and 42% of the national quota. The category of farms with more than 1,000,000 liters represents only 2.4% of Belgian producers. They hold 8.6% of the national quota. The milestone of 500,000 liters of quota is now hinge value below which the evolution of the number of farms is decreasing while above this value, the number of farms is increasing. This hinge value was still only 200,000 liters in 2004/2005. Note that the dairy industry provides essentially dairy products with low added value (milk powder, butter).

Table 8: Total animals slaughtered (2000, 2012)

	Slaughter weight (kg)		Number of animals	
	2000	2012	2000	2012
Total animals slaughtered *	1.314.493.753	1.379.831.903	12.050.991	12.659.391
Cattle	266.136.527	262.279.970	809.545	822.565
Bulls	104.181.656	81.232.327	237.820	173.647
Cows	103.296.755	125.7093.124	258.109	319.635
Pigs	1.040.009.196	1.109.610.337	11.091.289	11.695.145
Sheeps and lambs	2.656.775	2.074.111	128.324	115.874
poultry		410.213.989		309.117.589

* excluding poultry

Table 9: Dairy statistics, millions of kg (2000, 2012)

	Description	2000	2012
Collection	Dairy milk	3.124,5	3.071,7
Product	Milk consumption	663,8	706,3
	Cream consumption	95,9	176,2
	Acidified milk	213,2	261,9
	Condensed milk	80,7	91,7
	Whole milk powder	69,8	48,0
	Skimmed milk powder	67,0	100,6
	Butter	121,2	58,4
	Cheese	58,2	75,1

7/ Self-sufficiency rate

In 2009, Belgium was self-sufficient in pork (239.5%), beef (135.7%) and poultry (101.7%). It is not in sheep and goats since only 13.6% of domestic consumption is provided by national production. From 1999 to 2009, only the self-sufficiency rate of pork increased slightly (2.3%), self-sufficiency rate of other meats were down -8.2% for beef, -30% for poultry and -36.2% for sheep and goat meat (Figure 2).

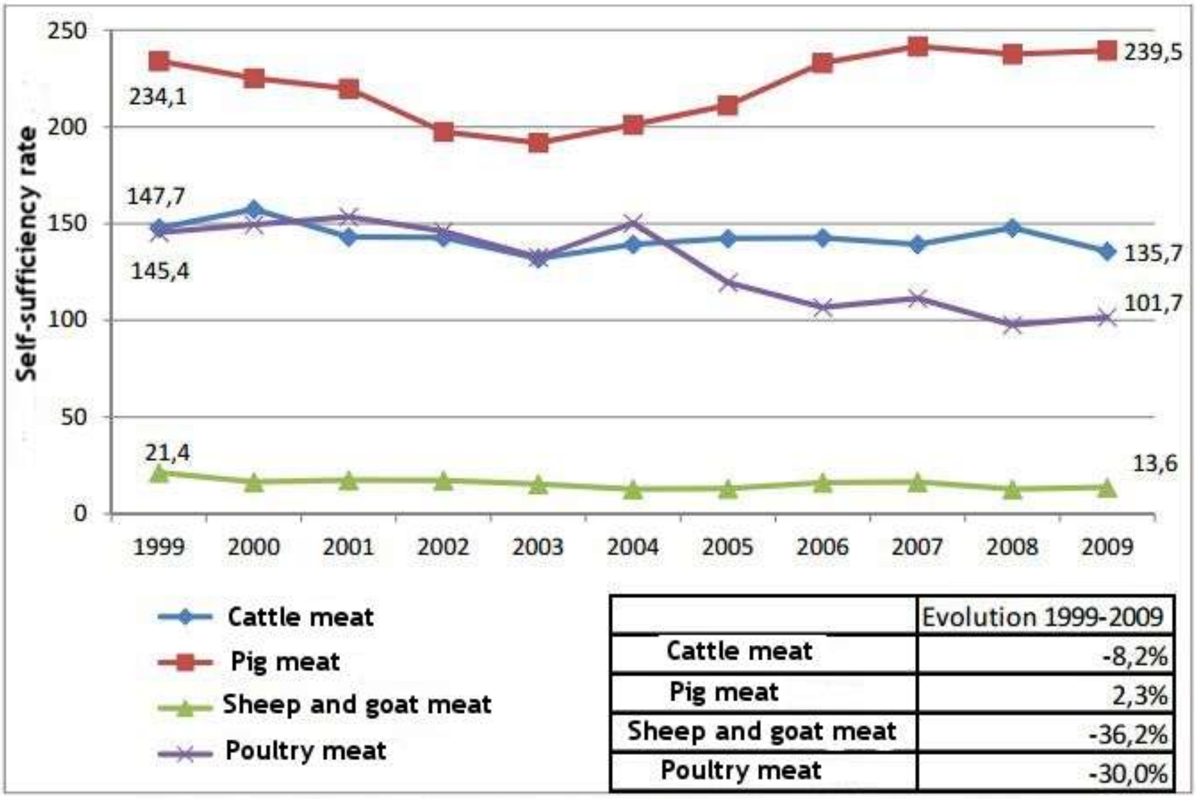


Figure 2: Evolution of self-sufficiency rate in meat in Belgium (1999 - 2009)

8/ Organic farming

Organic farming is gradually gaining importance in Belgium but figures the number of farms and acreage show that this phenomenon is more Walloon (Table 10). In Flanders, the change in the number of organic farms is however to be on the rise again, after a period of stagnation. It should be noted the very important changes in the number of certified organic cattle who has doubled in four years and increased again by 50% in Wallonia past two years.

Table 10: Organic farming: number and area

	1987	1997	2007	2012
Belgium				
Number of farms	109	291	727	1.183
Area (ha)	1.000	6.818	24.722	49.817
Number of cattle	-	-	33.234	64.130
Flanders				
Number of farms	72	107	230	299
Area (ha)	417	820	3.497	4.939
Number of cattle	-	-	2.090	2.797
Wallonia				
Number of farms	37	184	497	884

Area (ha)	583	5.998	21.225	44.878
Number of cattle	-	-	31.144	61.333

The distribution by type of farms shows that the conversion in Wallonia mainly affects breeders when Flanders is concerned particularly by horticulture, which reflects the specialization of these two regions. The proportion of organic livestock in Wallonia is growing, especially in sheep / goats and poultry (Table 11).

Table 11: Absolute and relative importance of organic livestock in Wallonia (2011)

	Number of animals	As % of total livestock
Cattle	66.062	5,3
Pigs	10.365	2,9
Sheep/Goat	9.179	17,3
Poultry	1.350.664	28,3

9/ Comparison with European agriculture

Belgium is, with Denmark, the country with the weight of the pig production is the largest (around 20% of the value of agricultural production in 2008, against 9% for all 27 countries, and 29% for Denmark).

Belgian agriculture is particularly efficient if one refers to the net value added per agricultural work unit (Figure 3). This agriculture also provides the "average" Belgian producer income generally higher than that of its neighbors (Figure 4). Production costs per hectare, they are still far from the average level of those of the Netherlands, are nevertheless very important when compared with other neighboring countries (Figure 5). This reflects the importance of very intensive enclosed production (pig, poultry, horticulture) dictated in part by a limited UAA (land pressure).

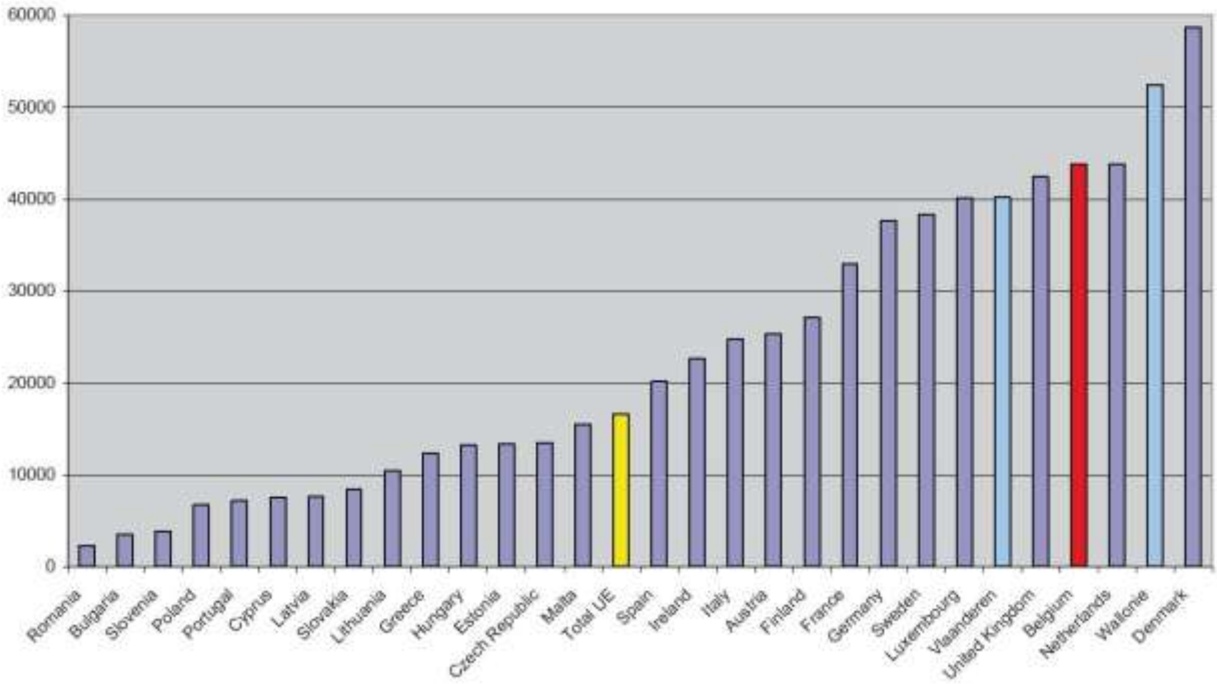


Figure 3: Net value added / agricultural work unit (€), 2007

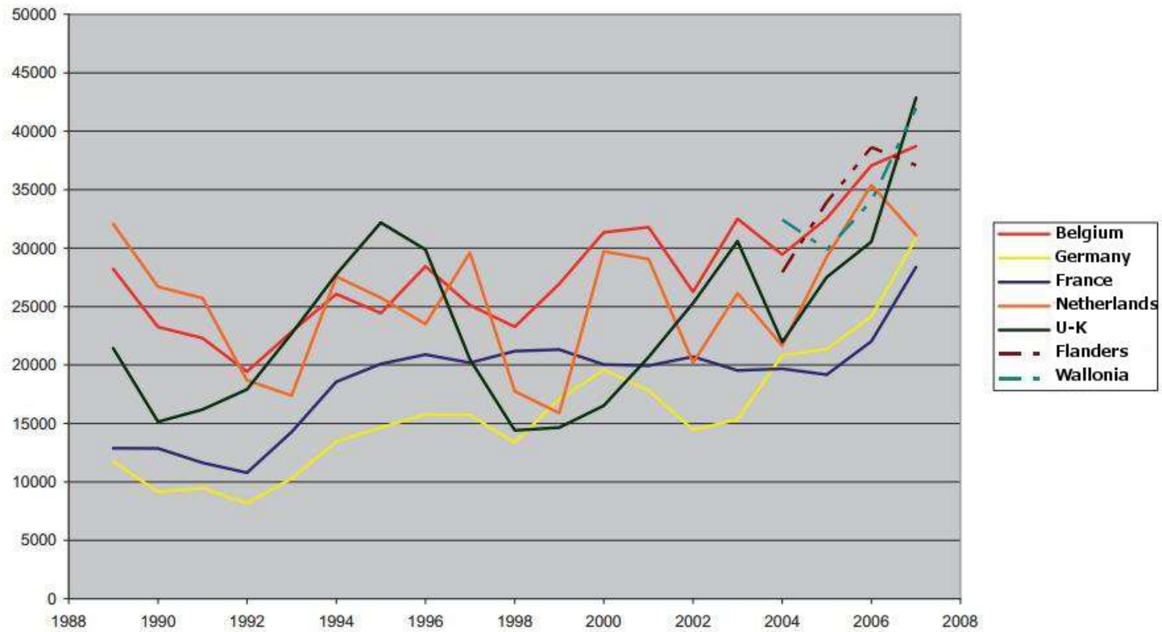


Figure 4: Evolution of net farm income per AWU (€)

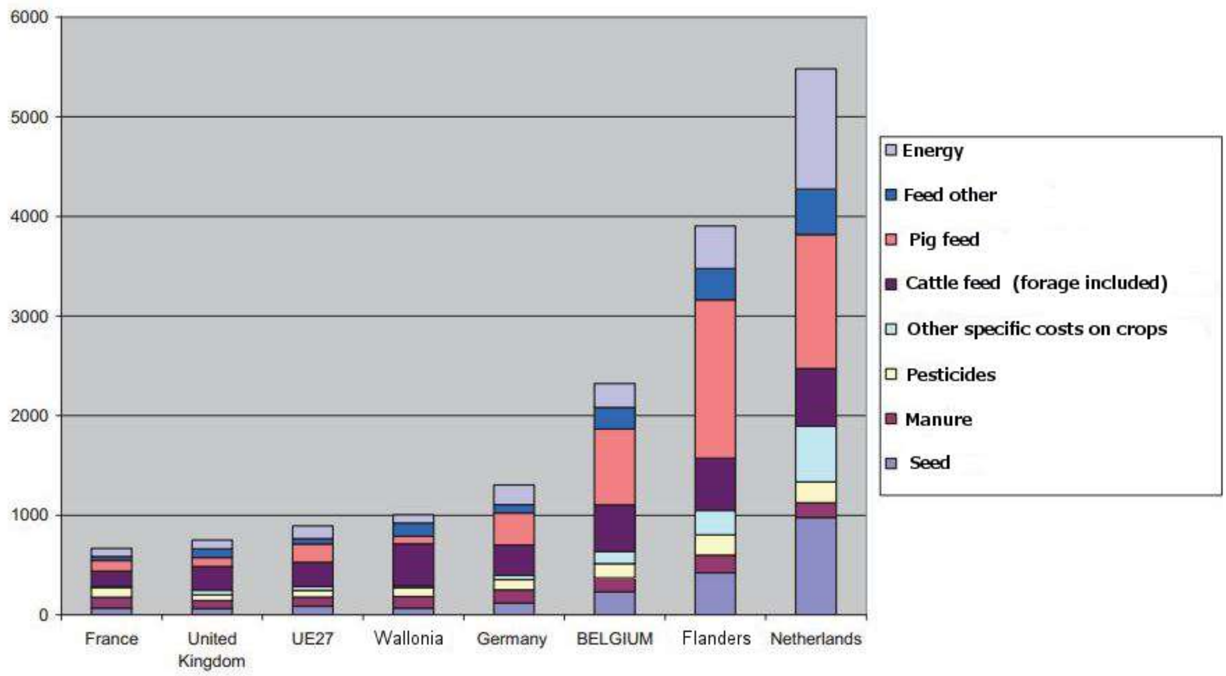


Figure 5: Costs of production per hectare (€ / ha), 2007

10/ Difficulties of the sector

a. Socio-economic crisis

Increased costs of production:

• Higher oil prices which impact on farms and on financial crisis that led speculators to turn to the market for commodities, including plant;

• Multiplication of European regulations (environment, animal welfare, health, etc..) That make agricultural production less competitive.

However, these numerous regulatory sanitary requirements also allow national production to be exported to the world that requires more quality products.

b. Reform of the Common Agricultural Policy (CAP)

Farmers fear the new CAP reform (2014-20). This new reform seems to liberalize markets and will only increase competition with emerging countries and price volatility.

Farmers also fear the withdrawal of European agriculture on the international scene. They fear that the discussions, especially within the WTO, are ultimately affecting the safety of the food supply in Europe.

c. Weaknesses in the cattle sector

Dairy producer income is undermined with higher production costs associated with a market that has become particularly volatile. If the breeder may partially contain production costs by optimizing its production, it has no influence over changes in the price which is increasingly dependent on world prices.

The meat cattle industry in Belgium is very specific with the BBB which dominates the domestic market. If this breed responds to the request of the Belgian consumer, it does not hold true for foreign consumers accustomed to other types of meat. This specificity may therefore constitute an obstacle to the export of beef, making it highly dependent on the evolution of national demand production. The BBB 'double muscled' is one of the most efficient cattle meat on a food and environmental sustainability point of view but is dependent on the caesarean (which is a problem for the organic farming and some countries).

The beef sector's image is also tarnished because of the environmental impact of greenhouse gas emissions (methane).

d. Unattractiveness of the profession

The average age of the farmer is high. Today, nearly 90% of farmers are over 40 years old. (30% over 60 years, 30% between 50-60 years and 28% between 40-50 years). Only 11% have less than 40 years (30-40 years 9.5% and 1.5% under 30 years).

Between 2007 and 2010, while 10 farmers stopped their activity, only two young farmers settled. In 15 years, more than 55% of the workforce Walloon farmers will have reached retirement age.

The main cause for this lack of renewal of the agricultural world is the dynamic expansion of farms. This dynamic discourages young farmers and does not create jobs. To make the sector attractive for young people, it is necessary that they have the guarantee of a decent income but the capital required for people wanting to take again a farm are becoming heavier while the selling price of foodstuffs become increasingly volatile.

11/ Origin of funding for research in animal production

There are international (Europ) and national (Belgium) funding. For national funding, we can separate federal and regional funds. There are also private funds.

Here are some sources of funding (not exhaustive):

- SPW: Service Public de Wallonie (Wallonia Public Service)
- SPF : Service Public Fédéral (Federal Public Service)
- Plan Marschall (Wagralim)
- Cost-Horizon Europ
- CORNET European Program
- FNRS : Fond National de la Recherche Scientifique (National Fund for Scientific Research)
- First-entreprise
- Moerman Fund (Using funds from the deduction of withholding granted to research institutions)

Consulted papers :

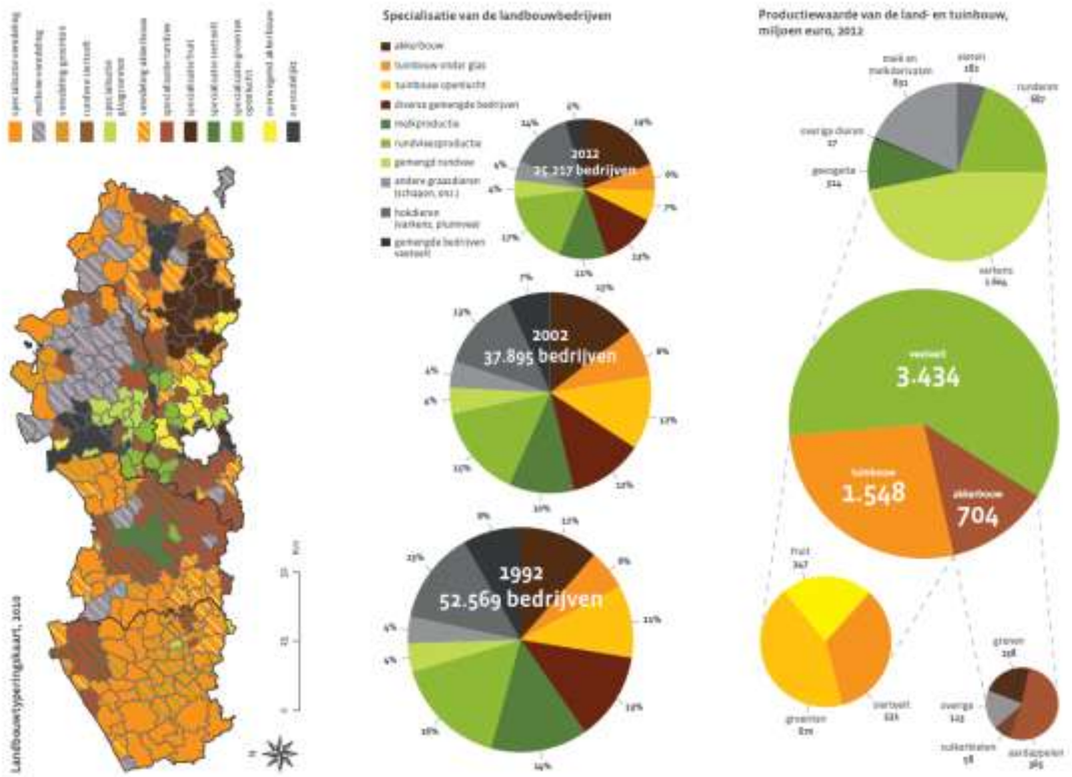
- L'agriculture wallonne en chiffres (MAJ. Fev. 2013)
- L'agriculture en Belgique en chiffres (2013). By SPF - Direction générale Statistique et Information économique.

- Boikete Ph. (2012). L'agriculture belge, bilan et perspective. By Institut Emile Vandervelde
- Bouquiaux J-M. et al. (2013). Performances et rentabilités en agriculture wallonne (années 2008 à 2011).
- Chiffres clés de l'agriculture 2011. By SPF - Direction générale Statistique et Information économique.
- Evolution de l'économie agricole et horticole de la Wallonie (2009-2010). By SPW - Direction de l'Analyse économique agricole
- Hennart S. et al. (2010). Walloon farm typology using the GENETYP method. In: Renc. Rech. Ruminants (17), Paris, France pp.241-244.
- Observatoire de la consommation alimentaire. Filières viandes – Rapport 2011. By Gx-ABT.

Websites:

http://www.belgium.be/
http://www.wallonie.be/
http://www.flanders.be/en

2.5.3 Belgium – Flanders



Structurele kenmerken	eenheid	2005	2011	2012
landbouwbedrijven	aantal	34.410	25.982	25.217
cultuurgrond	ha	629.684	613.860	618.183
grond in eigendom	%	33,8%	34,9%	35,6%
gemiddelde bedrijfsoppervlakte	ha	18,3	23,6	24,5
vennootschappen	%	6,8%	12,5%	13,7%
runderen	aantal	1.350.304	1.302.248	1.269.405
varkens	aantal	5.952.518	6.151.167	6.227.520
kippen	aantal	30.385.744	31.628.280	30.151.029
runderen per rundveebedrijf	aantal/ bedrijf	87	111	116
varkens per varkensbedrijf	aantal/ bedrijf	1.311	1.700	1.771
kippen per pluimveebedrijf	aantal/ bedrijf	32.171	42.606	41.036
nieuwe vestigingen die vestigingssteun hebben aangevraagd	aantal	222	184	158

Cultuurgrond, hectare	2005	2011	2012
voedergewassen	342.944	338.620	345.847
weiden	226.314	212.422	228.426
maïs	110.961	117.264	114.558
akkerbouw	229.637	224.428	221.472
granen	142.969	142.342	151.486
suikerbieten	32.747	21.407	20.703
aardappelen	38.960	46.606	35.752
tuinbouw	49.072	50.110	49.211
groenten	26.911	27.885	26.327
fruit	16.060	16.099	16.751
sierteelt	6.101	6.126	6.133
andere aanwendingen	8.030	702	1.652
braaklegging	7.976	685	1.652
benutte landbouwoppervlakte	629.684	613.860	618.183

Specialisatie van de bedrijven, aantal	2005	2011	2012
akkerbouw	5.551	4.998	4.843
tuinbouw	6.290	3.468	3.307
tuinbouw onder glas	3.457	1.675	1.534
tuinbouw openlucht	2.833	1.793	1.773
veeteelt	18.740	14.456	13.912
melkproductie	4.303	3.064	2.794
rundvleesproductie	5.061	4.289	4.292
gemengd rundvee	1.329	1.144	1.044
andere graasdieren (schapen, enz.)	1.727	1.117	1.118
hokdieren (varkens, pluimvee)	4.442	3.661	3.540
gemengde bedrijven veeteelt	1.878	1.181	1.124
diverse gemengde bedrijven	3.829	3.060	3.155

Productierekening, miljoen euro	2005	2011	2012
eindproductiewaarde	4.493	5.055	5.685
akkerbouw	413	488	704
granen	69	104	158
aardappelen	191	206	365
suikerbieten	96	70	58
tuinbouw	1.449	1.372	1.548
groenten	577	547	670
beschutte teelt	335	257	368
in openlucht	243	290	301
fruit	345	303	347
appelen	98	85	102
peren	133	97	130
sierteelt	526	523	531
veeteelt	2.632	3.195	3.434
dieren	2.002	2.381	2.621
runderen	491	655	687
varkens	1.255	1.410	1.604
gevogelte	231	299	314
dierlijke producten	629	815	812
melk en melkderivaten	519	695	631
eieren	110	119	182
intermediaire consumptie	2.964	4.001	4.219
veevoeders en stro	1.362	2.018	2.185
meststoffen-grondverbeteringsmiddelen	129	161	167
energie en smeermiddelen	380	504	526
netto toegevoegde waarde	1.333	855	1.252

Familiaal inkomen van de gespecialiseerde bedrijven, euro per arbeidskracht	2006	2010	2011
akkerbouw	28.399	44.011	41.028
glasgroenten	21.458	57.281	-8.340
groenten in openlucht	23.300	31.543	24.149
fruit in openlucht	33.830	52.397	12.486
melkvee	25.995	26.837	24.107
vleesvee	15.887	10.332	9.050
varkens	46.265	24.394	8.810

Opbrengsten		2005	2010	2011
tarwe	kg/ha	8.550	9.250	8.439
bewaaraardappelen	kg/ha	45.150	43.835	53.726
suikerbieten	kg/ha	68.080	74.640	85.050
melkgift	liter/koe	6.612	7.253	7.354
grootgebrachte biggen	aantal/zeug	19,9	22,9	23,3
worpen	aantal/zeug	2,16	2,20	2,20
groei vleesvarkens	g/dag	610	639	652
voederconversie vleesvarken	kg krachtvoeder/ kg groei	2,98	2,90	2,92

Belgische handel in landbouwproducten, miljoen euro, 2012	import	export	saldo
akkerbouwproducten	13.177	13.134	-43
tuinbouwproducten	6.025	6.565	540
dierlijke producten	5.898	7.898	2.000
agro-industriële producten	3.019	4.847	1.828
andere producten (vis, drank, enz.)	5.534	5.923	389
totaal	33.653	38.367	4.714

Belangrijkste exportproducten, miljoen euro en ranking	export (2012)	ranking wereld (2011)
diepvriesgroenten	1.033	1
aardappelbereidingen	1.287	2
chocoladeproducten	2.011	2
banketbakkerswerk	1.399	2
peren	206	3
bier	1.053	4
varkensvlees	1.336	5
appelen	126	10

Aandeel van rechtstreekse en plattelandsontwikkelingssteun in het inkomen in de periode 2009-2011	aandeel rechtstreekse steun	aandeel plattelandsontwikkelingssteun	totaal
akkerbouw	38%	13%	51%
glastuinbouw groenten en sierteelt	0%	15%	15%
fruit, groenten en sierteelt openlucht	2%	8%	10%
melkvee	34%	8%	42%
vleesvee	85%	10%	95%
varkens	16%	10%	26%
gemengde bedrijven	27%	7%	34%
totaal land- en tuinbouw	26%	9%	35%

Tewerkstelling	eenheid	2005	2011	2012
aantal tewerkgestelden	aantal	66.950	51.530	52.302
voltijdse equivalenten	aantal	49.717	40.828	41.249
aandeel vrouwen	%	35,4%	34,3%	34,7%

Profiel van de bedrijfsleiders	2005	2011	2012
gemiddelde leeftijd	48,7	51,0	51,5
ouder dan 60 jaar	18,3%	21,1%	21,9%
van 50 tot 60	26,4%	32,2%	33,9%
van 40 tot 50	34,1%	33,3%	32,0%
van 30 tot 40	18,6%	11,6%	10,7%
van 20 tot 30	2,7%	1,8%	1,6%
aandeel > 50 jaar met een opvolger	20,3%	18,4%	17,5%
scholingsgraad (van de bedrijfsleiders die vestigingssteun hebben aangevraagd)			
laaggeschoold	4%	5%	7%
middengeschoold	71%	77%	67%
hooggeschoold	25%	19%	26%

Tewerkstelling in de gespecialiseerde sectoren, aandeel voltijdse equivalenten	2005	2011	2012
akkerbouw	9%	11%	11%
tuinbouw	33%	31%	32%
tuinbouw onder glas	22%	18%	19%
tuinbouw openlucht	12%	13%	13%
veeteelt	47%	47%	46%
melkproductie	13%	12%	11%
rundvleesproductie	9%	10%	11%
gemengd rundvee	4%	4%	4%
andere graasdieren (schapen, enz.)	2%	2%	3%
hokdieren (varkens, pluimvee)	13%	13%	13%
gemengde bedrijven veeteelt	6%	5%	5%
diverse gemengde bedrijven	11%	11%	11%

Biologische landbouw	eenheid	2005	2011	2012
biologische bedrijven	aantal	236	282	299
instappers	aantal	14	40	33
areaal biolandbouw	ha	3.153	4.563	4.939
waarvan in omschakeling	ha	502	1.354	1.316
totale hectaresteun	euro	684.434	1.003.030	1.008.749

Milieukenmerken	eenheid	2005	2010	2011
N-kunstmestgebruik	kg N	71.980.967	75.318.494	71.711.624
P-kunstmestgebruik	kg P	4.065.395	2.605.493	2.449.715
verzurende emissie	Zeq	3.007	2.779	2.785
netto-energiegebruik	TJ	-	28.800	24.752
netto-elektriciteitsproductie door WKK-installaties	TJ	195	5.865	6.074
uitstoot van broeikasgassen	CO_2-eq.	9.013	9.048	8.804
emissie van fijn stof	ton	17.460	17.743	17.869
gewasbeschermings-middelengebruik	kg actieve stof	3.190.925	2.640.935	2.667.265
watergebruik	miljoen m³	51	54	52

Aandeel van gespecialiseerde sectoren in milieudruk, 2011	emissie van fijn stof	verzurende emissie	uitstoot broeikasgassen
akkerbouw	25%	6%	22%
glastuinbouw	1%	4%	12%
tuinbouw openlucht	10%	2%	2%
pluimvee	8%	7%	3%
runderen	41%	34%	39%
varkens	16%	44%	22%
overig vee	0%	1%	1%
andere	0%	2%	0%

Aandeel van gespecialiseerde sectoren in het gebruik van bronnen, 2011	N-kunst-mest	P-kunst-mest	energie (netto)	gewasbe-schermings-middelen	water
akkerbouw	15%	8%	5%	17%	1%
groenten in openlucht	2%	4%	2%	3%	3%
groenten onder glas	2%	10%	45%	2%	14%
sierteelt onder glas	0%	1%		1%	5%
fruit	2%	4%	2%	24%	1%
melkvee	21%	12%	7%	6%	11%
vleesvee	9%	6%	4%	3%	4%
varkens	7%	4%	12%	8%	21%
overige land-bouwbedrijven	39%	28%	20%	30%	26%
overige tuin-bouwbedrijven	4%	23%	4%	5%	13%

Bronnen:
Agentschap voor Landbouw en Visserij
Comext (Eurostat)
Departement Landbouw en Visserij
FAOSTAT
FOD Economie | AD Statistiek en Economische Informatie
Landbouwmonitoringsnetwerk (LMN - AMS)
NGI-AGIV
Vlaams Landbouwinvesteringsfonds (VLIF)
Vlaamse Milieumaatschappij (VMM)

Totale uitbetaalde rechtstreekse steun, miljoen euro	2007	2008	2009	2010	2011	2012
bedrijfstoeslag	222,2	227,5	233,2	230,1	229,4	233,9
zoogkoeienpremie	29,6	29,5	29,1	29,7	28,6	28,1
slachtpremie kalveren	5,7	5,9	5,7	5,7	5,7	-
overige plantaardige premies	0,7	0,8	0,8	0,0	0,0	-
kwaliteitspremie	-	-	-	1,9	1,9	-
extra betaling na modulatie	4,4	4,4	-	-	-	-
inzaai groenbedekkers	-	-	-	-	-	3,3
totaal	262,6	268,1	268,9	267,3	265,6	265,2

Totale uitbetaalde plattelandsontwikkelingssteun, miljoen euro	2007	2008	2009	2010	2011	2012
as 1 - concurrentievermogen	63,7	77,1	61,0	87,8	77,9	61,4
as 2 - milieu	21,2	24,6	27,9	21,4	21,4	17,5
as 3 - leefkwaliteit	1,7	7,7	10,6	12,1	12,0	12,3
as 4 - Leader	0,0	0,5	1,5	6,2	6,9	6,7
technische bijstand	0,2	0,3	0,6	0,6	0,3	0,5
totaal	86,7	110,2	101,7	128,1	118,6	98,5

Aandeel van steun volgens gespecialiseerde sectoren, 2009-2011	rechtstreekse steun	plattelands-ontwikkelingssteun
akkerbouw	11,9%	11,2%
glastuinbouw groenten en sierteelt	0,0%	12,1%
fruit, groenten en sierteelt openlucht	1,4%	10,2%
melkvee	23,4%	15,2%
vleesvee	17,8%	6,0%
gemengd rundvee	7,4%	3,7%
varkens en pluimvee	11,0%	20,2%
gemengde bedrijven	27,1%	21,4%

2.5.4 Denmark

Country Report

DENMARK

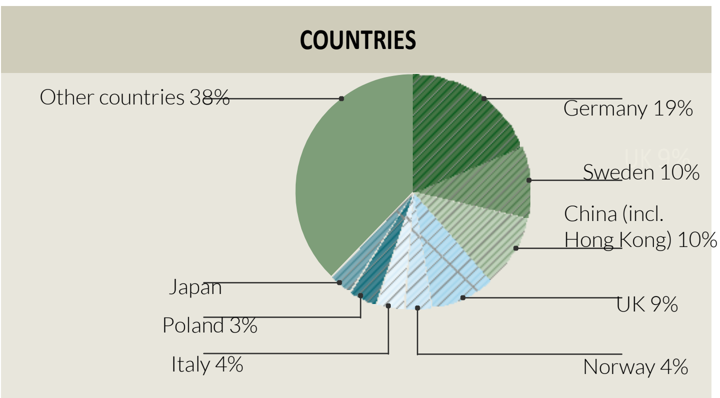
The Danish agricultural production is very diverse. The production comprises pork, beef, poultry meat, eggs, dairy products, pelts, grain, vegetables, fruit and grass seed. The production is performed at still fewer farms. However, the production has increased significantly - 18 % - during the last 20 years and has become more efficient as well as more sustainable with less environmental impact. It is the aim to increase the future production to meet the expected increasing demand for animal product. The challenge is to increase the production in an even more sustainable way - more from less.

Importance of agriculture in total

The Danish food cluster consists of the entire value chain from primary production to the food industry. The primary production includes agriculture, horticulture and fisheries. The food industry consists of slaughterhouses, dairies, the fishing industry, bread factories, bakeries, beverage industries as well as other industries dealing with food and feed, pelts and enzymes and agro technology. With an export value of 148 billion DKK (~19.7 billion euros), the food cluster constitutes 24 % of the total Danish export amounting to 612 billion DKK (~81.6 billion euros) in 2012. The export has doubled during the last 25 years and is still increasing. The agricultural export is the single largest contributor to the Danish export.

Sixty one per cent of the agricultural production was exported to EU countries in 2012 (Figure 1). Germany is the largest European market. Outside Europe, China was the largest export market in 2012. The export to China including Hong Kong was 10 %. The large export to China and Hong Kong can be ascribed to the large export and the high prices of pelts.

Figure 1 - Food cluster exports distributed on countries in 2012



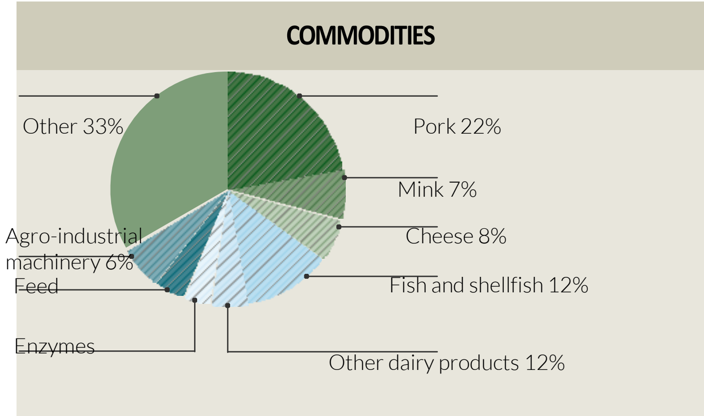
Source: Landbrug & Fødevarers udenrigshandelsstatistik baseret på Danmarks Statistik.

Pork constitutes 22 % and dairy products 20 % of the export from the food cluster (Figure 2). The food cluster contributes to a trade surplus of 56 billion DKK. (7.5 billion euros).

Regional distinctions / specifics

Denmark has an intensive agricultural production. Thus, 62 % of the area (2.645.00 ha) are used for production. The majority of animal husbandry production is found in the western part of Denmark, in Jutland.

Figure 2 – Food cluster exports distributed on commodities



Source: Landbrug & Fødevarers udenrigshandelsstatistik baseret på Danmarks Statistik.

Table 1

Area and farm distribution – size of holding				
Agricultural and horticultural holdings				
	1995-99	**2010**	**2011**	**2012**
Total numbers, 1,000 ha:				
Without cultivated areas	814	1.980	1.848	1.535
less than 5 ha	1.268	1.099	712	900
5-10 ha	10.139	8.031	8.125	8.097
10-20 ha	13.204	7.785	7.559	7.752
20-30 ha	8.668	4.304	4.076	3.220
30-50 ha	11.109	4.896	4.669	4.894
50-100 ha	12.003	5.925	5.632	5.516
100-200 ha	4.512	4.981	4.849	4.667
More than 200 ha	1.072	3.098	3.191	3.348
Total	62.788	42.099	40.661	39.929
Average holding size, ha	42,8	62,9	64,9	66,2

Source: Danmarks Statistik, Statistikbanken.dk, BdF07.

Number of farms, average size (ha), staff (self-employed, hired)
The number of farms is decreasing. The trend since 1995 is seen in Table 1. In the period 1995-1999 the number of farms was about 62.788. This number was reduced to 39.930 in 2012. The reduction is particularly significant for farms of sizes 20-30 ha. However, the area used for agricultural production during that same period has been fairly steady. It was 2.689.000 ha in 1995-1999 and 2.645.000 ha in 2012. Thus overall, the farm size has increased from 43 ha in 1995-1999 to 66 ha in 2012.

The employment related to the agricultural production has decreased significantly. In 1970, the number employed in the primary production was 242.000. This number was 66.500 in 2005 but increased to about 69.000 in 2012. For the total food cluster this number has dropped from 433.000 in 1970 to about 150.000 in 2005. However, this number has also increased recently and was about 183.000 in 2012. Of these 110.800 were hired in 2005. This number was increased to 150.415 in 2012, which corresponds to 7 % of the overall employment being within the agricultural production.

<u>**Description of livestock sector**</u>

Background / history / traditional knowledge
Co-operatives
Danish agriculture is based to a large extent on co-operatives. About 150 years ago, Danish farmers formed local co-operatives. These local co-operatives have now merged into enterprises acting on the global scene. Despite this, the enterprises are still managed according to the principles, on which they are based. However, due to their co-operative status, they are not registered among international food business operators.

Agricultural area
The Danish area is 4.310.000 ha. A large part of this area - 62 % in 2012 - is cultivated. However, this area has decreased over time. In the late thirties 76 % of the area were cultivated. Part of this area has been converted to natural areas and to use for recreational purposes.

Importance, share of total sector
The production value of the food cluster amounts to 216 billion DKK (~28.8 billion euros). This constitutes a little more than 6 % of the total Danish production value.

The number of pig slaughterhouses has decreased significantly from 54 in 1970 to 9 in 2012. In 2012, about 20 mill pigs were slaughtered in Denmark. This makes Denmark number 4 in Europe after Germany, Spain and France with regard to the number of pig slaughtered. The number of slaughterings has decreased due to a large export of Danish piglets to Germany and Poland.

The Danish dairy industry exports two thirds of the production. ARLA, the largest Danish dairy with a turnover of 63 billion DKK (~8.4 billion euros) in 2012, is also among the world's largest dairy industries. The number of dairies has been reduced over years. In 2013, the production of cheese was performed on 21 dairies, 12 dairies produced butter and 8 dairies produced drinking milk.

Three slaughterhouses are responsible for 83 % of the slaughterings of cattle in Denmark. About 500.000 cattle are slaughtered yearly.

Number of farms, average size (ha), staff (self-employed, hired)
The livestock sector has faced a development towards fewer and larger farms and also towards specialization with only one animal husbandry species at the farm. The number of farms and the average

number of animals per farm for the different species is given below. The size of the stock of the most important animal husbandry species is given in Table 2.

Species in livestock production, ranking

The most important animal husbandry species, with regard to production value, in Denmark are pigs, cattle, mink and poultry. Horses, sheep, goats, ducks and geese are only of minor importance. The ranking of the species based on production value is: Pork: 23.752 mill DKK (3166.9 mill euros); Milk: 13.190 mill DKK (1758.67 mill euros); Beef: 3.134 mill DKK (417.87 mill euros); Fur animals: 9.755 mill DKK (1300.6 mill euros); Poultry: 1.752 mill DKK (233.6 mill euros); Eggs: 724 mill DKK (96.67 mill euros); Minor productions: 345 mill DKK (46 mill euros).

Table 2

LIVESTOCK NUMBERS IN MAY/JUNE, 1,000					
	2008	**2009**	**2010**	**2011**	**2012**
Cattle, total	1.564	1.540	1.571	1.568	1.607
of which dairy cows	558	563	568	565	587
Suckler cows	107	96	101	99	97
Pigs, total	12.738	12.36	13.17	12.93	12.331
of which sows	1.059	9	3	2	1.011
Sheep	136	104	160	144	154
Hens more than ½ years old	3.521	3.280	3.900	3.815	3.958
Young chickens	11.189	15.94	14.18	14.39	14.216
of which broilers	9.737	4	4	2	12.576
Turkeys	169	165	201	212	435
Ducks	214	208	224	230	103
	14	10	7	7	4
Mink, breeding females	2.824	2.735	2.698	2.754	2.948

Source: Danmarks Statistik, Statistikbanken.dk, HDYR 1.

Main / most important species

Total number, average herd size, tendency to raise or decline, why

Pigs

In 2002, the number of pig farms was 11.747. This number was reduced to 4.181 in 2012. The number of farms with slaughter pigs and sows was 1.617 in 2012. The number of farms with slaughter pigs only was 1.790 and 445 farms had only sows. In 2012, the average number of pigs per farm was 2.949.

The pig sector is characterized by increasing specialization and larger production units. In 2012, the majority of pigs (more than 54 %) were kept on farms with more than 5.000 pigs. Generally, the number of pigs has been stable over years (Table 2). In 2012, the total number of pigs was 12.331.000. A reduction of 4.6 % in the number of pigs was ascribed to a reduced number of slaughter pigs and sows. This is reflected in an increasing export of living piglets. In 2012, 9.241.000 piglets were exported.

Cattle
An increase in the milk quota has resulted in an increasing number of milking cows (Table 2). This increase is expected to continue particularly after 2015 with the canceling of the milk quotas. In 2012 the number of farms with milking cows was 3.886. The average herd size was 151.1. The number of suckler cows has decreased from 2011 to 2012. It was 97.000 in 2012. The decrease is ascribed to production-related expenses and a change in the reward for males. The number of farms with suckler cows was 7.992 in 2012, and the average herd size was 12.2. The number of cattle farms was reduced from 20.264 in 2002 to 12.651 in 2012. The Danish cattle stock has been halved from 1984 until now. This is due to the milk quota being imposed on the production but even more that the production per cow has increased significantly. In 1984 the average production per cow was 5.900 kg milk pr. year. The average milk production was increased to 9.019 kg in 2012.

Sheep
Sheep production is minor in Denmark. The size of the stock was 154.000 in 2012 (Table 2).

Poultry
Chickens: In 2012 about 4.000.000 hens produced 67 mill kg eggs (Table 2). The number of slaughter chickens was 12.576.000. However, like for pigs, many living chickens are exported thus 13.888.000 in 2012. The major part of the slaughter chickens is produced on large farms with more than 25.000 slaughter chickens.

Turkey: The number of turkeys has more than doubled from 2008 to 2012 where the number of turkeys was 435.000 (Table 2).

Ducks and geese: A reduction in the number of ducks and geese has been ascribed to increased veterinary requirements for poultry production and a number of slaughter house closures. The number of ducks was reduced from 214.000 in 2008 to 103.000 in 2012. In the same period the number of geese was reduced from 14.000 to 4.000 (Table 2).

Mink
Denmark is one of the world's largest producers of mink pelts. The number of breeding animals has increased, particularly after 2009, to 2.948.000 breeding females in 2012 (Table 2). The number of produced pelts increased from 14.000.000 in 2009 to 15.600.000 in 2012. The increase can be ascribed to a large demand from China for high-quality pelts.

Main areas / regional concentration
Pigs
Pig production is concentrated in Jutland. In 2012, 30.0 % of the production was situated in the Southern part of Denmark, 35.2 % in Central Jutland and 22.5 % in the Northern part of Jutland. Only 12.2 % of the pig production is placed on Zealand.

Cattle
The main part of the cattle production is situated in Jutland. 37.0 % are placed in the Southern part of Denmark, 31.5 % in Central Jutland and 24.3 % in Northern Jutland. 7.2 % are on Zealand.

Husbandry systems
The Danish production is primarily intensive. However, 7 % of the farms are organic and proportionally, the organic market in Denmark is the biggest in the world, with organic food making up 8 percent of the total food market.

Products, output
The development of the Danish animal husbandry production is given in Table 3.

Cattle
The beef production was 138 mill kg in 2012. Compared to 2011 the production was reduced. This can to a large extent be ascribed to the improved milk yield per cow per year which results in a smaller stocks of cattle. Based on a quota of 4.799 mill ton in 2012, there was a production of 39 mill kg butter, 303 mill kg cheese and 785.5 mill ton milk for human consumption.

Pigs
The production of pork of 1.902 mill kg in 2012 was smaller than the production in 2010 and 2011. Still more than 19 mill pigs were slaughtered in Denmark but the export of slaughter pigs is increased by 1.6 %. Thus 453.000 pigs are slaughtered abroad. Likewise, the export of piglets has increased by 15 % from 2011 to 2012 to 9.240.000 piglets in 2012. The majority of the piglets are exported to Germany. The production benefits from an average number of 29.1 piglets per sow per year. Thus selection has increased the productivity significantly during the last 35 years.

Table 3

SIZE OF LIVESTOCK PRODUCTION, MILLION KILOGRAMMES

	Size of livestock production, mill kg.					
	1995-	2008	2009	2010	2011	2012
Total milk production	4.665	4.720	4.814	4.909	4.881	4.995
Butter	52	38	37	34	37	39
Cheese	297	324	321	292	275	303
Beef and veal	189	138	137	142	145	138
Pork	1.673	1.985	1.898	1.974	2.008	1.902
Horsemeat	1	1	1	1	-	-
[illegible]	2	2	2	2	-	-

Source: Danmarks Statistik, Statistikbanken.dk, ANI4-8 and Kopenhagen Fur.

Poultry
More than 100 mill chickens were slaughtered in Denmark in 2012. However, the production has been reduced significantly compared to previous years. Hens are not slaughtered in Denmark anymore. The overall production of poultry was 177 mill kg in 2012.

The egg production was 67 mill kg in 2012. Due to the high food security associated with the Danish fresh eggs the majority of the eggs are used for consumption.

Mink
The increase of the production to 15.6 mill skin in 2012 is due to a large demand for high quality pelts. Nearly all skins are exported. China is the most important market for the Danish pelts.

Main topics / problems with regard to sustainable animal production
Animal husbandry production in Denmark is predominantly intensive. Large focus has already been given to increase sustainability and the Danish food production is among the most sustainable productions in the world. However, the expected increased demand for animal products, the limited or more expensive resources for the production and the need for reduced environmental impact requires additional action to obtain a sustainable growth in the agriculture and food production cluster.

In Denmark, focus is on development of new technical solutions for a future modern, intensive animal production. This requires minimal impact on climate and environment and more focus on animal health and welfare, the work environment along with efficient resource utilization, hereunder utilization of the manure as a resource. Further, development and integration of methods and technology for measuring and documenting emission from the production is required. The final goal is to separate animal production from land use as it provides incentives for increased production while at the same time reduces environmental impact from the production.

More specifically required actions are:

- Identification of phenotypes and biomarkers associated with resource efficiency. Important traits are feed efficiency, GHG-emission, health, welfare and fertility traits. Coordination of recordings of phenotypes and data sharing across countries when appropriate.
- Development of breeding programmes including genomic selection to improve resource efficiency considering also conservation of genetic variation.
- Development of efficient feed chains using new feedstuffs e.g. local resources and new protein sources, precision livestock feeding and reuse of manure including recycling of waste constituents e.g. N and P.
- Improved management using biomarkers.
- Development of new housing systems with minimal environmental impact

Funding in animal production research
Danish public funding includes basic funding for the universities and governmental research programmes. The industry supports the research by means of levy funds. These funds are established through a fee per produced unit. Funds can be applied for yearly. Danish researchers also participate significantly in internal cooperations including EU-projects.

Miscellaneous
Organic production
Denmark has a large organic production. The number of organic farms is 2.680 which is between 6 and 7 % of all farms. Contrary to other conventional farms, many organic farms are less than 5 ha. Many of these farms focus on niche production. The export of organic products was about 1 billion DKK in 2011. In 2012, 8.1 % of all food sold was organic.

Environmental impact
From about 1990 the agricultural production has increased while at the same the use of fertilizers has been improved and the emission of greenhouse gases has been reduced. The total amount of discharged greenhouse gases was 16.1 mill ton CO_2 equivalents in 2011. The discharge of methane and nitrous oxide equalled 10.3 mill ton CO_2 equivalents.

A well established and well-functioning collaboration between research, advisors and farmers has resulted in a low use of pesticides based on needs.

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Tabelbilag til formændenes beretninger ved årsmødet den 4. februar 2014. Landbrug og Fødevarer, Axelborg Axeltorv 3, 1609 København V. Erhvervsfjerkræsektionen

2.5.5 Estonia

- overview

  › importance of agriculture in total

The share of agriculture, forest management and fishing comprises 3.2% in the GDP of Estonia (2012)

  › regional distinctions / specifics
  › number of farms, average size (ha), staff (self-employed, hired)

There were 19,613 agricultural holdings in Estonia in 2010. Compared to the 2001 Agricultural Census, the number of holdings decreased almost threefold.

Due to the disappearance of small holdings, the average size of holdings by agricultural area has increased in Estonia from 16 hectares to 48 hectares per holding, exceeding the EU average (14 ha) already threefold. The average size of a holding is larger than in Estonia only in six Member States – the Czech Republic, UK, Denmark, Luxembourg, Germany and France. It has to be taken into account that the average size of a holding is affected by the number of small holdings. In spite of the large decrease in the number of small holdings, 54%of the holdings in Estonia are still smaller than 10 hectares. Holdings with a size of 10-100 hectares account for 37% and holdings with at least 100 hectares for 9%. This structure differs considerably from the EU average (80%, 17% and 3% respectively) which is primarily influenced by the southern Member States where there are very many very small holdings.

Compared to 2001, both the number of persons engaged in farm work as well as their labour input decreased proportionally by the year 2010 to the decrease in the number of holdings by almost 60%. In 2010 57,800persons in holdings were engaged in farm work. 69% of the persons engaged in farm work were the family labour force, 22% were regular employees and 9% were non-regular employees. Although the number of persons in family labour force is continuously large, the family labor force is very often involved with small working time and therefore the family labour force accounts only for 53% of all farm work (in 2001 72%) and regular employees account for 45% of labor input. The rest of farm work is done by non-regular employees or by contractors' employees. The share of work done by regular employees has steadily increased. When analysing the agriculture in the EU, it can be said that it is mostly based on the family labour force, but in Estonia it is not a case any more

- description of livestock sector

  › background / history / traditional knowledge

Before World War II, in 1925-1939, there was a quick growth in agriculture, especially in livestock farming, as in this period the number of cattle increased by 30%, the number of pigs by 35%, the number of poultry 2.4 times and the number of beehives 2.3 times. Utilised agricultural area increased only by 4%, but the increase occurred on account of agricultural crops.The number of farms and farm labourers also increased (by 11% and by 6% respectively). In 1939, there were 139,984 farms in total in Estonia. The majority of these (62%) were small farms (less than 20 ha). There were 216,000 horses, 696,000 cattle, 421,000 pigs, 681,000 sheep, 1.56 million heads of poultry and 99,000 beehives in the farms. There were more than 495,000 persons engaged in farm work in 1939. 87% of them were family labour force. Together with holders' family members that were not working on the farm, the total farm population was 59% of the population of Estonia.

In 1940–1991, agricultural production concentrated into large farms, utilised agricultural area decreased, and intensive livestock farming was based on imported fodder. The goal of the agriculture of Estonia was to

provide Soviet cities with meat products. The first half of the Soviet period was accompanied by a downturn in agriculture caused by World War II, the nationalisation of land and the establishment of collective farms, Even ten years arter the war, in 1955, the number of livestock was more than a third smaller and agricultural area had decreased by one fifth, compared to 1939. The increase in livestock farming started in the 1960s and was at its peak in the mid-1980s when agricultural production was concentrated into 302 large farms (150 collective farms and 152 state farms). There was no substantial decrease in the number of animals until the dissolution of collective farms, and in 1990 there were 758,000 cattle in Estonia (107% when compared to 1939), 960,000 pigs (2.2 times more than in 1939) and 6.54 million heads of poultry (3.8 times more than in 1939). At the same time, there was a big decrease in sheep farming – there were 139,000 sheep in 1990, which was five times less than in 1939. The number of horses decreased even more dramatically. There were 8,600 horses in 1990, i.e. just 4% of their number in 1939.
In the Soviet era, the agricultural area as well as the rural population decreased substantially. The replacement of horses with agricultural machinery partly compensated for the large-scale movement of people from rural to urban areas, but labour shortage troubled agriculture until the end of collective farms.

After the restoration of independence in 1991, there were big changes in agriculture – land reform, restitution and privatisation of lands, collapse of the Soviet large farms, abandonment of agricultural area, restoration of farms. With the restitution of lands to the successors of previous owners, a large generation of land owners emerged instead of a small number of large farms (collective and state farms) in both rural and urban areas. However, many of them lacked the possibility or will to engage in agriculture – there were not enough means of production for everybody and not enough funds to buy the equipment. Some of the lands were sold from one owner to another, some were rented out and some remained out of use.
There were 140,600 persons working in agriculture in 2001; 78% of them were family labor force. Compared to the 1989 Population Census, the number of persons engaged in agriculture had increased but was still 3.5 times lower than in 1939.
The first ten years in re-independent Estonia saw a drastic decline also in livestock farming. Compared to 1990, the number of cattle decreased 2.7 times, the number of pigs 2.9 times, the number of sheep 3.2, times and the number of horses 1.7 times. The number of poultry decreased the most – three times – but was still almost 30% larger than in 1939.
After 2001, the number of holdings that had emerged in the first ten years of re-independence started to quickly decrease. It was mostly small holdings that were not sustainable – i.e. holdings with an agricultural area less than 10 hectares and producing agricultural products mainly for their own consumption. At the same time, the quick decrease in the number of holdings did not cause any substantial fall in agricultural production, as production concentrated into larger holdings and their number increased. Still, the number of persons engaged in agriculture decreased substantially together with the disappearance of holdings.

Livestock farming 2001–2010
When compared to 2001, the number of agricultural holdings with livestock has decreased more than threefold from 32,400 to 9,400. However, the number of livestock units has decreased only by 7%. If in 2001 there were on an average 10 livestock units per holding, then in 2010 already 32 livestock units. In 2010, there were 241,000 cattle in agricultural holdings, of them 96,300 dairy cows, 389,000 pigs, 87,000 sheep, 1.9 million poultry heads, 3,700 goats, 22,000 beehives, 3,400 female rabbits and 6,700 horses. Among horses there are all horses of agricultural holdings, including those used for leisure purposes and sports. An important role in the decrease of livestock units when compared to the previous census has the decrease in the number of cattle by 14%, especially among dairy cows (25%). The decrease of dairy cows refers to the increase in other bovine animals. The decrease in the number of cattle is partly compensated by the increase in the number of pigs – by 18% as well as the increase in the number of sheep by two times The number of poultry heads has decreased by 12%, but it has to be taken into account that in large holdings they are kept as sets and their number depends on the reference date (the reference date may

happen to be during the time of cleaning and disinfecting the poultry yards of sets). Goats have never been very popular in Estonia and now their number has decreased by 11% again. The number of beehives has decreased by 34% but a large share of beehives are probably kept also for own consumption within agricultural small units. The number of female rabbits has also decreased by 63%, at the same time the number of horses has increased by 31%.

In livestock farming the most important sector is cattle breeding (59% of livestock units); followed by pig breeding (29%) and poultry breeding (7%). Compared to 2001, the distribution of animal species has not changed substantially – changes are less than 5%.

At the same time the changes in the structure of livestock farming by size of herds are remarkable. Despite the decrease or increase in the number of particular animal species, the livestock farming concentrates into large holdings in case of cattle breeding, pig breeding, poultry breeding and also sheep breeding.

› importance, share of total sector

In agricultural production, the most important sector in year 2013 is dairy cow breeding (30%); followed by cereal production (18%) and pig breeding (11%).

› number of farms, average size (ha), staff (self-employed, hired)

In 2010, the number of agricultural holdings with livestock was 9,400.
In 2013, the number of agricultural holdings with livestock was 8,379.

› species in livestock production, ranking

In 2010, there were 241,000 cattle in agricultural holdings, of them 96,300 dairy cows, 389,000 pigs, 87,000 sheep, 1.9 million poultry heads, 3,700 goats, 22,000 beehives, 3,400 female rabbits and 6,700 horses.

In 2013, there were 261,400 cattle in agricultural holdings, of them 97,900 dairy cows, 358,700 pigs, 81,800 sheep, 2.1 million poultry heads, 5,000 goats, 39,000 beehives, 4,778 female rabbits and 6,300 horses.

› main / most important species:

- ❖ total number, average herd size, tendency to raise or decline, why
- ❖ main areas / regional concentration
- ❖ husbandry systems
- ❖ products, output
- ❖ main topics / problems with regard to sustainable animal production

In livestock farming the most important sector is dairy cow breeding (55%), followed by pig breeding (20%) and bovine animal breeding (11%). The most important species in livestock farming are dairy cows, pigs and bovine animals. The number of holdings with dairy cows is 2,532, with pigs 752 and with bovine animals 3,816. Main milk producing areas are Järva (119,948 tons) and Lääne-Viru county (95,902 t). If you compare all counties in Estonia then Hiiu county (2,407 t) produces the least milk. Pork production is the biggest in Viljandi (15,702 t) and Jõgeva county (8,739 t) and the smallest in Hiiu county (2 t). Järva (1,546 t) and Lääne-Viru county (1,207 t) produce the most beef and again Hiiu county (111 t) the least. Our livestock farming concentrates into large holdings in case of cattle breeding, pig breeding and as well as poultry and sheep breeding. Almost 60,5% cattle are kept in herds with at least 300 and 91,5% pigs are kept in herds with at least 2000.

- funding in animal production research

Animal production research has been funded by Ministry of Agriculture mainly by means of the national programme „Applied Research and Development in Agriculture“. The funding for basic research is provided by the Ministry of Education and Research. In addition, some of the research has been financed by the EU framework grants, etc. project funding.

2.5.6 Finland

FINNISH REPORT FOR CWG-SAP:

CURRENT RESEARCH ACTIVITIES IN SUSTAINABLE ANIMAL PRODUCTION FUNDED BY MINISTRY OF AGRICULTURE AND FORESTRY

Ministry of Agriculture and Forestry, Finland, is funding agricultural research directly by funds of Makera, agricultural development funds, in amount of 4,3 million € yearly and by research and development funds of 1, 4 million €/ year. ERA-Nets on areas of agriculture and forestry, including food chain and natural resources, are funded by these funds.

In addition Natural Resources Institute Finland, which has a budget of its own of 146 million € and Finnish Food Safety Authority Evira with a research budget of 1,2 million € are under the Ministry of Agriculture and Forestry. Research is only a minor activity in Evira whereas Natural Resources Institute Finland is a research institute.

The Research programmes in Natural Resources Institute Finland are

1) Sustainable and competitive food production »
2) Responsible food chain – better consumer well-being »
3) Environmentally friendly agriculture »
4) Green economy opportunities »
5) Smartly from renewable resources »

The research programmes in Evira are

1. Nationally significant virus infections and those threatening Finland

2. Animal healthcare and welfare

3. Bacterial infections among animals, food-borne bacteria, effect of antibiotic resistance on animal production and food industry

4. Diseases among wild and farmed animals, and among fish and crayfish

5. Chemical food safety.

In addition several projects in the University of Helsinki Faculty of Veterinary Medicine and in other Finnish universities are funded by Makera, agricultural development funds. These include projects in animal diseases and welfare.

University of Helsinki Faculty of Veterinary Medicine has a Research Centre for Animal Welfare. Ongoing projects on cattle ib the Research Centre are : Factors affecting cows`s sleep and the stall usage, Welfare technique in milk production , Pain after dehorning in calves , Detecting lame animals and Rubber slatted floor for bulls; on pigs tailbiting, environmental enrichment and lameness, in chicken "How chicks learn to pearch?", Animal welfare when killing mass of poultry - a litterature review and Welfare of turkeys during transportation; on horses crib biting; on dogs cognition; on other animals pain of elephants and cognition of rats.

The Finnish Ministry of Agriculture and forestry is taking part in several ERA-Nets, including ERA ARD II, CRUE ERA-NET, EUPHRESCO ERA-NET , ERA ARD II, ICT-AGRI, CORE Organic II, SUSFOOD, WOODWISDOM-NET+ and ANIHWA.

Finland Supports ATF:s white paper. The Finnish priorities are

-Fortify animal disease priority and control

-Animal welfare

-Robust and resilient animal production

2.5.7 France

The French Livestock Sector

1. Economic importance of the French livestock sector

France is an important country for livestock farming in EU and almost all types of livestock are produced (Table 1). France has the largest cattle herd in Europe with 19.2 million cattle (22% of European livestock) and is characterized by the presence of a suckler herd solely dedicated to meat production. The number of sucking cows is even greater than the dairy cows (4.1 vs. 3.6 million). Indeed after the milk quota, the number of suckling herds increased and partially substituted dairy herds. France is the third largest producer of pig in the EU, after Germany and Spain and just ahead of Denmark (IFIP, 2013). The population of sheep and goats is high, France being a major actor for ewe and goat cheese. The poultry production is diversified with chickens, ducks, goose, turkeys, quail, guinea fowl and fat palmipedes. France also produces rabbits.

Table 1. Size of the French livestock sector

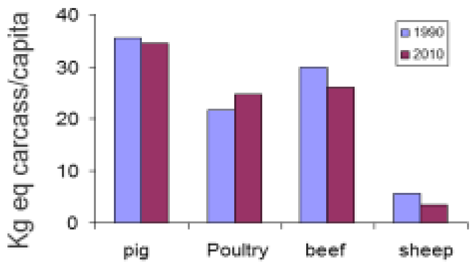
	Milk (million t)	Bovine (million)	Pig (million)	Small ruminant (million)
Germany	29	13	28	-
France	24	19	14	7
Netherlands	12	4	13	-
Italy	10	6	8	6
UK	14	10	-	23
Ireland	5	6	-	3

Animal sector is an economically important sector of the French agriculture. Total value of animal production is € 26.3 billion (without subventions) and the contribution of livestock sector in agricultural production averages 36% (€ 73 billion for all agricultural sectors). In comparison cereals and wines represent 15.5 and 9.5 billion euros respectively (INSEE, compte agriculture 2012). Bovine sector (milk and meat) represent 62% of the total (€ 5 billion in 2011 for beef and sheep, € 14 billion for milk), pig sector 13%, poultry 20%. Livestock sector positively contributes to national trade balance. The dairy sector has a highly positive balance of 3400 million euros per year, half of which being linked to cheeses exports. The trade of bovine meat is also positive (800 million euros), the export of live animal being more important than that of carcasses. Poultry sector balance is still positive (250 million euros) although this balance has declined in recent years. The balance of the pig sector turned negative from 2009's and trade deficit was well nearly € 600 million in 2011

In 2010 there were 490 000 holdings in France and ruminants are present in half of them. 30 000 holdings (6%) are specialized in monogastrics production (22 000 holdings produce pigs). Around 150 000 farms hold meat cattle and / or sheep meat and more than 85 000 farms (75 000 dairy cattle, 5,500 goats and in 5000 in sheep milk) are more specialized in dairy production. Ruminant are present in 95% of the small French farming regions and all departments. They play a key role for the economy of many territories, especially in marginal area (humid mountains, Mediterranean zone). Livestock sector contributes significantly to employment. More than 200,000 jobs than depend directly of livestock: 12 000 in feed industry, 45 000 in milk industry, 55 000 in slaughter houses, 35 000 in meat processing. It is also necessary to consider services: vets, extension services and research. For example, animal research represents more than 25% of total INRA staff (9000).

Consumption of red meat has been declining since many years (- 5kg/capita/year) but remains one of the highest in the EU-27 (25 kg / capita / year), this is for example two times higher than in Germany. The level of consumption of pork averaged 34 kg carcass equivalent per capita and has slightly decreased since 2000 (36 kg), the increase in population helping to maintain the total domestic consumption relatively stable since the late 90s. The average per capita consumption is lower than the European average (41 kg / year). The consumption of poultry meat has almost doubled in 40 years to reach that of beef but still remains behind pork meat consumption. The consumption of sheep is low and is still declining.

Figure 1. Meat consumption in France

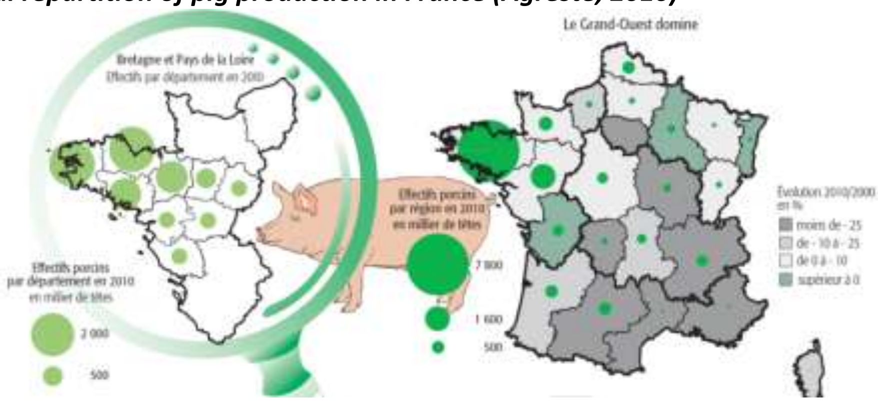


2. Geographical repartition of livestock

Pig sector

The French pig production is marked by a strong regionalization, Britain and the Grand Ouest with 58 and 74% of national production (IFIP, 2013) respectively or flocks (Agreste , 2013). This regionalization continues, mainly due to the reduction of production outside the Great West. Over the past ten years production has increased slightly and in the West (about 3 %), while it decreased by almost 8 % in the rest of France (IFIP, 2013). The other three significant production zones are South West (6%), Central East (6%) and the North (5.5%). This regionalization is a key consideration in the consideration of sustainability issues element. Questions arise mainly in terms of improving environmental sustainability in areas of high animal density and improved economic sustainability and social acceptability in other regions

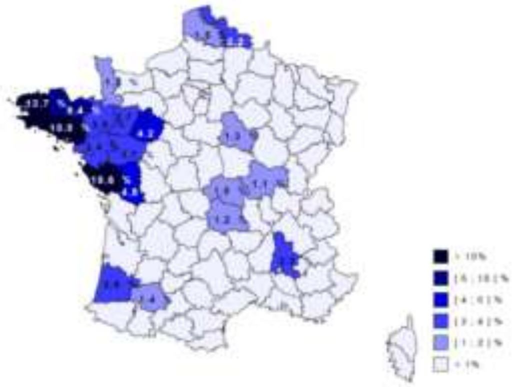
Figure 2. Regional repartition of pig production in France (Agreste, 2010)



Poultry sector

The poultry production is mainly located in the West of France. The main producing regions are Brittany (33% of controlled slaughter in 2010) and Pays de Loire (30%), the rest of the production is mainly located in neighboring or to some extent in more distant regions. Five regions of them (Aquitaine, Poitou-Charentes, Bourgogne, Centre) represent each of the order of 5 to 6% of production

Figure 3. Regional repartition of poultry production in France (Agreste, 2010)



Concerning eggs, Brittany accounts for 47% of conventional production capacity, against only 28% in free range systems. The Loire and Rhône-Alpes region represent each 15% of the total.

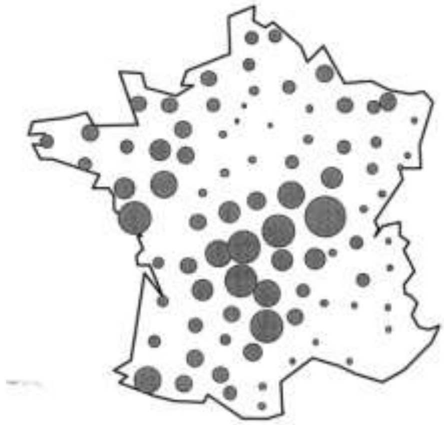
Figure 4. Regional repartition of fat palmipedes production in France (Agreste, 2010)

Ruminant sector (milk and meat)

There are various ruminant production systems and the stocking rates range from 0.5-0.7 to 2.5 LU/ha depending of the natural potential of the areas. All systems remain based heavily on forage that represent 70-100 % of annual diet, the forage being produce to more than 90% on farm with the notable exception of intensive goats production systems that have low food self-sufficiency. Suckling herds value over one third of the French UAA and dairy herd also values 30% of the national UAA and dairy enterprises are present in over 90 % of the small French farming areas. In many areas with limited agricultural potential and adverse climatic and topographical conditions (mountains, marshland...), ruminant valuing permanent grassland is a vital economic sector, it also shapes a wide variety of landscapes and tourism activities and recreation induced are significant economic returns.

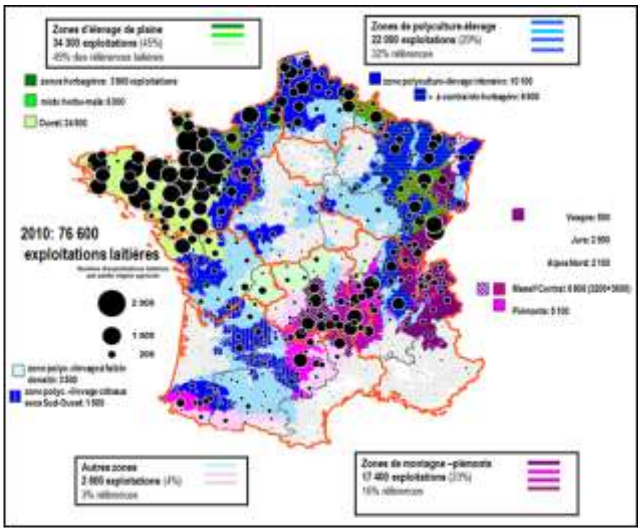
Sucking cows are present (i) in mountainous and mountain areas characterized by permanent grassland and which produce beef and sheep meat with grass and rustic breeds; (ii) in lowland where permanent grassland are dominant and with a limited proportion of annual crops and which produce lean males, heifers and heavy lambs from ; (iii) in more intensive zones with annual crops, maize silage and temporary grasslands which are specialized in calf production and fattening and (iv) in pastoral areas characterized by a more or less important proportion f of marginal pasture where sheep systems based on local and rustic breed predominate.

Figure 5. Regional repartition of suckler cows and beef sector in France



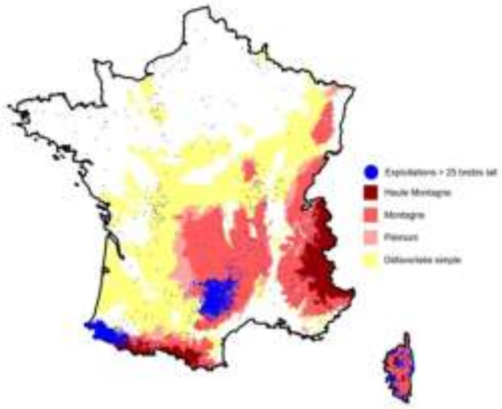
The cow milk sector is present (i) in lowland areas where annual crop and temporary grassland coexist (Brittany, Pays de la Loire, Low Normandy), which represent nearly 45 % of national milk production and are characterized by a very high milk density (150 to 180 000 L / km ²); (ii) in mixed zones producing both cereals and milk (or beef) in farms that combine milk and cereals which represent 20% of national milk production, the milk density is lower than in the previous zone (35,000 liters / km ²); (iii) in the grassland zones of the North -West and East where milk is produced in large farms, this zone represents 20% of the national collection ; (iv) in all mountains and foothills zones which represent 15 % of the national collection, much of the milk is valued for PDO products from the permanent grassland (corn is present in the foothills).

Figure 6. Regional repartition of dairy cows production in France (Agreste, 2010)



The sheep milk sector is more marginal in terms of land cover but it is a major activity in the less favored zones it occupies: Aveyron (Roquefort), Pyrenees- Atlantiques and Corsica representing 90% of ewe farms. In the Roquefort zone we consider that 7 jobs are created for 100,000 liters of milk valued in Roquefort cheese.

Figure 7. Regional repartition of ewe milk production in France (blue zones)



The goat sector is spread over several basins with very contrasting characteristics mixed. (i) The regions of Poitou -Charentes, Loire and Centre which provide 70% of domestic production and are characterized by specialized large herds or mixed farming systems with goats and cows (suckler or dairy) or annual crops and delivering their milk to the industry with the exception of some specialty cheese in the central region; (ii) traditional systems in dry areas of the South East with small herds selling cheese under quality labels and rewarding paths; (iii) systems based on grasslands in the Southwest, Massif Central, Bourgogne and Rhône-Alpes with specialized (in the case of Southwest) or not specialized systems, one third of the enterprises sells cheese under sign of quality.

Figure 8. Regional repartition of goat milk production in France (Agreste, 2010)

3. Economical context of the different sectors

Today, some sectors suffer from a lack of competitivity.

Pig sector

During the last decade the French pig production decreased slightly (-1%) while it increased in the EU (9 %). During the same period, German pig production increased by the equivalent volume of half the French production. According to the results of the 2010 agricultural census the number of pigs (13.8 million) decreased by 7% and the number of sows (1.1 million in 2010) of nearly 20 %. The increased productivity of sows and slaughter weight of animals offset much, but not all, of this downsizing. The decrease of production was even reinforced in 2012 and 2013. Over this period the self-sufficiency level of France declined but remained above 100% and the trade balance became negative. This is explained by differences in values between the imported products (spare cutting, processed products) and exports (offal, whole carcasses) partly related to national consumption patterns (high consumption of ham). The deficit comes mainly as boned meat (€ 255 million) and processed products (€ 311 million). Average imports and exports are equivalent to about 27 and 30 % of national production. Spain is the largest supplier (50%) followed by Germany (17%). To export the EU accounts for over two thirds of volumes, all China - Hong Kong 10% and 8% Russia (IFIP, 2013). At European level the self-sufficiency level of different countries varies widely with surplus countries (Denmark : 650 % Netherlands 290 %, Belgium 263 % , Spain 147 %, Ireland 146% , Germany 115%) and other high deficits (United Kingdom , Italy and most of the eastern countries) , France is located in an intermediate position.

Figure 9. Evolution of the pig production in France and Eu (adapted from IFIP, 2013)

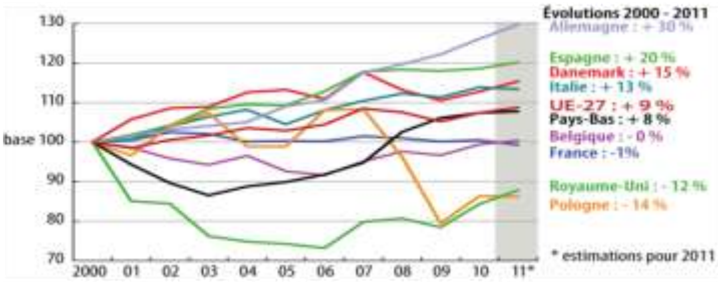
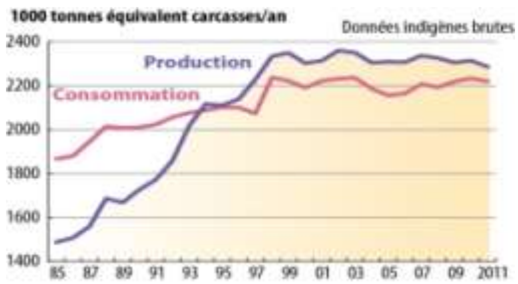


Figure 10. *Evolution of the level of self-**sufficiency** in France* ***(adapted from IFIP, 2013)***



The outlook for the coming years suggest, especially if no stimulus measure is taken, a further reduction in production in France. This contrasts with fairly good prospects of this production at the world markets. This is explained in part by the difficulties in taking into account the regulations relating to the environment and more recently in animal welfare, and secondly, by a certain lack of competitiveness of the downstream of the industry (labor cost, size of structures), relative to other countries, while the technical level of French breeders and performance of farms remained very satisfactory. It is in the context of competitiveness rather unfavorable to French pig production that fits this reflection on the evolution of breeding systems.

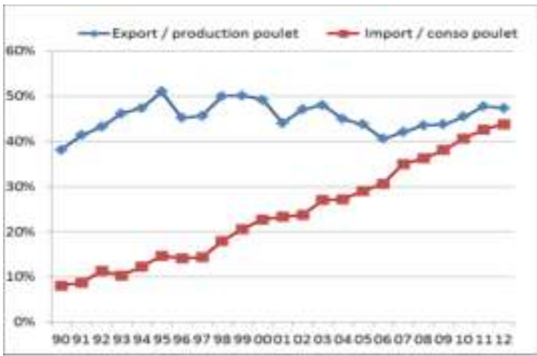
Poultry sector

French production is in decline (Figure 3). After the peak observed in the late 90s (2.3 million tons eq-carcass), production stagnated a bit over 1.8 million tons, supported by broiler (including export) and despite the collapse of the turkey (- 50% since the early 2000s). In the same time production increased in the European Union in the order of 1% per annum, with significant differences between countries.

Figure 11. Evolution of poultry production in tons of equivalent carcass (BSE: bovine spongiform encephalopathy, IA: avian influenza) (from European Commission DG Agriculture)

In addition, if the trade balance remains positive (+ 0.13 M tec in 2012); it continues to deteriorate (Figure 3). This apparent self-sufficiency in fact conceals significant differences between exports (+ 0.64 million tce) and "imports" including the EU (- 0.51 million tce). Thus, over 40 % of the chickens consumed are imported while just fewer than 50% of chicken products are exported mainly to a specific market (Middle East) dependent on the maintenance of refunds. The trade situation is more favorable in turkey but deteriorates sharply; France has lost its dominant position occupied at the beginning of the previous decade.

*Figure 12. E**volution of the share of imports in the consumption of chicken and exports in the production of chicken (Source: ITAVI, FAM and SSP)***



Consumption patterns have changed. Consumption of broiler ready to cook has declined sharply in favor of the cut (especially thighs and fillets) and elaborated preparations. This evolution has led to the production of heavy and standardized broiler (Northern Germany and the Netherlands in particular). The French poultry sector contrasts sharply with this model as it is characterized by its diversification in terms of species and type of segmented markets. If broiler production remains the majority (58%), the sector still gives a large place to turkey (22 %), duck for both roasting and fat (13%) and several other species with a more festive connotation (for example guinea fowl). Moreover only considering chickens, many categories are produced: various standard production (45% of standard strictly speaking, 20% of export light, 5% heavy) and various production with different signs of quality (8% certified, 14 % red label) and different other signs (PDO, organic). This diversification resulted in a proliferation of specifications generating extra costs both upstream and downstream. It has long been a protector to foreign competition, but it is no more the case due to changing consumption patterns. Todays the there is a strong competitiveness differential as shown by the international comparisons carried out by LEI Wageningen.

Table 2. Comparison of the cost of production of broilers

Broilers (2010)	France	Germany	Netherlands
Live weight (g)	1920	2200	2200
Efficiency (IC)	1.80	1.68	1.67
Production Cost (€/kg live animal)	0.881	0.842	0.810

Moreover, the production of export broilers, which still represents a significant fraction of the standard production will adapt to the disappearance of refunds.

Traditionally France is not self-sufficient for eggs

Bovine and ovine meat sector

Intra-European market of weaned calves for fattening is dynamic since 1999 (+5-to +8 % depending on the year) and diversified since the decline of the Italian market (first customer of France) was offset by demand in Spain and Greece. However, this trade could decline with rising cereal prices which makes fattening of calves born in France less attractive in these countries. Exports of young male are stable and young finished beef market is promising, exports grew by 10 % since the early 2000s and new markets, including exports of live bulls fattened to the Maghreb or Turkey increases. Domestic consumption declines but also there is an increased demand of minced meat at the expense of the meat into pieces. This is a worrying development in the medium term because it leads to a growing divergence between the market needs and the supply by specialized herds which produced continuously heavier animals. Dairy culled cows are here more suitable than animals from specialized herds. It therefore appears that it would be necessary to implement two complementary reasoned strategies: firstly a “mass” carcass production, based on young male quickly fattened, a secondly a "niche" for local high-value markets such products under labels.

Sheep production crumbles despite rather favorable situation (40% self-sufficiency). However lamb import and French lamb should be distinguished as they are positioned on two different segments, the French lamb being a local and high quality product and often enjoying a label, the price differential is a priori integrated in consumer choice.

Dairy sector

To benefit from rising global demand, the dairy sector has several assets with a highly innovative downstream sector, but so far, there are some weaknesses compared to others competitors (McKinsey, 2010). Specialized dairy systems are on average less competitive than Dutch or German farms due to smaller size of holdings (less economies of scale), loads of mechanization and buildings are less well controlled and labor productivity is lower. The transformation also suffers from a lack of competitiveness due mainly to a delay in the restructuring of production tools and performance differences between actors are important for their ability to promote their products and optimize the performance of their industrial tools. The cost of a single product is about 10 % higher in France than in Germany in connection with the size and rate of utilization of industrial sites, cost of marketing and R & D to support national labels and higher marketing costs in France. The great heterogeneity of the sector obviously complicates discussions on its organization at the end of the quota systems, the actors do not have the same strategy based on their (private or coop) status, their size, their regional specificities and their market positioning.

With the abolition of the quota system and the withdrawal of government in regulating the dairy market, the question of the relative competitiveness of farms and production areas between them will become more crucial. Natural, organizational and socio -economic characteristics of the different territories are increasingly discussed in terms of competitive advantages or constraints. Quotas had blocked the dynamics of the sector in some production areas, particularly in the Great West where growth of milk production was very rapid between 10970 and 1984. Farmers developed alternative production to compensate (especially poultry and pig). Tomorrow, it is likely that the geographical location of production will evolve with a higher concentration towards the West. The reorganization of the dairy groups to the west is also a harbinger of this scenario. Conversely, the current thinking of the European Commission for the mountain should also booster milk production in mountain regions where milk, combined with tourism, structures the rural life. However, milk production will decrease (the movement is already engaged) in some intermediate territories bordering grain regions. Some dairy farms, especially when they have a sufficient area, have an incentive to convert to grain production for reasons of reduction of working time and higher annual income.

4. Structure and evolution of the French livestock sector

There is a considerable diversity in typology of farming system in France. Farming systems are generally less specialized than in key competitor countries. This might apparently reduce the competitiveness of a specific production but might increase the resilience of the whole farm toward economic shocks and induce quite large difference in term of sustainability particularly in relation to the environmental dimension. The results of the 2010 agricultural census shows that specialized 'pig' farms represent about 70% of livestock (65% in 2000) but less than 30 % of farms. The pig production is often associated with milk production and/or with grain production. Similarly goat production is often associated with crops, mainly cereals in Poitou-Charentes and the Centre region, fruit trees and vineyards in the Rhône –Alpes, or is associated with other livestock (beef cattle, dairy cattle, sheep), and the association between goat and monogastric occurs in Vendee and in Dome.

Pig sector

France had in 2010, 22 300 farms producing pigs (59,500 in 2000), but 99 % of the herd was present in 11,500 farms with more than 100 pigs or more than 20 sows, with an average of 1,200 pigs (900 pigs in 2000). These are essentially very small farms have disappeared. Regarding sows, 98 % of the national herd is on 5700 farms. The dominant model is the model “piglets producers and fattening pigs” with 85% of sows and 66% of pigs raised in this type of farming. The distribution is different in terms of farms since the piglet’s producers and fattening represent 50% of farms, fattening specialize 43% and Piglets producers 6%. We also note the recent development of collective farms maternity which are large (more than 500 sows). These farms produce piglets on behalf of their associates who fatten them on their farms. This model, although different in its organization and economic logic is similar to the main model in the countries of northern Europe. It is interesting in terms of organization and work efficiency, environmentally and also economically. It also facilitates investment and reorganization of farms. It is also sometimes chosen by feeders in areas of low pig density to ensure the supply of piglet’s solution.

The French pig farms are less specialized and rather smaller than in key competitor countries. Although on average the sizes of structures are similar in France and Germany, there are differences in the dynamics of evolution with a strong recent development of large farms in northern Germany.

Table 3. Share (%) of the national herd owned by the large farms in 2007 (Source: IFIP, 2013)

	Farms > 200 sows	Farms >1000 pigs)
Germany	51	44
France	55	43
Netherlands	86	63
Denmark	94	81
Spain	78	75

The buildings are generally older and less automated in France than others countries and this lack of investment in buildings tends to penalize technical performance. Over the past 10 years sow productivity in terms of number of piglets weaned per year has increased less rapidly in France than in Denmark or the Netherlands and is now slightly lower than these two country about a piglet / year, while remaining higher than in Germany and Spain (about 1 piglet / year). However, in the short term, the costs of livestock production remain competitive, partly due to lower financial expenses (Rieu and Roquet, 2012).

The mean stocking rate varies quite widely depending on the types of farm with higher levels for specialized farms (60-90 pigs / ha) and lower levels for cereal farms (5-20 pigs / ha) or farms having cattle (5-10 pigs / ha). Pig farms with more than 100 pigs or more than 20 sows have 83 ha of UAA in average, from which 55% are cultivated with cereals, oilseeds and protein crops. UAA varies by region: 70 ha on average in Britain (5 acres / pig), 94 ha in Pays de la Loire (10 acres / pig) and 153 ha in Champagne Ardennes (12 acres / pig). But these averages mask considerable variability between farms. Farms do not having enough area for spreading manure are forced to treat their effluents or to spread to other farms, resulting in additional costs, while conversely farm using their own effluent benefit of lower fertilization cost

Poultry sector

Poultry production sector is divided into three main branches according to the type of product predominantly (or exclusively) obtained broilers, eggs, foie gras. Several strains of Gallus were selected for different productive orientations (meat or eggs). This distinction between different strains productive orientations also occurs in less common bird species such as ducks and goose (roast and foie gras).

Several species are used for these purposes. The most important remains Gallus species for which strains with very different productive orientations were selected long or to the flesh, and for spawning (although in the case of duck, duck distinction applies Barbary one hand and mule duck sterile hybrid in the other). Other species such as turkeys or guinea fowl are against a single high end flesh. In poultry the rule is specialization, animals being reared for a single product sector. However, complementarity between productions sometimes exists, as it is the case in particular for foie gras chain where the same animals produce foie gras, but also valued carcasses in meat industry. At the stage of production, the share of each type of product is 80% for poultry (3.56 billion euros) and 20% for eggs. The fat palmipedes represents 0.56 billion euros (2/3 as foie gras) and is include into poultry

Eggs production is highly concentrated in terms of number of farms. There are 910 conventional farms and about 1650 alternative farm (sol, outdoors, biologic). According to the 2010 agricultural census, 65% of laying hens are kept in farms with 50,000 heads or more, which represent only 13.4% of farms with at least 1,000 head. In contrast, the class of size 2000 - 10000 heads is by far the most represented 54.4%, while it represents only 12.5% of the production.

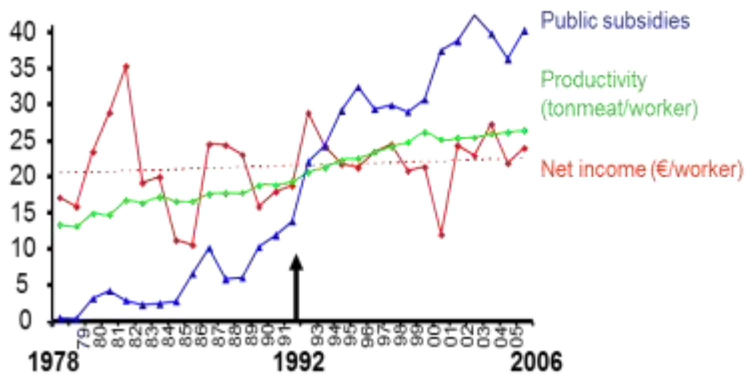
The average age of buildings constructed after 1975 (85%) was about 18 years, only 12% have less than 10 years. The annual survey however shows that after a decade of decline in the order of 2 to 3% per year (resulting from an almost total absence of new buildings and major shutdowns, particularly following “abandonment plans” in 2000, 2003, 2004) the park buildings has returned to growth, the balance between the construction of new buildings vs destruction (+1.8% vs. - 1.2%) being positive.

Bovine and ovine meat

Suckling systems are very diverse in terms of species, breeds, calving dates, types of products and different questions will focus on the efficiency of production while reasoning environmental impacts and standard of the products are market. In addition, public supports which are necessary for the economic equilibrium of these systems are increasingly subject to decoupling and cross-compliance. So farmers need to better take into account the demands of society as environmental point of view and from the point of view of quantity and quality (health, organoleptic ...) of products, ensuring some calendar regularity of supply and in return, the society must better recognize the ecological services provided by the nursing and rearing herd from grassland based system.

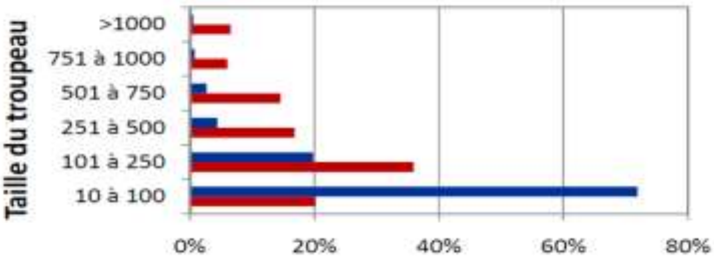
For over thirty years, the beef cattle herd size is increasing. It is now nearly 50 cows on average on farm with 90 ha, 25 % of farms hold 60 % of the cows. Although these herds remain modest in size compared to herds of large areas of "ranching" (Brazil, Australia, USA), gains in labor productivity have been raised but this is not found on farmers' incomes which is stagnating. The double evolution of fixed costs and proportional expenses completely gums improving productivity. These systems are weakened by the economic cost of production. The systems are also very dependent on public subsidies which average more than 150 % of current income. The herd management varies according to the genetic diversity of breeds, the diversity of forage resources in the territories (permanent grassland, fodder crops, pasture resources), and in relation to the demands of downstream industries. It should be remembered that the French beef cattle systems are conducted most often with pure bred (Charolais, Limousin, Bonde d’Aquitaine), which differentiates between regions, promotes the identification of their products and allows the establishment of superior quality courses based on breed (Label red for example).

Figure 13. Evolution of the net income in beef farms



For sheep, despite a restructuration, more than half of French herds are smaller than 250 sheep while it may be considered a specialized sheep farm must be conducted on the basis of 300 to 400 ewes per worker to generate a decent income. The current favorable situation is also partially offset by a gradual shift of production systems towards diets containing higher level of concentrated to match the demand of the industry (better structure of lamb leg) and costs are raising. This orientation is in part related to the pressure distribution for a regular production over the year. This request goes against the efficiency of systems, bumping both the seasonality of reproduction in sheep and that of grassland production. Efforts ("Reconquète ovine") allowed a rebalancing of CAP subsidies in favor of sheep production that helped to reduce the erosion of the number of sheep farms, especially in the west center part of the country where sheep production is very strongly challenged by crops. From the point of view of genetic material available, the diversity of breeds is a rich national heritage especially to value not favored territories. However, the existence of many breeds makes it difficult to maintain the objectives of improved performance; new tools related to genomic selection is not available in the short term.

Figure 14. Structure of the French sucking sheep herd



Dairy sector (cow, goats, ewe)

The restructuring was the most important for the bovine sector, the number of dairy farms decreased by 5% per year since the introduction of quotas in 1984. Since the introduction of quotas in 1984, the number of farms producing milk decreased from 384,900 to 76,000 in 2010. The rate of decline was faster in the areas of mixed farming systems (-9% / year in Poitou-Charentes and South West) than in mountain regions where agricultural potential substitutions are more limited and also because of the success of PDO cheese industries (Chatellier et al., 2013). This restructuring rate remains among the lowest in the EU member states. Annual rhythms of dairy farms disappearance were 8 % in Denmark, 7 % in Italy, 7% in the UK and 6% in the Netherlands and the United Kingdom and 13% in Spain over the same period (Livestock Institute 2013). At the same time, the volume produced per farm has increased sharply from 65,800 liters in 1983 to 330 600 L in 2011 with a marked acceleration in the past five years, especially in lowland areas (up + 47% per collection point in Normandy and +49 % in Normandy between 2006 and 2011). The gap between the average size of farms between lowland and mountain increases considerably and this trend will probably continue. The upcoming suppression of milk quotas could also accelerate the restructuring of production basins (Livestock Institute , 2009), especially as production costs are significantly higher in mountain areas which raises the question of the competitiveness of milk production not valued in PDO cheese in the region (that is 2/3 of the milk produced in Massif Central). The reorganization of the dairy groups to the West is also a harbinger of this scenario. However, the strengthening of support for mountain areas by the new CAP should contribute to maintain milk production. Milk production will decrease in some intermediate territories bordering grain regions and the movement is already engaged. The probable development of the milk in the West could be partly at the expense of the suckler herd because in this region, the rate of unprimed cows is higher than national average (Livestock Institute, 2011b). Today's production mainly result for Holstein genetics (70%) but Normand and Montbeliarde, which are dual purpose breeds still remain significant (10 to 10% of national milk). Other local breeds are also used (Brune des Alpes…).

The table shows that overall milk production per ha of foraging area and labor productivity are much higher plain than in mountain areas. In lowland productivity of land is higher for systems enhancing a lot of corn (unless when area used to produce soya is not taken into account) for those who value more grassland but labor productivity are not affected by the feed system. Milk production still uses a lot of concentrate (160 to 260 g / l of milk in specialized systems) which means that 30 to more than 50 % of milk production is tied to concentrate the bulk of which (60 to 90% depending on the system) is purchased off the farm. In return, the N balances are significantly higher plain that in mountain areas and higher for systems that use more corn than for those using more grassland. Against energy consumption per liter of milk tends to be higher in the mountains. Milk is never the only revenue of the French dairy farms, even in the case of the most specialized ones; meat, cereals and premium are part of it. The net income varies greatly between systems without being connected to the milk production per hectare or per cow

Table 4. Technical and economic data on specialized dairy systems plains, foothills and mountains (data from livestock networks corresponding to the year 2010)

	Lowlands - West		Lowlands - Other		Mountains			
	Corn dominant	Corn – grass	Corn dominant	Corn – grass	With Corn	Massif Central	Franche-Comté (Jura)	Savoie (Alps)
Quotas (1000 l)	502.8	347.5	578.2	408.8	367.9	265.2	339.4	223.8
UAA (ha)	93	73	100	89	79	75	130	55
Forage area (FA ha)	69	62	67	69	63	69	120	52
Corn sillage (% FA)	38	19	43	20	24	4	0	0
Dairy cows	69	56	71	54	54	43	58	43
Concentrate (g/l)	200	168	237	213	257	257	216	230
Milk (/ha FA)	8170	6044	9059	5916	6698	4010	3274	4994
N surpluss (kg/ha)	78	50	107	69	86	40	36	22
Fuel (1000 l)	89	84	107	104	109	101	99	97
Milk (% of the product)	64	64	63	63	64	59	65	71
Méat(%)	11	14	7	10	10	12	12	7
Premium (%)	14	16	16	17	21	25	20	21
Net income (€/worker)	34,6	36,4	32,1	28,8	21,5	24,5	42,9	20,1

The goat sector also restructured at a high rate, the number of goats per farm has increased from 40 to 186 and, in the absence of quota, and milk production has increased by 12% since 2001 due to higher production per animal and an increased number of goats. The goat farming is still characterized by a high proportion (38%) of farmers turning their milk into cheese on the farm. Consumption of goat cheese have reached a plateau, and facing the accumulation of carryover stocks, the sector seeks to stabilize the volume of milk collected since 2009 but it continues to grow even if at a slower pace above. This difficulty results in the reduction of milk prices paid to the producer. There are very diverse feeding systems for goat milk production according to the characteristics of the farm (availability of land, manpower, agronomical potential...) and external factors (input costs, belonging to a sign of quality...). Goat milk can be produced from (i) intensive dry ration system with concentrate, alfalfa hay and / or dehydrated forages which deviate from the image that consumers have of goat farming fed with hay and grazing, (ii) pasture based dominated system where grazing is practiced at least three months per year with days access to 8 hours or more; (iii) corn silage based systems where corn silage is at least 20 % of the annual diet, this is very convenient for mixed farming systems producing both cow and goat milk, (iv) pastoral systems using rangeland that are a valuable resources for goats even if the stocking rate is very low (less than one goat/ha) and where there is little purchased food distributed (less than 200 kg concentrate/goat).

Dairy sheep industry has so far characterized by a relatively good maintenance of the number of farms, but this number could fall more rapidly in the coming years, particularly in Corsica and the Pyrenees-Atlantiques. Traditionally, the production of ewe milk is seasonal production:-calving take place in autumn or early winter; lambs are suckled one month prior to slaughter (Pyrenees, Corsica) or fattened (Roquefort; the milking period starts after weaning lambs and ends in late spring or during the summer. Thus, 95% of milk is produced between early December and late July (Monthly Survey dairy FranceAgrimer / SSP).

In the traditional three basins, almost all farmers are engaged in production under signs of quality that required complying with the production conditions listed in the specifications. In fact, for almost all farms, grazing is an important resource of the systems: sheep graze throughout the year in Corsica and the Pyrenees-Atlantiques, from spring to early parturition which are in the autumn around Roquefort. Farmers are facing in recent years a sharp increase in the cost of inputs and experienced a significant drop in their income despite the increment of CAP premium after the mid-term review.

Specificities of the French bovine sector

The production of meat and milk are closely related. Red meat produced in France come from 35% of the dairy herd (Livestock Institute, 2011). Cull cows represent 48% of total product (half dairy), young cattle (males slaughtered between 12 and 24 months) and older males represent 32% (two thirds from beef breeds or crossbreeds), heifers 14% (mainly produced from beef breeds) and traditional old beef only 7%. This traditional production of old beef has been steadily declining for 30 years while that of young bulls increased by 10 % over the past 10 years. This movement was accompanied with the intensification of production methods with increased use of maize and a decrease in the pasture favored by evolution CAP which introduced a guaranteed price for cereals and a premium per hectare cereal in 1992. This production is now essentially a complement activity in some dairy farmers. Production of young cattle is also strongly related to milk production as dairy farms represent 50% of young cattle produced; this production is highly concentrated in the West part. It is also sensitive to changes in the availability of dairy calves by the veal calf market. Therefore there are large flows of animals between regions. In contrast, the majority of the production of meat from heifers is provided by specialist suckler herds.

This duality between milk and meat can be found at farm level. In dairy farms, meat is a source of significant income in many milk farms, cull cows and calves represent on average 12% of annual income. This is also the case in sheep where the production of lambs represents on average 20% of the annual products of farms producing ewe milk. In contrast, meat product is negligible in goat sector.

The sector is also characterized by a wide diversity of products. Cow's milk collected is used to produce a range of dairy products which was enlarged thanks to innovation efforts of the milk industry (several types of milk powder, butter, numerous cheeses, and functional foods). With a production of 1.8 million tons in 2011, the cheese sector values over one third of the collected cow milk. This volume brings together the cream cheese (667 000 tons), the soft cheeses (433 800 tons), the cooked pressed cheeses (359,800 tons), uncooked pressed cheeses (238 600 tons), spun paste cheeses (62 300 tons), blue-veined cheeses (39 700 tons) and processed cheese (26 700 tons). PDO cheeses (29 cheeses from cow's milk) represent 13% of cheese (excluding fresh cheese) volume but 25 % in value (CNIEL, 2012). Unlike cow's milk, goat milk and sheep are valued almost exclusively use to produce cheese, with a significant proportion in sign of quality and / or valued from shorted chains. Cow cheese, sheep cheese’s and goat cheeses represent 85%, 12 and 3% respectively of the amount of PDO cheeses. Among the most famous PDO cheeses, Roquefort (17500 tons) produced from ewe milk is the second cheese in France after Conté (cow milk, 47 000 tons)

Table 5. Production of different types of cheese from milk.

	Cheeses (%)	As PDO cheeses (%)	Number of PDO
Cows	> 1/3	13	29
Ewes	100	42	3
Goats	100	26	13

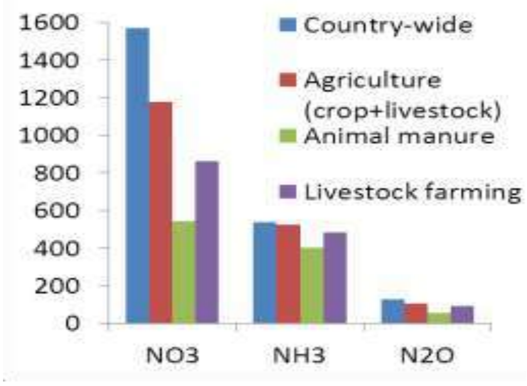
The downstream industry is highly diverse

The production sector supplies a downstream industry, characterized by a great variety of players. There are powerful groups for meat processing (Bigard - Socopa, Elivia, SVA, and Tradival) and four milk groups (Lactalis, Danone, Sodiaal, Bongrain) are among twenty world leaders in the sector. The dynamism of the hexagonal dairy sector is also due to the presence of many other companies (Bell, Lapita, 3A will approach Social etc.). Besides these well-known companies, France also has a large number of small structures or micro businesses (932 dairy units have less than 20 employees , more than 150 small local slaughter houses are spread across the country) with production-oriented cheese and the provision of customer retail butchers. These latter structures are not, or only marginally, claim export but they contribute to the creation of jobs in rural areas and generally allow producers to benefit higher prices for their products. The dairy sector is characterized by the presence of a private sector and a cooperative sector, which represent 54 % of the national milk. Because of historical constraints and strategic choices, cooperatives realize a larger share of the domestic production of milk (66%), powders (53%) and butter (51 %) and cheese (44%) (Hotelier et al., 2013). Similarly, with respect to private companies, they export fewer products with high added value in international markets in proportion to the volumes collected.

5. Livestock sector and environmental issues

All farms are concerned with the control of fossil energy and water consumption as well as emissions of greenhouse gases. Concerning more specifically Nitrogen, the nitrate issue has long been the focal point of discussion whereas in some northern European countries, ammonia has long been the centre of concern. The contribution of livestock farming systems to national ammonia emissions in France is 80% if only direct emissions from livestock farm waste are taken into account, and up to 90% if we include the fact that a large part of synthetic fertilizers is used to produce crops for animal feed. The largest contributor is the cattle production, but at the same time management practices can reduce the potential for emissions, for example by grazing . The environmental performance of sheep flocks is not subject of strong criticism by the society.

Figure 15. Livestock farming systems provide a major part of N flows at national level (Adapted from Peyraud et al., 2012)



However, the situation of the livestock farming is quite different according to the regions and the livestock sector concerning the Nitrate directive. If 50 % of the dairy cow production is located in vulnerable area for nitrogen management, goat dairy farming and dairy farming in mountain area (cattle, sheep) are far less affected by these constraints. Similarly, beef production is less affected by the nitrate directive. Pig production is highly concerned in Brittany. Nitrogen loads of different cantons were calculated based on the orientation of agricultural cantons (Table 1). Inputs in organic form are by far the highest t is in Cantons of the West of France, they exceed 130 kg N / ha UAA in several sectors that combine dairy and monogastric (Finistère, Côtes d'Armor, Morbihan), or dairy and production of beef and poultry (North of the Pays de la Loire), or specialized in intensive dairy production (South of Manche, North Mayenne, Ille - et- Vilaine). Conversely, livestock areas characterized by low stocking rate and diets based on permanent pasture (Massif Central, Jura, Alps) are characterized by very low organic N load. N surplus (the difference between total exports and inputs to soil by crops) are higher than 40 to 50 kg N / ha / year in several cantons/department (that is still far lower than values recorded in Netherlands or Denmark or in some part of Germany), while national average figure of N surplus is 29 kg / ha / year. Several ruminant specialized areas have balances well below 15 kg / ha / year.

Table 6. *Nitrogen loads from different regions according to the agricultural* ***productive*** *orientation (adapted from Le Gall et al, 2005)****.*** *The* ***N*** *surplus* ***is calculated*** *before manure treatment*

	N load (kg/ha AAU)	Mineral N (% inputs)	Ruminant Organic N (% inputs)	Monogastric organique N (% inputs)	N Surplus (kg N/ha)
Brittany Milk and Pig	221	33	36	31	84
Brittany Intensive Milk	179	43	44	13	54
North of Pays de Loire	161	45	45	10	37
Crops specialized territories	123	85	13	2	25
Grassland specialized territories	98	31	67	2	9

2.5.8 Germany

/01 Overview: German Agriculture

Approximately half of Germany's total area is used for agricultural production which amounts to approx. 17 million hectares. The regions in Germany with more than 80 % agricultural land dominate in the north-eastern part of Germany (Lower Saxony, Schleswig-Holstein, Mecklenburg-Vorpommern, Saxony, Saxony-Anhalt and parts of Bavaria).
In 2011, 74 ha a day of mostly farmland were used for development of residential areas and infrastructure. However, land use competition in agricultural production of food, feed, fuel and fibre is also increasing: since production of bioenergy is more profitable than production of food and feedstuffs, 2,1 m ha, that is 20 % of the total crop land is used for fuel production. While the total number of farms in Germany halved in the last 20 years to 270,000 (2010), the average size of farms has almost doubled to 61 ha. The number of organic farms is still below 10 % with a total of approx. 21,000 farms which cultivate 990,000 ha.
Germany is one of the most important agricultural producers in the EU. Of all EU member states, the most of EU-milk is produced and most of Europe's pigs are kept here. In the European Union, Germany is second only to France where animal produce is concerned.
Today, German agriculture generates a quarter of its sales revenue from agricultural exports. With 80 % of exports to and 68 % of imports from the EU Members States, they are the most important sales markets for German products and the most important procurement source.
Production of renewable raw materials and energy plants has grown by 500,000 ha in the last 5 years to 2,1 m ha in 2010 (12 % of the total agricultural area). Agriculture is therefore an important supplier of the base products for renewable energy sources.
Renewable energy helped reduce CO_2 emissions by around 109 m tons in 2008.
The renewable energy industry is becoming an important employer: approximately 278,000 people are employed in the renewable energy sector, 34.5 % working in bioenergy. Another 53,000 jobs have been created in the chemicals and materials area through the utilization of renewable resources.
In 2009/2010, 4,7 % of electricity, 7,7 % of heating and 5,5 % of biofuels were produced with biomass.

<u>Challenges:</u>

- reduction of loss of agricultural area to competing non-agricultural utilization
- balanced land use for production food, feed, fuel, fibre
- support expansion of organic farming as a form of sustainable production

Food production

Since the average wages have risen relatively faster than food prices, German consumers spent only 9,7 % of their income on food in 2010. This trend is a rather unfortunate development for farmers: while food is relatively cheap their revenue has dropped to 25 € cent per euro spent on foodstuff.
At the same time, farmers are paying relatively high prices for operational supplies, such as fertilizer, diesel and agricultural machinery. The price index for agricultural operational supplies in 2010 was 44.8 %higher than it was in 2000. At the same time, producer prices for agricultural products fell by 19 %.

Challenges:

- demand for high quality products, high production standards & high input costs vs. low producer prices and declining profits

/02 The Livestock Sector in Germany

Currently 60 % of the total agricultural area is used for animal feed production from crop land (mainly corn and wheat), permanent grassland or meadows. While most of the farm animals' demand for carbohydrates is produced nationally, almost 30 % of the protein demand has to be imported, most of it as soy from Brazil, Argentine or USA.
In 2010, more than 70 % of the total number of farms in Germany (> 216,000) kept livestock. The intensity of livestock production varies in the different regions in Germany with a high concentration in relation to the agricultural area in the northwest and southeast. Agricultural production in the new Bundesländer is mostly crop production oriented and livestock production therefore of low intensity.
Livestock farming is the main source of income in agriculture: 56 % of the revenues from German agricultural comes from the sale of livestock farming products, mainly dairy (24 %) and pork (17,8 %). Cattle, egg and poultry production make up 14,8 %. Sheep and goat production are of minor economic importance in Germany.
Against the European trend, meat production (carcass weight) has increased to 8.7 m tons in 2010. At the same time, meat consumption fell to 7,3 m tons so that self-sufficiency reached 114 % in 2010.

Challenges:

- new requirements for animal health & welfare and environment: how to put them into practice, financial requirements
- certified animal quality products: measurable criteria along the production chain, transparency for consumers vs. justifiable costs for producers
- migration of agricultural production outside EU in the face of high German and EU production standards

- conflict between optimization of animal welfare and environmental pressure
- pollution control: NH_3, bioaerosols, N-surplus, nutrient contamination, drug residues
- agricultural biodiversity
- economically viable production vs. (unrealistic) consumer image: “industrial” = bad vs. “traditional” = good
- conflict of interest and problems with acceptance of intensive production: construction permits, ground water pollution, environmental effects, noise and odour
- increase protein use efficiency of livestock
- increase national protein supply
- imported feeding, especially genetically manipulated soy
- concentration process of processing industry and world-wide retailing business vs. family-run farms
- problems associated with mass production: disease detection, disease transmission incl. zoonoses, production diseases, manure management

Cattle

In 2010 12.8 m cattle (4.2 m dairy cows) were kept in total in Germany. The dominant breeds are Holstein Friesian in dairy production, mostly in northern parts of Germany, and Fleckvieh in dairy and beef production in the southern parts. Beef production is mainly a side product of marketing male calves from dairy production therefore HF and Fleckvieh also dominate the beef production. With regard to beef breeds, the French Limousin and Charolais play a major role mostly in suckler cow production.
The total number of farms keeping cattle was approximately 145,000 (82,000 dairy) with an average of 86 cows per herd (51 dairy cows). However, the overall trend of fewer farms with more animals can be seen in cattle production, too: 26 % of the farms keep almost 70 % of all cattle in herds of more than 100 animals. There is a gap dividing the old and new Bundeslaender: whereas in the western part of Germany, the herds are traditionally small to medium sized, most of the larger sized herds are located in the eastern parts of Germany.
75 % of all cattle are kept in loose-housing barns. The husbandry system dominating in dairy production is freestall barns. Though stanchions are still legally permitted, the aim is to have this housing system abandoned by 2020. Outdoor keeping is limited to seasonal grazing and of certain importance for suckler cow production. Fattening cattle is mostly kept on slatted floor systems in small groups.
The average milk yield per cow and year has increased to almost 7,100 kg in 2010. A total of approximately 31 m tons of milk were produced, almost half of the total amount is processed into cheese products, 30 % are marketed as fresh dairy products (milk, yoghurt, etc.), the remaining 20 % into butter and powdered milk products.

Raw milk is mainly processed in farmer cooperative dairies, but still 1/3 is delivered to privately owned dairies. As in the whole agricultural sector, the dairies are declining in number and growing in size: while in the 1950s milk was collected by more than 3,400 dairies in Germany, in 2010 there were only 166 left and the concentration process is not finished yet.
In 2011, 34,83 € cents were paid on average for one kilogramme of milk (3,7 % fat) which is 1 € cent above the price paid in 2008. However, this does not cover the costs of production and therefore direct payments are an important part of the income in dairy farms.
The per capita consumption of milk was approximately 9 kg in 2010 and self-sufficiency is 117 %.
Germany is the 2nd biggest beef and veal producer in Europe with 1,2 m tons (carcass weight) in 2010. However, with 8,8 kg the per capita consumption ranges only third behind pork and poultry.
Beef and veal are marketed mainly fresh or frozen, approximately 15 % is processed to beef products. Prices per kg (class R3) increased slightly in 2011 and reached 3,60 per kg but nevertheless, revenues from cattle breeding and fattening dropped by 26.5 %.

Challenges:

- resource efficient, climate friendly dairy production (more milk per cow, reduction of methane emission) vs. animal health & welfare (life expectancy, fertility) vs. “natural” production
- situation after the quota
- volatile prices for milk, high input and land shortage vs. economically feasible production
- new (feed alternatives) and more efficient (e.g. elimination of antinutritives) feeding with a view to reduction of GHG and improving performance
- solution of problems associated with mass production: dehorning

Poultry

In 2010, 128 m animals were kept in poultry production in Germany incl. 35 m layers, 67 m broilers and 11 m turkeys.
More than 60,000 farms keep chicken, the flock size averages to 2,100. However, more than 50 % of the layers are kept in housing above 50,000, another 28 % in housing of more than 10,000 and almost three quarter of the broilers are kept in housing over 50,000. The largest concentration of chicken farms can be found in Lower Saxony where almost half of the entire German poultry population is located (50 m).
The specialisation process has reached a very high level in layer and broiler production. Only 6 % of the farms keep more than 85 % of all layers, and only 1,5 % keep 85 % of all broilers. Though chicken farms are largely individual companies, the industrial production of eggs and

poultry meat is vertically integrated and layers and broilers are hybrid strains from globally active enterprises.
In 2010, the dominant housing system for chicken was barn keeping (86 %). Free range could predominantly be found in organic farming systems in layer production and accounts for only 5,5 %. Production of eggs in battery cages was prohibited in 2009 which caused a decline in layer production (from 11.8 bn in 2008 to 9.7 bn in 2010).
There are 25 hatching stations in Germany which produced more than 128 m breeding eggs for layer production and 46 m chicks are used for egg production, an equivalent number of male chicks not suitable for meat production are killed after hatching.
The annual laying rate reached 292 eggs in 2010 and a total of more than 11 bn eggs were produced in Germany. The per capita consumption is 212 eggs per year, half of which are processed. The self-sufficiency is low in egg production with only 70 %.
Farmers received 10,6 € cents per egg in 2011 which after an increase by almost 5 cents is back to the price paid in 2005.
Each German consumed 11,1 kg poultry meat in 2010 and the total production of chicken meat reached 800,000 tons. Self-sufficiency is 108 %. The producer price for 1 kg chicken meat was 81 € cent.

Challenges

- alternative uses of male day-old chicks, e.g. sexing of eggs in layer production
- solution of problems associated with mass production: regional concentration, close proximity to residential areas, use of manure, beak cutting, use of antibiotics, production diseases (e.g. bone fractures)

Pigs

With a share of almost 20 %, Germany is the largest pork producer in the EU.
Pig production, too, is following the trend to fewer farms, bigger production: the total number of pig farms decreased over the last 10 years dramatically by more than half to 60,000. On average, a pig farmer kept 458 pigs in 2010, however, the vast majority of pigs are kept by only a few farmers: 14 % of pig farms keep more than 60 % of the total number of animals in stock of more than 1,000 animals.
Like poultry production, the largest concentration of pig farms can be found in Lower Saxony, too, where almost half of the entire German pig population is located (50 m).
The production on farm level is horizontally stratified into production of piglets, sow keeping and fattening.
Husbandry is predominantly closed housing on slatted floor in small groups. Straw bedding is of some importance for organic production as well as outdoor keeping which is, however, subject to very strict rules and regulations with regard to epizootic diseases.

58 m pigs were slaughtered in 2010 with a total of 5,4 m tons pork produced (carcass weight). Consumption of pork ranges first among meat consumption in Germany: per capita the Germans consumed 39,5 kg in 2010. Self-sufficiency is 110 %.
Producer prices per kg pork are subject to fluctuations and in 2011 were 1,41 € per kg (class II) was paid.

Challenges:

- boar scent: marketing of boar meat, alternatives to castration of male piglets (prohibited 2019)
- solution of problems associated with mass production: regional concentration, close proximity to residential areas, tail docking, teeth grinding, use of antibiotics.

Bees

There are more than 97,000 beekeepers who manage more than 700,000 bee colonies but for only 5 % bee-keeping is a main income. Though there has been a slight downward trend in the number of bee colonies, production has increased to 23,2 kg per colony and in total to 23,200 tons in 2010. Consumption of honey per head has been relatively stable in recent years with 1,1 kg in 2010. Self-sufficiency is low and in 2010 barely reached 25 %.
However, even more important is the "by-product" bees offer: the pollination service since 80 % of all national agricultural crops and wild plants are dependent on the honey bee for pollination. According to a study by the German Beekeeper Association (2005) the calculated value of the pollination service was 10- to 15 times the value of the honey production. However, this service is free of charge and no premiums are paid to beekeepers in Germany. Due to the periodic winter losses of bee colonies in recent years (2011/2012 almost 15 %), a bee monitoring is now in place in Germany since 2004.

Challenges:

- effects of plant protection products on bee health and production,
- effects of insecticides on bee health and production, especially neonicotinoids
- greening measures to provide (additional) feeding areas
- fight against varroa mite

/03 Society

Employment in the agricultural sector

Germany had 81,8 m inhabitants in 2010 and 40,5 m people were considered working population. All in all, about 10 %of Germany's working population work in the food sector incl. farming and the up- and downstream economic areas (around 4 m people), that is every 10th job in Germany is linked to the food sector which is therefore one of the largest employers in Germany in the following branches:

- slaughtering and meat processing
- milk processing
- production of bakery products and confectionery
- fruit, vegetable and potato processing
- breweries.

Though the total number of people working on farms has not changed considerably in the last 15 years, there is a clear trend towards seasonal employment: in 1995, 1.1 m of the total 1.4 m people working on farms were family members, in 2010, only half of the 1.1 m people working on farms were family members, 20 % were permanently employed staff and 30 % seasonal workers (for comparison: in 1995 only 6 %).

The vast majority of farms (90 %) are individual companies, mostly family run businesses, half of which gain their main income from agriculture. More and more farms generate additional income, though, by providing services like holiday on-farm with a large variety of possibilities, direct marketing or energy farming.

Professional training and education of farmers

The number of trainees in agricultural professions has declined slightly in recent years in Germany, less pupils finish their apprenticeship or continue further education in master classes. This does not count for higher education: the number of students in agricultural sciences has risen by 3,000 over the last three years to more than 13,000. Almost 10 % of the farm managers have a degree in agriculture nowadays.

Succession on farms

In 2010, approximately 61 % of the farm managers were older than 45. At the same time, the succession on individual farms with agriculture as main income is a problem: in 2010, almost 35 % of the farms with managers older than 55 had no succession or at least succession was uncertain, the situation was even more critical for smaller farms: succession is at least unclear for 65 – 83 % of the farms with less than 50 ha.

<u>Challenges</u>

- safekeeping of traditional knowledge and skills
- improving competence and know-how of livestock farmer
- continued use of farmland in case of unclear succession
- keep and further develop the potential of rural areas

/04 Environment

Emissions from Agriculture

The utilization of drained organic soils, livestock farming and the use of mineral fertilizers are the main emission sources of climate-relevant gases from agriculture. Agriculture contributes roughly 11 % of Germany's greenhouse gas emissions. Depending on the survey method employed, the contribution of the entire food sector, including production, processing, transport etc., lies between 16 and 20 %. The contribution of agriculture towards overall CO_2 emissions is 6 %, nitrous oxide (laughing gas) emissions 54 % and methane emissions 51 %. 93 % of methane emissions has to be attributed to cattle farming, mainly dairy herds; since 1990, however, there has been a reduction of more than 20 %. Agricultural emissions of CO_2 totaled 133 m to CO_2 equivalents including manufacture of nitrogen fertilizers and were balanced off by an estimated absorption of plants of 168 m tons.
One of the effects of climate change are extreme weather situations like storm, heavy rain, hail, flood or prolonged dry periods which lead to considerable damage for the agricultural sector.

Challenges:

- more efficient fertilizing
- energy saving
- increased efficiency in livestock farming
- preservation of grassland and increase of the humus content of soils
- expansion of organic and conventional farming
- slowing of the consumption of land at the expense of agricultural and forestry areas (carbon sink destruction).

/05 Animal production research

Federal Ministry of Food and Agriculture

Federal Research Institutes

- Julius Kühn Institute (JKI)
- Friedrich-Loeffler Institute (FLI)
- Max Rubner Institute (MRI)
- Thünen Institute (TI)

via Federal Office for Agriculture and Food

- European Research: coordination of German participation in the cross-national European Research Area Networks and Joint Programming Initiatives
- Research projects to supply the BMEL with guidelines for decision-making
- Animal Welfare: model and demonstration projects
- Innovations: Technical and non-technical

- Organic Farming: Research and development projects and/or measures for technology and knowledge transfer within the Federal Programme on Organic Farming and other forms of sustainable agriculture
- Biodiversity: Situation analyses and statistics in biodiversity; model and demonstration projects for the preservation and innovative, sustainable use of biodiversity

Federal Ministry of Education and Research (BMBF)

Several national and international funding programmes in the area of food and agriculture are granted by the BMBF. All initiatives are strategically selected to cover future demands in the agricultural related sector, i.e. food security, animal health and welfare, animal husbandry systems, reduction of GHG, etc. National programmes like FUGATO, GlobE and knowledge hubs for agricultural research are supported by international programmes like ERA-Net SUSFOOD, JPI HDHL, ERA-NET EMIDA, ERA-Net ANIHWA, FACCE-JPI, and ERA-Net plus FACCE and activities like CSA STAR-IDAZ to strengthen the agricultural research landscape in Germany.

References:

(1) Information on Germany agriculture (in German; information.medien.agrar e.V., 2013)
(2) Monitoring and perspectives of beekeeping in Germany (in German; BMEL 2013)
(3) Situation of German Agriculture (in German; Deutscher Bauernverband, 2012/13)
(4) Charta for Agriculture and Consumer (in German; BMEL 2012)
(5) Annual agricultural statistics (in German; BMEL 2012)
(6) Extreme Weather Events (in German; Helmholtz Zentrum 2012)
(7) Report of the project group on sustainable animal production (in German; 2012)
(8) Research and innovation requirements in livestock production (in German; BMEL 2011)
(9) Agricultural Report of the Federal Government (in German; BMEL 2011)
(10) Facts: milk and more (in German; Milchindustrie-Verband e.V., 2011)
(11) German Agriculture: Facts and Figures (in English; BMEL, 2010)

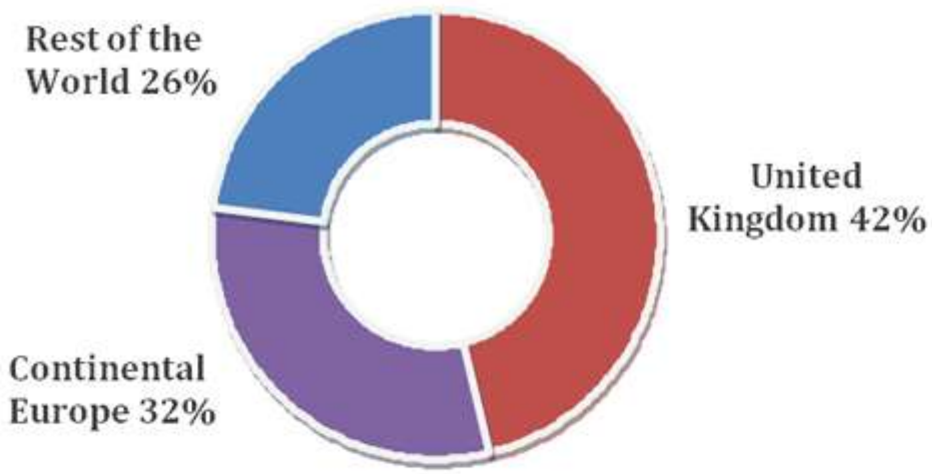
2.5.9 Ireland

Irish Farms

- There are approximately 139,900 family farms in Ireland with an average size of 32.7 hectares per holding. (CSO, Census of Agriculture 2011).
- The land area of Ireland is 6.9 million hectares, of which 4.5 million hectares is used for agriculture and a further 760,000 hectares for forestry (DAFM 2013).
- 81% of agricultural area is devoted to pasture, hay and grass silage (3.67 million hectares), 11% to rough grazing (0.48 million hectares) and 8% to crops, fruit & horticulture production (0.38 million hectares) (DAFM, 2013).

- overview

- The agri-food and drink sector accounts for 7.1% of Irelands economy-wide GVA, 11% of Ireland's exports and 8.6% of total employment. (DAFM 2013)
- In 2013, Irish agri-food and drink exports increased by an estimated 9% to approximately €9.9 bn (Bord Bia 2013).
- The UK was the main destination for Irish agri-food and drink exports in 2013 accounting for 42% of all exports. 32% of exports went to Continental EU markets while the remaining 26% went to international markets.



- The latest estimates of the distribution of our agri-food and drink exports in 2013 by sector are as follows: dairy products and ingredients (30%), prepared consumer foods (17%), beef (21%), live animals (2%), beverages (13%), pigmeat (6%), poultry (2%), sheepmeat (2%), seafood (5%) and edible horticulture (2%).

Primary Agriculture

- In 2012, Gross Agricultural Output (GAO) was valued at €5.58 billion. (DAFM, 2013).
- The beef category accounts for the largest share of GAO at 38 per cent, while milk accounts for 29 per cent. Other sectors to have a share in GAO include pig (8%), sheep (4%), cereals (6%), and other (15%)..

Cattle and Beef

- There were 6.9 million cattle in Ireland according to the June 2013 livestock survey. This represents a 2% increase on prior year levels.
- Irish beef production is predominately a grass based system, with 518,000 tonnes produced in 2013.
- In 2013, Ireland exported an estimated 466,000 tonnes of beef worth approximately €2.09 billion.
- In 2013, 209,000 cattle were exported live from Ireland worth approximately €240 million.

Sheep and Sheepmeat

- For 2013, the latest June livestock survey indicated that the Irish sheep flock decreased by almost 2% to 5.08 million head, with the breeding flock decreasing by around 1% to 2.65 million head.
- During 2013, Ireland exported an estimated 45,000 tonnes of sheepmeat which was valued at approximately €220 million.
- France is the main market for Irish sheepmeat exports, accounting for approximately 41 per cent of total exports in 2013. The UK is also a substantial export market, taking 22% of shipments.

Pigs and Pigmeat

- In the June 2013 CSO Livestock Survey, there was 1.55 million pigs in Ireland, this represents a decrease of over 1% on prior year levels.
- In 2013, Ireland exported an estimated 185,000 tonnes worth approximately €525 million.
- In 2013, the UK was the main market for Irish pigmeat taking over 44% of our total exports. Continental EU markets accounted for 20% of our pigmeat exports while the remaining 36% went to international markets.

Dairy

- In 2013, total milk output (incl. imports) was estimated at 5,831 million litres.
- From this total milk output, 480 million litres was consumed as liquid milk. In addition to this 152,000 tonnes of butter were produced in 2013. While 49,000 tonnes of skim milk powder were produced in 2013. 185,000 tonnes of cheese was produced in 2012 (CSO, 2013).
- In 2013, total dairy and ingredients exports increased by an estimated 15% to €3.045 billion.

› number of farms, average size (ha), staff (self-employed, hired)

- The vast majority of the farms in Ireland are family farms with small amounts of hired labour with on average 0.23 labour units hired on dairy farms and 0.05 labour units hired on beef farm rearing farms.

There are approximately 17,500 dairy farms with over 100,000 farms with beef animals and over 22,000 farms with sheep.

Dairy exports €3 billion, beef exports €2 billion, sheep €220 million and pigs €525 million

Bovines both dairy and beef animals are the most important species in Ireland.

Average dairy herd size is 68 cows and farms with suckler cows is 15

	Beef Cows	Dairy Cows	Sheep	Pigs
State	1.148 mill	1.14 mill	5.17 mill	1.57 mill
Border	203,000	103,000	1.11mill	429,000
Midland	146,000	79,000	335,000	271,000
West	251,000	49,000	1.38 mill	50,000
MidWest	159,000	182,000	131,000	100,000
South West	141,000	390,000	700,000	306,000
South East	157,000	259,000	745,000	340,000
Dublin Region	91,000	79,000	772,000	73,000

Outputs

Dairy 49,000 tonnes of skim milk powder were produced in 2013. 185,000 tonnes of cheese was produced in 2012 (CSO, 2013).
Pigmeat 185,000 tonnes
Sheepmeat 45,000 tonnes
Beef 518,000 tonnes

Important Sustainability Issues for Ireland

1. Economically viable ruminant grassland systems that have societal acceptance
2. Sustainable intensification of grassland ruminant production systems
3. Establishing the sustainability credentials for Ireland
4. Traceability and regulation of the food chain (Farm-Fork)
5. Communication of the strong sustainability message form Irish pasture based systems to the consumer.

2.5.10 Italy

LAND AND POPULATION

Italy has 302,071 square kilometers of land surface. The areas classified as “mountain” altogether cover 35.2% of the surface so as to affect significantly the distribution of population: in mountainous areas lies less than a fifth of the population (12.6%) which, conversely, tend to be located mainly in plain areas, with 23.2% of the territory and 48.3% of the population. The hilly area hosts 39.1% of the population, with a share of 41.6% of the Italian territory[1].

ISTAT data show that, on 31st December 2012, 59.7 million people are located in Italy, of which more than 4.3 million (7.4%) are of foreign nationality.

In 2012, the population grew by 291,000 units, or 0.5%. This increase was due to migration from abroad, which offset the decline in population resulting from the negative natural balance.

The study of the distribution of residents by geographical areas yields the following ranking: the municipalities of the North-West regions on top with 15,861,548 inhabitants (26.6% of the total), followed by those in the North-East with 11,521,037 inhabitants (19.3%), the Centre with 11,681,498 (19.6%), the South with 13,980,833 (23.4%) and the Islands with 6,640,311 (11.1%). Such percentages have decreased by a tenth of a percentage point, compared to 2011, for the South (including the Islands) in favor of the North-Central areas.

Use of agricultural land (000 ha), 2012

	Italy	EU-28
Total surface	17,078	214,578
Utilized agricultural area	12,856	172,920
Arable crops	7,009	103,923
Cereals (%)	51.6	54.5
Dried legumes (%)	2.0	1.6
Potatoes, sugar beets, hoed fodder crops (%)	1.4	3.3
Industrial plants (%)	4.9	12.1
Fresh vegetables, melons and strawberries (%)	4.3	1.6
Flowers and ornamentals (%)	0.2	0.1
Rotating fodder crops (%)	27.4	19.2
Seeds (%)	0.4	0.2
Fallow land (%)	7.8	7.1
Permanent crops	2,323	10,703
Vineyards (%)	27.9	28.6
Olive tree (%)	47.2	40.8
Fruit crops and other crops (%)	24.9	30.5
Kitchen gardens	32	350
Total permanent grasslands and pastures	3,434	57,945
Forested land annexed to farms	3,003	30,379
Non-utilized agricultural area and other land	1,220	11,273
Energy crops	17	480

Source: Eurostat.

With an average density of about 202 inhabitants per square kilometer Italy is among the most densely populated countries of the European Union (UE-28 average is about 116 inhabitants per square kilometer). Only Malta, the Netherlands, Belgium, United Kingdom, Germany and Luxembourg register higher density[2].

The total agricultural area (SAT) in Italy amounts to 17.1 million hectares, of which 12.9 million attributable to the utilized agricultural area (UAA).

At the regional level, the South contributes with 47.4% of the national UAA, outpacing the North (35.5%) and the central Italy (17.1%).

Population/agricultural area (inhabitants/100 ha UAA*), 2012

* As for Italy, the population is updated to 31/12/2012 and UAA to 2010; as for EU, the population is updated to 01/01/2012 and UAA to 2010.

EMPLOYMENT

In 2012, the Italian economy reached a deadlock and the employment reports a further slight decline. In this difficult context, however, the decline of the agricultural sector (-0.2%) was lower than that recorded in the overall economy (-0.3%). In addition, in this sector youth employment increases for the age group 15-35 especially in the South (+5.8%), the Italian area that suffers most strongly from youth employment, while at the national level the number of employed in the same reference category decreased in all sectors[1].

The number of people employed in agriculture is around 850,000 employees (of which 29% are women), with a distribution of 15.2% in the North-West, 22% in the North-East, 13.6% in the Centre and the remaining – nearly half – in the South.

Workers by age group and geographical area in agriculture and in the total economy (%), 2012

	Aged 15-34	Aged 35-64	Aged 65 and older	Total (000)	Empolyed (%)
		North			
Agriculture, forestry and fishing	17.5	73.0	9.5	315	31.8
Total economy	25.3	72.8	1.9	11,901	76.3
		Centre			
Agriculture, forestry and fishing	18.2	70.8	11.0	115	47.6
Total economy	24.4	73.6	2.1	4,818	75.0
		South			
Agriculture, forestry and fishing	22.4	74.5	3.1	419	65.1
Total economy	25.9	72.6	1.5	6,180	73.1
		Italy			
Agriculture, forestry and fishing	20.0	73.4	6.5	849	50.4
Total economy	25.3	72.9	1.8	22,899	75.2

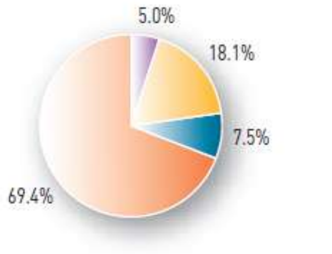
Source: ISTAT, Labour Force Survey.

[1] *Data derive from the Labour Force Survey, carried out by ISTAT, which is the main Italian labor market source of information. National Accounts Data are used for measuring employment in economic activities as shown in the above reported table and chart.*

The composition of employment by professional categories continues to change. Indeed, the number of selfemployed workers decrease (-3.7%) while employees increase in the same ratio, (+3.6%), thus overcoming the first component. The incidence of part-time workers strengthens, reaching 12.7% of total employment in agriculture.

Also the employment of foreigners in agriculture continues to record an increase, as well as their weight in the economy and in the Italian society.

Total work units (000), 2012



TOTAL	23,745.9
Agriculture, forestry and fishing	1,185.9
Industry in the narrow sense	4,296.2
Building	1,787.7
Services	16,476.1

Source: ISTAT, National accounts.

Foreign workers employed in agriculture by geographical area (000)

	Gender	2010	2011	2012
North	Male	22	30	34
	Female	8	7	7
	Total	30	37	41
Centre	Male	16	21	23
	Female	3	3	5
	Total	19	24	28
South	Male	25	30	33
	Female	10	12	12
	Total	35	42	45
Italy	Male	62	81	90
	% of total foreigners in agriculture	10.2	13.4	14.9
	Female	22	22	25
	% of total foreigners in agriculture	8.6	9.0	10.0
	Total	84	103	115
	% of total foreigners in agriculture	9.7	12.1	13.5

Source: ISTAT, Labour force Survey.

Employment in agriculture as a share of total employment (%), 2012

	15 years and longer	% of women[1]		15 years and longer	% of women[1]
Austria	4.9	42.4	Luxembourg	1.3	29.0
Belgium	1.2	27.0	Malta	1.0	:
Bulgaria	6.4	31.6	Netherlands	:	:
Cyprus	2.9	31.0	Poland	12.6	41.5
Croatia	13.7	45.3	Portugal	10.5	39.3
Denmark	2.6	20.0	United Kingdom	1.2	26.9
Estonia	4.7	28.5	Czech Republic	3.1	27.3
Finland	4.1	27.1	Romania	29.0	46.4
France	2.9	30.4	Slovak Republic	3.2	22.5
Germany	1.5	32.5	Slovenia	8.3	42.9
Greece	13.0	40.2	Spain	4.4	26.1
Ireland	4.7	12.1	Sweden	2.0	23.0
Italy	3.7	29.0	Hungary	5.2	25.9
Latvia	8.4	29.7	**EU-27**	**4.9**	**36.7**
Lithuania	8.9	37.3	**EU-28**	**5.0**	**36.9**

[1] Proportion of employed females engaged in the agricultural sector.

Source: Eurostat, Labour Force Survey.

PRODUCTION LEVELS

In 2012, the Italian primary sector has experienced a drop in the quantities produced (-3.3%) over the previous year and a boost in prices of 4.9%. As a consequence, the value of agricultural, forestry and fishing, at basic prices, in current terms, increased by 1.4% reaching 54.1 billion euros, secondary activities included. Also for 2012, the main sectors confirm their contribution to total production, with crop plant which account for 48.3%, livestock farming for 31.9%, support activities for agriculture for 12% and forestry and fishing for 5%. Analyzing the dynamics for each sector, it can be noticed that the value of crop production decreased by 1.4% compared to 2011, with a particularly negative result for fodder crops (-6.7%) and for herbaceous crops (-4.3%). The livestock sector experienced a better trend with an increase in the value of production (+5.7/%), thanks to the good performance in meat prices (+5.8%), while, as for milk, the value of production remains essentially unchanged (-0.1%).

Value of output and services at basic prices by main categories, 2012

Economic activities	Current values million euro	Current values %	% change 2012/2011 value	% change 2012/2011 quantity	% change 2012/2011 price
Herbaceous crops	14,036	25.9	-4.3	-3.9	-0.3
Fodder crops	1,643	3.0	-6.7	-6.4	-0.3
Tree crops	10,506	19.4	3.6	-7.8	12.4
Livestock	17,268	31.9	5.7	-1.0	6.9
Support activities for agriculture[1]	6,474	12.0	5.6	1.3	4.3
Secondary activities[2]	1,540	2.8	-1.5	-2.6	1.1
Forestry	655	1.2	-5.3	-9.4	4.6
Fishing	1,996	3.7	-5.6	-4.4	-1.3
Total[3]	**54,116**	**100**	**1.4**	**-3.3**	**4.9**

[1] Includes active and passive agricultural contract work, packaging of agricultural produce, maintenance of parks and gardens, services connected to livestock farming, artificial insemination, new sports facilities, etc.

[2] Agritourism, processing of milk, fruit, meat and other agricultural activities.

[3] Including secondary activities performed by other branches of the economy.

Source: ISTAT.

The value of support services to agriculture is increasing (+5.6%), whereas the secondary activities, such as farm and processing, decrease (-1.5%).

As for quantities, almost all major crops decrease, especially those of tree crops (-7.8%). In particular, the major negative changes have affected the production of pears (-30%), apples (-12%), table grapes (-9%), oil (-8%), wine (-8%); among the few tree crops on the rise, noteworthy are the lemons (+3%), mandarins (+7%) and loquats (+14%).

The increase in production at basic prices, in current values, of tree crops (+3.6%) is ascribable exclusively to a sharp rise in prices (+12.4%).

Also the forage production decreased (-6.4%) as well as herbaceous crops (-3.9%); worth of note is the strong drop in the production of sunflower (-27%), soybeans (-25%) and hybrid maize (-19%). In increase, however, is the production of durum wheat (+9.6%) and wheat (+23%). The decline in vegetable crops has affected, especially, the fresh peas (-16%), watermelons (-12%), tomatoes (-10%), cucumbers (-10%), fresh beans (-9.3%)and fennel (-9.2%).

In 2012, the livestock sector showed a slight decrease in the total quantity of meat produced (-0.6%), due to a decrease in the quantities of beef (-3.2%), pork (-2.2%), sheep and goat (-1.2%), offset by a good result in the production of poultry meat (+4.8%) and horse meat (+1.3%).

Also milk production has decreased, compared to 2011, with a decline in both quantities of cow's milk and buffalo milk (-2.4%), and that of sheep and goat's milk (-1%).

More generally, as for the livestock the increase in the price level (+6.9%) has managed to offset the decline in the quantities produced. It should be emphasized the significant increase in the value of production of eggs (+30.9%), as a consequence of a slight decrease in the production volumes (-1.2%) and a substantial price increase (+32.5%), and the sharp decline in honey production (-13.7%) which was not offset by the price increase (+8.2%).

Main livestock output, 2012

	Quantity[1]		Value[2]	
	000 t	% change 2012/2011	million euro	% change 2012/2011
Beef	1,394	-3.2	3,580	3.8
Pigmeat	2,017	-2.2	2,969	6.0
Sheepmeat and goatmeat	60	-1.2	191	-0.8
Poultry	1,772	4.8	2,907	9.7
Rabbits and game	417	1.0	996	3.1
Cow milk and buffalo milk (000 hl)	108,763	-2.4	4,555	-0.3
Sheep and goat milk (000 hl)	5,446	-1.0	432	1.5
Eggs (million)	12,777	-1.2	1,509	30.9
Honey	10	-13.7	36	-6.6

[1] Live weight

[2] Production at basic prices and values at current prices.

Source: ISTAT.

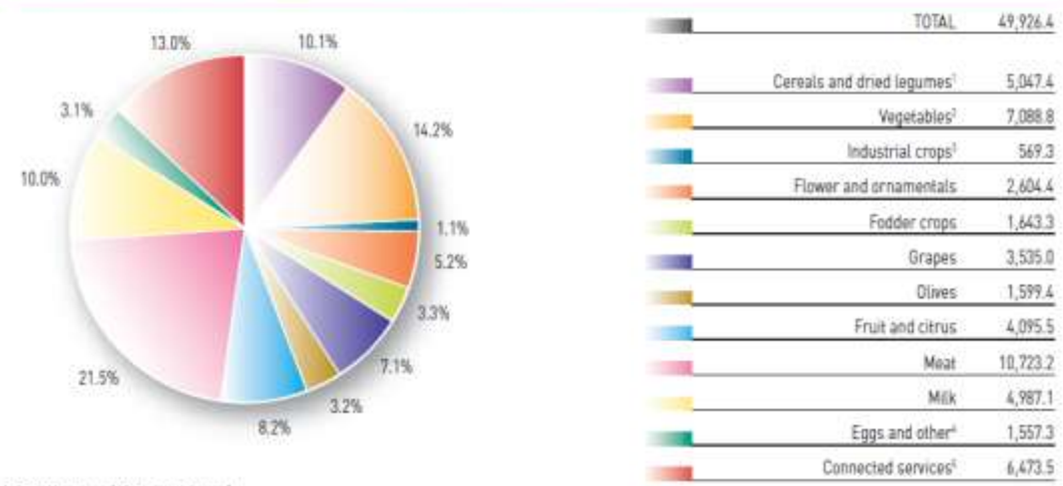
Also the value of forestry production dropped (-5.3%), due to a strong decrease in the production of berries (-25%); the average price increase of 4.6% has only weakened the negative performance.

A similar decline was experienced in the fisheries sector (-5.6%) which recorded a contraction of 4.4% of the amount drawn: -6% for fish, shellfish and aquaculture, +17% the production of shellfish and +5% services related to fisheries and aquaculture. Average prices for this sector fall by 1.3%.

In 2012, the production of services related to agriculture amounted to 8,013 million euro with an increase of 4.2% compared to 2011.

In the UE, the agricultural year 2012 was characterized by a positive change in the value of output at basic prices (+3.3%), compared to 2011, as a result of an increase in prices (+6.6%) and a decrease in production volumes (-3.1%). The decline has affected most of the crops and especially the wine (-15.4%), potatoes (-14.7%), maize (-13.4%), tobacco (-8.4%) and fresh fruit (-7.7%). Livestock sector production is in slight decrease (-0.6%). In particular meat production reduces (-1%) compared to 2011, while milk production is stationary (+0.3%).

Output of goods and services in agriculture at basic prices - values at current prices (million euro), 2012



[1] Dried legumes (101.9 million euro).

[2] Potatoes (662 million euro) and fresh beans (293 million euro).

[3] Sugar beets (116 million euro) Tobacco (219 million euro) Sunflowers (59 million euro) Soybeans (144 million euro).

[4] Of which honey (36.0 million euro).

Source: ISTAT.

Milk availability in Italy in 2012 (1000 T). Source “Il mercato del latte”, Rapporto 2013.

Cattle milk		
	Total production	11,526.6
	Total raw milk to industry	13,642,8
	For fresh products	3,205,1
	For industrial cheeses	10,446.2
	For other products	1.1
	Total milk use	13,652,4
Sheep milk		
	Total production	622.4
	Milk processed on farm	123.9
	For lambs nutrition	140.0
	Total raw milk to industry	358.5
Goat milk		
	Total production	201.5
	Import for industry	22.0
	Total available milk	223.5
	Milk processed on farm	43.3
	For kids nutrition	51.0
	Total raw milk to industry	129.2
	For fresh products	8.1
	For industrial cheeses	107.2
	Total industrial use	115.3
Buffalo milk		
	Total production	256.6
	Milk processed on farm	8.0
	For calves nutrition	14.2
	Total raw milk to industry	234.4
	Total industrial use (cheese)	234.4

Cheese production in Italy in Tons (2012)

Hard cheeses			**369,397.3**
	of which	Grana Padano	178,906
		Parmgiano Reggiano	136,919
		Pecorino Romano	25,453
		Montasio	6,898
Semi-hard cheeses			**176.351**
	of which	Asiago	23,362

		Provolone V.	6,957
Soft cheeses			**643,714**
	of which	Gorgonzola	49,803
		Taleggio	8,327
		Quartirolo	3,736
		Fresh cheeses	484,615
TOTAL			**1,189,462.3**
	of which	PDO	494,374.3

FARMS

The 6th general Agricultural Census shows a structural framework characterized by a strong decrease of farms (-32.4%) compared to 2000 and a more modest decline in total farm area (-9%) and UAA (-2.5%). The phenomenon is the result of a multiyear process during which agricultural lands and farms were concentrated in a substantially smaller number of farms. It has brought to an increase of the average farm's UAA that grows from 5.5 to 7.9 hectares.

Although there has been an increase in companies of larger size (>30 hectares), Italian agriculture continues to be characterized by a very large number of very small companies that affect the economic performance of the sector. Companies with a standard value production of less than 8,000 euro represent 62% of the total farms and they account for only 5.3% of the total standard production of domestic agriculture. It's clear that companies that have an economic weight so modest, although they have an important role for the care and protection of the environment and landscape, are mainly aimed at the production for selfconsumption or other ancillary functions such as hobbies and recreational activities rather than commercial purposes.

Only 310,000 companies (19% of the total) can be considered real "business". These companies account for almost 90% of the value of the Italian standard production (whose total value amounts to approximately 49 billion and 500 million euro).

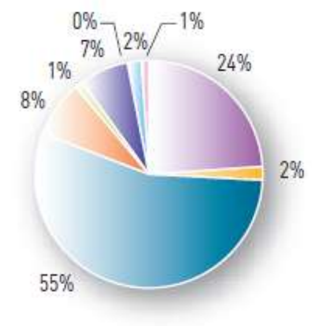
SPECIALIZATION

More than 81% of total farms is specialized in vegetable crops and produces 55% of the Italian standard agricultural production. About 8.6% is specialized in livestock but represents 37% of total standard production, thus showing the best economic performance. Mixed farms (with crops and livestock), together with those unclassifiable, do not reach 10.4% of the total and achieve 8% of the standard production.

The companies that are specialized in permanent crops (vines, olive trees, groves and citrus trees) represent up to 55% of the total and 28% of the total standard production. Then, there are companies specialized in arable crops (384,000) that account for 16% of the national agricultural standard production. Companies specialized in the breeding of granivorous account for 18% of the total standard production, although they represent only 0.8%. On average, the standard production of the granivorous accounts for 960 million euro per farm, against 15.4 million of the permanent, 23.5 million of arable crops and 28.6 of the mixed farms. Even the horticultural farms are particularly profitable, they are only 37,000 but they achieve an average standard production of 113 million euro.

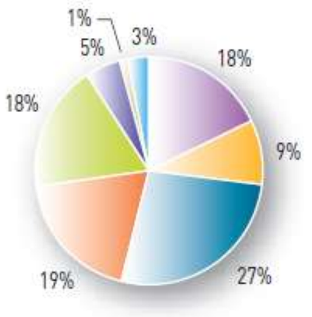
The national average value of the standard production amounted to 30,514 euro but only 7 regions, mainly northern (except for Tuscany and Sardinia), exceed this average. Among these, it is the value of Lombardy which stands out for the presence of great livestock companies (136,979 euro).

% distribution of farms and standard output by type of farm, 2010



NUMBER OF FARMS

Specialized in arable crops	383,761
Specializzate in horticulture	37,798
Specialized in permanent crops	891,401
Specialized in herbivorous	129,493
Specialized in granivorous	9,358
Polyculture	105,449
Mixed livestock	4,237
Mixed livestock and polyculture	35,587
Not classified	23,800

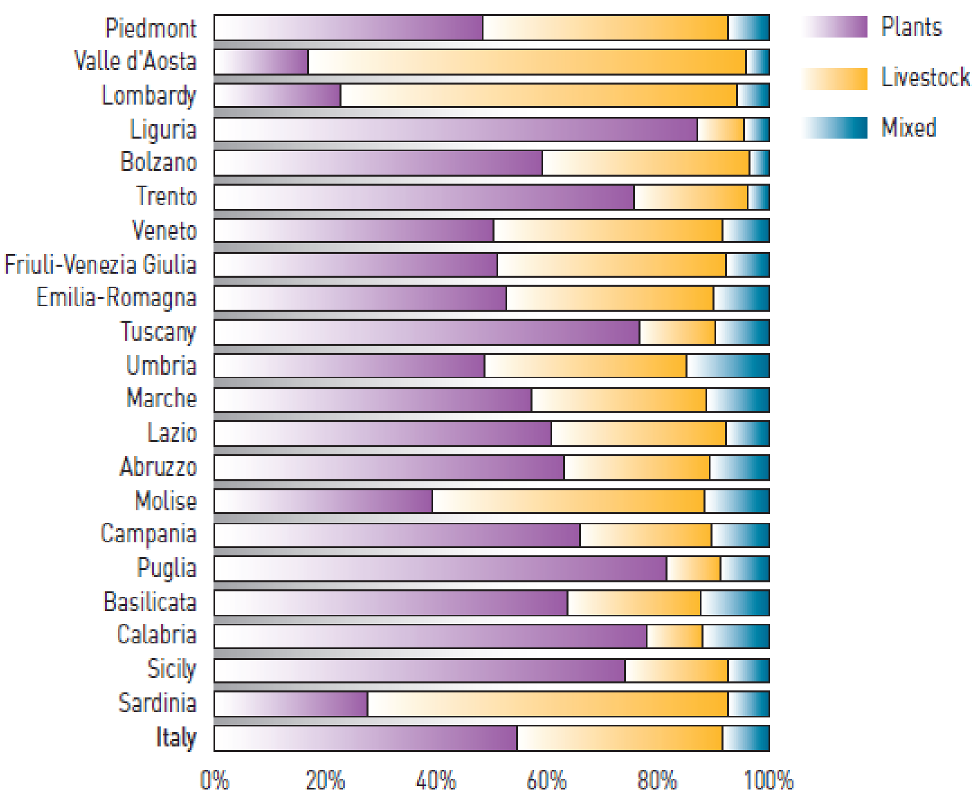


STANDARD OUTPUT

Specialized in arable crops	8,991,810,382
Specializzate in horticulture	4,268,038,822
Specialized in permanent crops	13,724,503,662
Specialized in herbivorous	9,341,279,898
Specialized in granivorous	8,979,335,586
Polyculture	2,296,925,382
Mixed livestock	429,766,102
Mixed livestock and polyculture	1,428,669,899

Source: ISTAT, 6th Agricultural Census.

% composition - standard output, 2010



Source: ISTAT, 6th Agricultural Census.

THE LIVESTOCK SECTOR

Farms involved in the livestock sector are 217.449 units, and they are equally distributed among the three main geographical areas, even if we can point out relevant regional specializations. On the whole these farms breed 9.957.384 LU20 (See table 3.6).

The main concentration of livestock is in the regions of the Northern part of Italy (in particular Lombardia are bred a number of 2,7 million LU, in Veneto 1,4 million, in Emilia-Romagna 1,2 and in Piemonte 1), where most of the farms for cattle, pigs and poultry breeding are located (in all the regions of the area – with the exeption of Liguria – the LU of these species overcome the 90% of the whole), on the contrary, in Centre, Sud and Insular area, farms are still focused on sheep and goats and water buffalo breeding.

Among these regions, Sardegna, Toscana, Calabria and Basilicata cover more of the 25% of total amount of sheep and goats in terms of UBA, in Sardegna, particularly the maximum rate of LU breed, 0,6 million of units, and the maximum on national basis for these species in terms of LU (56% of the total).

The dimension of livestock farms, in terms of LU bred, differ a lot on National basis, with important concentrations in some Provinces: given 48 as the national average of LU per farm, the 25% of Regions and the 25% of the Provinces are above the average.

These Provinces are located in the Northern part of Italy, on the other hand among the Regions of the Southern part of Italy, Calabria, Basilicata and Sardegna shows figures below the average for all the Provinces.

At regional level, the maximum value is registered in Lombardia with 128 LU (the province of Cremona distinguish itself with 315 LU), followed by Emilia-Romagna with 100 LU.

All the Regions of Center, Southern and Insular area are ranked below Umbria Region that represents the averag with 40 LU per farm.

Generally speaking the presence of cattle and water buffalo breeding farms influence the figures above mentioned: cattle and water buffalo breeding, is the leading specialization of the livestock sector, because, in term of LU, the two species represents the 44% of livestock species, bred in farms.

In terms of units, cattle and water buffalo present in farms are an average of 47 units. The highest figure belongs to Lombardia with an average of 101 units (Cremona Province 246 units), the lowest figure belongs to Liguria with an average of 13 units; at Provincial level the minimum figure of 5 units, belogs to Massa-Carrara.

The pig breeding sector is the second in Italy in terms of LU bred, representing the 24,7% of the total. This sector shows a very distinct concentration leading to big issues in managing the sewage.

The maximum amount of pig units per farm is registered in Lombardia (1.801 units), where in particular in Mantova Province the number of units grows up to the figure of 3.267, whilst the minimum of units are registerd in Liguria with 7 units per farm (in Imperia Province 7 units per farm are bred). Southern Regions do not exceed the 177 units registered in Basilicata.

The analysis of the distribution at National level of LU of pigs, shows that the 30% of Regions and the 21% of the Provinces exceed the national average value.

All the Provinces of Abruzzo, Molise, Campania, Basilicata, Calabria, Sicilia show values below the national average; the same happens for Lazio (Center). The highest value is registered in Lombardia, where pigs reach the 45% of LU bred (in Pavia Province the value is 70,5%) and the lowest value is registered in Valle d'Aosta (0,2%)

At national level poultry come sas the third sector of livestock farming, for what concerns LU in production, with the 21,5% of the entire sector.

In this case too, the production over the years has been concentrated and the farms have assume more and more a professional attitude.

The average units per farm in Italy is 6.993. Emilia-Romagna is the leading Region with an average of 28.853 units. At Regional level the Province Forlì-Cesena has the highest number of units per farm (87.746). The lowest value is registered, again as for pig farming, in Valle d'Aosta with an average of 32 units per farm.

At last the sheep and goat farming has an incidence on the sector of 7,7% in terms of LU per farm. In this case the concentration of the farms is not so evident as in the other species above mentioned.

In 2010, the average units per farm is 126. The sheep and goat sector is mainly concentrate in farms placed in the Southern, Center and Insular area, where the highest average values are registered (the highest value is registered In Sardegna with an average of 236 units per farm, and amongst the Provinces Sassari is the one with the highest value with an average of 286 units per farm), compared to the North, where the average units per farm is never higher than 73 (Veneto). Once again the lowest average value belongs to Valle d'Aosta with 20 units per farm.

The following tables show the livestock consistency per species, categories and Regions

Cattle under 2 years

Region	For veal production	Others			Males	Females		
		Males	Females	Total		For fattening	For replacement	Total
Piemonte	49.010	80.179	95.948	225.137	96.345	33.129	69.427	198.901
Valle d'Aosta	1.076	2.014	2.726	5.816	668	0	5.620	6.288
Lombardia	215.401	81.796	192.367	489.564	74.759	39.234	178.305	292.298
Liguria	384	1.574	648	2.606	128	0	2.001	2.129
Trentino Alto Adige	2.705	6.840	26.179	35.724	9.666	2.118	36.279	48.063
Veneto	88.996	82.251	73.655	244.902	197.670	59.510	53.938	311.118
Friuli Venezia-Giulia	3.902	3.224	20.230	27.356	2.736	17.633	16.358	36.727
Emilia- Romagna	21.100	20.420	103.305	144.825	28.376	6.615	111.864	146.855
Toscana	4.724	6.728	8.211	19.663	13.382	2.379	7.852	23.613
Umbria	3.621	7.639	7.390	18.650	8.413	1.163	5.451	15.027
Marche	2.109	4.691	6.374	13.174	5.503	1.479	4.258	11.240
Lazio	16.044	14.482	25.572	56.098	11.049	5.022	26.420	42.491
Abruzzo	6.542	9.535	10.581	26.658	1.963	864	7.744	10.571
Molise	3.125	7.680	5.170	15.975	5.583	290	4.942	10.815
Campania	15.062	19.142	31.102	65.306	16.090	2.891	30.266	49.247
Puglia	16.734	9.319	23.030	49.083	17.127	698	32.791	50.616
Basilicata	4.549	4.801	6.230	15.580	7.617	780	12.147	20.544
Calabria	4.389	3.591	12.755	20.735	2.330	1.546	19.802	23.678
Sicilia	16.665	22.237	35.359	74.261	15.201	2.330	35.241	52.772
Sardegna	7.418	19.690	30.689	57.797	5.235	2.588	13.725	21.548
Total	483.556	407.833	717.521	1.608.910	519.841	180.269	674.431	1.374.541

Total cattle (2013)

Region	Cattle over 2 years							Total cattle
		Females						
	Males	Beef heifers	Replacement heifers	Dairy cows	Beef cows	Total		
Piemeonte	17.048	17.408	72.703	163.788	83.013	353.960		777.998
Valle d'Aosta	303	164	4.750	21.860	518	27.595		39.699
Lombardia	10.885	7.339	82.678	456.464	21.864	579.230		1.361.092
Liguiria	0	387	1.671	2.856	631	5.545		10.280
Trentino Alto Adige	2.168	3.865	24.863	116.866	5.112	152.874		236.661
Veneto	6.227	9.174	57.112	186.931	19.368	278.812		834.832
Friuli Venezia-Giulia	326	1	2.893	36.720	412	40.352		104.435
Emili- Romagna	13.310	8.208	69.130	303.023	20.662	414.333		706.013
Toscana	4.477	2.246	7.553	13.201	15.844	43.321		86.597
Umbria	1.875	830	4.387	10.287	5.074	22.453		56.130
Marche	978	1.492	4.752	6.023	9.022	22.267		46.681
Lazio	2.938	7.853	22.314	68.767	13.625	115.497		214.086
Abruzzo	683	521	5.219	26.205	3.984	36.612		73.841
Molise	2.473	4	1.222	18.666	676	23.041		49.831
Campania	4.914	2.344	22.975	80.518	21.206	131.957		246.510
Puglia	4.707	2.004	19.455	101.639	13.416	141.221		240.920
Basilicata	4.915	2.701	6.077	38.178	11.416	63.287		99.411
Calabria	2.430	2.468	27.143	18.963	13.519	64.523		108.936
Sicilia	4.553	1.467	30.775	131.171	20.754	188.720		315.753
Sardegna	3.555	2.038	40.832	60.001	51.195	157.621		236.966
Total	88.765	72.514	508.504	1.862.127	331.311	2.863.221		5.846.672

Buffalos (2013)

Region	Cows	Other buffalos	Total buffalos
Piemeonte	49	0	49
Valle d'Aosta	0	0	0
Lombardia	1.863	1.679	3.542
Liguiria	0	0	0
Trentino Alto Adige	0	0	0
Veneto	607	350	957
Friuli Venezia-Giulia	39	0	39
Emili- Romagna	273	136	409
Toscana	22	26	48
Umbria	0	20	20
Marche	38.105	11.604	49.709
Lazio	52.389	16.855	69.244
Abruzzo	0	0	0
Molise	745	0	745

Campania	136.442	129.794	266.236
Puglia	5.955	44	5.999
Basilicata	287	143	430
Calabria	271	0	271
Sicilia	1.610	844	2.454
Sardegna	2.507	0	2.507
Total	241.164	161.495	402.659

Region	Piglets under 20 kg	Piglets 20 to 50 kg	50 to 80 kg	80 to 110 kg	Over 110 kg	Boars	Mounted sows	Mounted 1st time	Other sows	Not mounted sows	Total sows	Total
Piemeonte	137.621	185.993	153.929	158.892	230.461	1.510	49.831	7.399	11.323	4.038	72.591	940.997
Valle d'Aosta	0	0	0	0	232	204	0	0	0	0	0	436
Lombardia	763.472	713.873	675.945	689.129	954.270	3.896	208.743	30.995	45.889	21.465	307.092	4.107.677
Liguiria	113	57	57	113	284	57	170	57	0	0	227	908
Trentino Alto Adige	2.444	2.199	2.190	2.602	6.645	0	253	0	0	0	253	16.333
Veneto	168.675	126.906	80.151	71.430	109.501	1.424	30.559	5.053	7.566	1.939	45.117	603.204
Friuli Venezia-Giulia	35.444	56.451	34.509	36.784	58.653	778	8.950	1.215	2.046	154	12.365	234.984
Emili- Romagna	197.631	252.710	166.021	320.808	528.693	1.552	75.142	15.445	28.160	21.071	139.818	1.607.233
Toscana	8.180	47.593	9.362	30.488	44.997	303	3.127	25	387	21	3.560	144.483
Umbria	39.906	30.088	26.739	19.699	42.079	758	10.441	708	1.011	254	12.414	171.683
Marche	42.660	38.319	14.300	39.754	31.725	2.274	11.310	973	1.088	157	13.528	182.560
Lazio	5.343	4.014	2.917	6.980	39.952	1.385	1.816	272	697	26	2.811	63.402
Abruzzo	3.406	15.263	24.422	12.869	32.892	522	9.621	1.191	2.172	1.674	14.658	104.032
Molise	0	1.217	9.208	3.320	16.173	0	260	0	0	0	260	30.178
Campania	4.528	17.780	7.698	15.177	51.059	317	3.789	27	126	37	3.979	100.538
Puglia	6.933	6.398	1.818	3.683	19.576	121	6.681	3.944	133	4	10.762	49.291
Basilicata	2.731	26.473	10.175	38.438	6.610	1.208	4.303	2.535	580	51	7.469	93.104
Calabria	2.427	1.070	933	9.151	21.271	7.117	9.270	6.431	6.787	6.402	28.890	70.859
Sicilia	1.194	699	10.688	2.756	3.395	1.854	3.729	240	2.545	854	7.368	27.954
Sardegna	27.368	18.840	17.085	10.111	23.508	7.799	25.214	2.735	16.559	433	44.941	149.652
Total	1.450.076	1.545.943	1.248.147	1.472.184	2.221.976	33.079	463.209	79.245	127.069	58.580	728.103	8.699.508

Region	Sheep	Goats
Piemeonte	119.989	76.463
Valle d'Aosta	1.720	3.826
Lombardia	106.647	109.880
Liguiria	13.699	13.755
Trentino Alto Adige	64.509	22.708
Veneto	47.759	15.791
Friuli Venezia-Giulia	8.290	3.302
Emili- Romagna	88.835	13.742
Toscana	426.895	19.024

Umbria	229.227	4.681
Marche	136.551	4.179
Lazio	706.581	34.424
Abruzzo	181.174	23.389
Molise	71.426	7.904
Campania	187.416	39.918
Puglia	263.975	46.834
Basilicata	298.461	70.060
Calabria	247.967	113.728
Sicilia	713.883	151.539
Sardegna	3.266.824	200.711
Total	7.181.828	975.858

The next table shows the average consistency of the different species present in farms in the different regions

	average units per farm			
Region	**cattle/w.buffalo**	**sheep&goats**	**pigs**	**poultry**
Piemonte	62	48	929	6.247
Valle d'Aosta	28	20	8	32
Liguria	13	28	7	167
Lombardia	101	54	1.801	11.065
Trentino-Alto Adige	18	29	19	1.507
Veneto	59	73	445	15.677
Fruli-Venezia Giulia	44	64	369	17.733
Emilia-Romagna	76	57	1.058	28.853
Toscana	25	174	92	1.205
Umbria	23	71	251	10.457
Marche	18	140	115	5.571
Lazio	31	183	86	3.190
Abruzzo	20	69	48	4.479
Molise	19	68	43	10.509
Campania	43	58	46	2.474
Puglia	46	135	56	2.113
Basilicata	34	83	177	824
Calabria	20	78	23	531
Sicilia	37	139	62	7.734

Sardegna	32	236	35	1.564

TREND IN LIVESTOCK PRODUCTION

Among livestock production systems, farms specialized in the breeding of grainfed animals stand out for the exceptional economic results achieved compared to other livestock farms.

The sector is characterized by large industrial farms which explain such results: the average size of livestock farms exceeds five times the average recorded by the dairy cattle sector and almost 8 times the average of farms specialized in the breeding of sheep and goats. The dairy cattle sector and the mixed-breeding farms show, on average, the larger number of cattle and workers to carry out their activities. These sectors record higher values in productivity and profitability compared to farms that breed sheep and goats as well as mixed cattle which, on the contrary, appear to have the most extensive agricultural area and a reduced number of cattle per hectare. In particular, the average density of livestock, in farms with sheep and goats and mixed cattle, amounts respectively to 0.8 units/hectare and to 1.4 units/hectare in the mixed-breeding farms and it amounts to 2.5 units/hectare in the dairy cattle farms.

The farms breeding sheep and goats, although penalized on economic performance, show to be the most efficient in terms of income on the Gross Saleable Production (46%), thanks to the containment of current costs (33% of the Gross Saleable Production).

In the northern regions the best economic performance is achieved by the livestock farms, with the exception of the sheep and goat farms which excel in the southern regions and Islands.

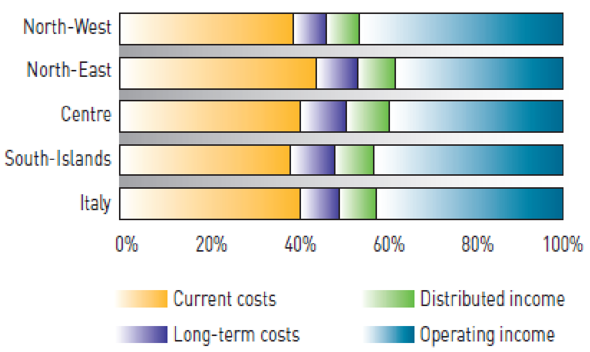
Structural and economic data by geographical area; dairy cattle TF: 2011

	UAA	LU	AWU	GSP/HA	GSP/LS	GSP/AWU	NI/FWU
	ha	n.		euro			
North-West	42.1	109.2	2.2	7,252	2,793	141,612	81,676
North-East	22.1	57.7	1.8	7,088	2,714	86,718	40,738
Centre	27.1	67.9	2.0	5,556	2,217	76,857	40,998
South-Islands	21.6	49.2	1.8	4,770	2,093	57,737	30,523

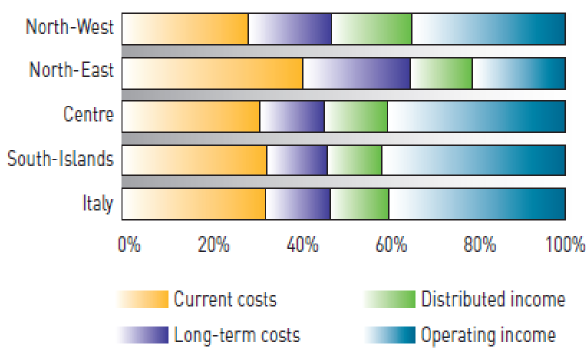
Structural and economic data by geographical area, goat and sheep TF: 2011

	UAA	LU	AWU	GSP/HA	GSP/LS	GSP/AWU	NI/FWU
	ha	n.		euro			
North-West	53.5	31.3	1.2	700	1,197	32,213	12,173
North-East	9.8	13.0	0.9	2,079	1,571	21,684	4,726
Centre	32.6	35.3	1.3	1,389	1,282	34,528	16,380
South-Islands	50.7	42.4	1.4	999	1,195	36,901	20,739

Farms specializing in dairy cattle: % composition of GSP, 2011



Farms specializing in goat and sheep: % composition of GSP, 2011



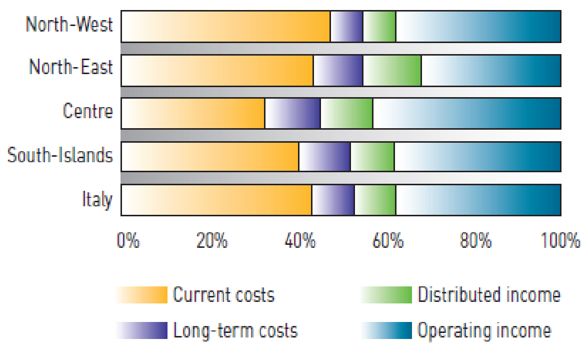
Structural and economic data by geographical area, mixed cattle TF: 2011

	UAA	LU	AWU	GSP/HA	GSP/LS	GSP/AWU	NI/FWU
	ha	n.		euro			
North-West	25.1	49.0	1.5	3,262	1,672	54,555	17,321
North-East	22.9	42.1	1.4	3,675	1,994	58,206	26,702
Centre	31.1	38.8	1.4	1,849	1,478	39,788	18,553
South-Islands	42.7	44.8	1.4	1,220	1,161	38,493	21,788

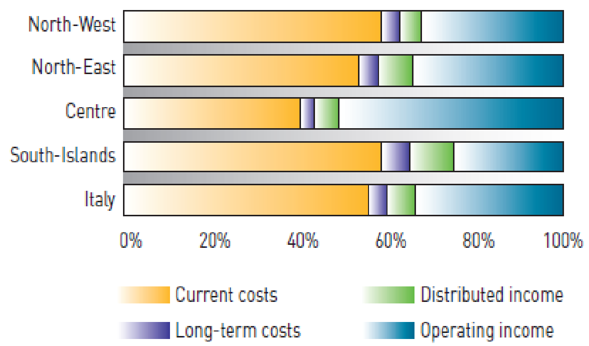
Structural and economic data by geographical area, granivorous TF: 2011

	UAA	LU	AWU	GSP/HA	GSP/LS	GSP/AWU	NI/FWU
	ha	n.		euro			
North-West	33.7	606.3	2.4	17,288	962	243,138	84,345
North-East	20.0	239.0	2.5	17,423	1,458	138,905	66,642
Centre	19.6	108.3	2.0	13,721	2,482	132,891	89,094
South-Islands	11.1	78.9	1.8	12,509	1,767	78,141	29,438

Farms specializing in mixed cattle: % composition of GSP, 2011



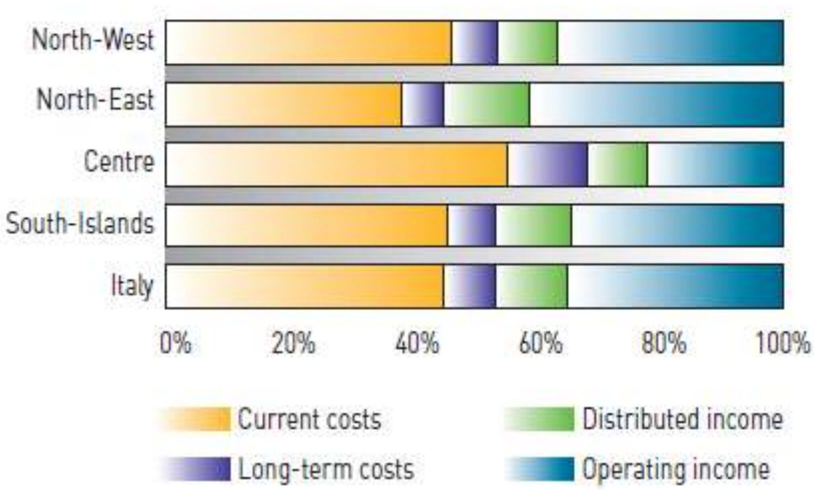
Farms specializing in granivorous: % composition of GSP, 2011



Structural and economic data by geographical area, mixed livestock TF: 2011

	UAA	LU	AWU	GSP/HA	GSP/LS	GSP/AWU	NI/FWU
	ha	n.		euro			
North-West	36.0	111.1	1.7	5,353	1,732	112,755	43,524
North-East	26.1	63.6	3.1	7,993	3,282	68,059	33,556
Centre	26.3	25.7	1.6	3,130	3,198	52,208	13,814
South-Islands	32.5	26.9	1.7	1,775	2,148	34,947	15,885

Farms specializing in mixed livestock: % composition of GSP, 2011



OUTPUT AND INCOME

In 2011, Italian farms (FADN database) recorded an average gross production of 56,597 euro, which corresponds to a net income of 22,478 euro, as a labour compensation of entrepreneur and his family.

The best results are achieved by the farms of the northern regions. In these areas the productivity and the profitability, both in absolute terms and per hectare and per worker, are marking values higher than the national average. Such results are explained by the predominance of livestock farms in the North, generally with high economic value, together with a greater presence of intensive farming.

In particular, in the North-East are located large industrial poultry farms, while in the North-West there are pig fattening farms. The farms located in the North-West have a wider agricultural surface (28.3 hectares as against the national average of 16.5), which contributes to the achievement of good economic results.

The farms in the South, including Islands, while recording the lowest values for productive efficiency, gain in terms of net income on the production: they achieve a net income that represents 42% of production against a value that does not reach even 40% of the Gross Saleable Production (GSP) in other districts. This result is primarily due to lower current costs, the main item of business expense, compared to the value of production: current costs account for 34% on the GSP compared to over 41% in the northern businesses.

Structural and economic indicators by geographical area, 2011

	GSP/HA	GSP/LU	GSP/AWU	NI/FWU	NI/GSP (%)	NI/HA	NI/LU
North-West	4,785	3,009	70,686	29,801	37.6	1,801	1,133
North-East	5,474	6,899	60,289	28,354	39.5	2,162	2,725
Centre	3,103	8,180	41,468	19,033	37.3	1,157	3,050
South and Islands	2,715	6,354	34,312	19,675	42.0	1,141	2,670
Italy	**3,608**	**5,352**	**45,920**	**23,087**	**39.7**	**1,433**	**2,126**

Structural data and main economic results by geographical area, farm averages, 2011

	UAA	LU	AWU	FWU	GSP	Current costs	Long-term costs	Distributed income	Off-farm management	Net income
	ha	n.			euro					
North-West	20.6	32.6	1.4	1.2	97,892	41,253	7,575	10,005	-2,118	36,941
North-East	14.2	11,3	1.3	1.1	77,800	32,382	5,386	9,714	412	30,729
Centre	17.9	6.8	1.3	1.1	55,560	20,422	6,105	8,791	438	20,680
South and Islands	14.5	6.2	1.1	0.8	39,269	13,441	3,094	6,719	482	16,498
Italy	**15.7**	**10.6**	**1.2**	**1.0**	**56,597**	**21,683**	**4,548**	**8,025**	**137**	**22,478**

1 Gross Saleable Production (GSP) includes, in addition to revenues from sales of products, those activities related to agriculture, as well as payments under the first pillar of the CAP. By subtracting current costs (consumption, miscellaneous expenses and third-party services), long-term costs (depreciation and amortization), distributed income (wages, social charges and passive rents), operating income is the result; adding off-farm management (financial and extraordinary management together with public transfers into capital accounts, rural development and state funds), we obtain net income.

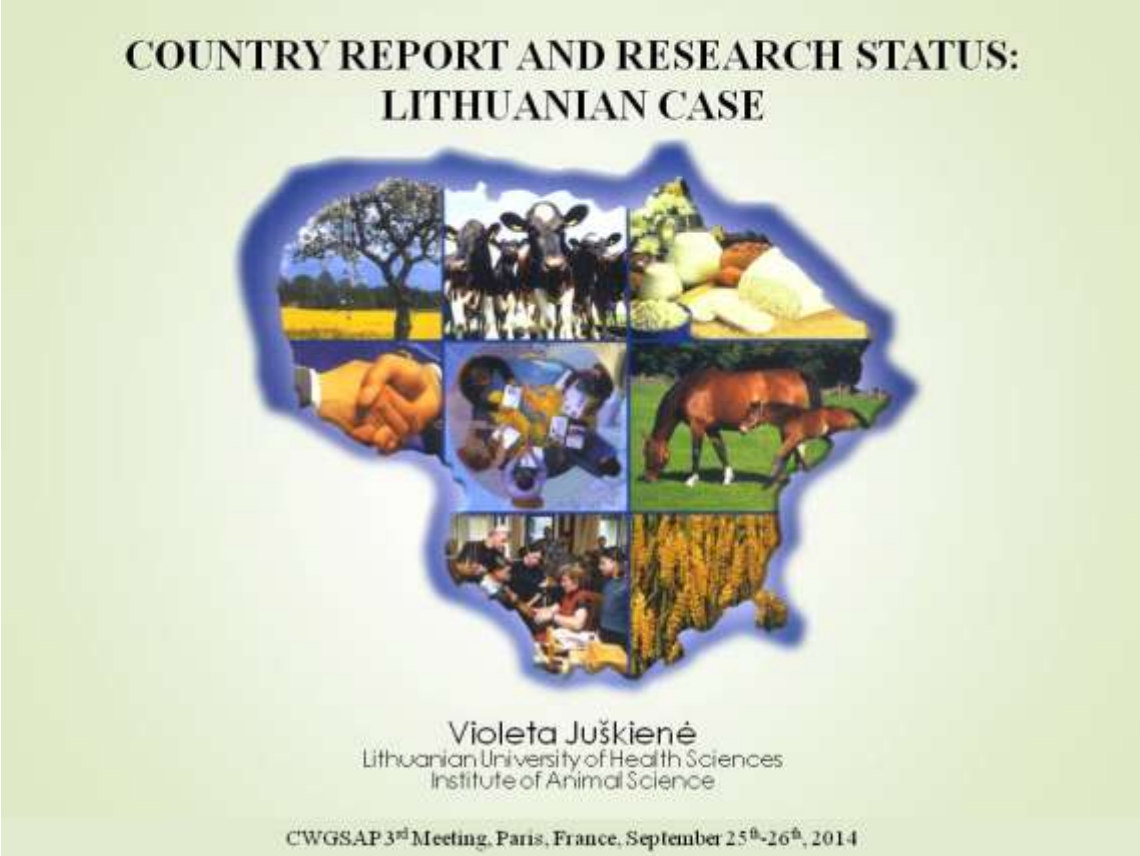
Structural data and main economic results by type of farm, averages 2011

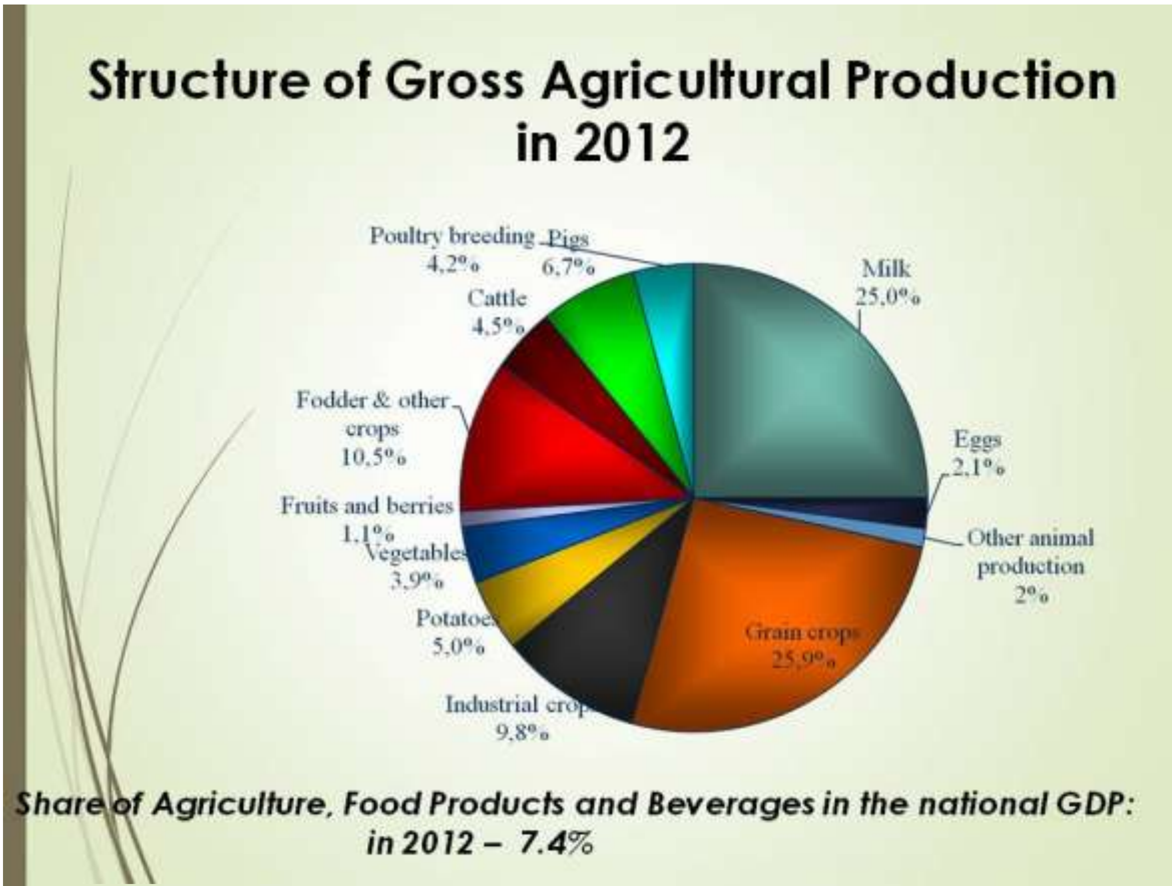
		UAA	LU	AWU	FWU	GSP	Current costs	Long-term costs	Distributed income	Off-farm management	Net income
		ha	n.			euro					
Vegetables	Cereal	23.2	0.1	0.9	0.9	45,518	19,868	3,303	5,543	-988	15,815
	Horticulture	3.7	0.1	2.4	1.4	136,966	57,715	6,410	21,789	-1,832	49,220
	Fruit	6.4	0.1	1.2	0.9	39,913	10,382	3,279	7,719	-248	18,286
	Wine	7.9	0.2	1.2	0.9	43,672	13,565	4,445	7,607	576	18,630
	Olive	6.7	0.0	1.0	0.7	24,995	6,557	1,751	5,758	380	11,308
Livestock	Dairy cattle	26.6	66.4	1.9	1.6	168,266	68,412	14,857	13,840	2,235	73,392
	Sheep and goats	44.6	37.6	1.3	1.2	45,875	14,830	6,673	6,023	2,874	21,223
	Mixed cattle	31.9	45.3	1.4	1.3	68,163	29,458	6,666	6,446	707	26,300
	Granivorous	22.6	311.5	2.2	1.7	370,625	205,505	16,267	23,203	-9,976	115,675
	Mixed livestock	30.2	47.0	1.9	1.7	114,600	51,559	9,516	13,280	233	40,478

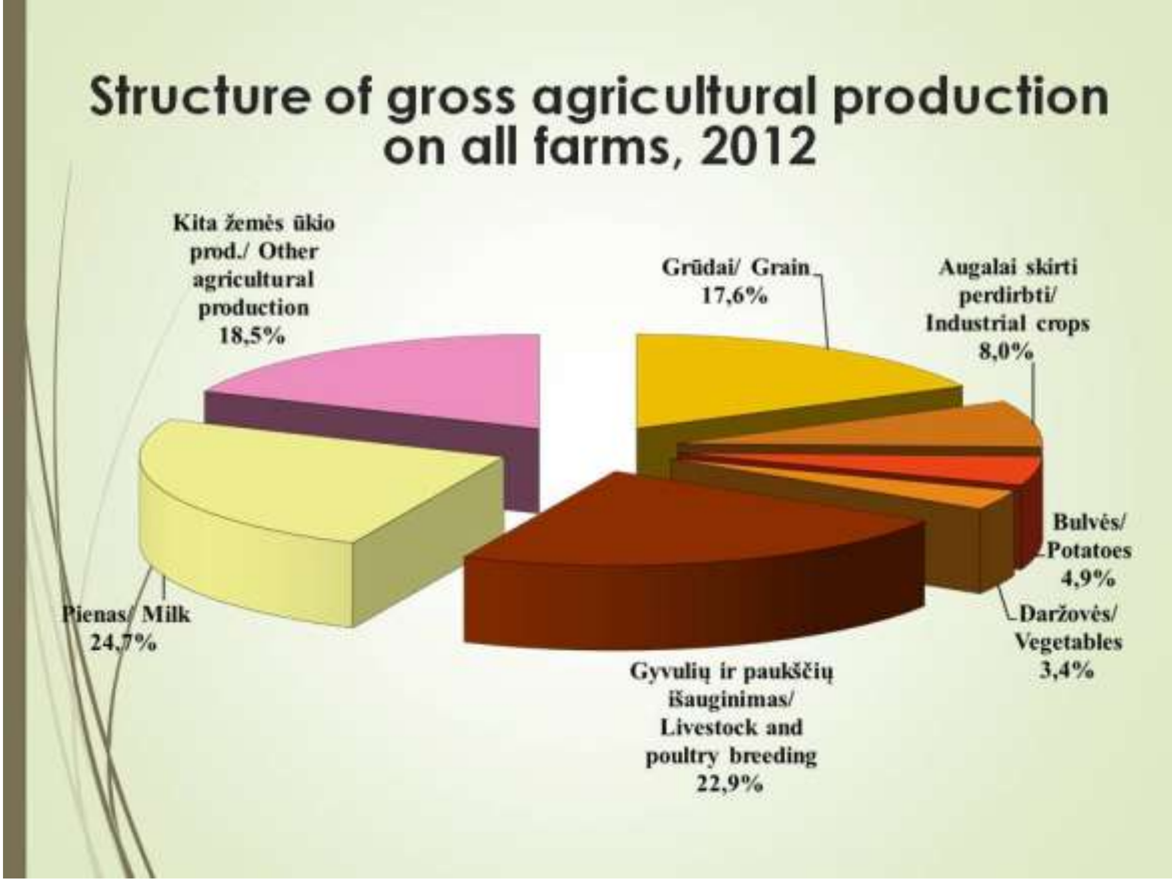
Structural and economic indicators by type of farming, 2011

		GSP/HA	GSP/LU	GSP/AWU	NI/AWU	NI/GSP (%)	NI/HA	NI/LU
Vegetables	Cereal	1,961	366,033	50,344	18,544	35	681	127,174
	Horticulture	37,050	2,218,855	56,353	34,439	36	13,314	797,364
	Fruit	6,271	595,166	32,985	20,283	46	2,873	272,676
	Wine	5,549	213,683	37,571	20,749	43	2,367	91,157
	Olive	3,756	4,430,696	25,447	15,945	45	1,699	2,004,463
Livestock	Dairy cattle	6,334	2,535	89,343	47,204	44	2,763	1,106
	Sheep and goats	1,028	1,219	35,168	18,155	46	475	564
	Mixed cattle	2,139	1,504	47,510	19,865	39	825	580
	Granivorous	16,429	1,190	164,802	69,741	31	5,128	371
	Mixed livestock	3,799	2,440	59,924	24,446	35	1,342	862

2.5.11 Lithuania




Structure of Gross Agricultural Production in 2012
Poultry breeding 4,2%
Pigs 6,7%
Cattle 4,5%
Milk 25,0%
Fodder & other crops 10,5%
Eggs 2,1%
Fruits and berries 1,1%
Vegetables 3,9%
Other animal production 2%
Potatoes 5,0%
Grain crops 25,9%
Industrial crops 9,8%
Share of Agriculture, Food Products and Beverages in the national GDP:
in 2012 – 7.4%


Structure of gross agricultural production on all farms, 2012
Kita žemės ūkio prod./ Other agricultural production 18,5%
Grūdai/ Grain 17,6%
Augalai skirti perdirbti/ Industrial crops 8,0%
Bulvės/ Potatoes 4,9%
Pienas/ Milk 24,7%
Daržovės/ Vegetables 3,4%
Gyvulių ir paukščių išauginimas/ Livestock and poultry breeding 22,9%

ANIMAL RESEARCH IS DONE BY:

LUHS INSTITUTE OF ANIMAL SCIENCE
R. Žebenkos 12, LT-82317 Baisogala

LUHS VETERINARY ACADEMY
Tilžės g. 18, LT-47181 Kaunas

Main Funds for Agricultural science

Programme for Rural Development:
- Funds for Applied research:
  2011-2014 ~ 4,86 mln.Lt/1,41 mln. EUR of which19.6 % for Animal research
- Funds for Demonstrational Trials:
  2007-2013 ~ 34,1 mln.Lt/9,87 mln.EUR of which 41.6 % for Livestock.

National Priority Programmes:
- "Healthy and Safe Food",
- "Climate Change".

EU Programmes, Bilateral Projects, Company's Orders

Funds for Research Infrastructures

7

Cluster -Valley "Nemunas"

Education, Science and Business Center

2002-2015

140 mln. Lt/48,2mln.EUR

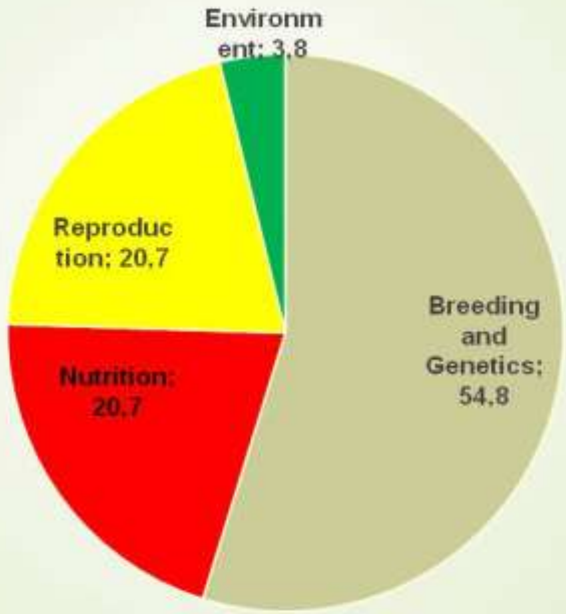
Participating Research and Education Institutions:

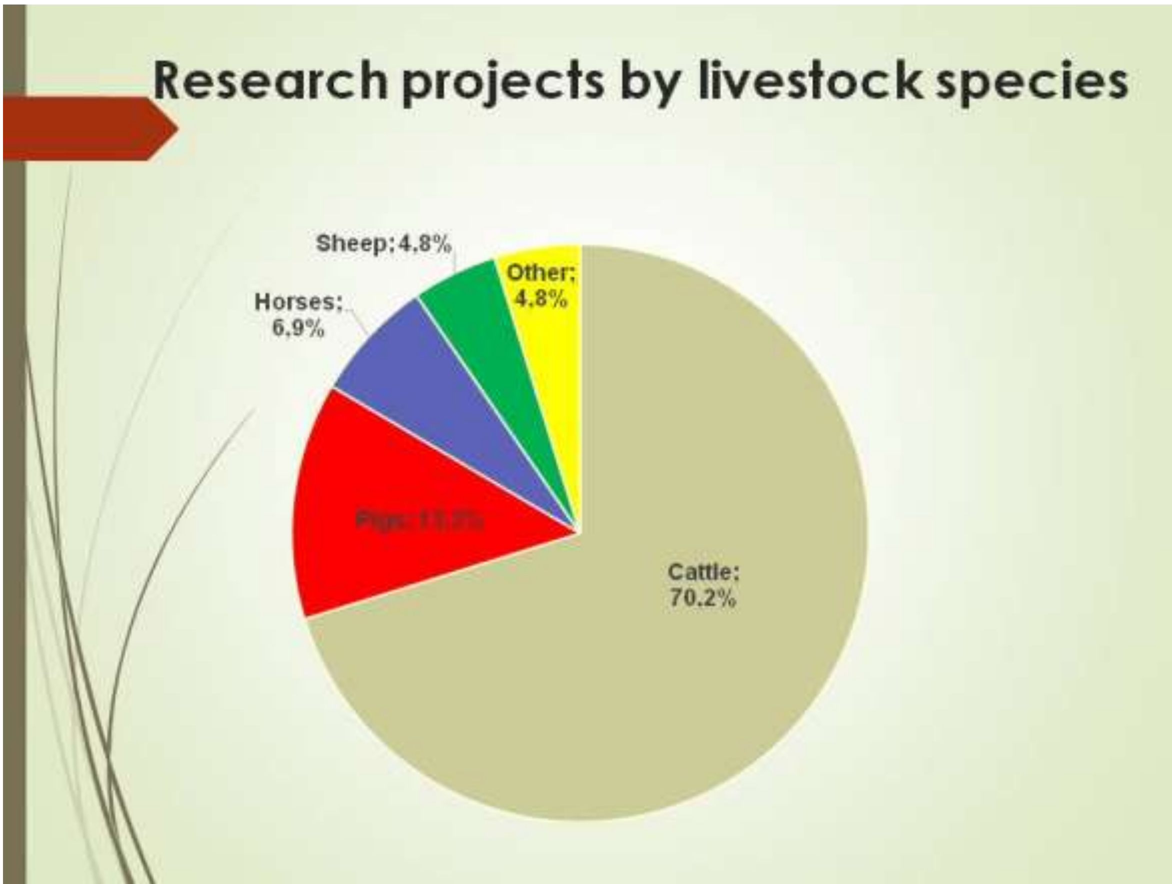
Lithuanian University of Health Sciences,

Stulginskis University,

Lithuanian Research Centre of Agricultural and Forestry Sciences.

Research projects funded in 2011-2014, %




Research projects by livestock species
Sheep; 4,8%
Other; 4,8%
Horses; 6,9%
Cattle; 70.2%


Research Topics in Ruminants
Meat; 11,4%
Breeding and Genetics; 22%
Milk; 22,7%
Reproduction; 14,4%

2.5.12 Luxemburg

2.5.13 Luxemburg

Status Quo « Where are we »

- Overview
  - importance of agriculture in total
  - regional distinctions / specifics
  - number of farms, average size (ha), staff (self-employed, hired)
- Description of livestock sector
  - background / history / traditional knowledge
  - importance, share of total sector
  - number of farms, average size (ha), staff (self-employed, hired)
  - species in livestock production, ranking
  - main / most important species:
  - total number, average herd size, tendency to raise or decline, why
  - main areas / regional concentration
  - husbandry systems
  - products, output
  - main topics / problems with regard to sustainable animal production
- Linkage to other reports, groups
- Funding in animal production research
- Miscellaneous

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Importance of agriculture in total

- Land use (2007)
  - Agricultural land: 50,8%
  - Forests and semi-natural surfaces: 37,7%
  - Built-up area: 11,0%
  - Wetlands and water area: 0,5%
- Importance of agriculture in the economy of Luxembourg (2011)
  - Gross value added for agriculture at basic prices in mio € : 130,3 (0,3% of the total economy)
  - Total agricultural labour input (x 1 000): 3,7 (1,0% of total labour)
- Importance of the food industry in the economy of Luxembourg (2011)
  - Gross value added for products from agriculture and the food industry at basic prices in mio €: 287,8 (0,7% of the total economy)
  - Employees in the agricultural and food industry (x 1 000): 5,1 (1,5% of total labour)

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Regional distinctions / specifics

- Luxembourg is one of the smallest countries of the European Union.
- The two main regions of Luxemburg are the Oesling in the north and the Gutland in the south.
  - The Oesling is part of the Ardennes or the « Rheinisches Schiefergebirge » and is a large plateau intersected by narrow valleys with steep slopes. It covers 32% of the total area.
  - The Gutland has various soils originating mainly by the geological formations of the Lias and Trias. It covers 68% of the total area.
- The altitude ranges from a maximum of 130m to 560m.

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Number of farms, average size, staff (self-employed, hired)

- Total number of agricultural holdings: 2.175. The vast majority of farms are traditional family farms which hire relatively few employees.
- The average farm size increased from 57,51 ha in 2008 to 61,53 ha in 2012 (+7,0%) with a total surface of farmed land of 131.492 ha.
- The share of agricultural surface being in own property was 42,8% in 2012; hired land represented 57,2%.
- Farm labour accounted for a total 5.068 employed persons representing 3.587 annual work units, with a quarter of them exceeding the age of 60. The average age is located in the 45-49 age class.

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Background, history, traditional knowledge

- In 2012, the arable land accounted for 47.6% of the total agricultural surface.
- Pasture land represents 51.2% of the total agricultural surface.
- Due to the pedo-climatic conditions, Luxembourg is classified as "less favored area". This explains the large part of pasture land and the predominance of herbivores (mainly beef and dairy cattle) in the agricultural sector.
- While the surface of pasture land is stagnating, the forage surface continues to grow.
- Forage crops increased from 25,5% in 1975 to 43,9% in 2012 and forage is now grown on 27 451 ha. Among the forage plants grown, maize harvested as corn silage represents the main culture. The cultivated area of corn grew from 4 589 ha in 1975 up to 13 550 ha in 2012 and corn now accounts for half of the total forage grown.
- Taking into account the surfaces used for growing forage and the surface devoted to pasture, the total surfaces dedicated to herbivores continues to gain in importance.

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Importance, share of total sector

- The livestock sector contributes more than half to the total agricultural added value. The main output products are milk and meat.
- Part of the different productions in the output of the agricultural industry at basic prices (2012)
  - Animal products 22,8%
    - Milk: 21,7%
    - Eggs: 1,1,%
  - Animals 21,1%
    - Cattle: 14,1%
    - Pigs: 6,5%
    - Other animals: 0,4%
  - Crop output 49,8%
    - Cereals: 7,9%
    - Industrial crops: 1,9%
    - Forage plants: 30,4%
    - Vegetables: 1,4%
    - Potatoes: 1,4%
    - Fruits: 0,6%
    - Wine: 4,6%
    - Other: 0,1%
- The evolution of agricultural prices has to be seen in a European and international context

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Number of farms, average size (ha), staff (self-employed, hired)

- Structure of agricultural surfaces according to the specialization of the different farm types

Tableau 8 : Structure des surfaces agricoles des exploitations agricoles selon leur spécialisation en 2012

Spécification		Ensemble des exploitations	Orientation technico-économique (OTE) OTE 1	OTE 2	OTE 3	OTE 4	OTE 5	OTE 6	OTE 7	OTE 8
Nombre total d'exploitations	Expl	2 137	170	37	351	1 366	20	12	46	136
SAU moyenne	ha	61.5	35.0	3.2	4.8	77.5	72.0	54.5	72.0	95.8
terres arables/exploitation	%	47.6	70.8	[illegible]	3.3	43.8	71.4	63.8	51.8	66.0
pâturages/exploitation	%	51.3	30.1	34.6	17.0	56.1	38.6	37.1	47.8	33.5
autres surfaces agricoles/exploitation	%	1.2	0.1	30.4	79.7	0.1	-	0.1	0.3	0.4

Source: STATEC, statistiques sur la structure des exploitations agricoles 2012

ruminants (OTE 4), pig and poultry (OTE 5), mixed livestock (OTE 7), Mixed livestock – plant production (OTE 8)

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Number of farms, average size (ha), staff (self-employed, hired)

- Structure of livestock composition according to the specialization of the different farm types

Tableau 9 : Structure des cheptels des exploitations agricoles selon leur spécialisation en 2012

Spécification		Ensemble des exploitations	Orientation technico-économique (OTE)							
			OTE 1	OTE 2	OTE 3	OTE 4	OTE 5	OTE 6	OTE 7	OTE 8
Nombre total d'exploitations	Expl	2 127	130	27	251	1 300	29	12	40	138
bovins en moyenne	têtes	88.2	1.0	8.6	1.6	127.5	22.2	17.6	77.8	66.4
dont vaches laitières	têtes	57.3	–	–	–	57.0	–	–	42.4	59.4
autres herbivores en moyenne	têtes	8.4	0.4	1.1	0.7	11.8	5.0	5.6	11.7	5.5
porcins en moyenne	têtes	42.1	4.1	22.4	0.0	8.8	1 828.1	-	240.8	68.6
volailles en moyenne	têtes	53.6	4.8	10.1	0.1	5.8	2 520.3	3.6	433.2	75.5
unités gros-bétail	UGB	98.0	6.3	41.9	32.1	96.2	455.6	17.4	145.3	68.3

Source: STATEC statistiques sur la structure des exploitations agricoles 2012

ruminants (OTE 4), pig and poultry (OTE 5), mixed livestock (OTE 7), Mixed livestock – plant production (OTE 8)

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Species in livestock production, ranking

- Livestock production systems found in Luxembourg mainly consist in keeping bovine cattle and to a minor extent pigs. Poultry, sheep, goats and equidae (kept for leisure) are only minor sectors.
- Main livestock species

• Bovine	188 473 heads
– among which dairy	43 436
• Porcine	90 023
• Poultry	112 798
• Ovine	8 211
• Caprine	4 898
• Equidae	4 887

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Main / most important species

- The bovine sector
  - In the period from 2008 to 2012 , the number of cattle decreased from195 661 to 188 473 animals (3.7%).
  - The number of keepers of bovine cattle was 1 495 in 2008 and 1 363 in 2012 (-8.8%). Despite the observed decrease in the bovine cattle population, the average number of heads of cattle kept by farmers shows an increase from130,9 in 2008 to 138,3 in 2012 (+ 5.7%).
  - Milk production represents the main pillar in animal production. With 43 436 heads of dairy cows, this number remains more or less stable in 2012 compared to 2008 (43 585 animals: 0.3%). As a consequence of the observed decrease in the total cattle population, the percentage of dairy cows in the cattle population has increased from 22,3% in 2008 to 23,0% in 2012. In 2012, dairy cows were kept by 756 dairy farmers. This represents an average of 57,5 dairy cows per farmer (2008: 50,7 heads).
  - Beef production represents the second largest pillar in animal production. The number of cattle decreased from152 076 animals in 2008 to 145 037 units in 2012 (-4.6%). The observed variations are influenced by the situation on the beef and veal market such as any major markets for agricultural commodities (cereals, etc.).

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Main / most important species

- The porcine sector
  - Only a very limited number of farms in Luxembourg are keeping pigs.
  - The pig population increased from 81 374 to 90 023 heads between 2008 and 2012 (+ 10.6%). The number of holders has yet decreased from 143 to 117 in the same period (-25.0%). Therefore, the number of heads follows an exponential increase between 1985 and 2012 reaching a total of 769,4 heads of pigs per holder in 2012.
- The poultry sector
  - The number of poultry including laying hens, broilers and other poultry was 81 375 heads in 2008 and 112 798 animals in 2012 (+ 38.6%). In the long term, the production structure has evolved from a rather secondary production to holdings specializing in keeping broilers and mainly laying hens.
- The horse sector
  - The number of horses housed on farms has almost tripled since 1985. Riding horses represent the major category (2012: 64.5% of the number of equidae kept on farms). Among the 4 887 equidae censored on farm holdings in 2012, 46,3% were in own property und 53,7% were taken into charge by farmers.

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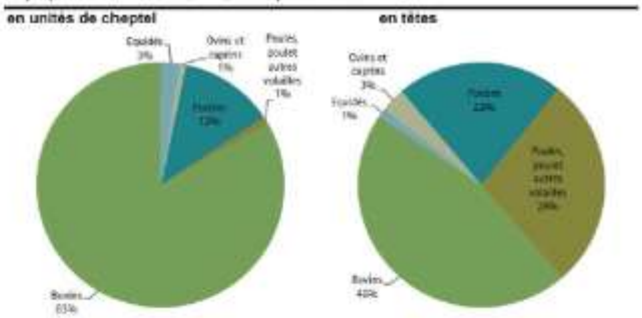
Main / most important species

- Livestock numbers as expressed in a reference unit → "equivalent grazing by 1 dairy cow assuming a production of 3 000 kg of milk per year without supplementary feeding of concentrates"
- In 2012, there were 1,23 units of livestock per hectare of utilized agricultural area (2008: 1,26).

Graphique 15 : La structure (en %) du cheptel en 2012



Source: STATEC, statistiques sur la structure des exploitations agricoles 2012

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Main topics / problems with regard to sustainable animal production

- In Luxembourg, water quality issues are high on the agenda of most stakeholders. The problem tends to be very localized with problematic regions showing increasing concentrations of nitrogen in deep and surface water and concentrations of phosphorus in surface water.
- GHG and ammonia emissions are no longer problematic because the levels of ammonia and GHG are well below the target levels (ammonia emissions 2010: 5 ,507 tons, with a target level of 7,000 tons; GHG emissions: only 4% of the GHG emissions originate from agriculture).
- Reductions in total livestock numbers (because of higher productivity) and in mineral fertilizer use, coupled with improvements in organic nitrogen efficiency via better application techniques, have resulted in reaching target emissions.
- Biodiversity is an important issue in Luxembourg; a lot of payments are linked to biodiversity maintenance and the pressure from environmental organizations on agriculture is high in this regard.
- Soil erosion and fertility have a high priority at a local level, i.e., in regions with annual crops on slopes and unfavorable soil types and farm management, such as growing corn on sandy soils, on slopes without catch crops or under-sowing.

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Main topics / problems with regard to sustainable animal production

- The economy is mainly based on the tertiary sector which is well developed. The Gross Domestic Product is one of the highest in the European Union and - consequently - incomes are also high.
- 43% of the working population come from the neighbour countries to work in Luxembourg every day. 44% of the resident population is not of Luxembourgish nationality. The population is increasing every year (2001: 439 500 compared to 524 900 in 2012) and more and more land is needed for constructing housings, buildings and street infrastructure. For the agricultural sector, this situation is a big burden, as infrastructure is consuming more than 1 ha of land per day and land prices are very high.

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Linkage to other reports, groups

- 2013 Bulletin du Statec: La structure des exploitations agricoles en 2012 et les méthodes de production agricole en 2010
- The agriculture of Luxembourg in figures 2013 (Publication Service d'économie rurale)
- Participation of Luxembourg in the Interreg project Dairyman

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Funding in animal production research

- On the Luxembourgish territory, there is currently no specific research institute active in the field of animal production / animal genetics
- The Centre der Recherche Gabriel Lippmann has some general plant oriented R&D activities in the agriculture and wine sector
- For the livestock sector, Luxembourg sustains a good collaboration with the University of Liege - Gembloux Agro-Bio Tech and through the participation at interregional or European networks and projects
- Luxembourg has two officially recognized breed societies
  - one for dairy only (CRV Luxembourg)
  - one covering all major livestock species (CONVIS)
    - Performance testing
    - Maintenance of breeding books
    - Farm consultancy (feeding, herd health, sustainability aspects of production, breeding consultancy etc.)
    - Genetic evaluation done by Rechenzentrum VIT-Verden and Institut de l'Elevage

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2.5.14 Spain

COUNTRY REPORT

Status Quo "where are we"

SPAIN

April 2014

Country Situation regarding Livestock

Spain is a country with an average value of 894.000 Agrarian Working Units (AWU) (Data Ministry of Agriculture, 2011). The total value of the agrarian production was 2011 41,375 mill €, what places Spain at the fourth place in the EU, after France, Germany and Italy. The average productivity per AWU was 23,937 €/AWU, slightly below the EU-average.

Spain has increased the volume of its agrarian production during the last 15 years, being this superior to the average agrarian production of the EU (figure 1).

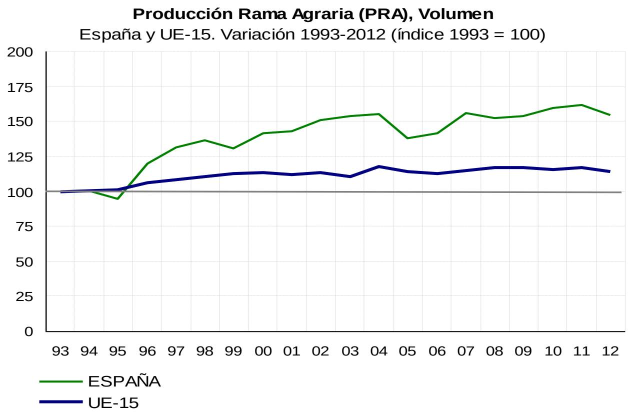


Figure 1: volume of agrarian production of the EU and of Spain

Regarding the employment rate at the agrarian sector in general, the actives increased 2012 in 3.2% with a decrease of unemployed people of 10.4% with a final unemployed rate of 25.4% at the agrarian sector (0.6 points less than the global unemployment rate of Spain).

Description of the livestock sector

A. Historic evolution: figure 2

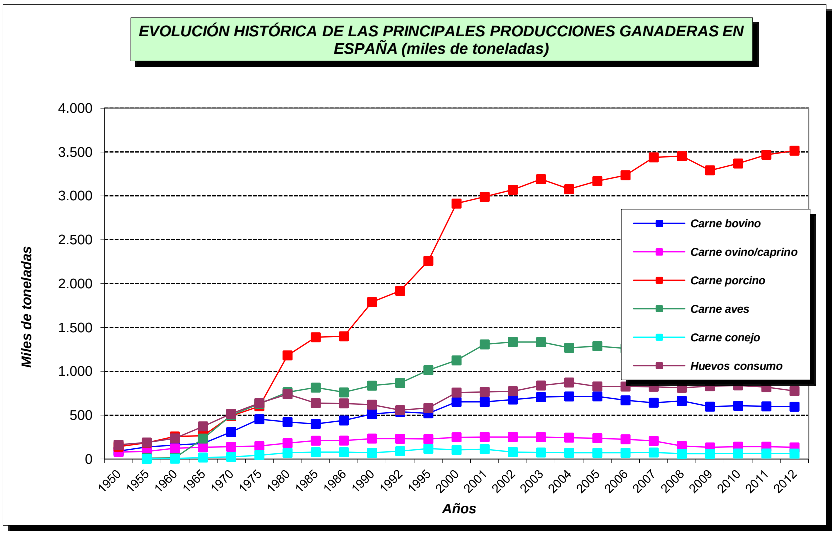


Figure 2: thousands of tons of livestock production subsectors in Spain during the years 1950 to 2012 (blue line: beef; pink line: small ruminants meat; red line: pork; green line: poultry meat; turquoise: rabbit meat; purple line: eggs consume).

B. Description of Livestock subsectors in Spain

B.1) SWINE:

The swine sector is the most important livestock sector in Spain with 34% of the total livestock and 12% of the total agrarian production. Spain is the second swine producer in the EU and the forth in the world (after China, USA and Germany). This sector is characterized by a high rate of self-sufficiency (over 140%). This means that Spain is a net exporter.

It is a modern and highly technical sector, highly intensified, with less and less familiar, small farms.

This intensification entails environmental challenges, especially regarding waste management. It is worthy to note, the huge effort that the producers have performed, in order to adapt their systems to the last welfare legislation (in force, since the 1st of January 2013).

The sector shows a clear verticalisation of the systems (producers and concentrate fabrics) with scarce cooperativism with the rest of the actors of the sector (slaughterhouse, industry and distribution). This situation causes a slow negotiation capacity by the farmers.

It is very important the high dependence on cereal prices: over 65% of production costs are imputed to the swine feed; hence, the volatility of the prices of soy and cereals affects highly the room of the economical efficiency in our systems.

Strengths

- Export capacity
- Modernization and progressive improvement of the performance of the farm
- Sustainable consumption, with increased demand for processed products: possibility of developing new products according to the demand.

- Production systems of European standards, which responds to the social concerns generated by the intensive production systems.

Weaknesses

- Lack of structuring and negotiating capacity of producers, leading to imbalance in the chain value.
- Added cost generated by the European production model
- Environmental management of farm by-products and waste.
- Cost of adapting farms to animal welfare requirements.
- Lack of communication to the consumer (bad image of the intensive production)
- The price volatility of raw materials for feed (mainly soy and cereals)

Production

Stable production 2012/2013 of 38,103 animals and 3,164,354 millions of tons.

In the EU Spain is the second producer with 17.3% of the total pig population and 15.5% of the produced tons. Within Spain the mean producer is Cataluña.

Farms

A total of 85,449 farms (December 2013) with a steady decreasing tendency since 2006.

Pig population:

Decreasing tendency during 2012 and a slight stabilization during 2013.

Total: 25,654,400 pigs (November 2013)

Sow population: 2,215,800

Employment rate

The average of agrarian employment rate ranges between 1.4 and 1.7 AWU/farm.

Consumption:

Fresh meat consumption 2012 (T): 491,808 (2012/2011: 0,3% less)

Transformed products consumption 2012 (T): 573,289 T (2012/2011: +2,3%)

Fresh meat consumption: January-October 2013/2012: +2 % (Kg), +3,5% €

Reformed meat products consumption January-October 2013/2012: +2 % (kilos), +1,6 (€)

Production costs:

During 2012 an increase in the prices of soy and cereals was observed affecting specially to the concentrates for piglets and pregnant sows. A stabilization of the prices was observed during 2013, and 2014 lies on the downside, what is a positive scenario for this sector.

Swine and swine products trade:

Exports increased until 2012 with a maximal quantity of 1,402,296 tons (3,299,554 thousand €). This represents an increase of 3.4 % from the total volume exported in 2011 (up to 12% in € value). In the case of exports to third countries the increase was 12.4% in volume (22.6% in value) and shipments to EU countries increased 0.6% in volume (+ 9.4% in value).

Destinations of exports in Europe are France, Italy and Portugal, while Russia is the largest recipient of Spanish exports outside the EU. China - Hong Kong has become an important recipient in the recent years.

A decline in total exports in volume (-4 %), maintaining the level recorded in 2012 has been observed in 2013 (provisional data), mainly caused by the restrictions imposed by Russia.

B.2) DAIRY CATTLE SECTOR

The total amount of farms has decreased from 141,000 farms 1993 to 21,000 2013 with a slighter decrease in the number of dairy cattle. This shows the clear change that this sector has suffered in the last 30 years.

Moreover, the milk quota system (the quota in Spain has never been enough to meet national demand of milk), has generated the false expectative that this situation would assure high prices for the producers. Obviously the common European market with surplus "neighbors" (France, Germany, ...) has originated much lower prices than expected.

Strengths:

- Implementation and development of a national payment system that will improve the balance of agrifood value chain
- Farms with good health standards
- Important modernization in many of the farms, as well as progress in the specialization and education of the workers
- Intensive farms with high yielding animals due to good implemented genetic improvement programs
- Concentration of the dairy cattle: enlargement of farms

Weaknesses:

- Weak negotiation capacity by the farmers when compared to other actors in the milk chain
- Price volatility of raw materials for animal feed and strong dependence on foreign protein matter
- Lack of market orientation and industry specialization that focuses on products with little added value
- Average farm size smaller than EU average
- Low availability of land, which also is a major handicap facing the design of a PAC -based on the property of hectares and not animals
- Deficit in the Spanish milk production related to consumption and demand (due to the milk quota system)
- Uncertainty regarding the future of the most vulnerable farms based on family labor, linked to the land and with scarce alternatives to this activity, after the abolishing of the milk quota

Production

The total fat adjusted deliveries of milk during the period 2012/2013 amounted 6,248,209 tons, 1.3% higher than 2011/2012. The milk quota was not exceeded during these periods.

The total milk quota in Spain 2013/2014 is 6,425,917 tons. The Spanish regions with most production capacity are the Cantabrian coast (56%: 38% Galicia, Asturias and Cantabria), followed by Castilla y León with 13%.

Farms /population

The dairy cattle population in January 2014 was 854,726 (1.56% more than 2013).

If the figures keep growing, this would be a change in the tendency (Spanish dairy cattle population has been decreasing during the last 30 years), probably due to the improved prices and to the new perspective without restricted yield capacity (without quota).

The amount of farms (2013/2014) now is 22,194 (2.7% less than 2012/2013). Moreover 968 farms in Canary Island have to be added (not in the quota system).

The regions with more dairy farms are the Cantabrian Coast (77%, with the smallest farms in size), with Communities as Galicia with 56 % of the farms, Asturias (13%) and Cantabria (8%). Castilla y León includes 10% of the farms.

Employment rate

The average of agrarian employment rate was 1.2 AWU/farm, with a total amount of 30,526_AWU generated.

Dairy cattle/milk trade:

Spain is a net importer of milk and milk products.

Regarding the price of the milk to the producers, this was 38.06€/100 Kg (0.5% lower than 2013), but it is 16.3% higher than 2012. It is too early to know whether this slight decline in the price will continue in the following months. The general price is 6.85% lower than the average price in the EU (figure 7).

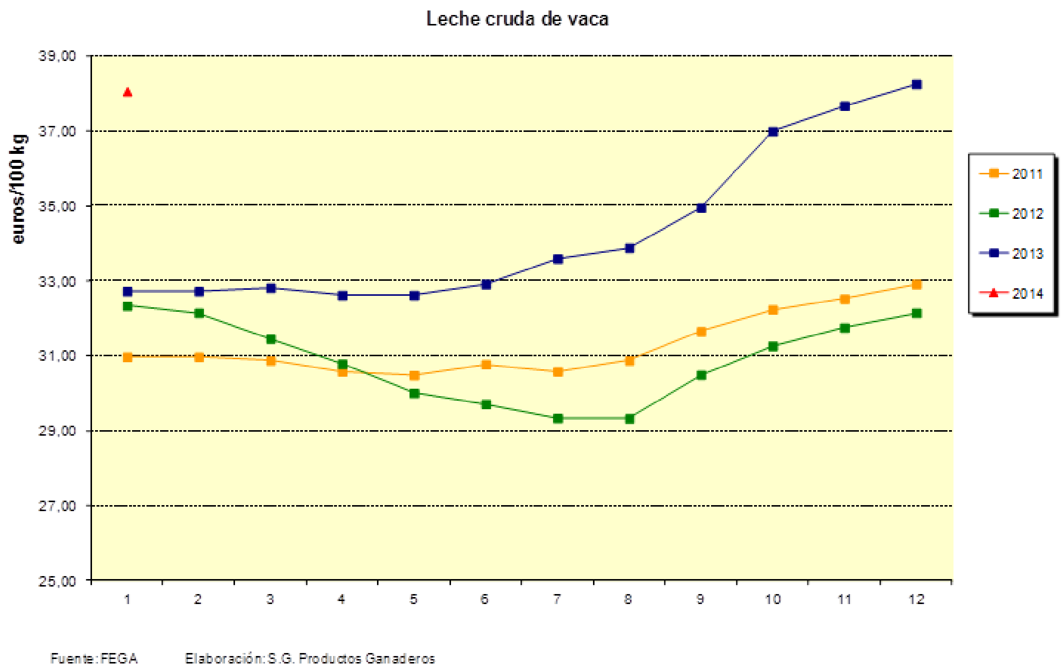


Figure 7: monthly price evolution of the milk during the years 2011-2014 in Spain

Consumption

The milk consumption 2011 was 5,201,500 tons of milk and milk products (slightly lower than 2010 -0, 49% less).

Production costs

The government data conclude that the crisis suffered 2012 has been overcome. Measurements that have helped are measures like the compulsory recruitment by the milk industry providing stability and transparency in the sector.

B.2) Beef sector

It is a sector with scarce cooperativism and mainly formed by medium-small farms.

Beef cows farms have a significant territorial base, with extensive schemes or semi-extensive production and localized in Spanish Cantabrian coast and in the west of Spain.

On the other hand, feedlot farms, that are highly intensified, are located close to major consumption centers (cities) or close to major cereal-growing areas in the northeast of Spain.

Strengths:

- Link to the local sector and the environment in the case of beef cows farms (biodiversity, preservation of rural areas)
- Variety of native breeds adapted to the environment
- Use of natural resources difficult to use by other species and in areas where few other economic alternatives are possible
- Large implementation of labeling systems that support consumer perception of these products as high quality products

Weaknesses

- Negative image of "intensive systems " for the feedlot subsector
- High feed costs (>50 % of production costs) for systems that do not have their own supply capacity. Dependence on foreign protein
- Dependency on beef animals proceeding of other EU-countries
- Low reproductive performance in beef cows
- Decrease of the beef consumption. Scarce level of innovation and of supply variability. Higher prices than other types of meat
- Low profitability of beef cows farmers
- Low level of cooperativism

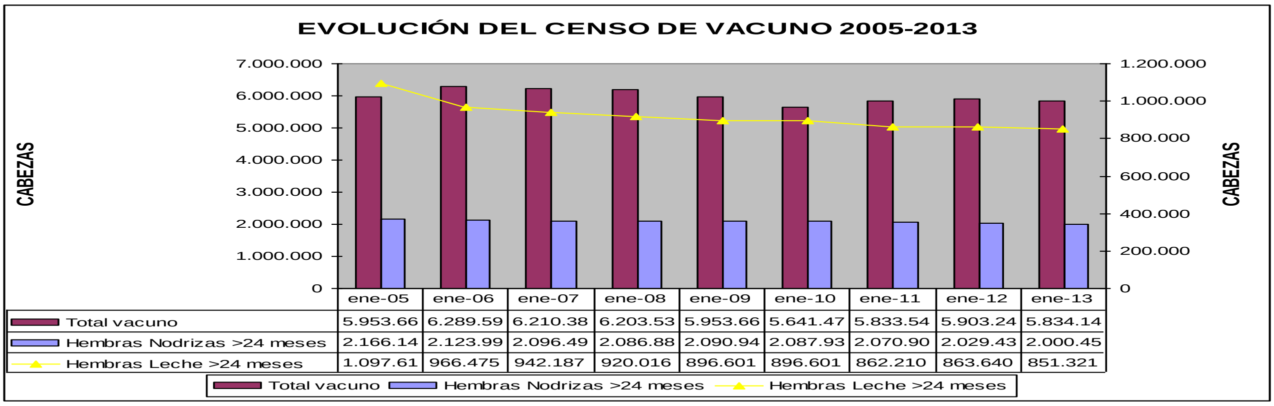
Production

November 2013: 2,028,499 of slaughtered animals (-3.14% than 2012) and 532,060 t (-1,92% than 2012).

Farms / population

Bovine population (beef and dairy cattle) is 6 millions of animals (December 2013 **5,800,270;** 1,65% less than 2013), with the decrease being due to the decrease in dairy cattle population.

Spanish regions with the higher cattle population are Castilla y León (21%), Galicia (16%) and Extremadura (13%) (figure 3).



	ene-05	ene-06	ene-07	ene-08	ene-09	ene-10	ene-11	ene-12	ene-13
Total vacuno	5.953.66	6.289.59	6.210.38	6.203.53	5.953.66	5.641.47	5.833.54	5.903.24	5.834.14
Hembras Nodrizas >24 meses	2.166.14	2.123.99	2.096.49	2.086.88	2.090.94	2.087.93	2.070.90	2.029.43	2.000.45
Hembras Leche >24 meses	1.097.61	966.475	942.187	920.016	896.601	896.601	862.210	863.640	851.321

Figure 3: Cattle population during the years 2005 and 2013 [(ene=January); purple bars: total cattle population; blue bars: beef cows >24 months old; yellow line: dairy cows >24m old].

Regarding farms, there are 155,514 farms (1.28% less than 2012) due to concentration of the bovine population in bigger farms, with smaller farms disappearing. Most of them are farms of beef cows (figure 4).

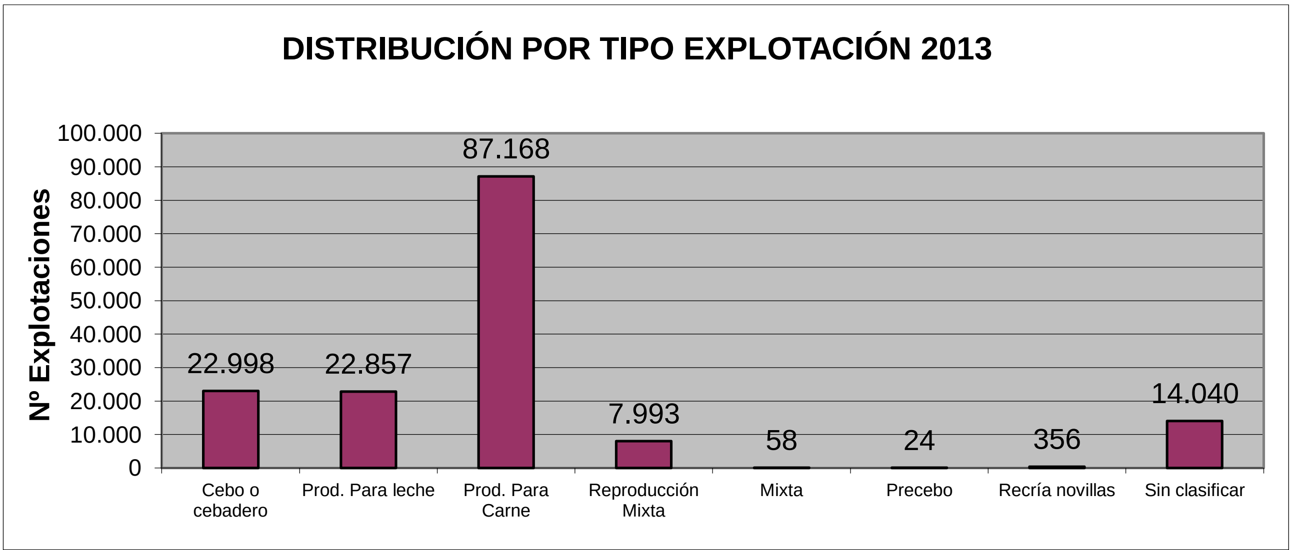


Figure 4: distribution of bovine farms in Spain. Number of farms (Cebo o debadero: feedlots; Prod. Para leche: dairy farms; Prod. Para carne: beef cows; Reproducción mixta: double aptitude cows; Mixta: mixed production systems; Precebo: suckling calves farms; Recría novillas: heifer farms; Sin clasificar: without classification)

The beef sector is the third in importance after swine and dairy bovine sector.

Employment rate

The average of agrarian employment rate is 1.1 AWU/farm at beef cow farms, with a total amount of 173,289 AWU generated.

Bovine animals/beef trade:

During the year 2013 (provisional data. Datacomex), both, imports and exports have dropped significantly in the period from January to November (imported tons of beef was 24.91% less when compared to 2012; exports (mainly within the EU): 116.122 tons, 5.95% less than 2012). The decrease in imports is due to a decrease in imports from the EU, while the decrease in exports has affected mainly non-EU-countries (mainly due to a fall in exports to Russia).

Live animals trade (figure 5)

Export of live animals remained constant until 2005. The increase in the last years is mainly due to new trade with non-EU countries (North Africa and Middle East).

During 2013 a total of 99,561 animals (mostly calves) were exported. A total of 46.99% went to non-EU countries, mainly Lebanon.

On the other hand, a total of 389,117 animals (mainly calves) were imported (7.32% more than 2012).

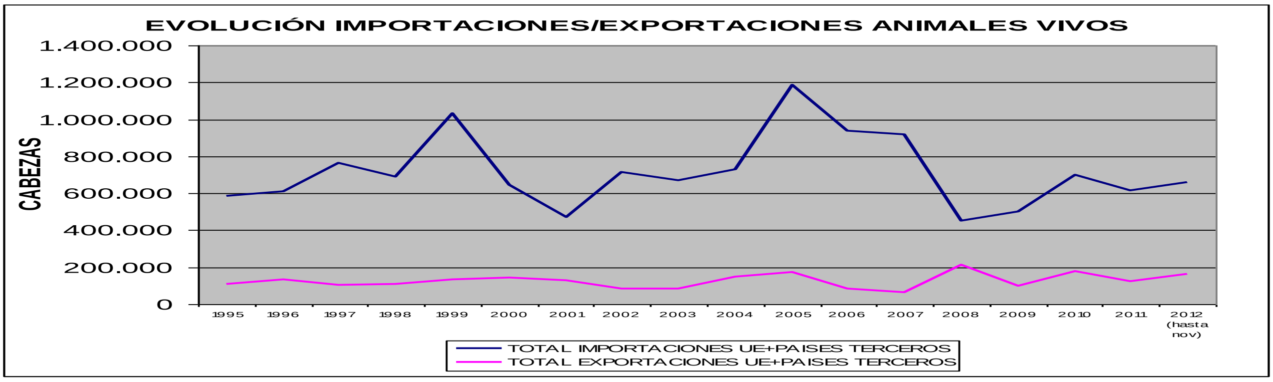
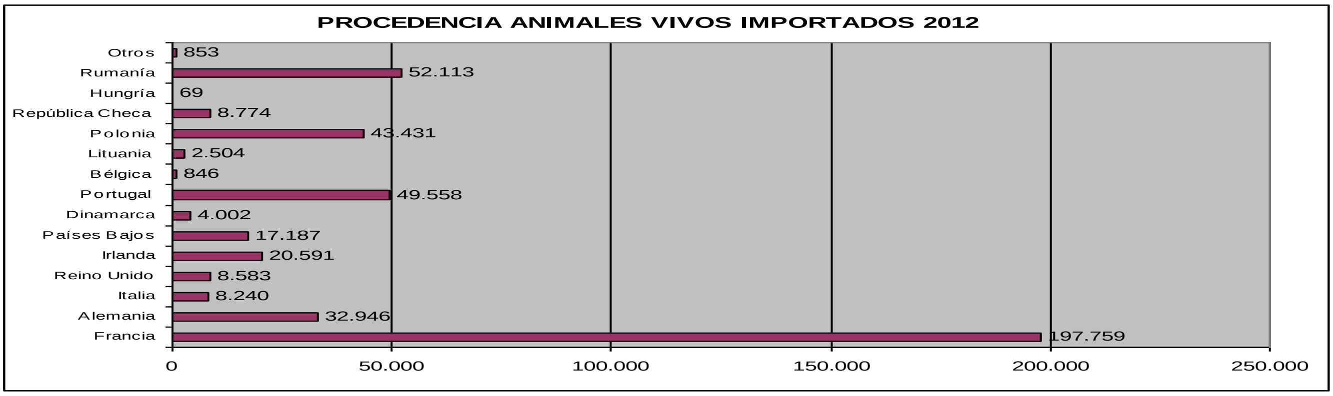


Figure 5: evolution of the exports and imports of live bovine animals. Blue line: total imports; pink line: total exports.

The countries involved in the trade with Spain of live bovine animals are depicted in figure 6



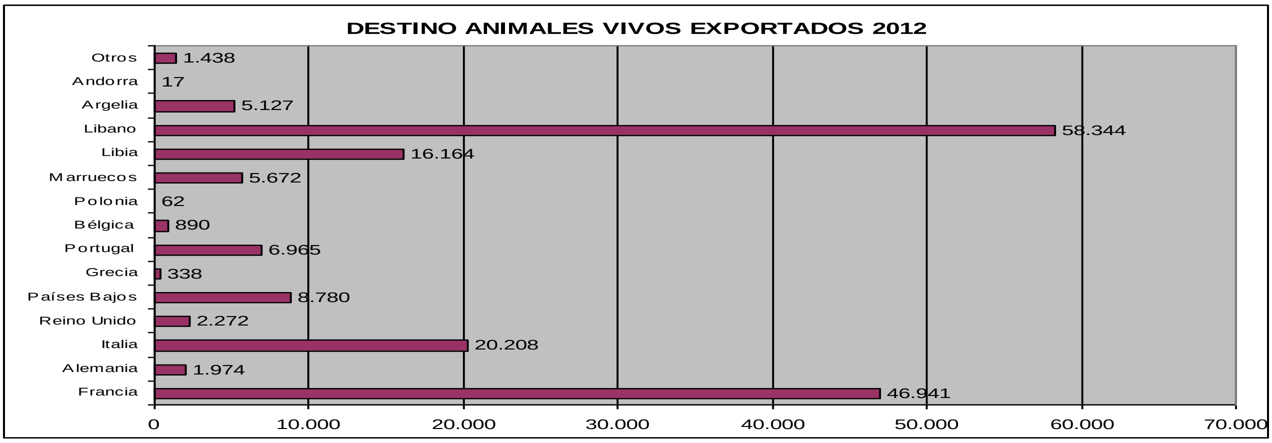


Figure 6: Origin countries of imported animals (upper figure) and countries of destination of the exported bovine animals (lower figure).

During 2013 very high prices for the beef has been observed. In the case of live animals, suckling calves price have showed a significant decline while the fattening calf had good prices (table 1).

Table 1: prices of live animals in the beef sector for 2012 and 2013 in Spain.

Price (€/animal)	2012	2013
Holstein animals <1month of age	123.63	95.13
Crossbreed animals <1month of age	326.82	305.35
Fattening calves 6-12 months of age	230.28	245.11

Consumption

The general consumption of beef shows a decreasing trend. The latest data available from the Consumer Panel shows total fresh meat consumed from January to October 2013 was 228,779 tons (3.39% less than 2012).

Production costs

Feed prices (cereals and soy) have dropped 2013, hence the profitability room for the farms has been higher than 2012.

B.4) SMALL RUMINANT SECTOR

The small ruminant sector plays a key role in the cohesion of the rural areas and in the sustainable use of habitats in these areas. Given its special features, this sector has been promoted by specific actions of the Ministry of Agriculture of Spain since 2007. Main goals of these actions were to encourage producers to continue in the sector and to promote the involvement of young farmers.

This sector has to adapt to cyclical rise and fall of production associated to external market.

Strengths:

- Strong link to the land and its environment (biodiversity, landscape preservation, fire prevention)
- Flexible and adaptable production systems, semi-extensive and able to use marginal forages
- Short production cycles, making possible the adaptation to market
- Low level of infrastructure requirements (permanent installations, machinery) and higher replacement rate of the animals
- High quality meat and dairy products
- Potential growth capacity based on external demand
- Large genetic variety (over 250 indigenous breeds)
- Production systems economically sustainable

Weaknesses:

- Lack of generational change. There is the need of young farmers
- Low profitability of the production activity
- Drop in consumption of lamb meat
- Little innovation and variety of supply
- Costs reduction by the processing industry
- Small size of farms and lack of farmers cooperativism
- Dairy goats: growing dependence on the products supply of other countries within the EU
- Increasing replacement of native breeds by more productive foreign breeds, which can reduce the production of traditional specialties

Production

2013 a total of 8,848,842 sheep have been slaughtered (3.2% less than 2012) and 103,631 tons of ovine meat was sold (4.4 % less than 2012). Regarding goats during the first two months of 2013 a total of 922 622 goats have been slaughtered (12.02% less than in 2012) and 7,301 tons of goat meat was sold (decrease of 10.33% when compared to 2012).

The production of sheep milk 2012 was 553,000 tons (9.7% more than 2011). With respect to the production of goat milk, the amount of goat milk produced 2012 was 444,000 tons, (4.9% less than 2011).

Farms /population

In January 2014 there was a total of 16,572,413 sheep and 2,759,494 goats (0.2% lower and 7.3% higher than January 2013, respectively).

The number of dairy farms was 7,772 of dairy sheep and 7,609 of dairy goats (January 2013).

Employment rate

The average of agrarian employment rate was 1.2 AWU/farm, with a total amount of 128.552 AWU generated. In the dairy sheep and goat subsector, employment rate was 1.1 AWUs, with a total of 46,386 annual AWUs generated.

Small ruminant trade:

The economic value of imports in 2013 was 50,576 thousands of € (21.7% on 2012) and exports of 182,909 thousands of € (5% higher than 2012).

Thus, the trade balance is positive, thanks to the decline in the economic value of the imports and to the increased exports.

The sheep-goat milk price observed during 2013 a substantial increase, especially in goat milk, due to the drop in production from countries like France and the Netherlands, that have been buying large quantities of milk to Spain.

The origin of the imported small ruminant meat is mainly coming from New Zeeland (34.8%), followed by Chile (12%) and Italy (11.6%).

The destination of exports is mainly EU (88%), however it should be noted that the increase in exports was mainly due to a significant increase in exports to non-EU countries (which have increased by 54% when compared to 2012; Figure 8). The most important destination is France (41% of exports), followed by Italy (17%) and the UK (10.9%). In the case of exports to non-EU countries over 50% of the exports went to Hong Kong, followed by Algeria (figure 8).

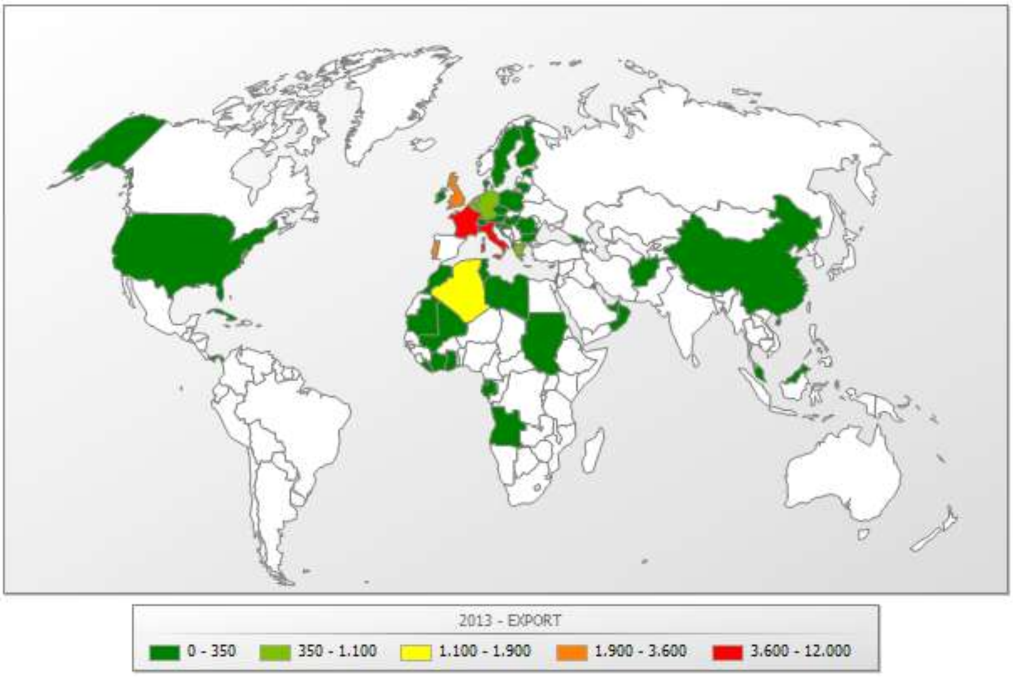


Figure 8: Countries of destination of export of small ruminant meat produced in Spain.

Live animals trade

During 2013 a decrease of 7.1% when compared to 2012 was observed in the imported animals with 394,060 animals (388,420 sheep and 5,640 goats), coming mainly from France (53.8%) and Portugal (39%).

The export of live animals has remained more or less constant until 2010. During 2013, exports were 855,338 animals (54% less than 2012). The most important destination country is France (66.9%). It seems that during 2013 finally begins the trend of increase in exports (existence of new markets in North Africa and Middle East with countries like Libya and Lebanon)

Consumption

During 2012 a total of 87,078 tons of fresh meat from sheep and goats were consumed, which represents a decrease of 9% when compared to 2011.

Production costs

The high dependency on the prices of animal feed makes this sector very sensible to the cereals and soy price evolution. Feed prices have dropped 2013, hence the profitability room for the farms are higher than 2012.

B.5) MEAT POULTRY SECTOR.

This sector is the major protein supplier of the Spanish population. Due to this status as a “commodity”, the influence of this sector on the shopping basket in Spain is essential. Its structure is articulated according to this principle; it is highly intensified, concentrated and vertically integrated. The growing demand for sustainability has increased the production requirements.

Strengths:

- The condition of commodity product ensures a high demand, being the only type of meat with increasing consumption worldwide and in the EU
- High growing capacity in alternative markets
- Very competitive structure, with a high degree of concentration and vertical integration in the meat subsector and completely renovated systems in the egg subsector structures

Weaknesses:

- Loss of negotiating capacity by the industry when compared to the distribution industry due to the use of these products as "claim" products to consumers, with very low prices
- Loss of productive fabric due to the concentration
- Essential purchase force is the price with the foreign products being a clear threat
- High dependence on feed costs, mainly on that of the corn-soybean (global commodity markets, currently very volatile).
- Absence of regulatory mechanisms from the PAC and of market sectors

Production

With a total production of chicken meat of 11.8%, Spain is Europe's second largest chicken producer behind the United Kingdom. Productive evolution tends to stabilize around one million of tons, an shows a slight supply deficit covered with imports from EU-countries.

Production in 2012 was 1,391,020 tons (1.01 % more than 2011)

Over 90% is production of chicken. Most important regions are Cataluña (28.7 %) Valencia (16.9%), Andalucía (15.8%) and Galicia (13.1%).

The production of turkey was around 116,000 t 2012.

Farms /population

Breeders farms: these farms can be part of the vertical system of a production company, or an independent farm dedicated to the production of hatching eggs. They are divided into two types of firms:

a) Selection farms: those engaged in the production of hatching eggs for the production of breeding poultry (broilers grandmothers). There are a total of 21 farms of this type in Spain.

b) Multiplication farms: those that maintain breeding poultry, engaged in production of hatching eggs for the production of productive poultry (broilers mothers). There are 338 farms in Spain.

Farms of chicken production (broilers): These farms may be owned by big company, or more frequently belong to the farmer, who has a contract with the integrator. The rate of return obtained by the farmer depends on the performance index (live weight, feed conversion, mortality, slaughter performance…). There are a total of 8,881 broiler farms in our country.

Other Poultry farms: this includes turkey production, with a total of 1,147 farms. Other productions of some importance are the partridge with 1,129 farms, pheasants, quail and pigeons, although in these cases often correspond to small farms.

The total Poultry population (slaughter data) was in 2012: 690,036,000 (+0.19% compared to 2011), whereas the total population of breeders was 4,280,000.

The average price of chicken meat in 2013 was 1.83 €/Kg (1.6 % lower than 2012).

Consumption

Recent data (2012) show a slight increase in both, consumption (+1.8 %) and in the value of the consumed product (+0.7 %). The consumer behavior during 2013 showed again a slight increase in both, the volume consumed (+0.29 %) and its value (+1.85 %). The increase in consumption was observed in all poultry products, especially turkey (+22.7 %).

Production costs

The major cost in the poultry production is feed (65 % of total costs). Hence, the volatility in the prices of raw materials for animal feed is notably desestabilizing.

The average price of poultry meat 2013 has been 1.83€/Kg (6.2% lower than the average of the EU).

Poultry trade

Although Spain is currently a net importer, the increase in exports to EU destinations has increased by 26% in the period 2013/2011. In regard to non-EU countries, our main destinations are Benin (34%) and Hong - Kong (17%).

B.6) LAYING HEN SECTOR.

This sector is considered again a major protein supplier for human. In terms of production structure the sector includes two different systems of production: high intensified systems concentrated in very few producers and on the other side, small farms that supply local markets with alternative production models (free range poultry, mainly).

Strengths:

- The condition of commodity product ensures a high demand
- High growing capacity in alternative markets
- Great exporting capacity to countries within the EU

Weaknesses:

- Loss of negotiating capacity by the industry when compared to the distribution industry due to the use of these products as "claim" products to consumers, with very low prices
- Loss of productive fabric due to concentration
- Essential purchase force is the price with the foreign products being a clear threat
- High dependence on feed costs, mainly on that of the corn-soybean (global commodity markets, currently very volatile)
- It requires currently a high level of profitability, in order to cover the high investments performed during 2012 (to adapt to welfare legislation)
- Absence of regulatory mechanisms from the PAC and of market sectors

Production

The total production 2012 was 912,900 thousands of dozens (-15 % when compared to 2011).

The adaptation of the industry to the welfare legislation during 2012 (cages had to be replaced in 90% of the national production), which required an investment of over 600 million €. This has been an actual upgrading of the systems.

Nowadays two production models are found: large-scale industrial farms with battery hens, and secondly, a growing number of small farms with alternative production system and free range hens.

During 2013 a clear increase of the hen population has been observed with a negative impact on the prices. Early estimates of this year indicate a slight production increase.

Farms /population

During the last 15 years a steady decrease has been observed with a cumulative decline of 40% in the amount of farms. In 2013 this process appears to have bottomed, with last data showing indeed a small rise. Nowadays, the number of farms is 1,128. Approximately 40% of them are small farms with ecological, free rage systems.

The compulsory rules of welfare, early in 2012, had a devastating effect on the number of hens in Spain that was reduced by around 20% to 34 million birds. This situation even led to spot shortages.

Currently, this situation is overcome, with a clear increase in the population (39 million of laying hens). This figures are 15% more than 2012 and 10% less than the usual figures before 2012 (44 million of hens).

Consumption

During the last decade the consumption of eggs has shown a steady decline (from 161 to 31 eggs per person per year).

Production costs

The escalating prices of raw materials for animal feed has led to increases in feed costs to more than 70% during 2012. Even now, with lower prices of cereals and corn, the low price of the product, makes the profitability for the farmers very marginal.

B.7) RABBIT SECTOR.

Spain is the third rabbit producer, after Italy and France within the EU (17.1%). This production has a strong cultural component and is consumed in few countries in the EU, with all the rabbit production (345,000 t) and consumption located in only eight EU countries.

During the recent years, the rabbit sector is experiencing a restructuring with a dramatic dropout rate in Spain. In the last four years, 25% of the registered rabbit farms have disappeared.

With over 60,000 t of production, this sector also represents an important source of development in the producing areas, very focused on certain mainland territories.

The scarce development of drugs and vaccines specific to rabbits results in a higher incidence of health problems. In the last year the sector has detected an increase in mortality due to hemorrhagic enteritis.

Strengths:

- Short production cycles that can quickly adapt to situations
- Final product with excellent perception by consumers in respect of its nutritional and organoleptic quality
- Growing potential as exporter to non-EU countries

Weaknesses:

- High production costs.
- Health concerns with different disease outbreaks with high mortality, reduced effectiveness of vaccines, and problems of availability of veterinary drugs as a minor species
- Scarce negotiating capacity by the farmers
- Decrease consumption rate with little acceptance by the younger population
- Shortage market in the EU due to the lack of tradition of consumption in most of the MSs

Production

Total production 2012: 63,413 t (-1.1% when compared to 2011).

Farms /population

Farms (January 2013): 3,501.

Rabbit population (June - 2013): 6,120,144 animals.

The sector shows a steady concentration with less and less small familiar farms and a higher amount of professional rabbit producers.

A total of 66% of the population is found in Cataluña, Aragón, Galicia y Castilla y León.

Employment rate

It can be assumed that the total activity of the rabbit sector produces 6.038 AWUs.

Producers are mainly associated in “Intercún”.

Consumption

The consumption of rabbit meat is suffering a worrying retraction during years. A notable effort has been made by farmer organizations and the Ministry, and during the period of January to September 2013 a considerable increase was finally observed.

Production costs

The escalating prices of raw materials for animal feed have led to net loss in the rabbit farms during 2012.

The export possibilities in 2012 offered positive results maintained during the first half of 2013.

2.5.15 Spain – Basque Country

COUNTRY REPORT ON ANIMAL PRODUCTION

BASQUE COUNTRY

1. ANIMAL PRODUCTION SITUATION IN BASQUE COUNTRY

Livestock farming has played a key role not only for the economy of the Basque Country, but also for the contribution of the traditional production systems (beef and cattle) to the cultural heritage, the generation of environmental values related to the management of the natural resources, including landscape modelling and preservation.

According to the statistical services of the Basque Government (Table 1), the Final Livestock Production (149 Million €) represent nowadays 33% of the total Final Agrarian Production of the Basque Country (449 Million €): the dairy cattle sector contributes with 61 Million € and beef with 43 Million €, followed by the production of eggs with a value assessed in 22 €.

Table 2.- Macromagnitudes in the Autonomous Community of the Basque Country 2013 (Preliminary data). Source: Órgano Estadístico de la Viceconsejería de Agricultura, Pesca y Política Alimentaria

MACROMAGNITUDES	Advance 2013 (x 1000 €)		Final Animal Product Advance 2013 (x 1000 €)	149.189
Total Final Agrarian Product	449.154		Cattle milk	60.989
Final Agriculture Product	249.576		Livestock/Beef meat	43.062
Final Animal Product	149.189		Eggs	22.236
Final Forestry Product	39.734		Animals/Sheep-Goat meat	5.484
Other Productions	10.654		Animals/Pig meat	3.558
			Other	13.861

During the last 25 years, the number of farms (Table 2) rearing livestock in the Basque Country has strongly decreased (especially in cattle and pigs), whereas the number of heads (Table 3) has decreased at a lower rate. This means that the animal production sector has evolved to a higher concentration and professionalization. In fact, the annual value of the livestock production within the Basque Country has only decreased 7% since 2000, basically due to the lower price of cow milk (-11%) but to the increase in the value of meat cattle (+16%).

Table 3.- Evolution in the number of farms rearing livestock in the Autonomous Community of the Basque Country between 1989 and 2013

	Livestock population (number of farms)				Difference 2013-1989 (%)
	1989	1999	2009	2013	
Cattle	14.877	10.352	5.946	5.930	-60,14
Sheep	3.855	4.790	4.546	4.539	17,74
Goats	2.585	1.778	1.616	1.605	-37,91
Pigs	5.787	2.891	902	898	-84,48
Poultry	13.372	10.444	6.304	6.299	-52,89
Horses	7.289	4.298	3.504		
Mother rabbits	5.837	3.502	1.858		

Data Source: *Eustat 2009* and *Eustat 2013*

Table 4.- Evolution in the number of heads of livestock existing in the Autonomous Community of the Basque Country between 1989 and 2013

	Livestock population (number of heads)				Difference 2013-1989 (%)
	1989	1999	2009	2013	
Cattle	177.551	179.328	135.448	139.855	-21,23
Sheep	263.985	313.896	271.433	294.747	11,65
Goats	22.717	19.402	21.549	29.806	31,21
Pigs	49.679	38.067	16.102	19.567	-60,61
Poultry	3.426.344	1.831.882	1.596.636	1.596.474	-53,41
Horses	16.444	15.366	19.249		
Mother rabbits	54.710	54.474	29.957		

Data Source: Eustat 2009 and Eustat 2013

However, the importance of livestock farming for the Basque Country cannot be measured only in terms of the economic impact. First, the natural conditions existing in the Basque Country (Atlantic weather, abrupt orography) are favorable for the growth of grass and shrubby species, as well as natural forests that can be used by herbivores: grasslands and shrubs covered areas represent 26% of the total surface, whereas natural forests mean 25%. As a result, some of the most traditional production systems have been modelled in order to make use of these natural resources, located at different altitudes, by grazing practices and transhumant farming systems, which is the case of beef cattle and sheep. Moreover, these systems are related to the utilization of many areas of the Basque Country comprised within the Natura 2000 Network (natural parks, reserves of the biosphere, LICs, Special Protection Areas, etc), which represent around 20% of the Basque geography.

In addition, the socio-economic conditions existing in the Basque Country (high human population density, scarce availability of agricultural land, easy access to markets, tradition, goals and preferences of livestock farmers, etc.) have modelled the features of the existing livestock production system.

Food safety is one of the most important objectives for the local administration. The prevalence of the main four food-borne bacterial pathogens (Salmonella, Campylobacter, E. coli STEC and Listeria monocytogenes) in livestock was carried out in the Basque Country in 2003-2006. The investigation of 377 healthy farms (124 beef cattle, 82 dairy cattle, 120 ovine, 17 porcine and 34 free-range poultry) identified a situation similar to that described in other European regions with thermophilic campylobacters as the most abundant food-borne pathogens, present in 70.6% of poultry farms (C.

jejuni and/or C. coli), 52.9% porcine (C. coli), 55.0% ovine, 58.9% beef cattle and 67.1% dairy cattle (C. jejuni and other thermophilic species). Prevalence of Salmonella-positive farms was low (2.4% beef cattle, 6.1% dairy cattle, 5.9% swine, 5.7% sheep and 2.9% poultry). L. monocytogenes was isolated from 46.3% of dairy cattle, 30.6% beef cattle, 26.5% poultry and 14.2% ovine farms, but not from swine. STEC were absent from broiler and porcine farms whereas high prevalence was found in sheep (50.8% farms) and cattle (46.0% beef cattle and 20.7% dairy cattle farms). However, O157:H7 serotype accounted for only 8.7% ovine, 7.0% dairy cattle and 1.6% beef cattle farms. This was one of the largest studies of this type carried out in Spain, in which these many agents were studied in the same group of samples selected to represent the population of the area

The current situation is **the result of the food and rural development policies applied by the Basque Government to try to guarantee not food safety of the population, but the sustainability of farming activities**, as well as to enhance and protect the **outstanding quality features of food products through Quality Labels** such as Protected Geographical Indicators or Denominations of Origin.

DAIRY CATTLE

The dairy cattle sector has evolved through a process of **withdrawal of many farms, increasing specialisation and concentration of the activity in bigger farms, modernisation of facilities, and intensification of the feeding practices**. There are 762 dairy cattle farms and 23571 adult dairy cows in the Basque Country, which produce more than 168.000 tons/year (Table 4), providing to the industry 3% of the total volume marketed in Spain (the 9th in the ranking of the different regions). This means that the Basque Country is the 3th Autonomous Community of Spain in annual milk yield per cow, with more than 7700 kg (just after the Communities of Valencia and Navarre, according to data from 2007). **The value of this production (61 million €) represents 41% of the value of the final agricultural product for the economy of the Basque Country**. Therefore, it is evident the strategic importance of this sector.

Table 5.- Cattle milk production in the Basque Country in 2013. Data Source: Eustat 2013

Cow milk	Thousands of lt
Consumed or transformed in the farm	7.071
Commercialised	161.413
TOTAL	168.484

The current situation of the sector is based on a set of key pillars, which are the sanitary status of the population, high genetic quality and the organisation of the sector.

Regarding the **outstanding health status of the livestock population**, it is the result of the policies developed by the Local Administrations and the Basque Government since the early 80's. As a result, the cattle population of the Basque Country was declared bovine brucellosis (B. abortus) officially free (Table 5). Also the incidence of Tuberculosis is below most of the other Communities, with only 0.17% of the herds affected in 2013 (Table 6). A pilot Paratuberculosis Control Programme is carried out on 27 herds to compare the impact of two strategies, vaccination and test & culling. In addition, the Local Administrations support other voluntary control programmes for Infectious Bovine Rinotracheitis (BHV-1), Bovine Viral Diarrhoea (BVD) and Neosporosis to improve the health status of the herds. Of course, the guidelines set by the Ministry in reference to other diseases like Bovine Spongiform Encephalopathy or Bluetongue are implemented.

In addition, **a breeding program was started during the 80's to improve the genetic value of the Holstein-Friesian cattle**, which was definitively supported in 1989 by the creation of Aberekin, a centre to provide farmers with high-genetic quality semen for the artificial insemination of cows. The production process of seminal doses is certified in agreement to the ISO 9001/2000 norm. The quality achieved and strict health politics applied has allowed that 42 countries are using these genetics.

Table 6.- Evolution of the prevalence of bovine brucellosis in the Autonomous Communities of Spain between 2001 and 2013. (Source: MAGRAMA)

CCAA	EVOLUCIÓN DE LA PREVALENCIA DE REBAÑO (EN %)												
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
ANDALUCÍA	3,06	2,70	2,70	2,66	1,91	0,95	1,00	0,36	0,27	0,11	0,02	0,02	0,00
ARAGON	1,44	1,44	2,66	1,68	0,64	0,29	0,27	0,00	0,00	0,00	0,00	0,00	0,00
ASTURIAS	0,31	0,34	0,22	0,19	0,19	0,04	0,00	0,01	0,00	0,00	0,00	0,00	0,00
BALEARES	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CANARIAS	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
CANTABRIA	4,81	3,27	5,49	3,84	1,54	0,66	1,04	0,98	0,60	0,55	0,53	0,41	0,33
CASTILLA Y LEÓN	2,46	2,52	3,45	5,23	2,71	1,91	1,09	0,72	0,48	0,25	0,08	0,18	0,33
CASTILLA LA MANCHA	3,80	3,59	3,52	3,40	3,35	2,78	1,44	0,99	1,27	0,76	0,34	0,04	0,00
CATALUÑA	3,62	0,54	1,34	1,18	0,91	0,34	0,21	0,16	0,44	0,10	0,00	0,00	0,00
EXTREMADURA	3,03	3,71	4,71	6,15	5,76	3,98	2,17	1,39	0,67	0,52	0,41	0,27	0,22
GALICIA	0,38	0,30	0,26	0,17	0,09	0,06	0,11	0,06	0,04	0,00	0,00	0,00	0,00
LA RIOJA	0,81	0,00	0,00	1,23	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
MADRID	0,91	0,43	1,68	2,23	1,35	2,07	1,51	1,03	1,21	0,65	0,30	0,00	0,00
MURCIA	3,28	0,00	0,00	0,89	0,00	0,26	0,72	0,00	0,00	0,00	0,00	0,00	0,00
NAVARRA	0,34	0,25	0,04	0,00	0,00	0,00	0,00	0,06	0,12	0,00	0,00	0,00	0,00
PAÍS VASCO	0,20	0,57	0,13	0,11	0,25	0,04	0,00	0,00	0,02	0,00	0,00	0,00	0,00
VALENCIA	2,33	0,68	0,67	1,16	0,99	0,00	0,19	0,00	0,00	0,20	0,20	0,00	0,00
TOTAL	**1,77**	**1,37**	**1,45**	**1,54**	**1,25**	**0,84**	**0,57**	**0,40**	**0,32**	**0,20**	**0,12**	**0,08**	**0,08**

Table 7.- Evolution of the prevalence of bovine tuberculosis in the Autonomous Communities of Spain between 2002 and 2013. (Source: MAGRAMA)

CCAA	PREVALENCIA DE REBAÑO											
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
ANDALUCIA	9,65	8,47	6,73	5,32	5,76	4,15	5,80	8,94	8,54	6,16	5,69	5,94
ARAGON	3,14	2,75	2,03	1,56	1,96	3,65	0,75	0,70	1,22	1,62	1,38	0,71
ASTURIAS	0,32	0,22	0,24	0,18	0,17	0,24	0,22	0,21	0,18	0,14	0,19	0,20
BALEARES	0,92	1,02	0,65	0,65	0,22	0,21	0,00	0,00	0,17	0,00	0,40	0,60
CANARIAS	0,34	1,05	2,40	1,00	0,36	0,37	0,24	0,00	0,00	0,00	0,00	0,00
CANTABRIA	1,00	1,34	1,41	1,16	1,05	2,25	1,57	0,91	0,79	0,74	0,89	0,88
CASTILLA LA MANCHA	7,69	3,36	7,19	7,02	7,71	9,51	11,62	10,27	7,11	5,35	3,54	3,33
CASTILLA Y LEON	5,10	5,66	3,78	3,37	5,11	4,16	3,71	2,75	2,62	2,57	2,66	2,88
CATALUÑA	1,93	1,74	1,78	1,70	1,65	1,08	0,85	0,83	0,59	0,81	0,25	0,04
EXTREMADURA	7,45	5,95	5,57	4,05	4,84	3,74	3,37	3,78	3,04	3,11	3,29	4,53
GALICIA	0,52	0,43	0,46	0,31	0,20	0,19	0,11	0,22	0,28	0,19	0,21	0,12
LA RIOJA	2,05	2,70	2,76	1,31	0,72	0,70	1,45	0,75	1,14	0,38	0,36	0,37
MADRID	3,69	3,92	1,99	2,58	2,59	3,41	5,72	5,54	5,45	7,22	6,13	4,51
MURCIA	5,79	1,48	7,59	4,46	4,96	8,05	3,29	3,51	1,59	0,33	1,40	1,84
NAVARRA	0,52	0,82	0,36	0,38	0,27	0,33	0,40	0,30	0,67	0,65	0,30	0,66
PAIS VASCO	0,06	0,17	0,22	0,64	0,19	0,14	0,20	0,57	0,37	0,33	0,25	0,17
VALENCIA	12,47	5,56	2,63	2,16	1,61	1,14	1,41	1,38	3,84	1,94	1,55	2,88
TOTAL	2,24	2,14	1,80	1,52	1,76	1,63	1,59	1,65	1,51	1,33	1,31	1,39

Nowadays, the breeding programme encompasses a total of 293 farms and 18000 adult dairy cows. It allows the calculation of 13728 lactations (15602 in the year from a total of 334000 in Spain), and has contributed to enhance the average milk yield per cow from 5600 litres in 1990 up to 9733 kg/year in 2013 (Efrife, 2013) (Table 7). The increasing evolution observed in the population of Holstein of the BC is over the average for most of the genetic tendencies, such as kg of fat, kg protein, IGT and ICO, but not so clearly for kg of milk during the last years, in comparison with the Spanish population of Holstein. Moreover, the population of Holstein of the Basque Country is the only one assessed for calving ease within the different regions of Spain.

Regarding the organization of the sector, the cooperative of dairy milk farmers (Kaiku Coop) is formed by 432 farmers (most of them from the Basque Country and Navarre, but also some from the northern areas of Burgos and Rioja) that produce every year around 166 million litres of milk. Kaiku Coop. takes part of the local dairy industry, Iparlat S.A. (with 36% of the capital) and Kaiku Food Corporation S.L. (with 8%), which try to obtain the highest quality and efficiency of the productive process, as well as to research and innovate in the development of new dairy products. These industries market a huge diversity of dairy products with their own label (from pasturized and UHT milk, to margarines and functional food products), some of them very well perceived within the market, as well as retailer brand products for one of the top-leading networks of supermarkets.

Table 8.- Evolution of average Total Milk yield and Standard Lactation (305 days) within the Holstein-Friesian population taking part of the breeding programme in the Basque Country. (Source: EFRIFE, 2013. Basque Federation of Holstein-Friesian Breeders)

	LACTACIÓN REAL							LACTACIÓN ESTÁNDAR (305 Días)						% vacas con Lactación Standard
	Nº Cabezas	Duración	Kg. Leche	Grasa		Proteína		Nº Cabezas	Kg. leche	Grasa		Proteína		
				Kilos	%	Kilos	%			Kilos	%	Kilos	%	
1990	16.684	290	5.642	215	3,81	169	2,99	14.467	5.832	222	3,81	178	3,05	87
2005	21.093	329	9.163	339	3.76	293	3.20	17.555	8.830	318	3.61	279	3.16	83
2006	20.715	338	9.486	352	3,71	303	3.20	17.519	9.060	332	3,67	285	3,15	85
2007	19.351	339	9.576	354	3,70	306	3,20	16.523	9.037	329	3,65	284	3,15	85
2008	19.893	338	9.498	351	3,70	304	3,20	16.751	9.005	328	3,64	283	3,15	84
2009	19.257	341	9.565	357	3,73	307	3,22	16.291	9.010	330	3,67	285	3,17	85
2010	18.451	341	9.778	363	3,71	315	3,22	15.602	9.217	337	3,66	292	3,17	85
2011	17.689	339	9.906	362	3,66	319	3,22	14.943	9.355	337	3,60	297	3,17	84
2012	17.442	336	9.763	362	3,70	317	3,25	14.710	9.272	338	3,65	296	3,19	84
2013	16.215	338	9.713	361	3,72	315	3,24	13.728	9.188	337	3,67	293	3,19	85

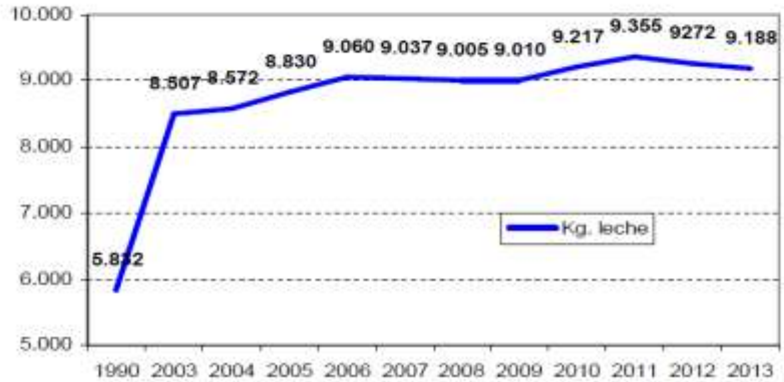


Figure 1.- Evolution of average Standard Lactation (305 days) within the Holstein-Friesian population taking part of the breeding programme in the Basque Country

As for milk prices, the sector has had to face huge variations during these last years. After the high prices paid at the end of 2007 and early 2008, a decreasing tendency followed for nearly two years (Figure 2). Afterwards, a very slow improvement has been observed, but still far from those peak prices. It is noteworthy that milk prices perceived by farmers in the Basque Country are usually over the average paid within Spain, but since 2010 prices have usually evolved under the average amounts paid in the UE.

Figure 2.- Evolution of cow milk yield paid to farmers in the Basque Country, Spain and EU since 2007.

The uncertainty related to the evolution of milk prices, together with the evident volatility of the price of inputs (cereals, energy, etc.) observed during these last years exert a huge impact in the economic profitability of the farms, and therefore in their long term sustainability. Specially, in view of the potential risks associated with the effects of the last review of the Common Agricultural Policy and the abolition of milk quotas.

DAIRY SHEEP

Dairy sheep production in the Basque Country is based in the local breed called Latxa in the Spanish Basque Country (SBC) and Navarra (NA), and Manech in the French Basque Country. Although they are basically the same breed, due to administrative, orographic and political reasons the evolution and development of the R+D programmes has been different in each side of the border. There are three main different ecotypes of Latxa breed: Blond-faced Latxa, Black faced Latxa of the SPB and Black-faced Latxa of NA. The differences are due to the skin colour and the presence or absence of horns. There is also another population of Blond-faced Carranzana featured by a bigger size and more convex face profile. Figure 3 shows the population census and geographical distribution of these breeds. From a total sheep population of 160631 heads in the Basque Country in 2013, the local breeds (Latxa with 145633; Carranzana with 6993 and Sasi Ardi with 218 heads) represent 95% of the census. The presence of high-yielding foreign breeds, such as Awassi, Assaff or Lacaune, is not significant yet and represents 1.75% of the total population.

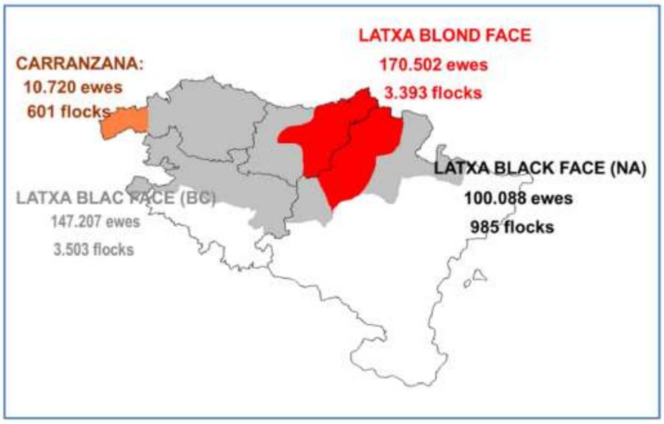


Figure 3.- Population census and geographical distribution of the Laxa and Carranzana breeds in Spain.

Although until 1980 the Latxa breed was considered to be a multipurpose breed, nowadays it is widely recognized as a proper dairy breed. However, comparing with other dairy sheep breeds (like Manchega in Spain or Lacaune in France) average milk production is still lower, around 1.3 l/day (ICAR, 2012). **Milk is basically used for Idiazabal cheese-making, a traditional product which origin, production process and outstanding quality features are protected and certified by the Protected Designation of Origin (PDO) of Idiazabal**. This label and the high degree of structuration of the sector existing in the Basque Country (Figure 4) have significantly helped to maintain the breed and the production system. The structuration has also canalized the professionalization of producers, technology transfer and R+D programs.

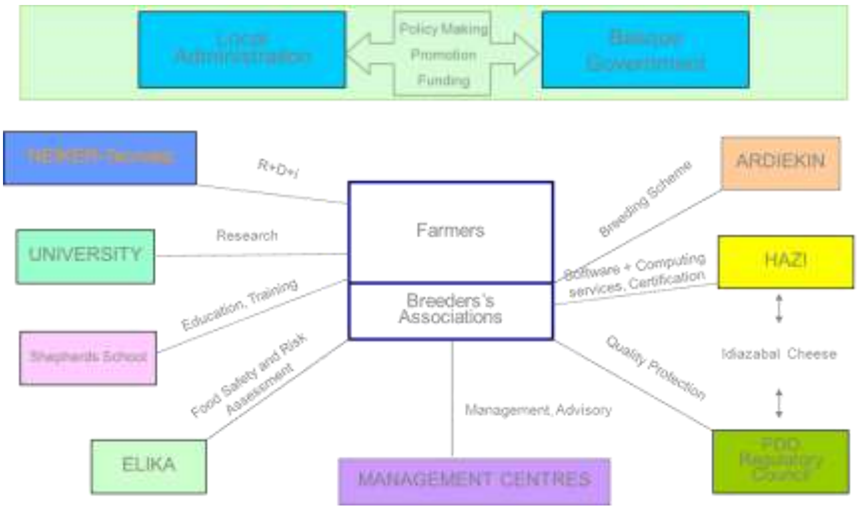


Figure 4.- Stakeholders involved in the R+D programmes of the dairy sheep sector in the Spanish Basque Country

The first activity proposed by the Basque Government to advance in the professionalization of the livestock sector was the creation of breeders' associations in the early 80's. These associations were created to conserve and promote the breed and to allow the implementation of animal health and milk recording programs. Three farmers' associations were also created by the Latxa sheep breeders, one for each province of the Spanish Basque Country (ACOL in Bizkaia, AGORALA in Araba, and ELE in Gipuzkoa).

Together they sorted CONFELAC, the Basque federation of Latxa sheep breeders associations. The association of breeders of Navarra (ASLANA) joined CONFELAC in 1991.
Around these associations different research and development programs have been developed and they have been essential in the adaptation of technologies and in the application of research results. Most of the research programs regarding animal health, animal production and environmental impacts have been carried out by NEIKER-Tecnalia (the Basque Institute for Agricultural Research and Development), whereas food quality related issues have been the scope of the University of the Basque Country UPV-EHU and AZTI-Tecnalia.
There are also the management centres that work very closely related with the farmers' associations. These centres provide different technical and advisory services to the livestock farmers' associations (sheep, cattle, poultry, pigs, rabbits, etc.), such as: animal nutrition, milk recording, data computerization, herd book management, artificial insemination, installations and facilities, etc. Since the human and technical resources are shared by all the associations, costs are cheaper and the programmes are more affordable than if each association would have their proper resources.
Approximately 6.6% of the sheep sector is formed by large professional farms (more than 100 sheep/farm, Table 8), representing 80% of the census and practically 100% of the milk and dairy products commercialized (Table 9). The remaining holdings are very small familiar farms.

Table 9.- Recent evolution of the number of farms existing in the Basque Country according to flock size, and the number of sheep (Data Source: Eustat 2013)

	2008	2009	2010	2011	2012	2013
1 - 99 sheep	5.094	5.443	5.548	5.549	5.355	5.343
>100 sheep	479	730	526	526	400	379
Total number of farms	5.573	6.173	6.074	6.075	5.755	5.722
Total number of sheep	333.090	333.255	324.223	308.129	274.982	274.490

Table 10.- Sheep milk production in the Basque Country in 2013. Data Source: Eustat 2013

Sheep milk	Thousands of lt
Consumed or transformed in the farm	4.226
Commercialised	2.890
TOTAL	7.116

Data Source: Eustat 2013

In order to improve milk yield, a milk recording and breeding programme was started in 1982. The Figure 5 shows the evolution of the number of flocks and sheep under control.

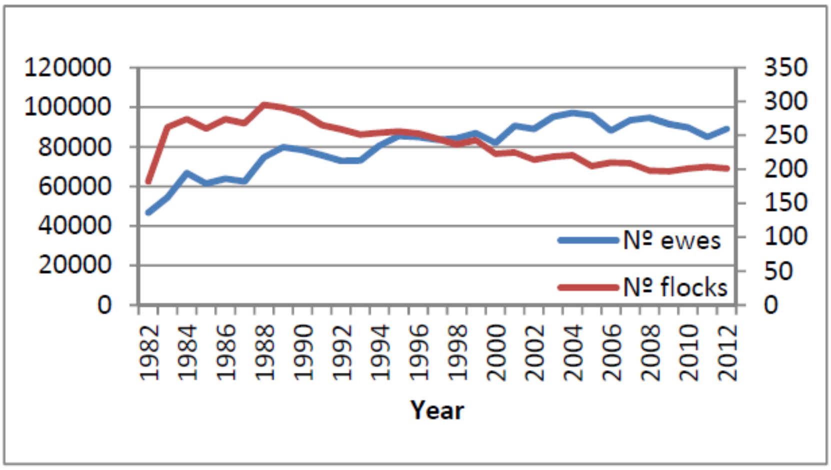


Figure 5.- Evolution of the number of ewes and flocks in the milk recording program of the Latxa breed

The basis of the milk recording program is the individual identification of ewes. At the beginning, the identification was done through double ear tags that ensured the identification of individuals in the event that one of the tags was lost. Such identification was performed with metal tag in one ear and a plastic tag. After some research projects, from 2006 the animals started to be identified with ruminal electronic devices, although the plastic ear tag is still maintained. The electronic devices ensure the identification of individuals during the milk recording by using an electronic reader. The milk yield is measured with volumetric jars and it is also recorded through the same electronic devices that automatically download the information into a database.

The electronic identification also facilitates data collection for quality and udder morphology traits, since the devices automatically identify the animals that must be controlled for these traits.

In the beginning, the control methodology implemented was the A4 (every month milk production was assessed in both milking: morning and evening). After some research (Gabiña et al, 1986) the method was changed two years later to the AT methodology (alternate recording: one month in the morning and the next month in the evening). Nowadays, the AC methodology is implemented within a limited number of flocks (ICAR, 2012).

The results of the program are clearly satisfactory and the annual genetic improvement is around 3 - 3.5 l / year depending on the ecotypes and varieties (Figure 6). Nowadays the efforts are devoted to assess the possibility to implement genomic selection and convergence with the breeding program of the Manech breed.

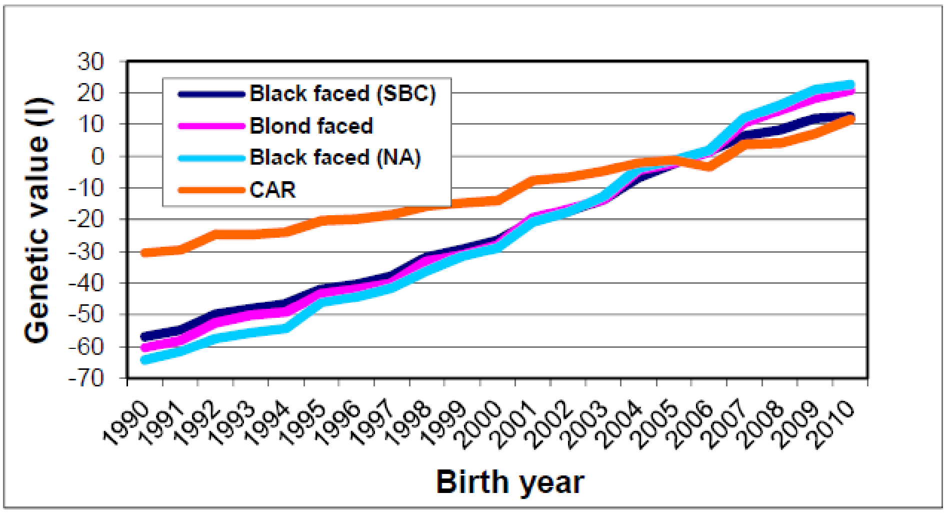


Figure 6.- Genetic trends in the Latxa breed

One of the most important values that the Latxa breed provides is the link with the land through a pastured-based production system based on the use of natural resources. For that reason different research projects have been carried out to study the use of grass as an important element of the diet (grazing times and patterns). These studies have showed that it is possible to obtain similar milk yield and higher milk and cheese quality, on the basis of a cheaper feeding strategy (De Renobales et al, 2012).

In the same sense some studies show that there might be very interesting local alternatives to soya as a source of protein. For example, the utilisation of cold-pressed cakes obtained from certain crops such as rapeseed or sunflower, similar milk yields and healthier characteristics can be achieved (Mandaluniz et al., 2012). These studies were completed with the nutritional characterization of these diets and the in-vitro assessment of digestibility (Goiri et al, 2010) and the behaviour of the diets in a RUSITEC equipment (Garcia-Rodriguez et al., 2010)

Nowadays, the interest is in the **holistic assessment of the sustainability of different farming systems** (Ripoll et al., 2012), as well as evaluation of the potential **environmental impact of the GHG emissions of and the ecosystem services provided by different Latxa sheep production systems**.

Finally, the development of software based on simulation and optimisation techniques to provide decision support systems to farmers is another area of research within the existing projects (Villalba et al., 2012).

Regarding added value and high quality food products, the **Idiazabal Protected Designation of Origin** (PDO) was created in 1987. This distinction attempts to protect outstanding quality features of a traditional product, the local breeds, the production systems and the areas of origin (SBC and NA). In 2013 there were 500 flocks providing milk to produce Idiazabal PDO cheese, and 122 cheese-making units (Figure 7), most of them being smallholders that transform their own milk. It has to be pointed out that nearly 60% of the total Idiazabal cheese was produced on-farm with their proper milk in 2013, whereas 40% was commercialized through the dairy industry: these figures where 47 and 53% in 2007, respectively.

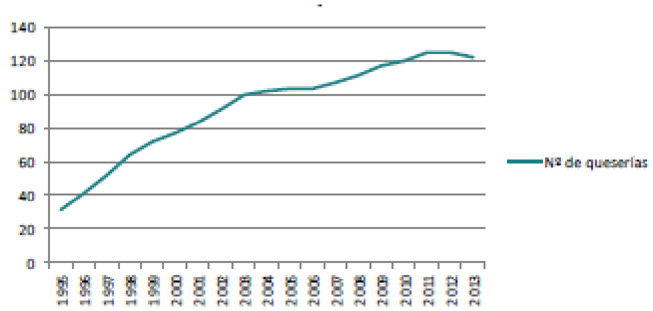


Figure 7.- Number of cheese-making units within the PDO Idiazabal

The production of Idiazabal PDO cheese showed a peak in 2010 with nearly 1500 tons (Figure 8), and has decreased afterwards due to the global economic crisis, and particularly due to the breakdown of the biggest dairy factories that collected milk.

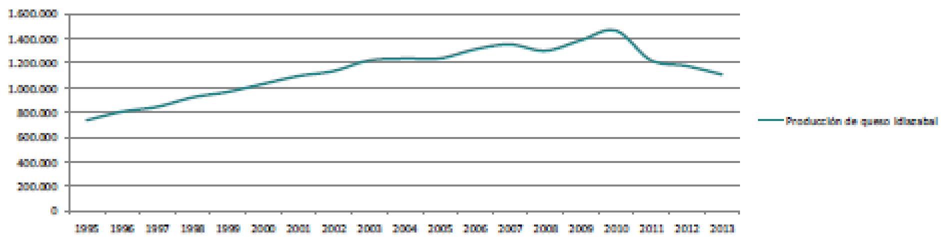


Figure 8.- PDO Idiazabal cheese production (kg)

During the last years, **Idiazabal PDO cheese has been awarded with numerous mentions of quality**, in particular in the annual editions of the World Cheese Awards, which shows the great job carried out by the shepherds who transform their own sheep's milk into cheese, especially related to their formation and professionalization. One of the most innovative aspects of Idiazabal cheese is the use of casein plates with counterlabels that ensure the total traceability of the product. Obviously, it is controlled by the corresponding certification entity, HAZI in this case. The Idiazabal PDO Council, together with the University of the Basque Country (UPV) has formed a professional panel of tasters who provide services for R+D programmes. For instance, they have been involved in some projects related with the use of indigenous natural starters. Nowadays, the PDO is trying to develop techniques to differentiate in the cheese whether the milk was produced by Latxa sheep or from other breeds, in an attempt to avoid potential frauds and to enhance the guarantees for the consumers.

In addition to the PDO label for the Idiazabal cheese, the "Euskal Esne Bildotsa" label was created to identify and guarantee the suckling young lambs produced, exclusively from the Latxa and Carranzana breeds.

The Autonomous Community of **the Basque Country is declared officially free of ovine brucellosis (Brucela melitensis) and is awaiting to be declared also officially free of contagious epididymitis (Brucela ovis)**. This situation is the result of the compulsory sanitary programs carried out every year in every flock since the early 80´s, and slaughtering every positive animal (Figures 9 and 10). Significant R+D activities have also been carried out to enhance the sanitary status of the sheep population regarding Q Fever, Border Disease, Blue Tongue, Visna-Maedi, Paratuberculosis, etc. Apart from epidemiologic studies or research about transmission vectors, most of the efforts have focused in the development of efficient early detection methods, as well as protocols to control and eradicate these diseases.

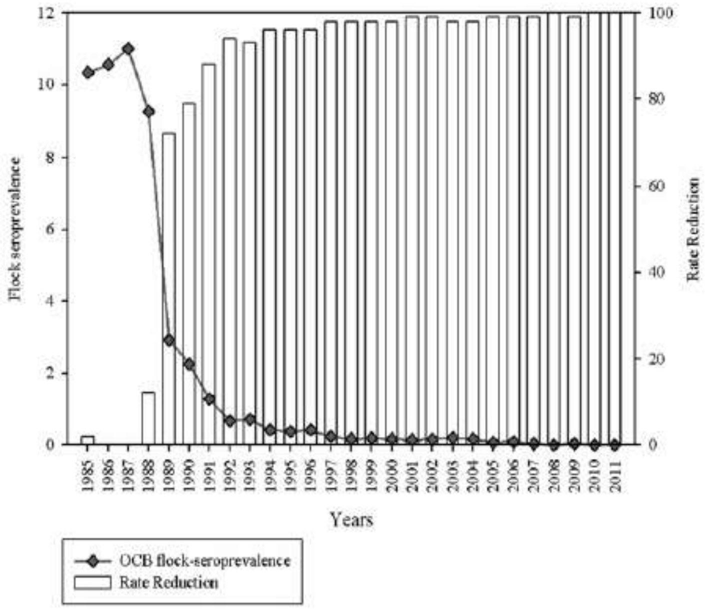


Figure 9.- Changes in seroprevalence of Brucella melitensis infection in sheep/goats farms in the Basque Country (1985-2011)

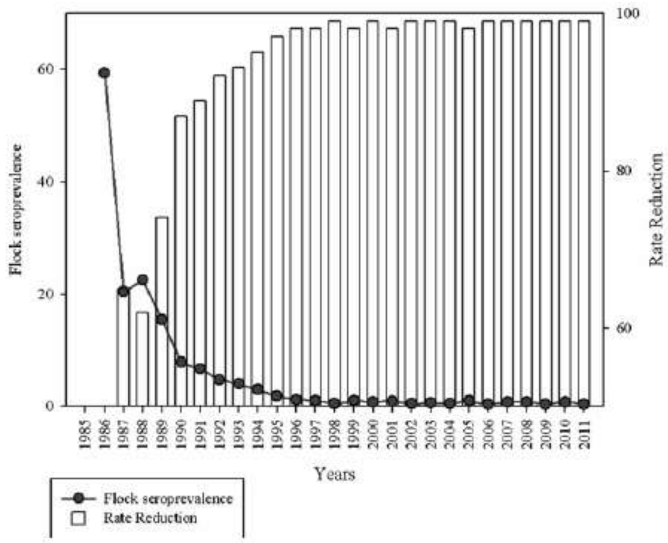


Figure 10.- Changes in seroprevalence of Brucella ovis infection in sheep farms in the Basque Country (1985-2011)

Finally, it can be concluded that **there are some common problems and challenges that will affect the impending future of this sector in the SBC**, such as:

- Access to land, since there is a high competence for other uses (industrial areas, infrastructures, etc.);
- The relatively high dependence on purchased inputs from outside the farms, especially in the more intensive systems;

- There are some issues related to climate change and the adaptation of the production system and animals to the new conditions. In fact, there is a growing concern about emerging diseases affecting animal health.
- The impact of predators (wolfs, basically) and the difficulty for coexistence of extensive sheep farming systems with wildlife is also a hot topic.
- The lack of confidence in the dairy industry generated after the recent crisis of one of the main companies that collects and process milk, and the payments still due to some farmers;
- The need to innovate in dairy sheep products.
- Finding solutions to process the whey generated within the artisan cheese making farms.

BEEF CATTLE

Whereas dairy cattle and Latxa dairy sheep have traditionally played leading roles in livestock rearing, other activities such as beef cattle, goats, horses, etc. have been relegated to a secondary status. Nowadays, beef meat accounts for 29% of livestock gross production. Most animals are crossbreds, mainly with Holstein, but there are increasing populations of purebreds Pirenaica, Limousín and Blond d'Aquitaine. The fact that beef cattle rearing can be a complement to other economic activities, either agricultural (dairy, cereal, etc.) or out of the farm (industry), has arisen increasing interest among farmers and the sector has behaved in a quite dynamic way. In fact, during the last decades the production of beef cattle has experienced a significant growth: whereas in 1990 there were 29758 suckling cows, in 2013 they were 4686 farms and 46015 adult suckling cows, even despite the slight decrease observed during the last years (Table 10). It is noteworthy the small size of the beef farms: 71% of them with less than 9 heads; 13% have more than 20 cows, and only 4% have more than 50 animals.

Table 11.- Distribution of beef cattle farms existing in the Basque Country on the basis of herd size.

	Nº de explotaciones aptitud cárnica					
Estrato	2007	2008	2009	2010	2011	2012
1-2 vacas	1.544	1.509	1.487	1.409	1.328	1.323
3-4 vacas	1.142	1.121	1.065	1.010	974	949
5-9 vacas	1.327	1.278	1.224	1.214	1.162	1.113
10-19 vacas	801	787	764	733	759	745
20-49 vacas	470	468	480	523	463	456
> 50 vacas	191	193	194	166	186	174
Total explot. aptitud cárnica	5.475	5.356	5.214	5.055	4.872	4.760

Regarding the distribution of the beef cattle population (Table 11), 55% of the heads are within the farms that rear more than 20 cows, and particularly 28% of the heads are in farms with more than 50 animals.

Table 12.- Distribution of the beef cattle population existing in the Basque Country on the basis of herd size.

	Nº de vacas aptitud cárnica					
Estrato	2007	2008	2009	2010	2011	2012
1-2 vacas	2.394	2.326	2.276	2.190	2.064	2.037
3-4 vacas	3.924	3.848	3.660	3.469	3.367	3.293
5-9 vacas	8.939	8.415	8.100	7.995	7.695	7.374
10-19 vacas	10.738	10.602	10.269	9.765	10.093	9.928
20-49 vacas	13.854	13.807	14.098	14.564	13.950	13.802
> 50 vacas	15.158	15.101	15.634	15.340	15.003	13.953
Total explot. aptitud cárnica	54.807	54.099	54.037	53.323	52.172	50.387

The beef cattle breeds with the higher number of animals are Limousin and Pirenaica (a local breed), with 16.916 and 16.596 heads respectively. Then, there are around 2600 animals belonging to Charolaise and Blond d'Aquitaine breeds, 1600 Parda de Montaña cows, and then a much minor number of animals of other breeds such as Betizu (another local breed), Sallers, etc.

The base of the sector is formed by farmers taking part of the pure breed beef cattle breeders' associations formally set up. At the province level, there are 15 Farmers' Associations around the main pure breeds: Pirenaica, Limousín, Blonda, Charolais, Betizu, Terreña and Monchina. In 2005 they encompassed 559 farmers and are responsible for data collection, management of recording programmes, data processing and management of Herd Books. On average, the local administration provides 65% of the cost of the different programmes carried out, the rest being supported by farmer´s.

The most important one in terms of number of animals inscribed, years of experience in conservation and genetic improvement is the Association of Pirenaica, the only autochthonous cattle breed reared in commercial flocks with productive purposes, whose Genealogic Book begun in 1988. The genetic programme is carried out together between BC and Navarra upon the following characters: live weight at birth and at 210 days-old. Genetic evaluations are done with a BLUP methodology including an animal model with repeatability and mother effect, in the Faculty of Veterinary, University of Zaragoza.

The Association of Limousin was sorted following the same scheme and methodology of Pirenaica's. The Basque Association takes part of the national breeding programme and evaluations are carried out simultaneously for the whole Spanish population by INIA. Since 1987 there is a national Genealogic Book managed by farmers under the control of the Ministerio de Agricultura, Pesca y Alimentación. The Blonde d'Aquitaine breed (Federation sorted in 1996) has recently been recognised and the national confederation is trying to set the bases for a national breeding programme following the criteria applied in France for beef cattle.

As for autochthonous breeds, to attempt to increase the scarce populations of Terreña, Betizu and specially Monchina, they receive economical support within the package of the existing environmental measures. Although Euskal Abereak is the association that works in favour of their conservation in general terms (sheep, cattle, poultry, etc.), specific associations have been formed to work more specifically with Terreña and Betizu breeds not only with conservation purposes, but taking into account productive objectives as well, so as in the future they could be economically profitable.

Provincial Breeders' Associations formed at the province level for a particular breed are joined together in a Federation for the entire BC. The role of the Federation is to coordinate the Recording Programmes in the three territories, put the data together and elaborate the database in the suitable format that will later be sent to the following level. National Confederations are responsible for collecting these databases from the different Autonomous Communities existing in Spain in a way that genetic evaluations can be carried out together.

The control of Bovine Spongiform Encephalopathy (BSE) has been one of the most important activities carried out following the outburst that shocked the sector during the 90's. In 1996 the Basque Government and the County Councils (Diputaciones Forales) designed a Plan for the Prevention, Vigilance and Control of BSE. Since 1994 feeds containing animal protein by-products cannot be fed to ruminants, being foodstuff processing plants and livestock farms regularly controlled. Since 2001 every animal slaughtered ageing over 24 months-old is analysed for BSE detection test in the P3 Laboratories of Neiker-Derio, results are obtained in 24 hours and, if positive, the carcass will be removed from the food supply chain. Anyway, animals must be slaughtered in allowed instalments and specific risk materials must be removed from the carcass (Order 218/2000, 7th of November). As for labelling, since the 1st of January of 2002, it is compulsory to include two new pieces of information: i) country where the animal was born, and ii) country (or countries) where the animal was raised. According to the Order 235/2000, any sort of information that cannot be controlled, proved or could induce to misunderstanding or confusion within the consumer is absolutely forbidden. The objectives are: i) that according to the current knowledge, every beef meat product goes through very strict controls, even above those legally required, before arriving to consumers; and ii) to provide consumers with all the information to which they have a right of access.

Precisely ELIKA was created as a foundation in January 2001 as an initiative of the DAPA after the outburst of BSE and is engaged in the area of food safety and risk assessment with an integrated, preventive and quick response approach. Initially ELIKA was in charge of risks assessment and alert management in relation to the primary sector and the Basque agro-food industry, and later have been promoting the preparation of a set of Good Practice Guidelines for the primary sector to identify potential hazards.

Apart from Holstein-Friesian sires, the artificial insemination centre stated for dairy cattle, ABEREKIN also keeps males of Pirenaica, Limousin, Blonde d'Aquitaine, Charolais, Belgian Blue, Brown-Swiss, Salers, Fleckvieh and Normande breeds.

Regarding marketing and commercialization activities, the joint purchase of foodstuffs, fertilisers, phytosanitaries, seeds, farming implements, etc. was initially promoted by means of cooperatives (MIBA, ANOGA, etc.) or management centres. Later, KALITATEA Foundation was set up in 1998 by the Agricultural Department of the Basque Government as a non-profit making organisation, aiming to encourage, promote and develop added value quality food products. It is basically a control and certification agency. Nowadays there are 17 products with the "Eusko Label" of quality, controlled by a particular Technical Regulation and periodically controlled: 5 vegetables, 4 wines, 3 meat products (beef meat, suckling lamb and poultry), 2 fish products, 2 dairy products and honey.

As for beef meat, Euskal Okela is the beef certified with the Eusko Label - Kalitatea mark, which complies with all requirements regarding origin, health and quality defined in the technical regulations that control this product. It comes exclusively from animals born and raised on farms in the Basque Country, controlled at all stages of their development and selected according to their quality in authorised abattoirs of the Basque Country. It is sold exclusively in authorised butcheries, easily recognisable by a particular symbol. Every time consumers purchase Euskal Okela meat, butchers provide them with an adhesive label printed on special scales, indicating all the details of the operation and with the logo. Therefore, the Fundación Kalitatea Fundazioa guarantees the origin of animals, above-average quality, additional health guarantees and product authenticity.

A similar label (GIOKELA) was created in Gipuzkoa by a group of farmers that certifies that animals are raised and slaughtered in the Basque Country, but not necessarily being born there.

Except in dairy cattle, where KAIKU Coop. has been crucial for the development of the sector, nearly nothing has been done in relation to the joint commercialization in the remaining livestock sectors. Several explanations can help to explain this fact. First, the Basque market of foodstuffs is deficient in nearly absolutely every product. Then, in addition to a high population density, the prestige of particular products and transformers, valuation of know-how practice, celebration of weekly rural markets, and the chances for a mutual knowledge producer-consumer, etc account for a high fidelity in the purchase of some products (cheese, vegetables, etc.)

But selling meat products has usually become much more complex. To try to offer a solution to the sector, the Basque Government promoted in 2004 the creation of Gurokela SL by 254 farmers, who represented 15000 cattle, 30% of the Basque census, 15% of total meat production and 30% of the "Euskal Okela" total sales volume. Gurokela aimed to improve the competitiveness of local farms by means of better production strategies and commercialisation of high quality products. To do so, they started concentrating the existing offer, reducing operating costs at slaughtering and quartering, and selling within the Eusko Label Regulation, but also trying to adapt better to the new purchase tendencies (formats, habits, etc.). Gurokela considered that these strategies would bring a better situation for negotiation and higher margins, and shocked the local sector, already in a weak situation due to the predominant existing structures (scattered sector, small sized farms, decreasing margins, etc.), and caused unrest within certain farmers and butchers. For instance Farmers' Unions showed their mistrust in this initiative and considered that such concentration would decrease the chances for commercialisation specially for small producers and would damage their sustainability in the medium term. However, the initiative did not succeed as it was expected and was extinct 5 years later.

Additionally, some measures (such as the privatization of the management of the slaughterhouse of Bilbao, closing those of Durango and Vitoria-Gasteiz, etc.) were also very controversial at that time.

Meanwhile, a limited but growing number of individual farmers started **short food supply activities t**o commercialize the meat they produce directly to consumers. To do so, they have to slaughter their animals in any of the few facilities existing in the Community. The meat is packaged in vacuum plastic bags, usually containing around 800 grams and then put together to provide the consumer with a 5 kg packet offering the different cuts of the animal (sirloin, steak, fillets, ribs, mince, etc.). By doing so, the price perceived by farmers is significantly higher than marketing through the conventional commercialization channels, improving the profitability of the activity. In addition, the direct contact with the consumers usually provides the required positive feedback that contributes to the better self-steem of the farmer. However, farmers keep on claiming that slaughterhouse services should be improved, as well as the adoption of measures to make the existing EU hygienic and sanitary package more flexible for the development of short food supply chains.

In conclusion, **there are a certain number of factors that constraint the sustainability of the beef cattle sector in the BC**, such as the small size of the farms, abrupt orography, land availability, dependence from subsidies, adoption of EU or local policy measures, etc.. However, there already exist the **tools and stakeholders required to face them** and even to afford making profit from the opportunities that can be envisaged for the future.

POULTRY FARMING

There is a **very active poultry sector in the Basque Country either under conventional and alternative production systems**. Every year between 10 and 11 million chickens are slaughtered to produce around 23000 tons of meat (Figure 11) and around 1.5 million hens that produce 27000 dozens of eggs (Figure 12). Most of these productions are obtained under conventional conditions.

However, over the past 2 decades a very active production sector has been developed under **free-range conditions**, which is currently organized around common structures and differentiated quality products: *Lumagorri* for poultry meat and *Euskaber* for eggs.

Lumagorri S.L. was sorted in 1993 by 10 farmers to produce **free-range meat chicken**, and there are nowadays 42 farms that share the same production model (rustic genetics, healthy and balanced feeding, high welfare standards, access to grasslands, type of facilities, etc.) and slaughter and commercialization resources. Each farmer can only have up to 3 barns for poultry, each one to produce 1100 chicken per cycle at a density of 11 animals/m^2. Moreover, each barn must guarantee that animals have daily access to an outdoors paddock of more than 2600 m^2. During the 12-13 weeks of the production cycle, chickens are provided with a feedstuff containing at least 60% of maize. Once that the whole lot is slaughtered, it is compulsory to proceed to a sanitary vacuum of the barn for 14 days. Therefore, the need for medication and the risk of biohazards is minimized. A diversity of high quality chicken meat products are commercialized, all of them controlled, guaranteed to the highest nutritional and sanitary standards, and marked with a distinctive label. Around 12% of the broilers and 9% of the free-range meat of Spain, is produced in the Basque Country (Galicia contributes with 48 and 59% respectively, and Catalonia with 10 and 10.6%)

Euskaber S.L. was created some years later with a similar view, philosophy and organization structure to produce and commercialize **free-range eggs**, some of them even produced under organic conditions. They are nowadays 18 farmers scattered throughout the BC.

Lumagorri, Euskaber and the conventional **poultry industry of the Basque Country keep on very active and participatory in R+D activities,** in particular in those developed by Neiker-Tecnalia regarding **animal welfare and environmental enrichment**.

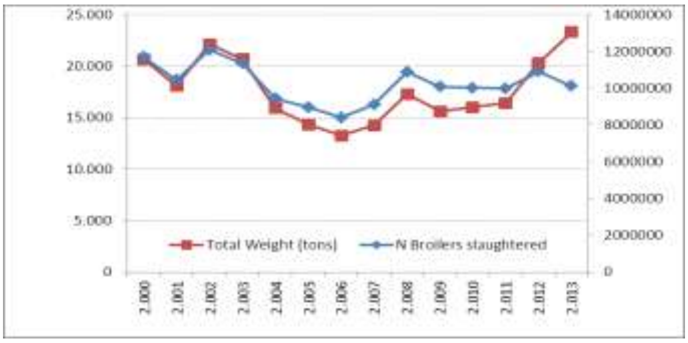


Figure 11. Poultry meat production in the Basque Country

Figure 12. Egg production in the Basque Country

PIG PRODUCTION

A similar process to the previously described for poultry, has been observed in this sector during the last decades. Pig production has strongly decline either in terms of number of farms or pig population census. There are nowadays around 100 farms that manage around 20000 pigs every year (Table 12).

However, as a result of a R & D project between a local association of mountain Agriculture (Tolomendi) and Neiker-Tecnalia, an association was created to produce free-range pigs and to commercialize added value meat products differentiated by means of a quality label: Txerrizaleok. Nowadays, the association brings together 31 farmers (2 of them organic) that share the same farming system to produce around 7000 pigs of. Farmers receive one-month old piglets with an average weight of 20 kg, which are fattened during 5 months with a mixture of GMO-free raw materials, mainly cereals until they reach 150 kg live weight. Since they are free-range, they have additional access to grass, corns, etc. Animals are slaughtered in the same abattoir and meat is processed to get a diversity of high quality food products that are guaranteed and certified by a quality label. There is a quite stable demand for these food products within the Basque market. The main challenge of the Association is to have access to lower priced feedstuff of a local origin in order to improve the profitability and economic sustainability of the farmers.

Table 13.- Recent evolution of the number of farms rearing pigs in the Basque Country and pig population census.

	2001	2003	2005	2007	2008	2009	2010	2011	2012	2013
Number of farms	416	282	203	144	117	n.a.	n.a.	n.a.	100	108
Number of heads	40873	36.038	31.991	31.836	32.357	24.409	18.817	17.445	19.567	21.761

RABBIT SECTOR

Every year between 1.2 and 1.4 million rabbits are slaughtered in the Basque Country to produce around 1400-1700 tons of meat (Figure 13). Most of them (98%) belong to the 33 farms that take part of the Farmers Association. Although it is a minor sector in Basque Country, it is deeply entrenched for decades and perfectly structured. In fact, the whole value chain (feed mills, farmers, slaughterhouse, distribution, etc.) is clustered around a platform addressed to improve the competitiveness and sustainability of the sector.

Figure 13.- Production of rabbit meat in the Basque Country

2. ANIMAL PRODUCTION STRENGTHS IN BASQUE COUNTRY

- **Good environmental conditions for grazing resources: natural grasslands, shrubs, forest areas…**
- **Local breeds adapted to the valorisation of natural resources (Latxa, Carranzana, Pirenaica, Terreña, Azpi Gorri Ahuntza, Arabako Mendi Zaldia, Pottoka, Euskal Oiloa …)**
- **High health status of the livestock population: consolidated and successful health programs.**
- **Highly structured and organised sector: farmers associations, cooperatives for inputs provision (feedstuff) and commercialisation, advisory management programs, food quality label, training and education stakeholders, etc.**
- **Breeding (genetic) programs running consolidated, with successful results.**
- **Modernized, specialized and professional sector.**
- **Proximity between production and populated areas (consumers): tradition (and potential) in short food supply chains.**

- **High public awareness of the important role and quality of local food products.**

- **Good market position of food quality labels developed to distinguish Basque products (PDO Idiazabal cheese, Euskal Okela, etc.).**

- **Long tradition in cooperative production and marketing.**

- **High food safety and quality standards.**

2.5.16 Sweden

Country Report Sweden

- overview
  - importance of agriculture in total
    Agriculture is less than 2 % of GNP as in most EU-countries but is still important for Sweden
  - regional distinctions / specifics
    The distinctions are mostly geographic according to climate and soil-properties. Most farms are found in south and in the middle of Sweden.
  - number of farms, average size (ha), staff (self-employed, hired)
    See below
- description of livestock sector
  - importance, share of total sector
  - number of farms, average size (ha), staff (self-employed, hired)
  - species in livestock production, ranking
  - main / most important species:
    - total number, average herd size, tendency to raise or decline, why

      Chicken

      Broilers

      Number of farms is 120 with an average size of 670,000 chickens. Farm sizes increase due to competitiveness from imports and the need to be more and more efficient.

      Egg

      Number of farms 297 (93% of eggs from farms >10,000 hens); Average of farms with 400->50,000 birds is 24,200; Sizes increase.

      Milk

      Approximately 4 600 herds with dairy cows in total in Sweden. The number of herds decreases steadily. During the last 10 years the number of herds has almost been “cut in half”, from over 8 000 to 4 600. The average no of cows/herd in official milk recording is now 72 cows. I would guess that the no of cows/herd is slightly less if you include all cows in Sweden.

      Cattle

      Approximately 20 000 herds with cattle for slaughter in total in Sweden. The number of herds decreases steadily. Meat production is based on animals from milk production (67%) and the rest of the animals are from self-recruiting cattle herds

      Sheep

      Approximately 9 000 herds with sheep in total in Sweden. The numbers of herds increase steadily.

      Aquaculture

      Total number of fish farms year 2012:
      Food fish: 75 – mainly in northern Sweden (Jämtland, Norrbotten, Västerbotten)
      Fish for stocking: 61 – more evenly spread in the country.
      Crayfish: 26 – mainly in the southern part of Sweden
      Crayfish for stocking : 7 – only southern Sweden

Blue mussles: 13 – only in Västra Götaland
Oyster : 1 – Västra Götaland

Trends number of farms: A general decrease in number and increase in size of aquaculture farms from 2003 to 2012.
Size of the farms: The number of farms (rainbow trout) is highest in Jämtland but the largest farm are in Västernorrland if multiple sites of the same farmer is combined. Only two large farms, measured by international standard exist in Sweden. Both are open cage farms. One in Jämtland, Vattudals fisk, and one in Västerbotten, Malgomaj. Malgomaj is the largest site of UmLax, with main office Vilhelmina.

Pigs
Approximately 1320 pig herds in Sweden, most of the herds have integrated production. The average herd size is 160 sows. The numbers of herds decrease steadily.

- main areas / regional concentration

Chicken
Broilers
Farms and slaughter houses are situated in crop growing areas, i.e. from Mälardalen and South.
Egg
Production concentrated to west, south and south east of Sweden- mainly south of Mälardalen. Farms are smaller in average north of here. Insulation of buildings is also thicker. Fewer birds are also kept outside.

Milk
Production concentrated to west, south and south east of Sweden- mainly south of Mälardalen.

Cattle
Production concentrated to west, south and south east of Sweden- mainly south of Mälardalen.

Sheep
Production concentrated to west, south, south east of Sweden and Gotland - mainly south of Mälardalen.

Pigs
Production concentrated to west, south and south east of Sweden- mainly south of Mälardalen.

- husbandry systems

Chicken
Broilers
Broiler chickens are always kept on litter beds in large modern buildings. Organic production is less than 1 %. Genotypes used are Cobb and Ross.
Egg
Barns are very modern normally since a lot of houses have been built and/or the entire equipment had to be changed to due the ban of conventional cages. The total flock of layers comprises 7.2 mill. (april 2013). They are spread in percent on Free range 0.6%; organic 11.5%; Furnished cages 29.1%; Floor keeping inside 58.8%.

Milk

Percentage of cows in loose house system is 57% and in tie stall systems, 43%. (31% of cows in automatic milking systems or around 900 herds). Proportions of different breeds 2013; Swedish Holstein is about 53% and the Swedish red and white consists of 40% of the population and the rest is a mix of everything. We have less than1% of Jersey cows.

Cattle
In loose house system. The vast majority of cattle are cross breeds but we have Charolais and Hereford and some Simmental, Highland cattle, Angus, Limousin and Blonde d´aquitaine.

Sheep
In loose house system

Aquaculture
Fish: Swedish aquaculture is dominated by rainbow trout and char farmed in open cage systems in general (mainly northern part of Sweden) - used in both inland and coastal waters. However, numbers of small farms are also high in Värmland/Dalsland region. Fish for stocking can also be farmed in ponds and tanks. Fish for stocking is separated from other production if included in the official hydro power dam compensation program. There are some land-based systems (recirculating aquaculture systems, RAS), mainly in the southern part of Sweden. However, the number of RAS has decreased from 84 in year 2008 to 2 in year 2012. Even so it is questionable how many of these 84 farms ever appeared in reality or only represents an application for a site.

Mussles: farmed mainly in long-line systems (repodlingar) on the west coast. A number of pilot farms has also been tested in the Baltic during the last four year period. Of these several has tested the new “Smart farm” system using nets attached to floating pipes instead of the traditional rope system. The smart farm system is combined with new harvesting systems.

- products, output

Chicken
Broilers
Products may vary from cuts of leg and brest meat or whole carcasses. The two former products mainly originate from somewhat older birds/heavier carcasses while for the latter smaller birds are used e.g. for grilled chickens. Perhaps the small niche production of organic broiler production but this is very limited so far in Sweden
Egg
Perhaps the small nish production of brown eggs.

Aquaculture
The dominating species is rainbow trout (10 499 tonnes in fresh weight in 2012, which equals to 84 % of the total production of fish for consumption) – mainly farmed in Jämtland and Norrbotten, but otherwise rather evenly spread in the country.

The main product is food fishes independent of species, but second largest product is fish for enhancement purpose (ca 10%) and for sport fishing tourism (put and take), numbers not known.

- main topics / problems with regard to sustainable animal production

Chicken
Broilers

The biggest challenge for the broiler producers in the future is to compete with low-price imported chicken meat, which does not follow Swedish legal requirements or standards. Future research on broilers should focus on main areas in order to strengthen profitability, competiveness and sustainability in the Swedish broiler production.
Food safety: campylobacter, antibiotic resistance in bacteria found on broiler meat
Infectious diseases: botulism, alternatives to coccidiostats
Nutrition and health: leg health, alternative protein sources
Market, economy and farm management: profitability, Swedish broiler production in an international perspective, competiveness and added values
Environmental issues: new techniques for good environment in chicken houses and the general environment, nutrient utilization and emissions, methods of analyses of emissions.
Egg
A very recent development is that layers should be kept considerably longer, e.g. from 75 weeks of age today to 100-110 weeks of age in the very near future which implies almost 50% longer life cycle. This means that fewer birds need to hatched, reared and fed which reduces energy costs of recruitment (brooders, hatchers, rearing house temperature, use of feed considerably) also less male chicks have to be killed after hatching. However, special attention for egg shell quality, bone strength and perhaps plumage condition and mortality need to be considered as will both management and nutrition needs to be fulfilled.
The finding of alternative feed ingredients in order to reduce and/or exchange feed ingredients that is not very sustainable in their production e.g. soy bean or fish meal.
To reduce the ammonia leakage from oversupply of N in the organic production due to the ban against essential amino acids like methionine and lysine.
To look for management/nutrition modifications and stress level assessment methods in order to reduce/minimize feather pecking – a mal behaviour which still is a considerable problem in large group housing systems and which causes a huge waste of energy/feed due to poorly insulated skin of the birds. A poorly feathered hen consumes between 20 and 40 % more feed. Feed comprises about 65% of production costs and hence, have a major impact on sustainability. Until now most countries in the EU allow beak trimming as a method to prevent pecking but as for now Sweden, Finland and Norway are exemptions of this. There is a trend however; that more countries will not allow this and hence, feather pecking will most likely also be a European problem.
Facilitating the acclimatization of pullets after the transfer from rearing to laying hen facility.

Milk
We must cut the environmental cost for keeping livestock and the uttermost important issue is that ruminants should not be fed any feed that can be used for human food. Therefor the challenge is to find sustainable alternatives to protein feeds such as soybean meal and also substitutes for grain and to feed more of forage-type feed sources. It is important to stress, though that systems must be sustainable also with regard to farmer's economy.
A more holistic approach is necessary and therefore more research needs to be directed towards optimization of the whole production system and to minimize losses in the whole chain from farm to fork. There is a lot of focus right now on trying to improve feed efficiency in ruminants. I don´t think that much can be done on individual animal, but on the efficiency in the whole production chain. One bottleneck in the chain is the ensiling process. Improvements can be achieved by developing systems that minimize losses in the chain from field up to when the silage is presented in front of the animal. Research must be combined with LCA-analyses or similar models.
Another challenge is how to optimize and better use ruminants on marginal land, such as pasture based systems and at the same time contribute to eco-system services and improved biodiversity.

Energy and water-resources is another important research area, maybe not the most urgent in our part of Europe, but for the whole of Europe, for sure.
The development of antibiotic resistance is an urgent area of research.
Better diagnostic tools to identify cows that does not perform “up to standard” and develop disorders in early lactation. Such tools should be part of precision livestock farming, i.e. integrated into management systems.
Transition cow management is extremely important to prepare cows for the upcoming lactation and knowledge is still needed here, especially in combination with the major revisions in feeding (above) that will be needed.
It is likely that cows with flatter and more persistent lactation curves are more sustainable and resilient, but we need to know how to predict which cows are most suitable for such management (with prolonged calving intervals).
A lot of emphasis in EU today is put on prevention of (infectious) diseases in dairy cows, but most of this seem to be directed by the pharmaceutical industry and thus focus on the use of vaccines and antimicrobials, but an integrated management of animal health including e.g. biosecurity measures is a more sustainable approach. However, more research is needed to identify the most efficient actions.
Robust animals are a must, especially with regard to longevity, but in my opinion this is mostly a management-issue. The knowledge is there, it´s a question of transferring the knowledge to the farmers and convinces them about the benefits of increasing the longevity of the dairy cows.
However, one important and higly significant area is of course the increased interest in using new technology for breeding aiming at improving the dairy cows with regard to their genetic capacity for high forage intake and thereby to identify important genomic regions and estimate genomic breeding value for forage intake capacity. See also below.
Research into how to best deliver advisory services is imperative to be able to bridge the “knowing-doing gap”, because current strategies are apparently not efficient enough. This also entails identifications of barriers, constraints and drivers among farmers (and their advisors) for uptake of best practices.

Cattle and Sheep

Beef and lamb production differs in a sustainability point of view from many other production sectors by not only generate negative environmental impacts, such as nutrient and carbon footprint, but also being necessary for the positive environmental effects the grazing animals produce through their grazing. So-called natural pastures are the most species-rich soils we have in Sweden in terms of both flora and fauna and continued grazing is the main criterion for these values to be maintained. Globally, biodiversity loss is our biggest environmental threat (Rockström et al, 2009). The conflict of objectives that have grazing animals to conserve natural pastures while minimizing negative environmental impact will be an important area of research.

Aquaculture
It depends as we need to separate between different systems. The biggest challenge for open cage farm systems are:
Tools to identify suitable locations acceptable by the authorities and public, with enough environmental space. Development and incorporation of acceptable feed ingredients from an environmental stand point but with economic limits allowing a profitable industry.
Access to fingerlings of good genetic and health status to an affordable price.

At present estimated maximum expansion volume of open cage farms in Sweden is between 50-100.000 tons. Expansion above that must most likely be by more closed systems. The biggest challenges for closed integrated and RAS systems are:
Affordable technology for RAS
Solve issues with risk of organoleptic downgrading in RAS
Improved knowledge for integrated systems especially for green house, algae and yeast production utilizing nutrients from fish.

2.5.17 UK

LIVESTOCK FARMING IN THE UNITED KINGDOM

Overview of UK agriculture

Agriculture is crucial to the UK economy, food production and food security and it is central to our way of life. Agriculture forms an integral part of our rural infrastructure, is a significant employer particularly in rural areas and has a vital role in conserving biodiversity and the natural environment.

Agriculture accounts for 70% of total land use within the UK. In 2012, the total area of land on agricultural holdings[1] in the UK was 17.1 million hectares. Around 64% of this is classed as permanent grassland[2] used for grazing livestock with the remainder available to grow crops. Over 9 million hectares of farmland in the UK is managed under agri-environment schemes. These incentivise farmers to adopt land management and farm practices that are beneficial to the environment.

UK agriculture's contribution to the national economy was estimated at £8.7 billion in 2011, 0.65% of total UK Gross value added. By value, it provides us with around three quarters of the indigenous type food that we eat in the UK and around 62% of all food. Agriculture provided direct employment to 481,000 people (including farmers and spouses) in 2011.

The structure of the industry

In June 2012 there were 222 thousand farms in the United Kingdom (Table 1). Around half of these were at least 20 hectares in size; accounting for around 96% of agricultural land. The average size of these farms was 139ha. Farms of more than 100ha account for around three quarters of agricultural land.

Table 1: Numbers of holdings by size group for the UK at June 2012 (a)

[1] Includes all arable and horticultural crops, uncropped arable land, temporary and permanent grassland and land used for outdoor pigs, woodland and other non-agricultural land. Excludes common rough grazing.
[2] Permanent grassland is defined to have been grass for at least 5 years, including sole right and common rough grazing. In addition 8% of the UAA is classed as temporary grassland (sown within the last 5 years), typically within arable rotations.

		2012 Number of holdings (thousand)	Hectares (thousand)
Total area on holdings	under 20 hectares	104	694
	20 to under 50 hectares	42	1 399
	50 to under 100 hectares	34	2 428
	100 hectares and over	42	12 628
	Total	222	17 149
	Average area (hectares)		77
	Average area on holdings with >=20 hectares		139
Croppable area (b)	0.1 to under 20 hectares	49	309
	20 to under 50 hectares	20	652
	50 to under 100 hectares	15	1 089
	100 hectares and over	19	4 208
	Total	103	6 258
	Average croppable area (hectares)		61

Source: June Surveys of Agriculture, SAF land data

(a) Figures for England relate to commercial holdings only.
(b) Croppable area is defined as land under crops, temporary grass under five years old and uncropped arable land.

Table 2: Numbers of holdings by size group and country at June 2012 (a)

	England (a)		Wales		Scotland		Northern Ireland	
	Number of holdings (thousand)	Hectares (thousand)	Number of holdings (thousand)	Hectares (thousand)	Number of holdings (thousand)	Hectares (thousand)	Number of holdings (thousand)	Hectares (thousand)
Total area on holdings								
Under 20 hectares	36.4	321	25.5	107	32.4	165	9.7	102
20 to under 50 hectares	21.4	715	6.3	208	6.2	203	8.4	272
50 to under 100 hectares	19.4	1 398	5.1	362	5.2	375	4.3	293
100 hectares and over	26.7	6 551	4.4	892	8.9	4 862	1.9	324
Total	103.8	8 985	41.3	1 569	52.6	5 604	24.3	991
Average area (hectares)		87		38		106		41
Average area on holdings with >=20 hectares		129		93		269		61

Source: June Surveys of Agriculture, SAF land data

(a) Figures for England relate to commercial holdings only.
(b) Croppable area is defined as land under crops, temporary grass under five years old and uncropped arable land.

Labour force on UK agricultural holdings

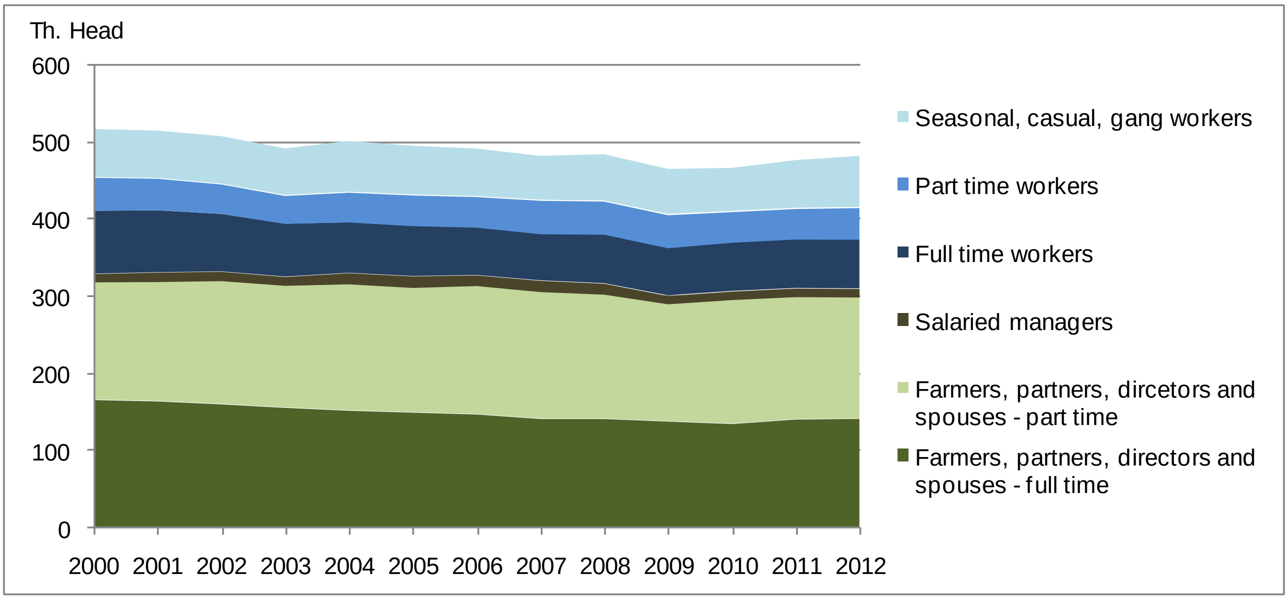


Table 3: Proportion of holders in each age group (a) (b)

					% of holders
	2000	2003	2005	2007	2010 (c)
Holders' age					
Under 35 years	5	3	3	3	3
35 - 44 years	18	15	14	12	11
45 - 54 years	26	24	23	23	25
55 - 64 years	26	29	29	29	29
65 years and over	25	29	31	33	32
Median age (years)	56	58	58	59	59

(a) The holder is defined as the person in whose name the holding is operated. The data in this table relate to all holders whether or not the holder is also the manager of the holding.
(b) Holdings run by an organisation (such as limited companies or institutions) do not have a holder and are therefore excluded from these figures.
(c) 2010 figures relate to commercial holdings only.

Livestock sector

Livestock and livestock products account for just over half of (55% in 2012) of Gross Output in the United Kingdom (Table 5) with cattle accounting for the greatest share (28%) followed by poultry (12%), pigs (5%) and sheep (4%). Livestock farming is more prevalent in the west of the United Kingdom. In Wales and Northern Ireland, livestock and livestock products account for a much higher proportion of gross output (86% and 82% respectively) compared to 59% for Scotland and 49% for England. Whilst cattle (including milk) accounts for the greatest share of output for each Devolved Administration[3], sheep account for a greater share of output than poultry in Wales and Scotland, reflecting the prevalence of upland grazing.

[3] England, Wales, Scotland and Northern Ireland

Livestock output as a proportion of gross output, 2012 by NUTS1 region (a)

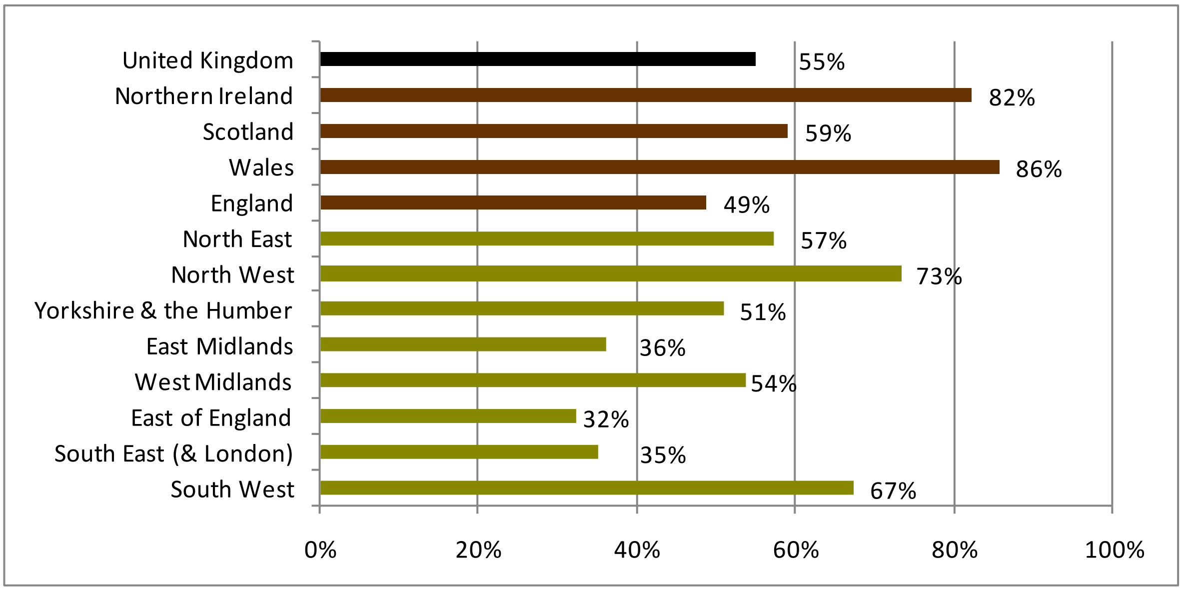


Table 5 Livestock output (a) as a proportion of gross output, 2012

					% of gross output (at basic prices)
	England	Wales	Scotland	Northern Ireland	United Kingdom
Livestock, of which	32%	51%	43%	53%	36%
Cattle	*8%*	*24%*	*24%*	*24%*	*12%*
Sheep	*3%*	*18%*	*8%*	*3%*	*4%*
Pigs	*5%*	*0%*	*3%*	*7%*	*5%*
Poultry	*9%*	*4%*	*4%*	*14%*	*9%*
Gross fixed capital formation	*6%*	*5%*	*4%*	*5%*	*6%*
Livestock products, of which	16%	34%	16%	34%	19%
Milk	*14%*	*30%*	*13%*	*30%*	*16%*
Eggs	*3%*	*3%*	*3%*	*4%*	*3%*
Livestock and livestock products	49%	86%	59%	82%	55%

(a) Includes livestock products
Sources: Defra, The Scottish Government, Welsh Assembly Government, DardNI

Livestock populations

At June 2013 there were 9.8 million cattle and calves in the UK. The long term decline in cattle numbers has been driven by the reduction in dairy cow numbers following the introduction of milk quotas in 1984. Under the milk quota regime there is a financial penalty to producers for over-quota milk production and, historically, increasing milk yields and the limit of milk quota have led to a continued reduction in dairy cow numbers. The abolition of milk quota across Europe in April 2015 may lead to changes in the dairy sector as the UK has been under quota for several years, we are unlikely to see major changes in the near future at least. The most recent figures from December 2013 show a 1% increase in the size of the UK dairy breeding herd. There are a number of factors driving change in the dairy sector including changes in input and output prices, reduced bovine tuberculosis (bTB) compensation, changes to the Nitrate Vulnerable Zone (NVZ) Action Programme, anticipated Water Framework Directive (WFD) measures and diseases such as bTB, Foot and Mouth Disease and Blue Tongue Disease.

The number of beef cows in England increased rapidly during the 1980s and 1990s due to the introduction of headage based subsidy schemes and the introduction of milk quotas leading some producers to switch from dairy to beef. Following the decoupling of subsidies in 2005 with the introduction of the Single Payment and poor underlying profitability of many beef cow enterprises, it was anticipated that there would be a subsequent reduction in beef cow numbers. However, there has been little overall change.

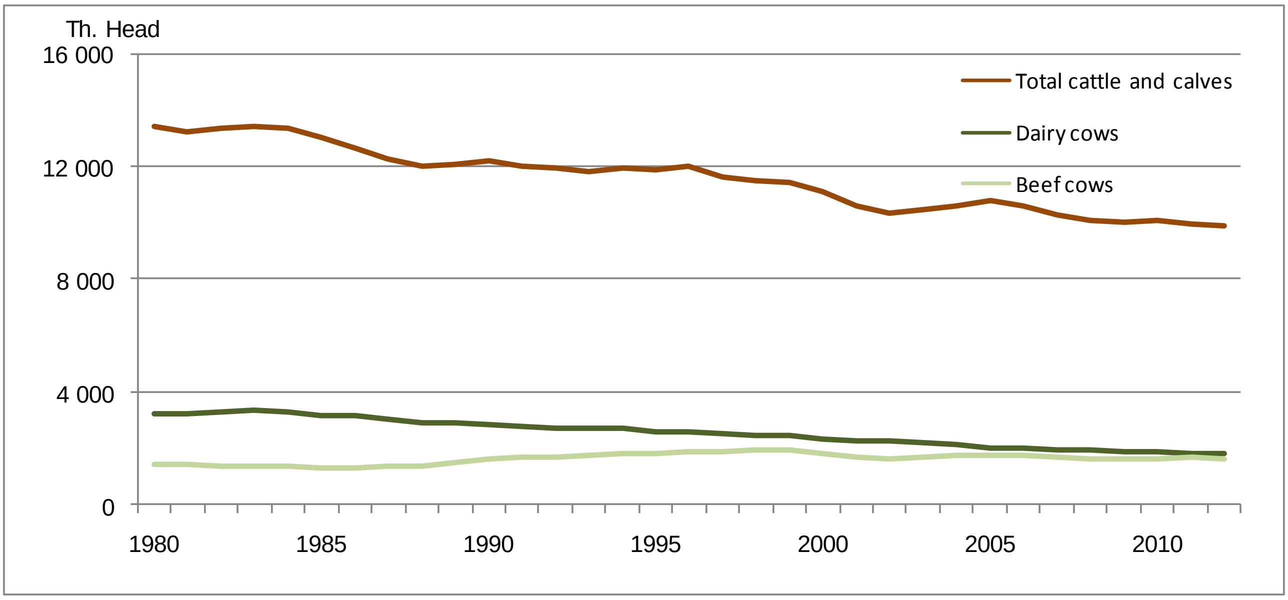
Sheep numbers increased throughout the 1980s as headage based subsidy payments encouraged producers to increase numbers of breeding ewes. National quota limits forced a ceiling on ewe numbers during the 1990s, before changes to subsidy eligibility rules in 2000 and Foot and Mouth Disease in Great Britain in 2001 resulted in a sharp decline in ewe numbers. From 2005 the Single Payment Scheme replaced most of the direct aid paid to farmers in the United Kingdom, thus removing the incentive to maintain sheep numbers to receive subsidy payments. Between 2005 and 2009 the sheep flock herd fell by an average of 2.7% a year. In 2010 this decline halted as strong prices and tight global supplies encouraged growth in the sector. Numbers have continued to increase gradually and at June 2013, there were over 32 million sheep in the UK. The most recent figures from December 2013 show a 4% year on year growth in the breeding flock.

Pig numbers have been dramatically affected since the outbreak of Classical Swine Fever in 2000, followed by the outbreak of Foot and Mouth in 2001 which led to the start of a decline in the pig herd. Lower productivity as the result of pig wasting diseases, lack of profitability in the industry and, more recently, high input costs have also contributed to the decline. At June 2013, there were over 4.9 million pigs in the UK, a reduction of 45% from the peak in 1998.

Poultry numbers for both table chickens and laying hens have declined by 10% and 7% respectively over the last decade. Unlike the cattle and sheep sectors the UK egg and poultry industry has not received direct subsidies on production. The total number of table chickens rose during the 80’s and 90’s as consumer demand for chicken increased. Numbers fell slightly until 2009 but have since remained reasonably stable at around 105 million birds. The number of birds in the laying flock (i.e. those producing eggs for human consumption), decreased steadily during the 80’s and 90’s to just under 30 million birds. The laying flock remained stable until 2008 when numbers fell. From 2009 there has been a modest growth in the size of the national laying flock to 27 million birds in June 2013, a result of improved market conditions.
Table 6 Livestock populations, June 2013

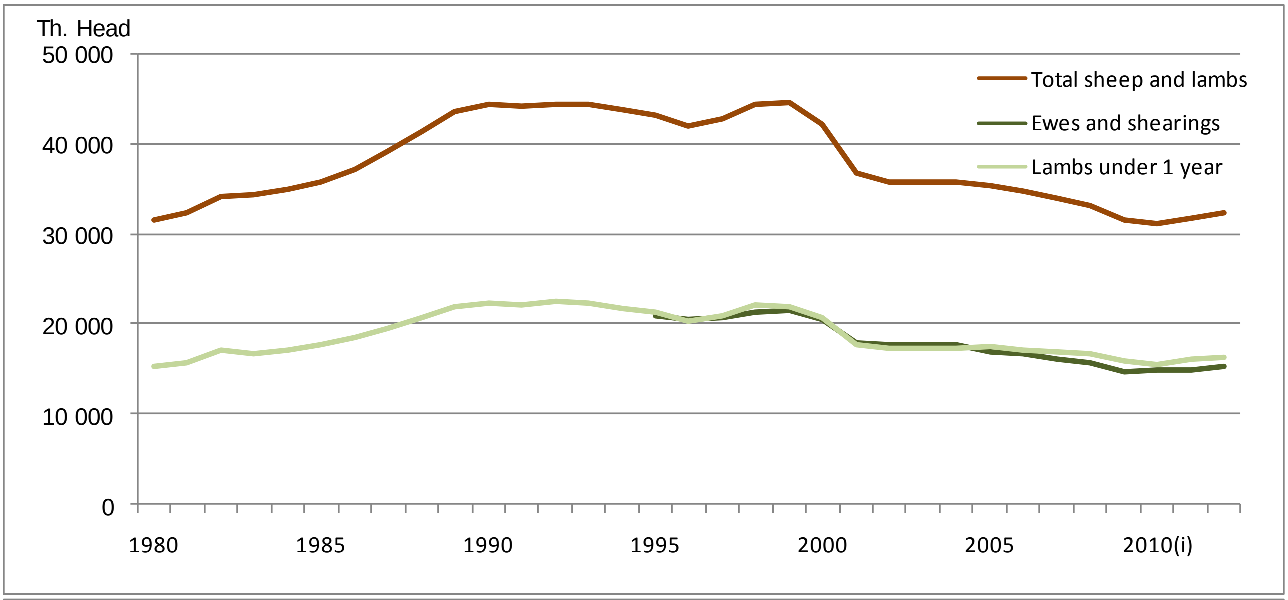
	England	Wales	Scotland	Northern Ireland	United Kingdom
					Thousand head
Total cattle	5,364	1,095	1,797	1,588	9,844
Dairy cows	*1,113*	*223*	*166*	*279*	*1,782*
Beef cows	*720*	*174*	*447*	*270*	*1,611*
Total sheep	14,922	9,461	6,571	1,904	32,856
Breeding flock	*7,091*	*4,275*	*3,274*	*921*	*15,561*
Lambs	*7,448*	*4,888*	*3,105*	*940*	*16,381*
Total pigs	4,066	25	314	480	4,885
Breeding herd	*346*	*4*	*28*	*42*	*421*
Fattening pigs	*3,632*	*20*	*278*	*432*	*4,363*
Total poultry	120,504	8,559	14,172	19,374	162,609
Breeding and laying fowl	*33,349*	*2,199*	*5,978*	*5,498*	*47,024*
Table chickens	*76,999*	*6,079*	*8,086*	*13,412*	*104,576*
Other poultry	*10,156*	*281*	*108*	*463*	*11,008*

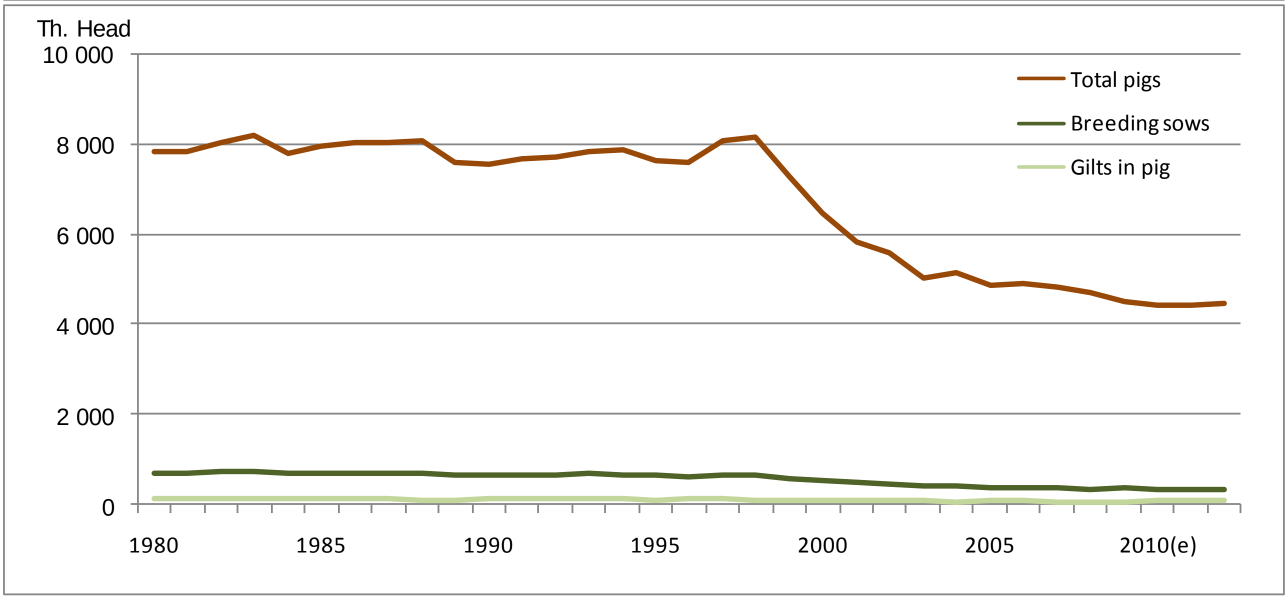
Trends in UK cattle populations

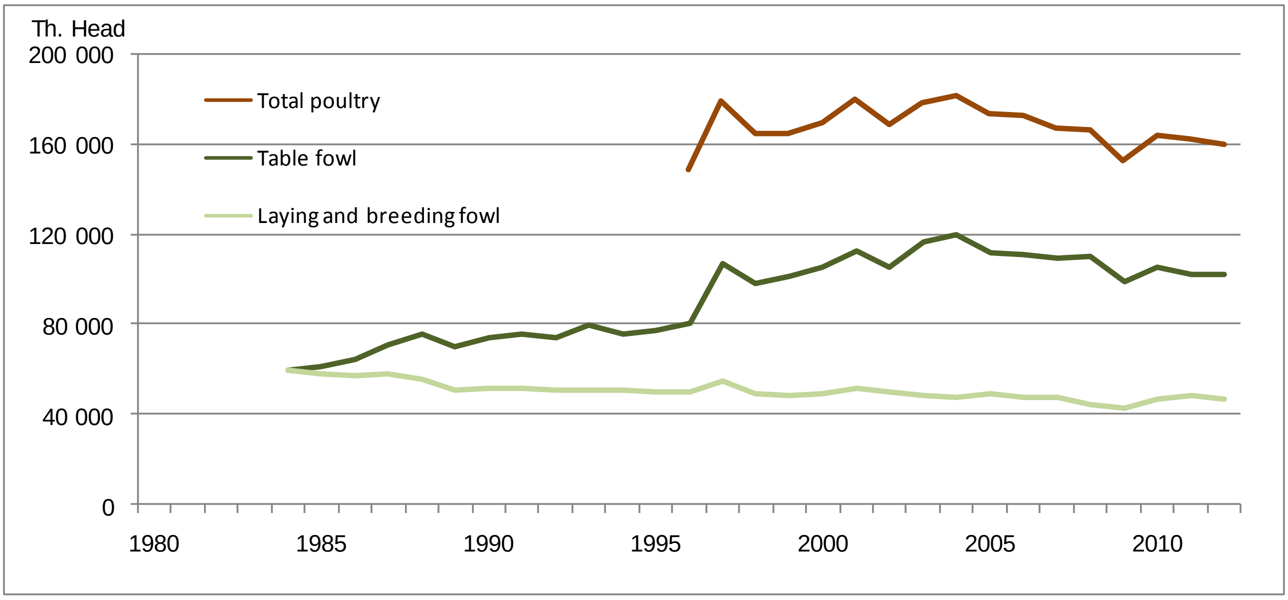


Source: Agriculture in the United Kingdom 2012

Trends in UK sheep, pig and poultry populations

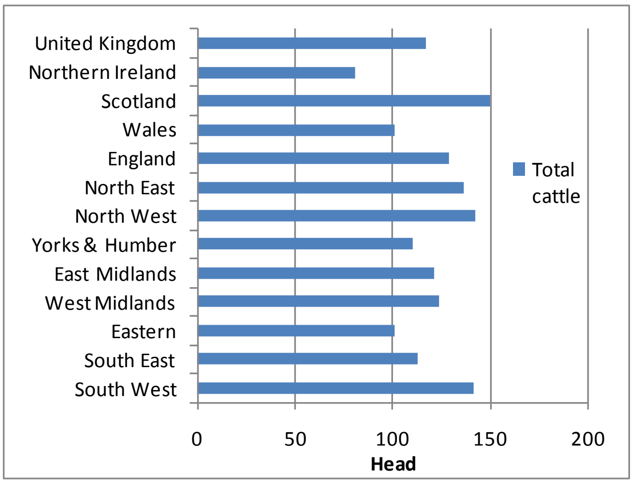

Th. Head
50 000
40 000
30 000
20 000
10 000
0
1980
1985
1990
1995
2000
2005
2010(i)
Total sheep and lambs
Ewes and shearings
Lambs under 1 year

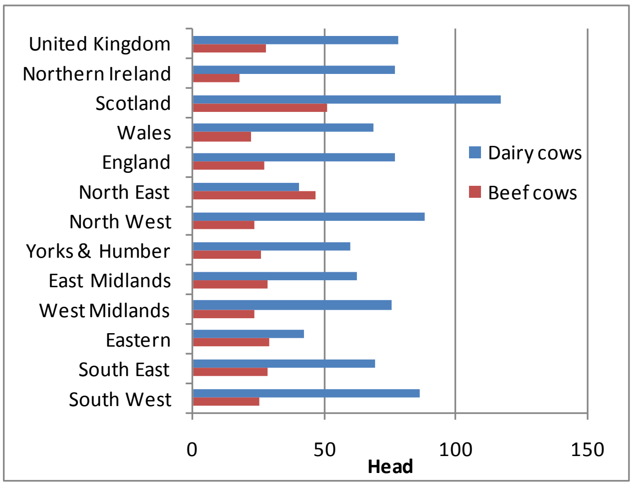

Th. Head
10 000
8 000
6 000
4 000
2 000
0
1980
1985
1990
1995
2000
2005
2010(e)
Total pigs
Breeding sows
Gilts in pig

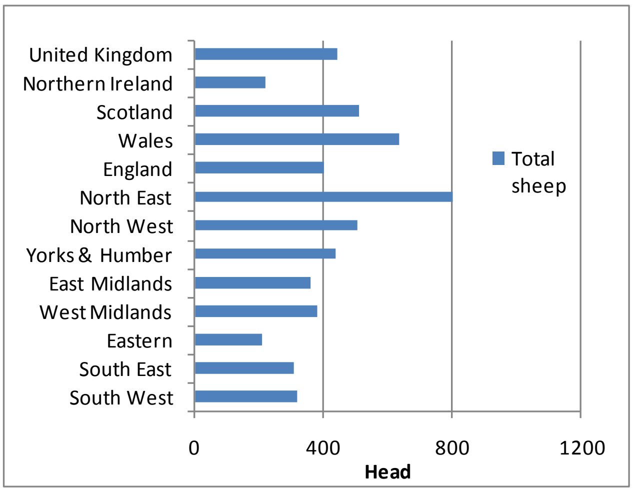


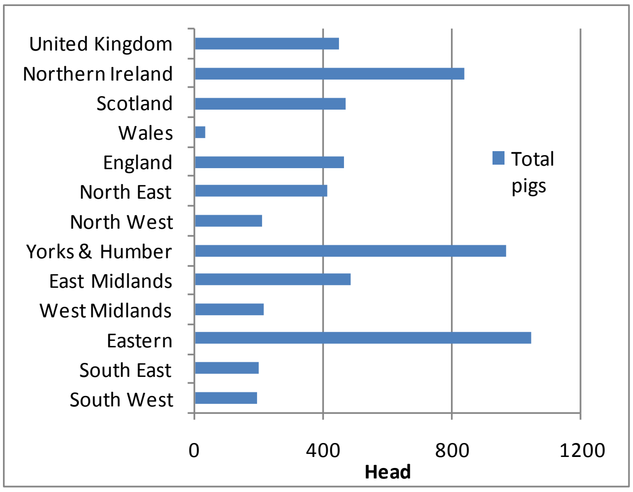
Source: Agriculture in the United Kingdom 2012

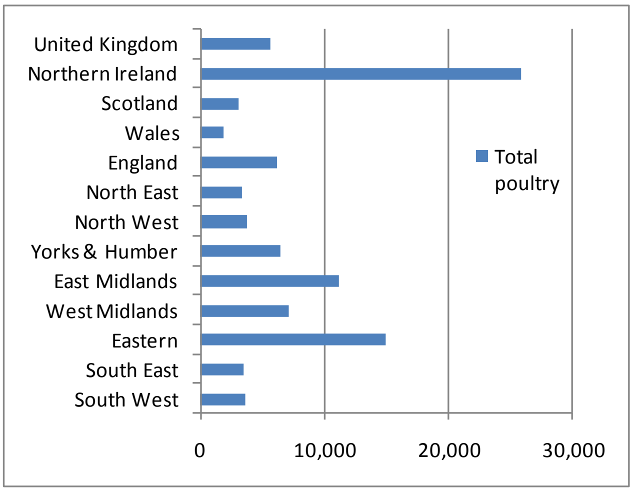
Average herd and flock sizes, 2010





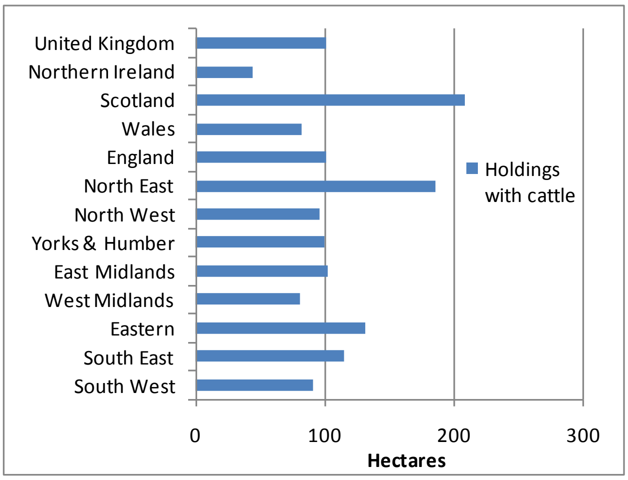


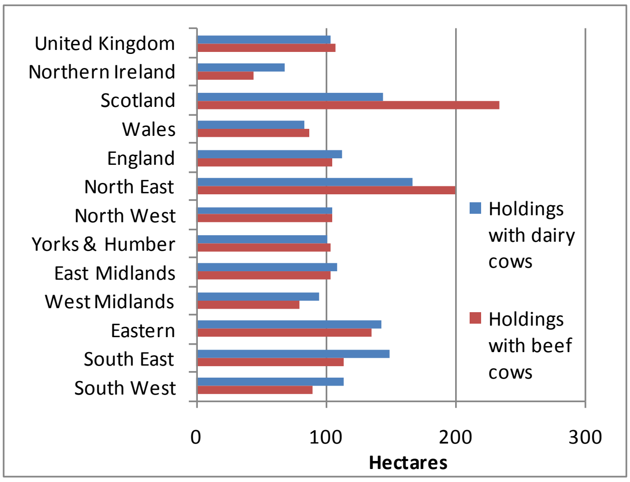


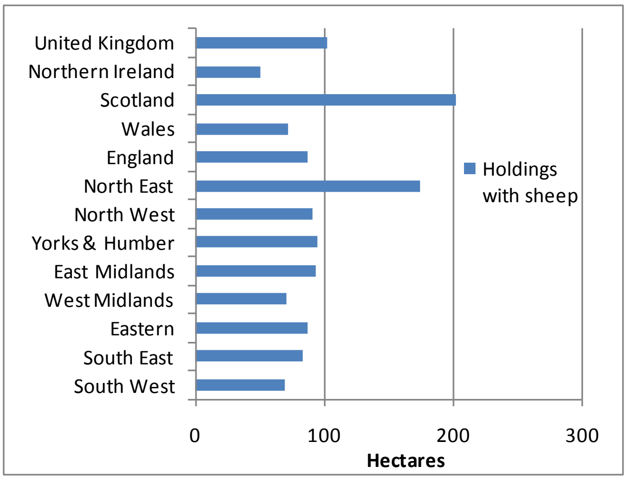


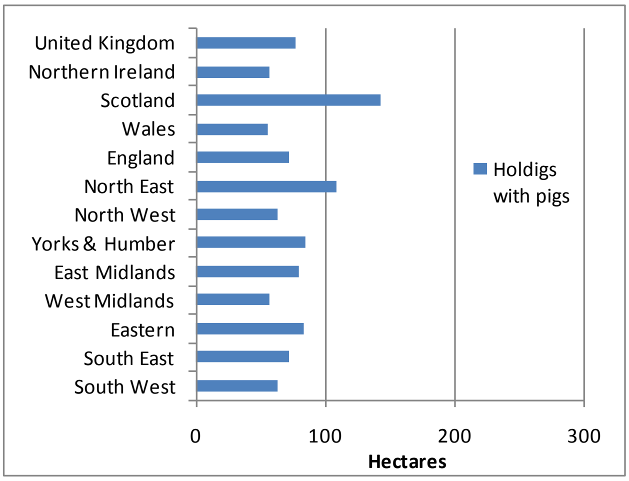
Source: EC Farm Structure Survey 2010

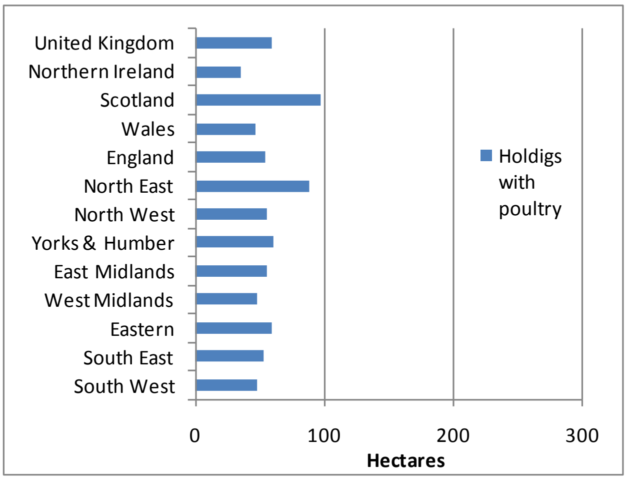
Average utilised agricultural area, 2010







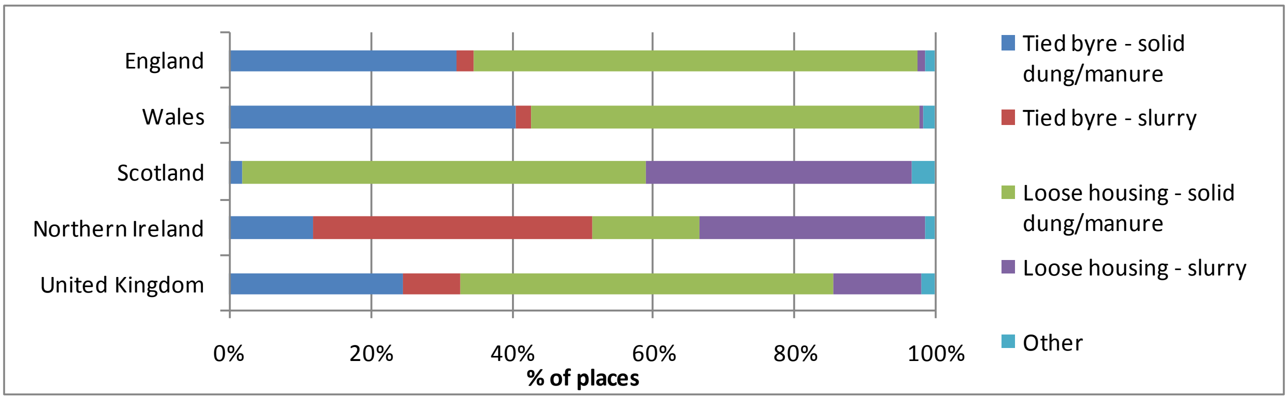




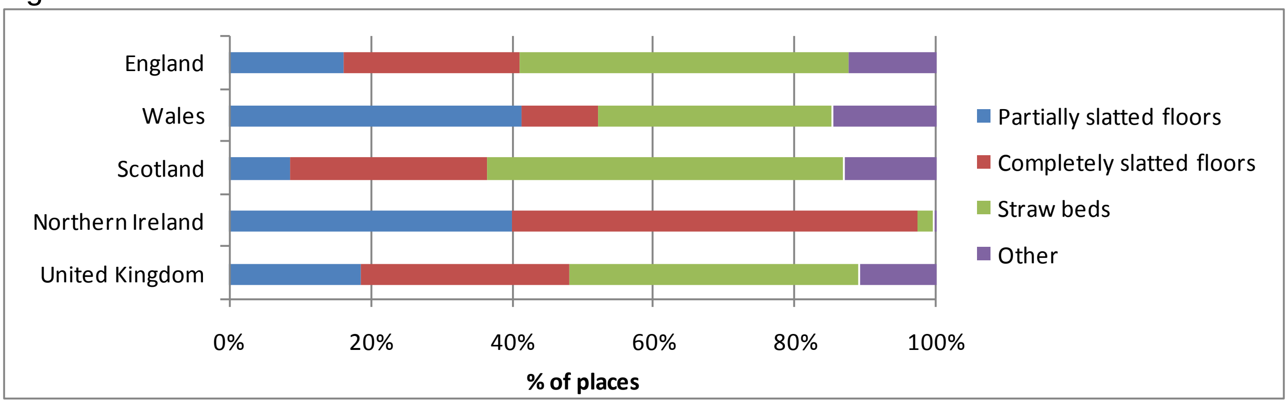
Source: EC Farm Structure Survey 2010

Housing systems

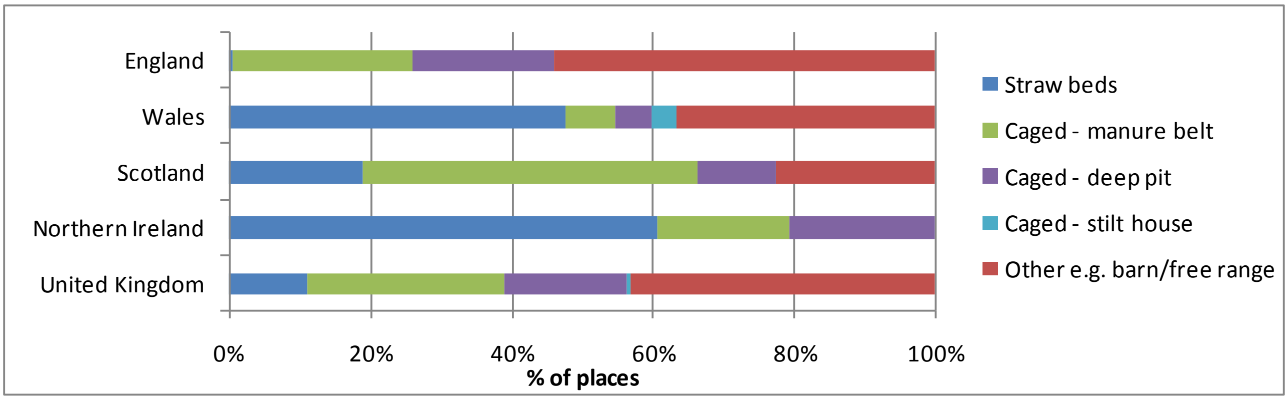
Cattle



Pigs



Poultry



Source: EC Farm Structure Survey 2010

[Note: NI poultry provisional – no barn/free range placings – their publication says that there are but our & Eurostat's databases say there aren't]
[Note: data are for % of places and not livestock, from structure dataset we know only livestock on holding so if holding has more than 1 type of housing, you can't split livestock numbers to type of housing]

3 Research in Animal Production

3.1 Europe

3.1.1 FP6 & 7

…

3.1.2 H2020

…

3.2 Country reports (2): National research in animal production and research priorities

3.2.1 Austria

Research priorities / preferred topics

Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management - BMLFUW

- With its **research programme PFEIL 15** (2011-2015) BMLFUW supports research in the field of animal production
  - via funds for the **Federal Research Institutes of BMLFUW** and
  - via **contract research** with academic and/or industry **partners**
  - via **international cooperation** in ERANETs, JPI FACCE and others
- **Average annual budget** awarded
  - ~2,3 mio. EUR to Federal Research Institutes
  - ~0.35 mio. EUR to contract research
- National research **cofinancing partners**
  Federal Ministry of Health BMG
  provincial governments AUT
  national breeders associations
  national agri collectives, production associations

Research priorities / preferred topics

BMLFUW

Priority areas of PFEIL 15 in regard of animal production:

- **Animal husbandry & production systems, feed, animal health**
  ie. livestock adequate feed, in particular for grassland regions (climate change)
  early disease detection by rumen monitoring/sensors
- Research in **feeding** and **breeding** (**genomic selection**) in ruminants, pigs and horses **in regard to animal health factors**
- **Animal diseases** and herd **health management** (with BMG)
- Livestock friendly husbandry systems and **welfare**
- **Housing systems** , technical (farm) **infrastructure**
- **Climate change** – mitigation / adaption (→AT CC adaption strategy)
- Special PFEIL 15 segment: **Organic farming**

Specific topic interest in AUT (stakeholder)

- **Climate change – feed security**
  Impact of climate change on local/regional plant population and crops
  Efficient feeding / basic rations in grassland regions with particular focus on climate change

- **Breeding / genetics**
  New phenotypes and their use for breeding – relating genomic selection parameters to procution diseases (claw health, metaboli cdiseases) resistance and resilience
  New phenotypes for fertility improvement
  Behavioural traits as selection criteria
  Breeding strategies for small breeds in the era of genomics

- **Automated / digital systems**
  (Cross-)Utilization of data from automated systems (e.g. AMS systems, pedometers...)
  Electronic herd book, etc.
- PLF

Research priorities / preferred topics

Federal Ministry of Health - BMG

Small **ad hoc budgets for emergencies**, contract research only

No dedicated research **funding programme**

Current priorities

- AMR – **antibiotic usage** in agriculture / veterinary medicine
- MOSS – refinement of (disease) **monitoring and surveillance systems**
- AHE – animal health **economics**
- **Biosecurity** and **animal hygiene**

- Databases, digital systems – electronic registers / herdbook
- Vectorborne diseases, zoonoses
- Welfare, housing systems, ...
- ...

3.2.2 Belgium – Wallonia

Belgian Report for CWG-SAP:
Current research activities in sustainable animal production
and research gaps for Wallonia

Pierre Rondia ;
Walloon Agricultural Research Center,
Animal Nutrition and Sustainability Unit,
Rue de Liroux 8, 5030 Gembloux - Belgium

1/ Foreword

As mentioned in the Belgian Status Quo report, agricultural skills were regionalized (Wallonia and Flanders). Because the participation and the funding to ERA-NET programs are decisions which are taken at a regional level, we will only present below the point of view of Wallonia.

This report presents the current research activities in SAP (grouped by theme) and the research GAPS identified by the Walloon actors of agricultural research. The current research activities are topics that are studied at a regional level with limited funding. Most of these topics are not self-sufficient to go around the issue and also need to be taken into account at European level with joint activities between Member States (eg common databases as suggested hereafter).

A demand for a funding support of this cofunded call has been asked to the Minister of the Walloon agriculture. But, at present, we don't have any response because the new Minister of Agriculture has not been yet appointed following the recent elections (late May 2014). The previous Minister was in favor of it. We hope that his successor will also be.

2/ Current research activities in sustainable animal production

Evaluation of husbandry systems

- On the environmental level in pigs and milk and meat cattle (life cycle analysis; carbon footprint).
- On resilience in dairy farming (externalities issued; adaptation capabilities; link to terroir, sustainability).
- In terms of sustainability in pig (differentiated vs standard production) and dairy cows sectors (with a focus on painfulness of work and working time).

Herd management

GHG/climate change :

- Reduction of GHG emissions through housing setting (fattening pigs) and feed strategies (dairy cattle).

Nutrition :

- Optimization of milk production on grass: livestock, environmental, economic and human health benefits from rich legume pastures.
- Ways to improve protein efficiency in dairy farming (modeling, food self-sufficiency; reducing waste).
- Valorisation of by-products from the food industry or bioethanol industry (meat and milk cattles, broilers).

Tools development :

- Prediction of the milk abilities for processing from *Infrared Spectroscopy*.
- Prediction of ruminal methane emission based on the spectral analysis of the milk.
- Automatic measurement of composition and quality kinetics of milk in the milking parlour.

Genetic :

- Implementation of genomic selection in cattle breeds (meat and milk).
- Genetic evaluation of the Belgian Blue female fertility.
- Selection of resistant strains bee to mite Varroa destructor.
- Selection of a new line of Pietrain pigs genetically resistant to stress, E. Coli diarrhea, edema disease and influenza.

Reproduction (fertility improvement) :

- Characterization and optimization of the lipid composition of the Belgian Blue seed.
- Study of metabolites in blood and milk (eg fatty acids) as indicators of reproduction in dairy cattle.

Health :

- Early detection of viral infections of cattle from blood or milk.
- Study of defects and hereditary diseases component in Belgian Blue breed.
- Monitoring udder health on the basis of milk composition changes, detection of specific antibodies to S. aureus and rational use of antibiotics.

Boar taint :

- Alternative to surgical castration of piglets by vaccination.

3/ Priority topics (GAPS) :

1/ Developing indicators of precision farming for a better efficiency of animal husbandry

- Phenotypes on-farm : data collection including animal data (use of sensors / types bolus, ...), robots data, veterinary data (including emerging diseases), feeding data (self-sufficiency, ...), management considering the entire life of animal, techno-economic data and working time aspects.
- Phenotype off-farm : performance monitoring (including new approaches such as MIR).
- Genotypes : Using genomics (whole genome selection) for the supervision of farms and not only for a selection purpose => new management indicators through SNP (single nucleotide polymorphisms).

2/ Developing / sharing databases at national level and between Member States

- transfer of data to common databases,
- consolidate the databases to optimize their usefulness,
- development of advances algorithms to analyse the consolidated databases,
- creating relevant advisory tools based on the results, potentially communicated through web-based tools.

3/ Developing differentiated livestock production

The uncompetitiveness of national production on the world market requires to stand out from the mass production and to propose something different to the consumer. These differentiated products could be based on a strong connection to the land (identity, know-how), on more stringent standards for animal welfare and environmental criteria (eg better use of manure) and / or on a specific quality (eg healthy products for consumers). It can also come to support the preservation of local breeds and the development of marginal animals' livestock (sheep or poultry on open-air runs in Wallonia). This topic could also take into account the importance of consumer education / information for a better sustainability of local livestock productions.

3.2.3 Estonia

/01 Research Funding

» funding bodies (public)

- **Ministry of Agriculture** is funding research by means of its national programme "Applied Research and Development in Agriculture", as well as co-funding research by means of the Rural Development Programme (development of new products in cooperation between the enterprises and research institutions).
- **Ministry of Education and Research** is funding basic research.
- **Estonian Research Council** is a governmental foundation for funding Estonian research (distribution of institutional and personal grants, the handling of grant applications, incl. national programmes for research, such as Health R&D programme, Environmental Conservation and Environmental Technology R&D Programme and Estonian Research Infrastructures Roadmap activities, etc.) and acting as a National Contact Point for Horizon 2020 Framework programme and other international, bi- and multinational cooperation programmes.

» national research programmes & available funds

- **National programme for Applied Research and Development in Agriculture** (2014-2020) ~1,2 MEUR/year;
- **Estonian Rural Development Programme** (2014-2020), esp. Cooperation measure (RD projects, innovation clusters) ~2 MEUR/year; Knowledge Transfer ~1.7 MEUR/year.
- **Budget:** Total estimated available budget 4.9 MEUR/year

» available funds for ERA-Net research

As an estimation based on the current practices, the expected available amount in the National programme "Applied Research and Development in Agriculture would be in the total amount of up to 100 000 Euros.

/02 National Research Focus

» state of the art in research on sustainable animal production

The Institute of Veterinary Medicine and Animal Sciences of the Estonian University of Life Sciences claims to provide an excellent education in veterinary medicine, aquaculture, animal science, and meat and dairy technology, with special emphasis on the capability and flexibility of modern teaching and research activities to respond to the needs of the agricultural and food industry.

The present-day Institute of Veterinary Medicine and Animal Sciences was formed on January 1, 2005 by amalgamation of the Institute of Animal Science, the Faculty of Veterinary Medicine, and the Estonian Agrobiocentre of the former Estonian Agricultural University.

Research conducted by the departments and working groups of the Institute involves almost all aspects of the "from farm to fork" production and processing chain of animal products. The Institute of Veterinary Medicine and Animal Sciences performs high-level modern teaching and R&D activities in the field of animal nutrition, animal production, including aquaculture, animal genetics and breeding, reproductive biology, biotechnology, normal and pathological morphology, animal health, infectious and invasive diseases, therapy, food hygiene, food technology, and other subject areas related to animal science and veterinary medicine.

The research priorities foreseen for the nearest future include:

- Feed security: Alternative feed resources, non-competing with food
- Robust and resilient animal production
- Phenotyping and precision livestock farming
- On farm animal welfare performance indicators
- Fortify animal disease prevention and control

Ongoing projects:

1) Evaluation of the effects of different feeding and management strategies on milk quality and animal healt in loose housing bans
2) Sustainable nutritional strategies to produce compositionally designed milk to promote human
3) Strategies for improving feeding of dairy cattle in robotic milking systems.
4) Investigation of maize silage nutrition value and feeding strategy for dairy cows depending on the maturity stage at harvesting
5) Developing and implementing the prevention system for lipid-related metabolic disorders, vased on milk metabolites
6) Fertility and health in dairy cattle
7) Cattle health and welfare - aspects of precision livestock farming
8) Development of efficient animal reproduction technologies for the sustainable cattle breeding
9) Possibilities to increase the efficiency of protein fed, and to reduce nitrogen excretion, on dairy farms using different technologies, including robotic milking
10) Development of cloning technology for the production of biopharmaceuticals from the transgenic cattle
11) Physiology, pathology and biotechnology of animal reproduction
12) Bovine Sperm Sexing
13) Application of sexed semen for production of female offspring, regulation of estrous cycle and pathology of reproductive organs in bovine
14) Reproductive performance and fertility management in dairy cows
15) Genetic diversity, differentiation and relationship of Estonian farm animal breeds
16) Sustainable breeding strategies to produce compositionally designed milk to promote biotechnological properties of milk and increase profitability of milk production
17) Increasing profitability of beef cattle breeding
18) Improvement of Raw Milk Coagulation Properties
19) Population genetic, genomic and transcriptomic approaches in studies of genetic diversity and local adaptations in fish and farm animals
20) Improvement of farm animals breeding and local endangered breeds conservation methods
21) Genetic diversity and sustainable management of genetic resources of farm animals and fish
22) Animal WelfAre Research in an enlarged Europe
23) Risk assessment of the most frequent diseases and parameters reflecting the health status of dairy cows, their influence on cows' retention in herds, reasons for culling and successful service. A complex study

» national research priorities

Important fields of agricultural research, deriving from the objectives as defined in Europe2020, include climate change and resource efficiency, food safety, healthcare and aging, environmentally sustainable production methods and land management.

National research priorities relevant for livestock farming in the field of agrifood and fisheries are as follows:

- plant and animal breeding
- developing environmentally friendly and effective technologies for plant and animal production
- animal health and welfare
- food quality and safety, food security
- effective management/resource efficiency of natural resources
- mitigation of and adaptation to climate change
- waste reduction and recycling
- biotechnology

» future challenges
The future challenges are connected with the effective use of existing resources and production systems, as well as improving the animal health and welfare. In particular, with the following:

  - Feed security: Alternative feed resources, non-competing with food
  - Robust and resilient animal production
  - Phenotyping and precision livestock farming
  - On farm animal welfare performance indicators
  - Fortify animal disease prevention and control

3.2.4 France

French research on animal and livestock production systems

Background

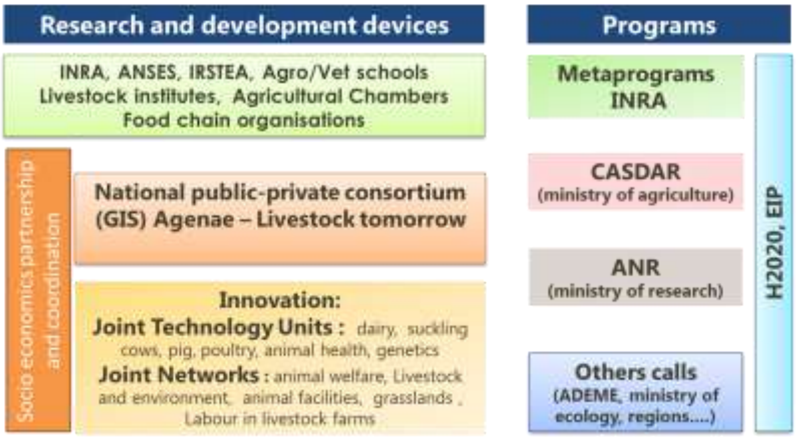
In France the research in the animal production sector is conducted by INRA (and associated agronomic and vet schools) and technical institutes of animal production (Livestock institute (IDELE), Pig institute (IFIP), Poultry institute (ITAVI), Horse institute (IFCE)) and to some extent Institute for Organic farming. Other national organisms contribute to research on the animal sector. This is particularly the case for IRSTEA who is very involved in issues related to environmental aspect and land management, for ANSES for animal health and for CNRS for studies on fundamental animal physiology.

The research conducted by INRA concerns the biology of farm animals (including analytical levels) up to the management and evaluation of farming systems at farm, food chain and territorial levels, the role of stakeholders involved in the evolution of livestock systems (including policy makers) and the social demand expressed by the society. Three of the thirteen INRA research departments are directly involved in research on the animal sector: Animal Genetics, Animal Physiology and Livestock Systems, Animal Health. Four others department also consider livestock sector for a part of their activity: Economy, Science for Action and Sustainable Development, Department of Microbiology and Food Chain and Science and Process Engineering of Agricultural Products. Beyond research department, metaprogramms are developed with the aim to address, through research, cognitive or socio-economic grand challenges and to foster, and align with, national and international partnerships. Two of the eight metaprograms are devoted to livestock (Integrated Management of Animal Health; Genomic selection) and four others consider some aspects of animal production: Ecosystem Services, Transition to Global Food Security, Microbial Ecosystems and Adaptation of Agriculture and Forestry to Climate Change

Research conducted by the technical institutes is more applied and more directly dependent of economic organizations (which are part of their board). Micro economy and competitiveness of farms is a more pregnant theme than for INRA but animal genetics, animal health, feeding strategy and environment as important topics as well. The research is also increasingly conducted in partnership with INRA for the development of innovative knowledge based systems. Collaborative project over long term (5 years renewable) are set up as Joint Technology Unit or Mixed Technology Networks. Jointed Technology Units are dedicated to issues for one specific chain sector (for example Dairy systems, Pig systems, Poultry systems, cattle and small ruminant genetics, agro pastoral systems - there are 10 JTU in the animal sector). Networks are dedicated to relevant common issues for the animal sector as a whole (Livestock and Environment, Livestock Buildings, Labour in livestock system, Animal welfare, Grasslands) and brings together scientists and engineers from different regions. Two National public-private consortium (GIS AGENAE and GIS “Livestock Tomorrow”) brings together INRA, technical institutes, training institutions and various stakeholders organisation. The mission of AGENAE is to propose projects in the area of genomics and the mission of Livestock Tomorrow is to promote research, training and development on animal production systems incorporating sustainable management of the environment and the economic viability of farms. This approach reflects the desire of all stakeholders of the animal sector (ruminants, pigs, and poultry) to propose new production models, economically viable, environmentally and socially acceptable. Current researches concerns the acceptability of livestock systems by the societies, evaluation of livestock dependent jobs, services provided by livestock’s including social services.

The topics and research actions are very diverse in France because they have to integrate the wide diversity of sectors (cattle, sheep and dairy goats, cattle and sheep for meat production, pigs, poultry, rabbits, horses ...), various contexts from very intensive areas (such as Britain) to territories valued by extensive ruminants production based on permanent grassland or Mediterranean zone and various type of products (mass production vs labelled products). Researches include generic approaches and must also incorporate regional characteristics.

Organisation of the French Research and R&D in livestock sector



1. Livestock production system

The global challenge for livestock production systems is to improve productivity and efficiency to guarantee farmers' incomes and to improve the production of social and environmental services in addition to livestock production.

1.1. Evaluation of new feeding systems

Animal feeding is still the largest expenditure item of farms (about 50%). It is also the fastest and most easily reversible lever to manage the quantity and quality of animal products.

1.1.1. New feed characterization (including new forages) and feeding systems

The priority issues to be addressed relate to the characterization and evaluation of novel feeds necessary to adapt farming to climate change, to deal with the scarcity of resources, or from the development of biofuels, to limit competition between food human and animal and to reduce de dependency of imported protein sources. These new feeds must also be more efficient, more environmentally friendly both in their mode of production and wastes generated by animals and have effects positive about the quality of animal products.

Development and test of innovative plant production systems (including agro forestry) and new multispecies grassland with legumes requiring less nitrogen and with a high water use efficiency and higher resilience to drought are among priorities. Close collaboration of animal scientists with plant breeding research and agronomists are developed. Development of co-products to reduce competition with human consumption of certain resources, and multi-criteria evaluation of feeds and diets (using LCA analysis), including consideration of the environmental and health impact of their use are other priorities.

Risk assessments and life cycle assessments (LCA) play a key role in the evaluation of the potential of these new resources. Multipartenarial and national projects deal with this objective in order to evaluate the economic, environmental and social impact of the use of the alternative resources.

1.1.2. Feeding systems and feed evaluation system

New feeding practices are studied in order to reduce emissions by animals, to reduce dependence on imported protein and to improve the health of animals. This work deals mainly reducing levels of protein in the diet associations with utilization AA synthesis and utilization food additives (including enzymes, probiotics, essentials oils, etc.).

The last aspect is the development of new systems to evaluate the feeding strategies. New feed evaluation systems are currently under development. The innovative models on the nutrition of farm animals include dynamics and kinetics in digestion and metabolism and consider animal responses in a multi-facetted manner (e.g., animal performance, emissions, tissue and product composition, health and behaviour). These new systems are expected to significantly contribute to a further reduction of energy and nutrient losses, better quality of animal product and better use of alternative resources.

1.2. Eco conception of Innovative livestock systems

1.2.1. Multicriteria evaluation

Multi-criteria evaluation of farming systems are required to take into account the three dimensions of sustainability. The definition of relevant indicators will be an important step to that question.

If the technical and economic performances are more or less easily noticeable by the actors, it is not the same for different dimensions of environmental and social performance. The indicators must be able to cover the three pillars of sustainable development and therefore consider the technical and economic performance, the overall environmental impacts, production of ecosystem services, fossil energy consumption and energy production, and different dimensions of social performance. Research on multicriteria evaluation focus on critical points to solve methodological limitations: (i) in some areas, the proliferation of indicators often not validated, can be confusing, especially when they differ by the choice of functional units and clarification are required, the indicators should be valided to prevent the misuse; (ii) some area are poorly covered by indicators, this is particularly the case of biodiversity, animal health issues, risk to human health, and social performances; (iii) aggregation of indicators in global assessment tools is crucial, the life cycle analysis (LCA) does not yet cover all impacts (e.g. biodiversity) and its static nature is a limitation and (iv) extend the areas covered by the indicators and more generally by assessment tools to take account of the diversity of livestock systems, to evaluate the robustness of the systems facing increasing economic, climatic and health hazards.

1.2.2. Innovation for more efficient and environmentally friendly livestock’s systems.

The priority issues to be addressed concern the design and evaluation (using multicriteria analysis) of innovative livestock specialized and mixed farming systems with the primary objective of improving the environmental performances of the system, the anticipation of regulatory changes and social demands while maintaining competitiveness. This objective combines experimental and modeling approaches and many partnerships with other INRA departments including the interfaces between plant and animal systems department and w with technical institutes with the management of networks of commercial farms on different scales (farm, production areas, national, or more) to imagine and implement various scenario of evolution. Increased attention is given to maximising the 'ruminant advantage' by developing grassland and forage based systems for ruminants, including improved crop rotational systems (depending of the local conditions), that are cost effective, environmentally sound, manageable and having a reduced demand on land that can be used for other purposes.

To meet the challenges, the main fronts of science that we have identified focus particular attention to the multi-scale modeling and declination of agroecology in the area of livestock that constitute the major obstacles to the development of innovative work systems rearing. The fronts of sciences are (i) the declination of agroecology principles in the field of animal husbandry, i.e. the integration of ecological concepts in the analysis, design and evaluation practices and livestock farming systems. Here the priorities are limiting the competition between resources for animal and human (feeding efficiency, new feed), to assess the impact of new forage systems on grassland biodiversity, to manage the resources for a better recycling on nutrient from manure, to offer alternatives to the use of antibiotics or hormones ; (ii) the reduction of methane emission through nutritional strategies, better understanding of ruminal microbiota structure and functions and genetic variations; (iii) modeling, in particular multi-scale models, particularly necessary for the analysis of livestock systems. For this latter level, specific scientific problems are addressed regarding the interactions between biotechnical subsystems and decision support systems, changes in temporal, spatial and organizational scales, consideration of hazards and ability to validate models of complex systems and to use them for virtual experiments; (iv) taking into account individual performance variability and dynamics of individual responses and use of this variability for driving herds, understanding of the elaboration of phenotypes (see 2.1) and (v) multicriteria evaluation (see 1.2.1). The development of methodologies for predicting the quality of products related to farming practices is another priority.

There are several operational objectives despite their relative importance can vary between local contexts and production chains: (i) improving the efficiency of feed conversion to animal product using an holistic approach including from the feed chain side to feeding strategy and management and livestock efficiency; (ii) Increasing the level of protein and energy autonomy to reduce the dependency of imported/fossil sources, (iii) reducing the emissions (methane, nitrate, ammonia, nitrous oxide) from livestock; (iv) closing the mineral loops through the efficient recycling of nutrient in manure (N, P, C); (v) increasing the production of ecosystems services and biodiversity by livestock systems; (vi) Developing very low (purchased) inputs system using the adaptive capacities of animals (body condition and reproduction, compensatory growth, etc.); (vii) developing efficient grassland based production systems for ruminant production; (viii) improving the animal welfare while avoiding negative effects on farmer income or environmental impact; (ix) Improving the management of risk (market volatility, climate change) through the adaptive capacities of the systems and (viii) providing end-users with appropriate and easy-to-use tools to achieve integrated farming performances goal in differing local contexts and to evaluate the performances of the systems.

1.2.3. **Precision Livestock System**

The development of PLF offers potential solutions for the development of innovative and multi-performing livestock production systems. Thus PLF is an integral part of the previous section. However it is put outside because PLF development poses some very specific questions and become a new area of research. The objective is to optimize the opportunities that precision livestock farming has to offer for increasing the performances of livestock systems (efficiency, environmental, workload) from ccontinuous automatic monitoring of animal production, environment, health and welfare in real-time. Research will focus mainly on biological models and decision support tools while industry (including innovative SME) considers hardware structure. The objectives are (i) to develop support tools that combine information on individual animals with ration formulation and management routines to achieve optimal productivity and simultaneously avoid wastage; (ii) to develop physiological models to better interpret and use sensors data by converting data from these tools into useful information and decision support systems for farmers and service providers to better manage the individual animals and the herd both on a short term basis (early detection of infections or metabolic disorders, precise feeding considering animal responses, regulation of environmental condition in building) and a medium term (improving the practices from clear historical information); (iii) to measure production efficiency which is not yet feasible although there are increasing number of monitoring systems and (iv) to overcome the significant hurdles to achieve data integration due to different frequencies, precision, and reliability of measures of technologies which are stand-alone (for most of them); (v) to analyse the evolution of the relationship between farmer and animals.

1.2.4. Integrated health management

Reducing consumption of antibiotics and drugs through an integrated management of health is another aspect of more sustainable systems. Animal health is a multisectorial issue because animal diseases are the cause of economic losses on farms (production diseases) and on sectors (epizootic diseases), environmental impact (spreading of xenobiotics ...) and social (the diseases affect animal welfare) and can additionally compromise public health. Poorly mastered anti-infective uses have also encouraged the development of resistance to antibiotics or anthelmintic that compels public authorities to adopt measures restricting the use of drugs. The research deal with the control of livestock diseases by focusing on production diseases and diseases linked to an infectious agent, and taking into account the different modes of control in a holistic way (animal breeding, livestock management, prophylaxis and treatment). The priorities are (i) the anticipation and the analysis of pathological emergences with climate change, increased trade and increased mobility of individuals; (ii) knowledge of the economic impacts of enzootic, epizootic and zoonotic diseases and better understanding of the behavior of actors (farmers, veterinarians, government ...), including the representation of risk, health management and assessment instruments for public intervention or coordination of actors ; (iii) better knowledge of the biology and evolution of microbes and parasites evolution to understand how and why infectious agents often evolve from symbiotic state to highly virulent entities ; (iv) Antimicrobial resistance: evolution of antimicrobial resistance, emerging resistance profiles, alternatives to antimicrobials, impact of livestock in the spreading of drugs in the environment, the emergence and spreading of bacterial and parasitic resistance and how to manage and overcome them; (v) Disease resistance, analysis of genetic factors and genomic selection; (vi) Influence of the GI microbiota on host fitness, metabolism and immune system and role of probiotics and prebiotics; (vii) vaccine development and refinement and other alternative to antibiotics (peptides, plants, phages, probiotic, prebiotic…); (viii) the development of research at the interface between health and welfare and managing these issues in a context of climate change;

1.3. Integration of livestock farming in the society and the food chains

1.3.1. Management of livestock farming at the farm scale

The animal farming activity is a matter of growing importance. Professional identities and the relationships between farmers and work is changing among the younger generations who aspire to a better quality of life than their parents had, the job of farmer and labour conditions are rapidly changing with the possibilities of mechanization, increasing the size of the herds, and more pregnant administrative aspects. Profound transformations occurred. In this area, the research concerns (i) the attractiveness of the business, its transformations and the relationships between livestock farming and other actors in the territories, (ii) evaluation of the farming activity as a formalized system with interactions between livestock management, other farming activities, non-farming and private activities, the available workforce on the farm and available equipment's (including buildings), especially in the context of expected new farming systems (PLF, very large farms); (iii) attractiveness of the profession, including the livestock salary men and analysis of the abandonment and non-transmission situations vs successful process of transmission; (iv) the construction of tools, methods and actions for more efficient advising to farmers.

1.3.2. The territorial scale of livestock farming

Apart the farm level, geographical or broader economic entities are also considered as they open up new possibilities for a better balance between nutrients (manure management / fertilizer requirements), to play more effectively on the synergies between productions, to provide efficient landscapes and management of biodiversity. It is also at a regional level that can be highlighted environmental (landscapes, biodiversity, environmental impacts) and societal services provided by livestock systems, and to take into account the strategies of sector organization (including downstream actors) that strongly impact the locations of production areas. Territorial level also allows us to account for the diversity and dynamics of global activity systems in which livestock has its place and so to connect the "environment side of the sustainability with its social dimension. Finally, it is at this territory level that the conditions for the development of collective action consolidating livestock as signs of quality-related environments, the quality of the environment and local cultures must be analyzed. Therefore the territorial / local scale appears more and more as a pertinent scale for reasoning the sustainable development of livestock system. Here research aim to (i) identify and quantify with relevant indicators and analyze the correlations between types of services; (ii) develop modelling approaches of eco-systemic services produced by livestock at the territorial level and explore the trade-off and synergies between different types of services; (ii) quantify the employment impact of livestock activity as one of the major criteria of evaluation of livestock contribution to local development; (iii) quantify the production of patrimonial services (aesthetic value of landscape, tourism, gastronomy, etc.); (iv) describe and analyse the development both in term of production and consumption and territorial forms of inclusion of peri-urban and urban livestock; (v) characterize and analyse the benefits and risk of the coexistence of a diversity of (contrasted) livestock systems and food systems within a territory and the way these systems co-exit, interact or compete.

1.3.3. External factors and constraints affecting the behavior of actors

Three main groups of factors were identified relating to the public policies, ways of organizing collective arrangements both within sectors that territory, and finally the acceptability of SPA by the company. Public policies aiming at improving the environmental performance of livestock systems were so far mainly based on an obligation of means and not an obligation of result. Today, we must determine the socio-economic and political conditions to achieve the best compromise between the different categories of performances and that would encourage actors to integrate simultaneously economic and environmental performances in their objectives. The construction of agri-environmental policies on the basis of a monetary evaluation of the positive and negative impacts on the environment of livestock systems raises the question of the evaluation of non-market goods by indicators and the assessment of consumer willingness to pay for the production of non-marketed goods.

In the area of collective arrangements, supply chain organization in relation to the territories and rural communities is a central subject. The researches deal with the organization and contracting within sectors to ensure farmers' income and development of insurance funds to absorb shocks (weather, economic, health). They also relate to methods of organization at the territorial level for developing agro-environmental management and/or common health management, at different geographical scales depending of the problems to be treated (manure management, management of fragile environments, synergies between livestock sectors and plant sector ...).

Regarding the acceptability of livestock farming, the main issue is the growing awareness of animal welfare by society. The researches focus on (i) the improvement of housing conditions for animals, (ii) a better understanding of emotional processes of animals and their perception of the environment to objectify the concept of animal welfare and develop innovative systems that take into account both the needs of animals (adapting the environment to the animal) and acceptability by the farmer, (iii) innovation and acceptance of new technologies (such as cloning), (iv) the barriers between the farmer and the rest of society by promoting better acquaintanceship between the world of each other to avoid stereotyping, whether negative or otherwise idealized.

2. Animal for high performing livestock systems

2.1. Understanding of phenotypic expression

2.1.1. Multi-level phenotyping

There is a need for animals that can adapt to various conditions of management, these conditions being increasingly diversified. Sources of variability and uncertainty are manifold with hazards and long-term changes that are both nutritional, climatic, health, economic and social. The development of innovative systems requires the ability to adapt the animals to the characteristics of these systems. Improvement of sustainability in animal production relies on selection of the animals as biological entities based on valid recordings of phenotypes. Priority issues concern (i) improving the feed efficiency, the productive and reproductive efficiency of farm animals, in particular from analysing the functioning of producing organs (muscle, udder, avian oviduct, liver Palmipeds) in response to particular changes in the environment, to increase the efficiency of their metabolism, (ii) obtaining more robust and suitable animals well adapted to various livestock farming conditions in terms of resources, climate, biotic risks ...), either in the short or long term. High throughput phenotyping needs to be further developed for farm animals. In “deep” phenotyping a large number of measurements are recorded on a sample of animals. Results from “deep” phenotyping can be implemented in new improved breeding programs but need to be combined with “broad” phenotyping of often simpler measurements that are made on a large number of animals. Biomarkers, sensor information and recordings from Information Communications Technology (ICT) which are predictive of sustainability characteristics such as efficiency, robustness, health, reproduction and welfare and easily measureable should be determined for inclusion in breeding plans. The study of extreme phenotypes or divergent breeds using “omics” technologies enables the understanding of animal function with the potential of practical application.

2.1.2. Understanding the elaboration of phenotypes and predictive biology

Understanding the elaboration of phenotypes requires both the characterization of phenotypes (including using the best approaches to high-throughput phenotyping), and the exploitation of genome comparisons and the study of their role in the development of the major functions. Here the objective is to enhance understanding of the role of genes in the regulation of functions and also the responses of animals to their environment. "Omics" approaches generated exhaustive datasets about expression of genes or proteins for many physiological functions in model animals. The issue of interactions between functions will be crucial, especially the relationship between production functions and functions of animal survival (reproduction, health, body reserve mobilization. Studying rare genotypes and developing dynamic model that are predictive enough at cell level and animal level (animal as a system) level are other issues and way of progress to understand the elaboration of phenotypes. "Omics" approaches are todays extended to metagenomics because the digestive microbiota plays a major role in the host-microbe holobiont. It influences the metabolic phenotype, protects against pathogens and dietary toxins, stimulates the immune system, promotes development of body tissues, influences behaviour, and plays a fundamental role in nutrition through bacterial fermentation. The influence of pollutants environmental, including endocrine disruptors on physiology and productive and reproductive capacity of animals is also considered

The emerging field of epigenetics is of upmost importance because, by understanding epigenetic processes, we can start to understand how the environment affects animal performances. Research concern (i) Epigenetics and consequences on phenotype development, (ii) Epigenetics and metabolic adaptation and (iii) nutrient-induced epigenetics regulation.

2.1.3. Interaction animal x management

Appropriate animals are also required for high performing systems. In intensive grassland based system, it is demonstrated that breed/genotype has a significant impact on the sustainable intensification. To maximise the profitability and sustainability of a forage based systems requires an animal with relatively good milk production, as well as high capacity to convert forage into milk, excellent fertility, good longevity and survival. In less favoured regions with permanent grassland extensively managed, we need to exploit the adaptive capacity of herbivores to make better use of marginal land (land on which the only thing that will grow is grass). This would mean a better understanding of adaptive capacity (genetics, early life experience, ability to cope with environmental fluctuations). Also, the need to manage this adaptive capacity, i.e. matching animals to environments, getting the right blend of animals with different capacities in a herd (leads to the notion of the adaptive capacity of a farm), and tailoring management to best exploit adaptive capacity.

2.2. Animal breeding

2.2.1. Genome organization and regulation

The reference sequences of farm animals is today available for major species as well as related tools (SNP chips and transcriptome) and INRA is involved in large consortia for complete sequencing of genomes of livestock. It is now crucial to continue the work of characterization of genome structure by taking advantage of new technologies of genomics. The first priority concerns the study of the plasticity of the genome structure (including traces of selection) and the regulation of its expression, the study of the traces of selection in different species will help to identify functionally important regions. The second priority is to understand the regulatory systems of genomes and the impact of genetic variability on their dynamics by integrating four different approaches: functional mapping, descriptive generic approaches, approaches to functional analysis to validate the role of candidate genes and integrative approach of biology in relation to the traits of interest.

2.2.2. Characterisation and utilisation of genetic variability (in relation to animal phenotyping):

The primary target is the study of the genetic of robustness (including welfare) in order to provide animals that can express their potential in a wide range of environments and the genetic of efficiency (including reduction of methane emission). This comes through a renewed series of characters animal health, ability to adapt to different and changing environments to efficiently produce high quality products. The animal adaptation to new constraints requires in particular the understanding of the genetic component of the mechanisms that determine disease resistance, adaptation to heat, and the valuation of non-conventional foods. It also involves improving feed efficiency and control of reproduction remains a major theme. Regarding animal welfare, the study of behavioral characteristics and neuroendocrine reactivity to the environment has developed around emotion and fear, docility, mother-young relationships and social interactions more generally in various species (poultry, ruminants, and pigs). In this context, we can highlight three scientific priorities: (i) the identification of genes that influence these traits of interest (how genes are organized and regulated), ii) detailed study of the effect of these genes and their alleles on these features of interest, iii) analysis of new phenotypes (measurement, genetic parameters) and modeling of these characters to better understand the genetic contributions and identify levers.

Hereditary diseases that are a handicap to the sustainability of animal production, both in economic terms as welfare for animals and image for breeding continues to be the subject of research to locate (s) gene (s) (s) responsible for disposing of and markers for the development of a diagnostic test.

2.2.3. Genomic selection

Genetic evaluations will continue to evolve by integrating more and more genomic information in addition to phenotypic information in an increasing number of species and breeds. Part of this work is carried out under the metaprogramm "Genomic Selection" and the new selection strategies are studied in close partnership with technical institutes. There is a necessity for improved breeding programmes for more robust animals, including the development of new selection traits reflecting resource efficiency, ecological footprint of animal production, health and welfare and longevity aspects of animals.

The research focuses on (i) the adaptation of the methods of genomic evaluation to the specific characters studied, the characteristics of the supply chains and the variability of environments; (ii) Economic analysis are performed to optimize changes and the new devices; (iii) the implementation of appropriate management of populations to avoid the loss of genetic variability. In the context of relocation of certain productions/product (PDO, short chains, etc.) we seek to understand the changes that are at work in management devices and selection of local breeds.

2.3. Animal Heath

2.3.1. Pathogen biology, host-pathogen dialogue and reciprocal adaptations

Knowledge of pathogens is a key issue for research on animal health and the challenge is now to articulate the nature of the structures of these agents with their pathogenicity taking account of the dynamics of adaptation to the host and to the environment. The research focus on (i) knowledge of the genomes of pathogens and molecular determinants of their pathogenicity; (ii) biological behavior of pathogens in their environment; (iii) molecular and cellular determinism of toxic hazards (transportation, metabolism and bioavailability of biological toxins). Finally, the development of synthetic biology should address the development of innovative vaccine strategies (vaccines DIVA, DNA vaccines,) and development of tools for diagnosis and gene or cell therapy.

Concerning the responses of the host, the main issues are to better understand the dialogue between the host and pathogen agents and to take into account the adaptive response of the aggressor to the nature of the host, the selection pressures and environmental conditions. The work involves (i) analysis of the mechanisms of infection / infestation and inter individual spreading of diseases; (ii) inflammatory and immune responses of the host and the mechanisms associated with genetic resistance; (iii) the fate of drugs and toxins in the body and the environment, (iv) the development of resistance to anti-infective drugs and (v) the roles of microbiota (barrier function, robustness in neonates, effect of hunsbandry on microbiota, etc.)

2.3.2. Epidemiology and socio economic impacts of health problems

Beyond knowledge of the mechanisms involved in the various host-pathogen interactions (see 2.3.1), it is also important to better know the health status of animal populations, to control the epidemic processes and the socio-economic impacts and to be able to better anticipate risks. This research is conducted in partnership with sector stakeholders and national and international organisations and includes (i) improving methodologies in epidemiology (relevant sampling for accurate prevalence calculation, modelling); (ii) more precise knowledge of the health status of herds, the conditions of pathogens transmission / contamination, the associated factors of risks and the deployment of required observatories and information systems; (iii) prediction of pathologic emergences and risk assessment (role of modeling) and to assist in the decision; (iv) precisely quantify the economic impacts of disease and the economic and sociological determinants of strategy for health management on the farm (willingness to finance, acceptance of health hazards ...).

3. Conclusion: main domain of interest for an ERANET

The research should support innovation for more competitive, more efficient in resource utilisation, environmentally friendly and socially acceptable livestock production systems. Our research priorities are:

- Enhancing food security in a sustainable way that requires an efficient use of all resources. This means to (i) improve the efficiency and robustness of animals to reduce the amount of feed require for the production and direct livestock losses. This requires a better knowledge of phenotypes, valid recordings of phenotypes, the characterisation and utilisation of genetic variability and genomic selection. Omics" approaches extended to metagenomics because the major roles of digestive microbiota and research on epigenetics can be mobilized at this stage to better understood and predict the phenotypes. (ii) develop more efficient feed chains and alternative feed resources, including legumes, which are not competing with food for humans or having a large impact on land-use change and reduce the use of mineral fertilizers; (iii) develop more efficient use of grassland for ruminant systems; (iv) to close the mineral loops through the efficient recycling of nutrients in manure with a better control of the entire storage and manuring chain and by assessing the efficiency of different products from manure (from pure minerals to organic matter fractions).

- Optimizing the opportunities that precision livestock farming has to offer for increasing efficiency of livestock production system through fine adaptation of feed needs to individual animals and monitoring of health, welfare and environment. This requires new indicators or biomarkers of productive functions, health, welfare as well as waste emission, over long term and in different environments including harsh conditions. Although there are increasing numbers of monitoring systems, there are some crucial gaps notably in being able to measure production efficiency and too many of these methods and technologies are stand-alone, therefore a major challenge is to overcome the significant hurdles to achieve data integration due to different frequencies, precision, and reliability of measures to be combined. Extension of PLF to the specific question of extensive system is also very relevant for some French livestock systems.

- Developing climate smart systems through an integrated approach taking simultaneously into account adaptation to climate change and mitigation of emissions. Research on mitigation must focus on mitigating GHG emissions, especially the reduction of methane emission by ruminants from new smart feeding practices and animal breeding and reduction of emissions linked to the utilization of manure and mineral fertilizers (here grassland management and legumes have a key role). Concerning adaptation our priorities are (i) the ddevelopment of animals and animal production systems that are more robust and resilient to large variations in feed supply through adaptation of crop and forage production, herd and manure management; (ii) develop solution to face successfully high ambient temperatures and emerging diseases for livestock management and plant production system as well,

- Reducing consumption of antibiotics and drugs through an integrated management of health is another aspect of more sustainable systems. Animal health is a multisectorial issue because animal diseases are the cause of economic losses on farms (production diseases) and on sectors (epizootic diseases), environmental impact (spreading of xenobiotics ...) and social (the diseases affect animal welfare) and can additionally compromise public health. Including animal welfare research in sustainable livestock production is essential to develop ethically acceptable livestock production system and animal welfare may contribute to animal health.

- Improving social acceptability has also a high priority in our agenda. At farm level work load and organization and finally the attractiveness of the profession will be determinant for the future of livestock system in France. Moreover, facing the evolution of e-technology (including NTICs, web platforms…) the advisory system should evolve and new organizations are required. Beyond the farm scale the territorial / local scale appears more and more as a pertinent scale for reasoning the sustainable development of livestock system. Wider geographical or economic entities than farms open new possibilities to find solution to better close the nutrient cycles, to play more effectively the synergies between productions systems, to develop innovative collective actions and to highlight eco-systemic and social services (including employment) procured by livestock.

3.2.5 Finland

FINNISH REPORT FOR CWG-SAP:

CURRENT RESEARCH ACTIVITIES IN SUSTAINABLE ANIMAL PRODUCTION FUNDED BY MINISTRY OF AGRICULTURE AND FORESTRY

Ministry of Agriculture and Forestry, Finland, is funding agricultural research directly by funds of Makera, agricultural development funds, in amount of 4,3 million € yearly and by research and development funds of 1, 4 million €/ year. ERA-Nets on areas of agriculture and forestry, including food chain and natural resources, are funded by these funds.

In addition Natural Resources Institute Finland, which has a budget of its own of 146 million € and Finnish Food Safety Authority Evira with a research budget of 1,2 million € are under the Ministry of Agriculture and Forestry. Research is only a minor activity in Evira whereas Natural Resources Institute Finland is a research institute.

The Research programmes in Natural Resources Institute Finland are

1) Sustainable and competitive food production »
2) Responsible food chain – better consumer well-being »
3) Environmentally friendly agriculture »
4) Green economy opportunities »
5) Smartly from renewable resources »

The research programmes in Evira are

1. Nationally significant virus infections and those threatening Finland

2. Animal healthcare and welfare

3. Bacterial infections among animals, food-borne bacteria, effect of antibiotic resistance on animal production and food industry

4. Diseases among wild and farmed animals, and among fish and crayfish

5. Chemical food safety.

In addition several projects in the University of Helsinki Faculty of Veterinary Medicine and in other Finnish universities are funded by Makera, agricultural development funds. These include projects in animal diseases and welfare.

University of Helsinki Faculty of Veterinary Medicine has a Research Centre for Animal Welfare. Ongoing projects on cattle ib the Research Centre are : Factors affecting cows`s sleep and the stall usage, Welfare technique in milk production , Pain after dehorning in calves , Detecting lame animals and Rubber slatted floor for bulls; on pigs tailbiting, environmental enrichment and lameness, in chicken “How chicks learn to pearch?”, Animal welfare when killing mass of poultry - a litterature review and Welfare of turkeys during transportation; on horses crib biting; on dogs cognition; on other animals pain of elephants and cognition of rats.

The Finnish Ministry of Agriculture and forestry is taking part in several ERA-Nets, including ERA ARD II, CRUE ERA-NET, EUPHRESCO ERA-NET , ERA ARD II, ICT-AGRI, CORE Organic II, SUSFOOD, WOODWISDOM-NET+ and ANIHWA.

Finland Supports ATF:s white paper. The Finnish priorities are

-Fortify animal disease priority and control

-Animal welfare

-Robust and resilient animal production

3.2.6 Germany – BMBF

Project Management Jülich

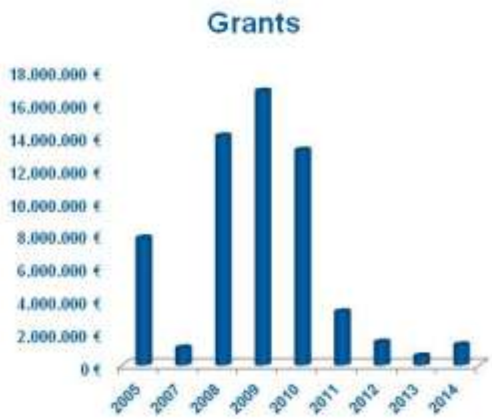
Partner for Research Management

CWG – Sustainable Animal Production

Sabine Dues

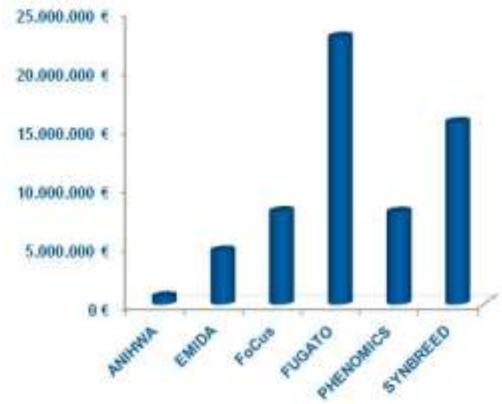
Activities from 2005 to Today

- Since 2005 BMBF/PtJ funded 128 projects with a volume of 59.4 Mio€
- 6 different inter-/national initiatives
- Main focus on health/welfare and breeding resp. health/welfare and infectious diseases
- Project duration 3-5 years each



Main Focus Areas

- FUGATO (-Plus), PHENOMICS, FoCus & SYNBREED
  - 108 projects funded with volume of 54.2 Mio€
  - Breeding characteristics for animal husbandry use in terms of animal welfare and health aspects
  - SYNBREED additionally covers plant breeding topics to promote sustainable agricultural production
- EMIDA & ANIHWA ERA-Nets
  - 20 projects funded with volume of 5.2 Mio€
  - Emerging and infectious diseases in terms of health and welfare aspects



ANIHWA	EMIDA	FoCus	FUGATO	PHENOMICS	SYNBREED
2	18	11	72	12	13
652.149 €	4.566.600 €	7.922.955 €	22.813.945 €	7.876.084 €	15.539.077 €

Results - Links

- FUGATO: www.fugato-forschung.de/?lang=1
- FoCus: www.focus.uni-kiel.de/
- SYNBREED: www.synbreed.tum.de/
- PHENOMICS: www.phaenomics.auf.uni-rostock.de/en-home.html
- EMIDA ERA-Net: www.scar-cwg-ahw.org/index.php/emida/
- ANIHWA ERA-Net: www.anihwa-submission-era.net

Potential Future Focus Areas*

- Resource efficiency - sustainable use of limited natural resources along the entire value chain
  - need-based animal nutrition, which includes breeding of plants with low environmental demands and high feed values
  - New farming /animal husbandry systems
  - Breeding robust, adaptable and powerful animals with high feed conversion
  - Sensor-controlled smart livestock farming
  - Improved utilization of by-products
  - Reduce resource utilization and recovery of valuable components from by-products and sewage sludge
  - Material- and resource-saving lifestyle (incl. consumer behaviour)

*Result of technical discussions at the BMBF: they does not reflect the future focus of the BMBF funding for livestock in full. Final funding strategy is not yet known; however livestock will also be part of the concept of "future agricultural systems" which currently is under development.

Potential Future Focus Areas*

- Alternative food sources - development of innovative methods for technological production of quality food *in-vitro* and use of new animal species for human consumption
  - Synthetic biology for a cell-free biotechnological production of animal proteins
  - Improved cell biology methods for a stem cell-based production of animal tissues
  - Modification of plant proteins with similar amino acid pattern as animal proteins
  - Attitude, propagation and processing of alternative livestock species for human consumption (i.e. insects)
  - nutritional assessment of alternative food sources
  - ethical evaluation of alternative food sources incl. consumer behaviour

*Result of technical discussions at the BMBF: they does not reflect the future focus of the BMBF funding for livestock in full. Final funding strategy is not yet known; however livestock will also be part of the concept of "future agricultural systems" which currently is under development.

3.2.7 Germany – BMEL

Bundesministerium
für Ernährung
und Landwirtschaft

Animal Production
Research in Germany

4 Institutes under the umbrella BMEL
- FLI
- TI
- JKI
- MRI

Universities in the lands

www.bmel.de

Bundesforschungsinstitut für Tiergesundheit
Friedrich-Loeffler-Institut (FLI)

- Animal protection welfare
  animal behaviour
- Animal diseases
  infection diseases
- Animal breeding

10.08.2015 | Folie 2

Julius-Kühn-Institut (JKI)

- Plants
- Plant protection

10.08.2015 | Folie 3

Max-Rubner Institut (MRI)

Nutrition and food

10.08.2015 | Folie 4

Thünen-Institut (TI)

- International competition
- Economy
- Climate change
- Energy

10.08.2015 I Folie 5

Special Research Needs

- economical evaluation

- bees

10.08.2015 I Folie 6

Need for Research - Economy

In the past, the research in the area of farm animals concentrated primarily on questions that, to a greater or lesser degree, addressed aspects that were either technological, natural-science-related (z. B. animal-physiological and breeding-related) or economic in nature.

Economy

There is a whole range of conflicts of goals inherent in the aims involved:

e.g. the aim of taking animal-welfare and sustainability considerations better into account in animal farming while minimising the constraints imposed on competitiveness

Economy

So as to balance out what initially are diverging interests such as these, while minimising the level of conflict involved, even the approaches adopted in research terms must target a whole range of diverse objectives at the same time.

Economy

In this context, the following assumes essential importance:

- the overall economic and the regional-economic assessment of animal-production systems

- the integrated economic research to accompany approaches pursued to improve these systems and

Economy

- the analysis and estimation of consequences, either for possible binding requirements issued by the State and aimed at better animal protection and environmental sustainability, or for relevant incentive systems

Economy

An existing and substantial obstacle to new and more sustainable forms of animal husbandry is the lack of rigorous data regarding the economic effect of

Economy

- animal-welfare-oriented systems of animal husbandry (investments for buildings and technology),
- management concepts for forms of animal farming oriented towards animals' well-being and
- consultancy concepts for animal- husbandry forms directed towards animal well-being.

Economy

It is an increasingly significant point of research emphasis to develop innovative and practical possibilities for reducing the effects on the environment that are involved in outdoor animal-husbandry systems.

Bees
Background

Due to their pollination services to arable crops and other entomophile flowering plants, honey bees are indispensable both from an economic and ecological point of view. They provide these services in passing when they search for and collect their food (a supply of approx. 40 kg of pollen and 120 kg of nectar are required per colony and year).

The number of bee colonies depends on the activities of beekeepers.

Bees

Need for research

Wild bee species, in particular, have only rarely, if at all, been taken into account.

Bees

A meta-analysis combining the results and research data of various already existing EU member state studies would be helpful. This particularly applies to studies of complex landscapes and their factors, e.g.

10.08.2015 | Folie 17

Bees

- food supply (nectar, pollen, honeydew),
- spread of bee pathogens causing various diseases (e.g. virus infections, varroasis, American foulbrood, European foulbrood, nosemosis, amoebiasis),

10.08.2015 | Folie 18

Bees

- impact of agricultural measures (e.g. pesticide application, treatment / protection of field margins and ecotones, blossoming areas) on the abundance of wild bee species and honey bees, as well as on the conservation of plant species and biodiversity.

10.08.2015 | Folie 19

Bees

A major challenge lies in providing a deeper understanding of the complex interactions of

- diseases,
- bee-keeping effects,
- nutritive/plant factors, and
- sublethal exposition to pesticides

to the health and productivity of bee colonies.

10.08.2015 | Folie 20

Research in Germany

In Germany, different public sector bodies at Federal Government and *Länder* levels are engaged in research in the field of animal husbandry.
At Federal Government level, the Federal Ministry of Education and Research provides support funds for projects. The projects are being assessed and, as appropriate, promoted* via a project executing agency. The Federal Ministry of Food and Agriculture (BMEL) also allocates support funds for research projects and, in addition, also has its own departmental research within its remit:
This includes four large-scale institutions that provide the BMEL with technical advice:
The Federal Research Institute for Animal Health – Friedrich Loeffler Institute (FLI).

- Individual institutes focus, inter alia, on animal welfare and protection as priority areas (in particular behaviour of animals).
- animal health, including research on animal diseases and infectious diseases
- animal breeding

The Thünen Institute (TI) addresses, inter alia, issues related to international competitiveness regarding the economy, climate change and energy.
The Julius Kühn Institute (JKI) deals with plant production and plant protection.
The Max Rubner Institute (MRI) inter alia addresses issues related to nutrition and foodstuffs.
A specific aid programme made a total of € 60 million available for animal welfare and animal husbandry in the next few years. The emphasis here lies in issues related to animal welfare and, in this regard, notably issues related to the behavioural patterns of farm animals. A further field consists of issues related to emissions from farm animal husbandry, issues concerning ventilation etc.
A particular need for research is seen in the fields of economic assessment and bees.
The need for research in the economic field is stated in greater detail under the topic "economics". Further details on the need in the field of honey and wild bees are set out below:
Measures to minimise the transmission of antimicrobial-resistant bacteria or with regard to antimicrobial resistance properties along the food chain are being promoted under a special funding programme (BMEL innovation).
In order to ensure a high quality of the funded projects, the BMEL, as a rule, assesses the eligibility for funding of the submitted project outlines in a competitive procedure based on the project outlines. External experts are always consulted when assessing the project outlines that have been submitted. Only if project outlines have been deemed eligible for funding, will applicants be invited to submit a formal application. Otherwise participants will be informed that their projects will not be followed up further.

Economic objectives

There is, for instance, a need for research on the following aspects:

1. Identification of the environmental policy implications of animal husbandry with a stronger regional focus in part
2. Assessment of the implications of export-oriented animal husbandry in some MS
3. Analysis of the different social expectations of animal husbandry in different MS
4. Analysis and impact assessment of possible government requirements for animal welfare and the environment or relevant incentive schemes
5. Economic analysis of the demand made on animal husbandry to achieve zero emissions
6. Economic analysis of decentralised animal husbandry
7. Economic analysis of extensified animal husbandry, including organic livestock production
8. Analysis of approaches in EU policy aiming at a shift away from intensive livestock farming
9. Assessment of slurry as an international commodity that could thus potentially be exported

3.2.8 Ireland

1 ANIMAL PRODUCTION

Animal health and wellbeing

1. Develop management strategies that reduce the use of treatments for microbial and parasitic infections in animal production systems.
2. Support sustainable control of economically important endemic and emerging diseases including increasing the role of existing and new diagnostic tools.
3. Develop sustainable solutions to optimise animal welfare (including objective measures of animal well-being) appropriate to EU food production systems.

Breeding

1. **Maximise genetic gain for key profit traits (both current and future) for farmers and food industry.**
2. Greater integration of genomic, animal breeding and reproductive technologies to advance gains in profitability at farm level, including potential use of precision breeding tools.

Reproduction

1. Development of methodology to predict male fertility in both conventional and sexed semen in bulls used for artificial insemination
2. Development of novel automated methods to accurately and efficiently detect oestrus, adverse health events and onset of parturition in cattle.

Nutrition & Product Quality

1. Increase livestock productivity from forage-based systems using precision feeding systems
2. Deepen our knowledge on the interaction between genetics and nutrition, and exploit the differences between individual animals in feed efficiency by matching their input to their needs as this change with time (and the animal's physiological state).

2 Grass AND CLOVER ForageS

Production

1. Evaluate the benefit of incorporating legumes into grazing pastures in terms of pasture production, and quality, animal performance and nutrient use efficiency
2. Develop NIR calibrations to predict fibre parameters of home-grown forages.

3. Development of more accurate, high throughput, phenotyping of desirable plant characteristics (e.g. FTIR and NIRS).

Breeding

1. Develop on farm evaluation systems for grass and legumes to increase the rate of genetic progress under EU grassland farming systems.

2. Development of genome-based approaches (genomic selection, marker assisted selection) in crop (including grass, clover) breeding programmes from proof of concept phase to implementation phase.

3 Sustainable management of Natural Resources

Management of Natural Resources, Biodiversity and Ecosystem Services

1. Develop strategies and technologies to reduce the impact of food production on water quality, including supporting the delivery of the Water Framework and Marine Strategy Framework Directives and other policy instruments related to water quality.

2. Improved energy efficiency and reduce fossil fuel use in food production systems, identifying and avoiding any adverse effects from the substitution of fossil fuels with biofuels.

Soils and Land Use

1. Develop best management practices to enhance soil functionality and productivity across contrasting soil and land use types.

2. Develop soil husbandry and land management strategies and practices that are economically and environmentally sustainable, and that simultaneously improve the productive and environmental performance of farming and food production systems at field, farm, catchment and national scales, across all soil types.

Sustainable Food Production Systems

1. Develop sustainable animal production systems focusing on economic competitiveness and profitability, environmental sustainability, good animal health, welfare and fertility, and producing high quality animal products.

2. Exploit the convergence of agriculture science with ICT and sensor technologies in order to strengthen innovation in the agri-food sector.

3. Develop and support actions that reduce or offset greenhouse gas emissions, maximise carbon uptake, and optimise carbon/greenhouse gas efficiency in the agriculture and land use sectors in

EU, bearing in mind the need for resilience in agriculture to climate change and weather volatility.

3.2.9 Italy

Collaborative Workig Group on Sustainable Animal Production (CWG-SAP)

Italian overview on research gaps on sustainable animal production

Theme 1
Sustainable improvement of productivity, profitability and of efficiency use of natural resurces in agro eco-systems

There is need of:

1. Innovative plant and animal resources (include aquaculture), improved in
   - pathogen resistence
   - use of natural resources
   - harmonization with consumers' needs
2. Innovative feeding strategies for improving feed efficiency, animal health and longevity
3. Improved holistic environmental impact assessments of production strategies at national and farm level

Theme 1. Activities (1)

1. Improvement of competitiveness, productivity, sustainability of crops and animal production systems:
   a. varietal choice and animal breeding considering:
      - trade offs to other economic sectors (i.e. relationships milk and beef)
      - new traits with direct effects on environment
      - relationships between genotype and fenotype

   b. adoption of innovative feeding strategies to reduce emissions of greenhouse gases, N, particulate etc.

   c. simplified methods for emission measurements

Theme 1. Activities (2)

Use of life cycle assessment (LCA) methodology has increased in studies about livestock farming in last years for different purposes.

New studies and researches are required to:

- standardize models and procedure
- consider some important aspects such as carbon sink, land use change, allocation system
- reliable emission factors, appliable to different production systems and environmental conditions
- develop uncertainty and scenario analysis, for utilizing LCA as tool for designing and managing mitigation and adaptation strategies at national and farm level

Theme 1. Activities (3)

3. Sustainable use of pesticides, medicines, biotic and abiotic nutrients, even using new formulation molecules of natural origin
4. Improvement of farm equipments and infrastructures, by means of technological development and innovative process application
5. Improvement of water management and quality
6. Development of process and post-harvest preservation methods and food waste reduction
7. Development of low-cost and user friendly managent sofwares, for small and big enterprises aimed at environmental impact assessment

Theme 2
Climate change, biodiversity, ecological, and other social agricultural services

- Climate change is a serious risk to food security and environment
- Soil fertility: organic content and biodiversity
- Soil carbon sink as strategy for climate change mitigation
- Biodiversity: to preserve and exploit the bilogical variability, that particulraly in Mediterranean area can be exploited and valorized for mitigation and adaptation strategies
- Ecological and social services in urban ecosystem

Theme 2. Activities

1. Strategies for climate change mitigation and adaptation
2. Valorization of local valorization and breeds, genetic resources safeguard
3. Safeguard of quality, fertility and microbial biodiversity
4. Valorization of ecological services provided by agriculture (environment maintenace, urban green, polluted soil remediation)
5. Valorization of social and ecological service of livestock farming (fire and landslip prevention, landscape preservation, labor condition etc.)

3.2.10 Lithuania


13
Future research needs
Improvement of nutritional composition and nutritional value of animal origin products (fatty acids, essential elements..).
Improvement of animal welfare in combination with environmental issues and other sustainability requirements.
Developments of measures and optimization of technological processes for environmental pollution reduction.
Assessment of nutrients in manure and optimization of manure handling to preserve nitrogen looses.
Improvement of technologies for ecological raising of animals.

3.2.11 Luxemburg

CWG-SAP

RESEARCH REPORT LUXEMBOURG

Jeanne BORMANN
CWG-SAP meeting in Paris (September, 2014)

ASTA
Administration des Services Techniques de l'Agriculture

Content

- Former and current research activities (Examples)
- Future research needs
  - Topic
  - Concerned species
  - Title
  - Description
  - Priority ranking

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Administration des Services Techniques de l'Agriculture

Former research activities

The present slides only list the most relevant research activities done in recent years. The national breed society has long term experience with life cycle assessments on the farm level, which are not covered here. Also minor research activities were carried out by other institutes and bodies.

Topic: Livestock production systems, Environment, Evaluation and assessment, Collaboration and knowledge transfer

Species: Dairy cattle

Title: DAIRYMAN – Improving regional prosperity through better resource utilization on dairy farms and stakeholder cooperation (Interreg IVB North West Europe)

Description: DAIRYMAN aimed to strengthen rural communities by improving farm resource management in a profitable way. New ways of working and innovations were jointly demonstrated within the NWE networks of commercial pilot farms and Knowledge Transfer Centers. There was a cooperation in the development of education programs and interregional exchange of farmers and farm advisors. DAIRYMAN highlighted examples of profitable cooperation between dairy farmers and other rural stakeholders. Public authorities were to be shown how to take into account region-specific factors by implementing EU regulations in a transparent way that can be easily verified by the EU, aiming to reduce the cost of effective regulations, leading to a high degree of acceptance by local farmers.

ASTA
Administration des Services Techniques de l'Agriculture

Current research activities

Topic: Livestock production systems, Animal Breeding, Animal Health & Welfare, Environment, Collaboration and knowledge transfer

Species: Dairy cattle

Title: OPTIMIR – New tools for a more sustainable dairy sector (Interreg IVB North West Europe)

Description: The project aims to develop innovative farm management web applications that will use the spectral analysis of the milk recording samples to enable a sustainable and profitable management of the milk production. The Mid Infra Red (MIR) spectrum is used as a mirror of the cows' status giving indicators on traits like

- fertility
- feeding
- health
- GHG emissions (environmental impact)
- milk quality

ASTA
Administration des Services Techniques de l'Agriculture

Current research activities

Topic: Livestock production systems, Animal Nutrition, Evaluation and assessment, Collaboration and knowledge transfer

Species: Dairy cattle

Title: AutoGrassMilk (FP7)

Description: AutoGrassMilk is a joint research project for the benefit of SME Associations, which objective is to develop and implement improved sustainable farming systems that integrate the grazing of dairy cows with automatic milking (AM) which are appropriate to the different approaches to dairy farming to be found in the different regions in Europe. It will be achieved by

•developing optimum feeding strategies for dairy cows incorporating grazed grass and AM for various production systems in Europe

•optimizing the integration of AM with cow grazing using new technologies

•increasing the sustainability of integrated grazing and AM technologies

•developing tools that will allow dairy farmers to optimize economic efficiency when combining grazing with AM systems

Future research needs

Topic: Livestock production systems, Animal nutrition, Animal breeding, Animal health & welfare, Environment, Evaluation and assessment

Species: Dairy cattle

Title: Precision livestock farming tools

Description: Develop innovative, computer-based management tools for an automated regular or real-time monitoring and early detection system of parameters relevant for sustainable dairy production, e.g. feed efficiency, environmental impact, fertility and health status, animal welfare aspects, milk quality parameters, etc. The project Optimir has shown that a certain number of economically relevant parameters may be derived from the MIR spectral data measured during routine milk control, therefore following-up this research and developing a set of practical tools, automating the process of data exchange and integrating this information into payment schemes of the dairy industry would support the development of sustainable dairy production systems. The survey and collection of non-traditional traits is essential for setting up of a link between the milk spectral data and observations collected on the animal.

Priority ranking: ***

Future research needs

Topic: Environment, Evaluation and assessment, Collaboration and knowledge transfer

Species: All species

Title: Life cycle assessment

Description: Extending the life cycle assesment to the entire production chain (from the input products to the finished product) and evaluate a possible integration of this information in quality assurance schemes (foodlabeling). The aim is to develop a holistic approach including not only environmental issues such as greenhouse gas emissions, biodiversity, soil, water, CO2 sequestration, but also the economy and diversification of holdings, as well as social aspects and the impact on the local economy. This methodology would enable not only farmers, but also processing plants to use a coherent, uniform methodology to monitor their carbon footprint and other impacts of their operations and to quantify any achievements in the reduction of greenhouse gas emissions. With this computer-based tool, consumer could test the impact of their consumption behavior on the environment, the society, etc. In addition, in a political context, appropriate consumption models could be defined in the longer term. Also, better and stronger communication towards the consumer is required (information campaigns on the subject of agriculture, specific training with regard to dealing with food, information for policy makers, etc.).

Priority ranking: ***

ASTA
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Future research needs

Topic: Animal nutrition, Evaluation and assessment, Collaboration and knowledge transfer

Species: All species

Title: Autonomy in the supply of protein-rich feed

Description: Development of sustainable, alternative protein and energy supply strategies in animal nutrition. This can be achieved through the use of alternative protein or energy sources (e.g. legumes, grazing, use of by-products from the bio-refinery and the food industry, etc.), as well as the selection of animals with high feed efficiency. In this context, promote the development of computer-aided tools for the characterization of the national feed and food autonomy, based on simulation models and decision tools used for weighing the impact of certain socio-political decisions on the national feed and food balance (e.g. extension of organic farming, promoting extensive agricultural systems). Such a tool could also evaluate the consequences of outsourcing protein production to other regions of the world (e.g. Brazil – soybean production).

Priority ranking: **

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Future research needs

Topic: Livestock production systems, Animal nutrition, Animal breeding, Animal health & welfare, Environment, Evaluation and assessment

Species: All species

Title: Climat smart agriculture

Description: The process of climate change increasingly results in more extreme climatic conditions often showing long term effects. In addition to the requirements of a reduction in the greenhouse gas emissions in the livestock sector, climate change has an impact on animal production systems. The greatest danger lies in the increase of extreme weather events, such as prolonged droughts or periods with high and intense precipitation. Although the impact in Europe compared to other continents are not as strong, climate change exerts its influence on the availability of feed, the heat stress and the risk of new animal diseases. Climate change calls for an integrated approach where food security, increased productivity (selection on feed efficiency), availability of appropriate animal and plant genetic resources (conservation measures), heat tolerance and the reduction in greenhouse gas emissions go hand in hand. The resilience of husbandry systems is a complex matter.

Priority ranking: ***

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3.2.12 Netherlands

Challenges for sustainability differ from livestock type, for livestock productions systems and for specific local environment in which the production takes place

- **Pig**
- **Poultry**
- **Dairy cattle**

System innovation (from farm level to value chain)

- **Integral sustainable livestock systems and stables**
  - **Welfare, emissions (ammonia, fine dust, methane, endoxinen)**
- **Farm management (education and training)**
- **Strong value chain approach (farm – industry/processors – retail – supermarket - consumer) – private chain quality systems (contracts)**
- **New product – market combinations**
- **High quality monitoring**
- **Biotechology**
- **Reallocation of proteins (food, feed, fuel, fibre chemical (also medicins)**

Animal welfare and health

- **Stimulating natural behaviour**
- **Prefenting interventions (cutting beaks and tails)**
- **Reducing use of antibiotics (and other structural medication)**
- **Minimal and high quality transport**
- **High quality feed (welfare and health, reducing gas emissions)**
- **Biodiversity – species - genotypes**

Social integration (acceptance)

- **Local integration – rural areas, nature and landscape**
- **Transparancy in production and chain (from farm to plate)**
- **Innovative track and trace systems (meat fraud)**
- **Interaction farmer – consumer (also neighborhoud)**
- **Ethical aspects are considered (biotechnology)**

Public health, environment, resources and climate change

- **Healthy animal proteins**
- **Responsible consumption**
- **Local emissons (fine particals, ammonia, smell/odor)**
- **Closed cycles for manure-feed (circular economy)**
    - **Processing surplus of manure > phosphate and biogas (at site, centralised) -**
- **Soil and water quality – also water quantity**
- **Reduce emissions of green house gases (innovative feed measures)**
- **Sustainable produced recources for feed (RTRS – soy)**
- **Land use change**

3.2.13 Poland

Current research scope in the animal production area.

In Poland Ministry of Science and Higher Education is the leading research policy-making body. The Ministry designated two executive agencies that are responsible for coordination and funding research in Poland. National Science Centre coordinates basic research, whereas National Centre for Research and Development is engaged into the coordination of the applied research. General document that describes the objectives and principles of the scientific activity in Poland - Polish National Research Programme, formulates strategic directions for research and development. These directions are in accordance with EU 2020 principles for smart sustainable and inclusive growth, as well as with several European and global documents (e.g. Innovation Union flagship initiative, the OECD Innovation Strategy).

The National Research Programme comprises seven strategic, interdisciplinary R&D directions:

1. New energy-related technologies,
2. Diseases of affluence, new medicines and regenerative medicine,
3. Advanced information, telecommunications and mechatronic technologies,
4. New materials technologies,
5. **Natural environment, agriculture and forestry,**
6. Poland's social and economic development in the context of globalizing markets,
7. State security and defence.

Natural environment, agriculture and forestry, as one of the strategic R&D directions in Poland, includes research on animal production. The priorities as described in the National Research Program comprise among others: rational use of natural resources, biodiversity protection, management that reflects principles of sustainable growth. Particular actions, considering animal production that are on accordance with the National Research Programme are as follows:

- reduction of the greenhouse gases emission,
- rational water and other non-renewable resources management,
- new food management technologies, ensuring food safety and food security
- nature and forest conservation, including protection of genetic resources
- use of satellite-based monitoring data for the control of the sustainable use of resources
- environmental impact of animal production
- replacement of existing consumption and production models with more sustainable ones

National Centre for Research and Development in 2014 launched national strategic programme on **Natural environment, agriculture and forestry – BIOSTRATEG**. First call for proposals was announced in August 2014, and the evaluation process was ended in December 2014. The main objective of the BIOSTRATEG Programme is to develop knowledge about the environment, agriculture and forestry that will increase international position of Poland in scientific research, experimental development and enhance transfer to socioeconomic environment innovative solutions developed in the following areas:

- *food safety,*
- *rational management of natural resources with particular emphasis on water management,*
- *prevention of and adaptation to climate change, with particular emphasis on agriculture,*
- *protection of biodiversity and sustainable development of agricultural production space*
- *forestry and wood industry,*

Chosen research topics, aiming at animal production, within the above described areas are:

- molecular genetics and biotechnology for the biological progress in animal production and fishery;
- Modifications of the existing or development of the new methods for animal production to: improve the productive-life span, sustain animal health and reproductive performance, ensure animal welfare, biodiversity and environmental protection;
- Complex control of the food chain safety, including methods for tracking the product inside the chain to ensure their origin;
- Complex solutions for the zoonoses diagnosis and monitoring, including molecular studies of their etiological agents;
- Safe methods for producing traditional and organic foods;
- Methods for obtaining and processing non-nutritional ingredients from food and by-products;
- Technologies for the production of functional foods;
- Methods for the protection of the reproductive potential of endangered species of farm animals and fish;
- Farm animal and fish welfare;
- Greenhouse gas emissions reduction;
- Climate changes monitoring systems;
- Determination of the carbon- and water-footprints for the “standard food basket” and methods for their limitation;
- Research on the factors affecting pollinators number and means of monitoring of their populations
- Rural areas biodiversity condition and threats;
- Invasive alien species infestation limitation;

3.2.14 Spain

Overview on national research on SAP

and

Prioritized national research gaps

SPAIN

July 2014

Overview on national research: "live" national funded projects in Animal Production

Spain counts with two main lines for funding research projects in the agrarian field: the "national funding program" with a planned budget for livestock agrarian research. This is what we will call "national funding" in the following tables and graphics. The topics funded with this program aims to be more basic and of a general interest for the country and for the knowledge.

Approximately 250 mill € are designated for research, and from this budget, approximately less than 2.8% is for livestock research.

On the other hand, INIA (the National Institute for Agrarian Research" can manage funds for research on its own. This funds is what we will call "INIA funding". The porpoise of the INIA funding is to be more applicative and of direct effect on the field.

The total funding of INIA assigned to livestock research is approximately 2.5 mill € /yearly research program.

The reviewed projects are "live" projects (projects currently running), that have been funded from 2010 onwards until the just approved call (2013).

The total of projects with national and INIA funding was 156 and 129, respectively.

The type, species and topics are delighted in the following tables and graphics.

Table 1: Topics of research of "live" (from 2010 to 2013) research projects funded by the National Research Program in Spain

TOPICS	
HEALTH	48.08%
REPRODUCTION	16.03%
SYSTEMS	15.38%
GENETICS	7.05%
MEAT	5.13%
WELFARE	5.13%
ENVIRONMENT	1.92%
ANTIMICROBIAL RESISTANCES	1.28%

Health includes all infectious and prion related topics; Reproduction includes topics related to Prenatal Programming; Systems include production systems, as well as nutrition strategies; Meat includes all kind of processes that can affect meat quality from the farms to the industry; Antimicrobial resistances includes antibiotics and antihelmintic resistances related topics.

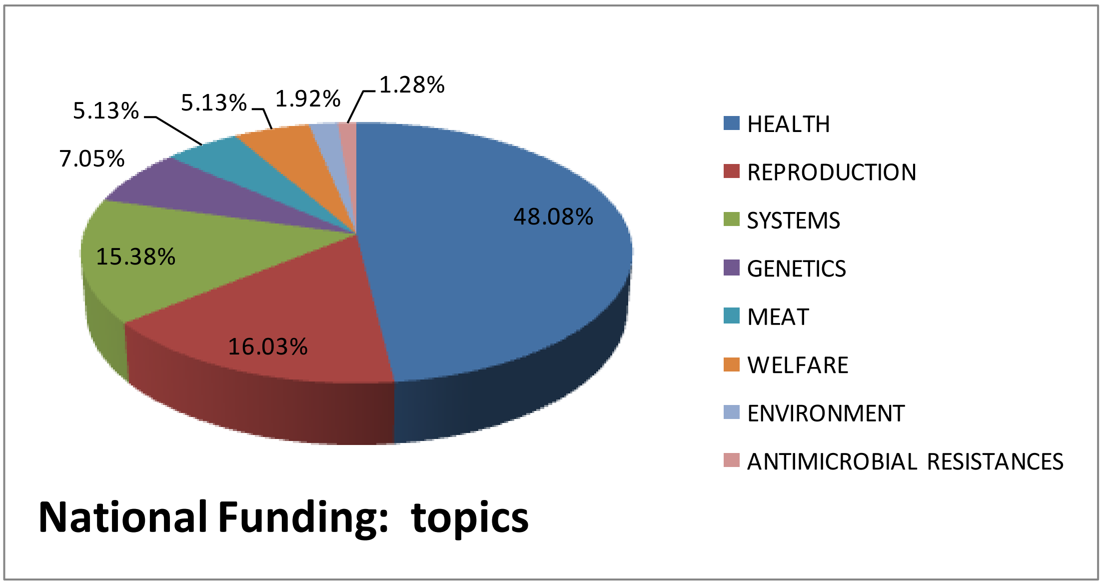


Figure 1: Topics of research live (from 2010 to 2013) projects funded by the National Research Program in Spain

Health includes all infectious and prion related topics; Reproduction includes topics related to Prenatal Programming; Systems include production systems, as well as nutrition strategies; Meat includes all kind of processes that can affect meat quality from the farms to the industry; Antimicrobial resistances includes antibiotics and antihelmintic resistances related topics.

Table 2: Animal Production Species of research in "live" (from 2010 to 2013) research projects funded by the National Research Program in Spain

SPECIES	
SWINE	31.41%
LIVESTOCK	26.92%
S.RUMINANTS	17.95%
BOVINE	14.74%
POULTRY	5.77%
RABBITS	3.21%

Livestock refers to one of more different animal production species, when investigated together in one single research project

Health represents almost half of the total budget for animal production research, followed by Reproduction and Production systems. Regarding the species, these are represented

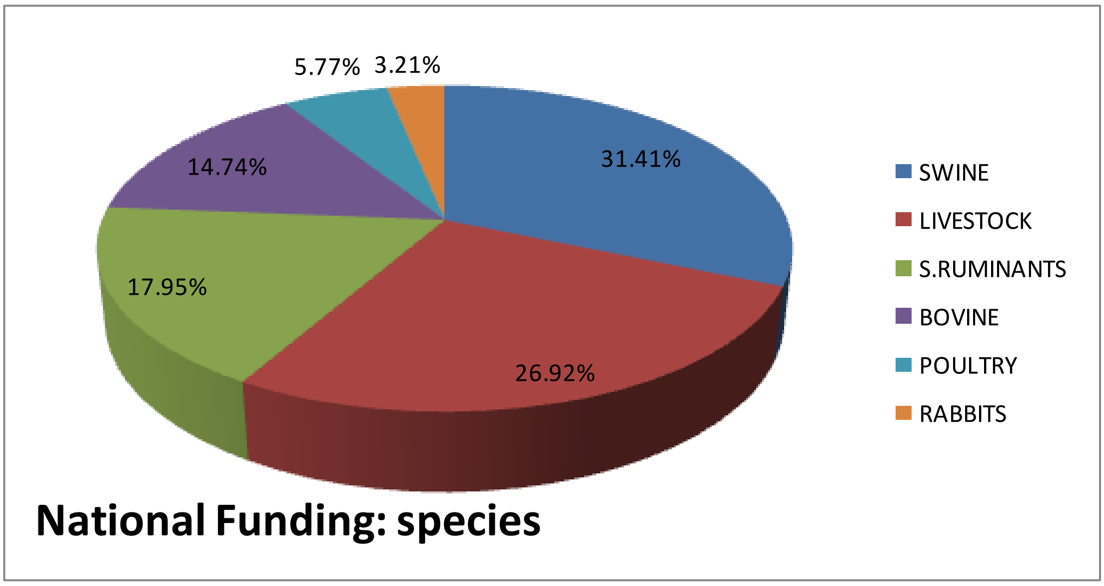


Figure 2: Animal Production Species of research in "live" (from 2010 to 2013) research projects funded by the National Research Program in Spain.

Livestock refers to one of more different animal production species, when investigated together in one single research project

Swine is the most frequently researched specie in this program, being the animal production specie more important in the livestock sector of Spain. After topics that can be applied to the combination of different animal production species, the animals that receive the highest funding for research are the small ruminants, highlighting the relevance of this sector in Spain, despite its current relevance in terms of census or macroeconomic figures (it is the fourth sector after swine, bovine and poultry).

The research project funded through the program of INIA-agrarian calls are depicted in figures 3 and 4, as well as in tables 3-4.

Table 3: Topics of research of "live" (from 2010 to 2013) research projects funded by the INIA Research Program in Spain

TOPICS	
SYSTEMS	32.56%
HEALTH	30.23%
GENETICS	10.85%
MEAT	10.08%
REPRODUCTION	8.53%
ITIMICORBIAL RESISTENCIES	3.10%
WELFARE	3.10%
ENVIRONMENT	1.55%

Health includes all infectious and prion related topics; Reproduction includes topics related to Prenatal Programming; Systems include production systems, as well as nutrition strategies; Meat includes all kind of processes that can affect meat quality from the farms to the industry; Antimicrobial resistances includes antibiotics and antihelmintic resistances related topics.

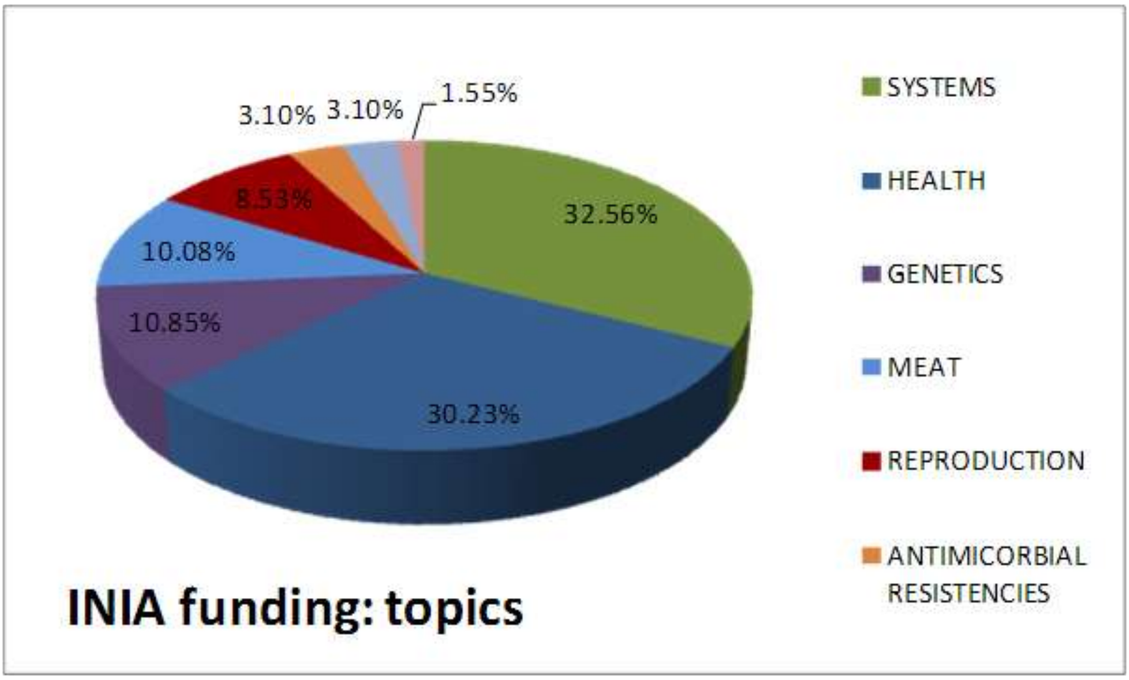


Figure 3: Topics of research live (from 2010 to 2013) projects funded by the INIA Research Program in Spain

Health includes all infectious and prion related topics; Reproduction includes topics related to Prenatal Programming; Systems include production systems, as well as nutrition strategies; Meat includes all kind

of processes that can affect meat quality from the farms to the industry; Antimicrobial resistances includes antibiotics and antihelmintic resistances related topics.

The order of the funded topics are differently funded, when compared to the National funding program. Production systems related topics is the group of projects more frequently supported followed by Health topics. This fact reflects the different aim of this INIA program, with the aim of funding more applicative research.

Table 4: Animal Production Species of research in "live" (from 2010 to 2013) research projects funded by the INIA Research Program in Spain

SPECIES	
S.RUMINANTS	24.81%
LIVESTOCK	21.71%
SWINE	18.60%
BOVINE	16.28%
BEES	6.98%
FISH	4.65%
POULTRY	3.88%
RABBITS	3.10%

Livestock refers to one of more different animal production species, when investigated together in one single research project

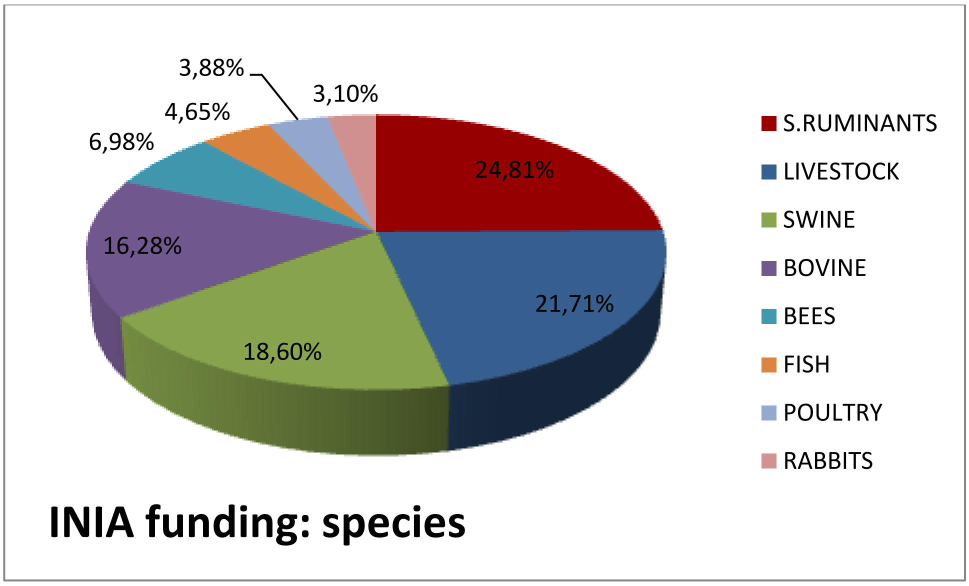


Figure 4: Animal Production Species of research in "live" (from 2010 to 2013) research projects funded by the INIA Research Program in Spain.

Livestock refers to one of more different animal production species, when investigated together in one single research project

Regarding the species, the high attention designated to small ruminants reflects the high interest and priority that this sector triggers in Spain.

This sector is of high interest, not only because of its production characteristics, but because of the impact of these systems on the environment, and the societal level.

In the last call a relevant weight has been given to research in bees, mainly in health issues.

Finally, there is a third funding line for livestock research managed by INIA institution that is addressed to the conservation of genetic lines and germoplasma bank conservation. Within these programs, the projects currently funded covers ruminant species (bovine and small ruminants), as well as poultry, swine and in a lesser amount, equine.

Prioritised national research gaps

Based on different documents, consultations among different stakeholders, and after a prospection exercise performed by the Institution of INIA and the Ministry for Agriculture Food and Environment, the following list of priorities of research gaps have been prepared.

This document in not intended to represent the national priorities, but the research priorities for Sustainable Animal Production that could be optimally addressed from a global perspective and through international efforts, with the direct involvement of different EU-members and/or countries near to Europe.

The lines / topics that are listed are general ones, and there different Animal Production species and systems can be included.

1) **Sustainable intensification in livestock farms**

- Alternative raw materials, additives and ingredients
- New models of livestock production management aiming at improving productivity and environmental, energetic and economic sustainability
- Converting residues in valuable products: cadavers, manure, slurry, contaminated water, egg shells…)
- Bioinformatic, machinery, robotics, automation and ICT applied to food production, particularly to optimize the use of inputs: precision livestock. Development of methods for the use of this instantaneous information for decisions regarding management on the farms.

2) **Enhancement of the sustainability of intensive and traditional /extensive production systems**

- Genetic / genomic selection of more efficient animals (more productive, more robust, more efficient, less environmentally loading…)
- Physiology and digestion in ruminants. Gut flora, microbial and immunology interaction
- Revalorization of the products from the livestock industry, i.e. natural antimicrobials, functional products, etc.
- Development of management systems to support public and private decision making: economic and competitive intelligence decision making and modeling systems for livestock sector.
- Knowledge sectorial networks, platforms and systems of supply-demand transfer results and training to enhance the EIP on Productive and Sustainable Agriculture

3) Global determination of sustainability and environmental load of Animal production systems:

- GHG emission / carbon footprint / water footprint measurement and interpretation
- Production systems efficiency determination: relative to protein production vs. used? Energy use? Water use?
- Sustainability markers: economic, societal and environmental. Sustainability of the extensive animal production systems
- Development of global tools and methods for international and national traceability.
- Development of tools to record and unify productive livestock data bases and banks from different national systems, into one unique international Databank

3.2.15 Spain – Basque Country

RESEARCH PROGRAMME ON SUSTAINABLE LIVESTOCK PRODUCTION

BASQUE COUNTRY

December 2014

1. STRATEGIC OBJECTIVES OF NEIKER TECNALIA:

1) **Enhancement of the sustainability** (economic profitability, social acceptability and environmentally friendly) **of the agricultural, livestock and forestry activities**
    a. Increasing productivity: health, genetics, reproduction, nutrition, welfare….
    b. Decreasing production costs: new or alternatives raw-materials for animal nutrition, valorisation of food residues, etc.,
    c. Added value: healthier food products for people through the innovation of animal nutrition
2) **Generation of new productive activities in the primary and food sector**
    a. New production systems to enhance sustainability (free range, grassland based, integrated agriculture, organic farming, regenerative agriculture…);
3) **Bio-security and food safety**
    a. Chemical and biological hazards: techniques for early diagnosis and control
    b. Zoonosis and contaminations: development of vaccines, control and eradication programs.
    c. Vigilance and prevention: epidemiologic vigilance.
4) **Environmental sustainability and conservation of natural resources**
    a. Conservation of natural resources: rational utilisation of mountain pastures
    b. Assessment of sustainability and ecosystem services
    c. Biodiversity: conservation of local breeds managed upon the utilisation local & natural resources, landscape preservation,

d. Valorisation of residues generated within the primary sector and food industry: converting residues into co-products or raw materials (new molecules with high value, feed additives, fertilizers, energy,…)
e. Climate change: farming practices aiming to decrease GHG emissions or to enhance carbon fixation, local food systems…

2. RESEARCH AREAS OF NEIKER-TECNALIA:

Animal Breeding (Mejora genética)

Animal Nutrition (Alimentación y Nutrición animal)

Ethology and Animal Welfare (Etología y Bienestar Animal)

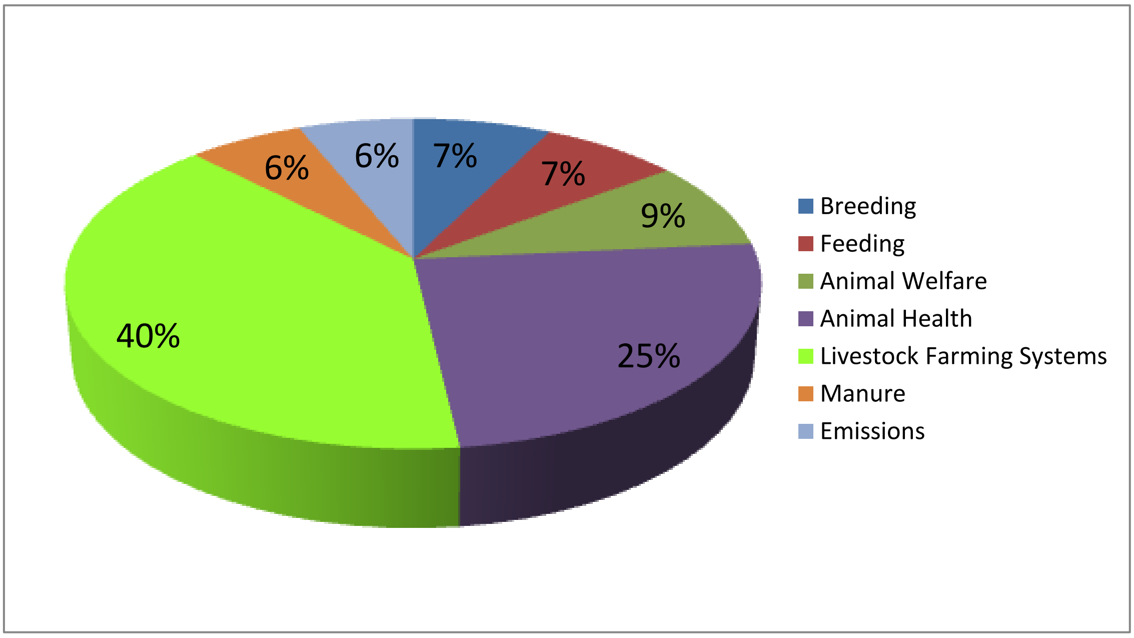
Livestock Farming Systems (Sistemas de producción animal) includes

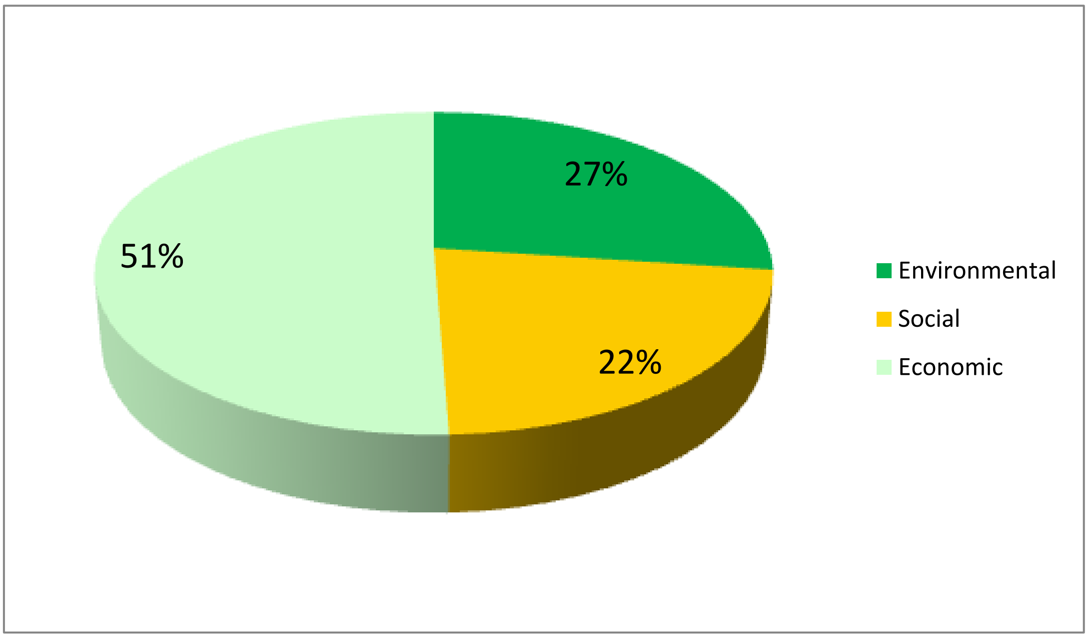
- Modelling livestock farming: simulation y optimization
- Ecosystem services (Servicios eco-sistémicos)
- Programm development (Diseño de programa)

Animal Health (Sanidad Animal) includes

- Development of techniques for diagnosis and control of diseases and animal health hazards (Desarrollo de técnicas de diagnóstico y control de enfermedades)
- Development of vaccines for animal diseases (Desarrollo de vacunas animales)
- Epidemiologic vigilance (Vigilancia epidemiológica)
- Zoonosis

3. EXPERTISE OF NEIKER-TECNALIA IN SUSTAINABLE LIVESTOCK





4. PAST AND ON-GOING PROJECTS

BREEDING

LEADERSHIP AND MANAGEMENT OF THE CONSERVATION AND BREEDING PROGRAMME OF THE LATXA AND CARRANZANA SHEEP BREEDS (SINCE 1982): MILK YILD, MILK QUALITY FEATURES AND UDDER MORFOLOGY (RESPONSABLES TECNICOS DEL PROGRAMA DE CONSERVACION Y MEJORA GENÉTICA DE LA OVEJA LATXA (desde 1982). CARACTERES: PRODUCCION Y COMPOSICIÓN DE LECHE Y MORFOLOGÍA MAMARIA)

INTEGRAL RESEARCH ABOUT CALVING EASE IN THE DAIRY CATTLE OF THE BASQUE COUNTRY
("ESTUDIO INTEGRAL SOBRE LA FACILIDAD DE PARTO EN VACUNO LECHERO DEL CAPV")
Funding Body: DEP. AGRICULTURA Y PESCA. GOBIERNO VASCO, DEPARTAMENTO DE EDUCACIÓN DEL GOBIERNO VASCO
2003 - 2007

OPTIMIZATION OF THE GENETIC EVALUATION MODEL USED WITHIN THE BREEDING PROGRAMME OF THE LATXA SHEEP ("OPTIMIZACION DEL MODELO DE EVALUACION GENÉTICA EN EL PROGRAMA DE MEJORA GENÉTICA DE LA RAZA LATXA ")
Funding Body: INIA, DEP. AGRICULTURA Y PESCA. GOBIERNO VASCO
1998 - 2002

LINKAGE AND COORDINATION BETWEEN THE BREEDING PROGRAMMES OF THE BLONDE D' AQUITAINE BEEF CATTLE BREED BETWEEN THE DEPARTMENT OF ATLANTIC PIRENEES (FRANCE) AND GIPUZKOA ("CONEXIÓN Y COORDINACIÓN ENTRE LOS PROGRAMAS DE MEJORA GENÉTICA DE LA RAZA BLONDE D' AQUITAINE ENTRE EL DEPARTAMENTO DE PIRINEOS ATLÁNTICOS Y GIPUZKOA ")
Funding Body: INTERREG-CE; DEP. AGRICULTURA Y PESCA. GOBIERNO VASCO, INTERREG IIIA-CONEXBLONDA
2002 - 2005

ECONOMIC PROFITABILITY OF THE DAIRY SHEEP FARMS THROUGH THE INCORPORATION OF THE GENETIC ECONOMIC MERIT INTO THE BREEDING PROGRAMA OF THE LATXA SHEEP ("RENTABILIDAD ECONÓMICA DE

LAS EXPLOTACIONES DE OVINO LECHERO A TRAVÉS DE LA INCORPORACIÓN DEL MÉRITO GENÉTICO ECONÓMICO EN EL PROGRAMA DE SELECCIÓN DE LA RAZA LATXA")
Funding Body: Proyecto INIA RTA02-002-C2-1
2002 - 2004

"LARGE-SCALE METHANE MEASUREMENTS ON INDIVIDUAL RUMINANTS FOR GENETIC EVALUATIONS"
Funding Body: EU
2013n - 2015

ANIMAL WELFARE AND ETHOLOGY

"EVALUATION OF THE WELFARE, HEALTH, AND PERFORMANCE STATUS OF LAYING HENS UNDER INTENSIVE AND EXTENSIVE PRODUCTION SYSTEMS"
Funding Body: ANIMAL HUMANE
2009 - 2010

ENHANCEMENT OF THE PRODUCTIVITY AND ANIMAL WELFARE STATUS OF THE LAYING HENS AND FREE-RANGE POULTRY WITHIN THE "EUSKO-LABEL" FOOD QUALITY FRAMEWORK
("MEJORA DE LA PRODUCTIVIDAD Y EL BIENESTAR DE GALLINAS DE PUESTA Y POLLOS CAMPEROS BAJO LA DENOMINACIÓN EUSKO-LABEL")
Funding Body: GOBIERNO VASCO
2010 - 2014

"STRATEGIES FOR THE IMPROVEMENT OF EGG AND MEAT POULTRY PRODUCTION"
Entidad financiadora: DAGU
2011 - 2012

"DEVELOPMENT, INTEGRATION AND DISSEMINATION OF ANIMAL-BASED WELFARE INDICATORS, INCLUDING PAIN, IN COMMERCIALLY IMPORTANT HUSBANDRY SPECIES, WITH SPECIAL EMPHASISON SMALL RUMINANTS, EQUIDAE & TURKEYS"
Funding Body: FP7-KBBE-2010-4. Collaborative Project - 266213
2011 - 2015

MODELLING THE EFFECT OF GROUP SIZE AND FENOTIPIC APPEARANCE THROUGH GAME THEORY MODELS FOR THE OPTIMIZATION OF WELFARE, HEALTH AND PRODUCTIVITY FEATURES IN LAYING HENS
("MODELIZACIÓN DEL TAMAÑO DE GRUPO Y APARIENCIA FENOTÍPICA A TRAVÉS DE MODELOS DE TEORIA DE JUEGOS PARA LA OPTIMIZACIÓN DEL BIENESTAR, SALUD Y PRODUCTIVIDAD DE GALLINAS DE PUESTA")
Funding Body: MICIM
2011 - 2015

"META-ANALYSIS ON THE EFFECTS OF THEHOUSING ENVIRONMENT ON THEWELFARE OF GROWING RABBITS,FOCUSING ON SPACE ALLOWANCE,ENRICHMENT, AND GROUP SIZE"
Funding Body: Compassion in World Farming
2014

INTELIGENT SOFTWARE FOR DECISION SUPPORT IN THE IMPLEMENTATION OF SUSTAINABLE STRATEGIES IN THE POULTRY MEAT CHAIN
("SOFTWARE INTELIGENTE PARA EL APOYO DE ESTRATEGIAS SOSTENIBLES Y TOMA DE DECISIONES EN LA CADENA PRODUCTIVA DEL POLLO DE CARNE")

Funding Body: MINISTERIO DE ECONOMICA Y COMPETITIVIDAD
2014 - 2016

ANIMAL NUTRITION

INFLUENCE OF THE GRAZING PRACTICES AND THE CHARACTERISTICS OF THE FEEDSTUFF SUPPLEMENTATION PROVIDED DURING MILKING IN THE UTILISATION OF GRASS, MILK YIELD AND MILK QUALITY IN SEVERAL SHEEP BREEDS
("INFLUENCIA DE LAS CONDICIONES DE PASTOREO Y DE LAS CARACTERÍSTICAS DE LA SUPLEMENTACIÓN EN ORDEÑO SOBRE LA UTILIZACIÓN DEL PASTO Y LA CALIDAD Y PRODUCCIÓN DE LECHE EN DISTINTAS RAZAS OVINAS")
Funding Body: FEDER.
2000 - 2003

OPTIMIZATION OF THE QUALITY OF THE DIET PROVIDED TO CATTLE FOR A MORE SUSTAINABLE AND HIGHER QUALITY PRODUCTION.
(“OPTIMIZACIÓN DE LA DIETA DE GANADO VACUNO PARA UNA PRODUCCIÓN SOSTENIBLE Y DE CALIDAD”)
Funding Body: INIA, RTA03-11
2003 - 2006

BIOLOGIC METHODS TO ASSESS THE NUTRITIVE VALUE OF FEEDS FOR RUMINANTS: DEVELOPMENT OF THE IN VITRO GAS PRODUCTION TECHNIQUE AND COMPARATION WITH IN SITU DEGRADABILITY
("MÉTODOS BIOLÓGICOS DE ESTIMACIÓN DEL VALOR NUTRITIVO DE LOS ALIMENTOS PARA RUMIANTES: DESARROLLO DE LA TÉCNICA DE PRODUCCIÓN DE GAS Y COMPARACIÓN CON LA DISGETIBILIDAD "IN SITU")
Funding Body: INIA
2001 - 2004

A TRIAL TO ASSESS THE GROWTH OF PIGLETS FED WITTH SUPPLEMENTS CONTAINING HIDROLIZATED FROM FISH RESIDUES
(“PRUEBA DE CRECIMIENTO DE LECHONES ALIMENTADOS CON PIENSO INCORPORANDO HIDROLIZADOS DE PESCADO”)
Funding Body: ETORTEK
2005 - 2007

ASSESSING THE INFLUENCE OF WINTER SHEARING IN THE INTAKE AND PRODUCTIVITY OF DAIRY SHEEP
("EVALUACIÓN DE LA INFLUENCIA DEL ESQUILEO INVERNAL DE LAS OVEJAS SOBRE LA INGESTIÓN, EN GESTACIÓN Y LACTACIÓN, Y LA PRODUCTIVIDAD DE LAS OVEJAS LECHERAS”)
Funding Body: Departamento de Agricultura y Pesca, Gobierno Vasco
2003 - 2005

“VALORLACT - FULL USE OF THE WHEY PRODUCED BY THE DAIRY INDUSTRY”
Funding Body: LIFE (LIFE11 ENV/ES/000639)
2012 - 2015

LIVESTOCK FARMING SYSTEMS

ASSESSMENT OF THE FACTORS THAT AFFECT MILK PRODUCTION IN THE LATXA SHEEP DAIRY FARMS
("FACTORES DE PRODUCCIÓN QUE AFECTAN A LA PRODUCCIÓN LECHERA EN LOS REBAÑOS DE RAZA LATXA")
Funding Body: DEP. INDUSTRIA AGRICULTURA Y PESCA. GOBIERNO VASCO e INIA
1995 - 1998

ASSESSING THE ESTRUCTURE AND PRODUCTIVITY OF MOUNTAIN PASTURES: RECOMMENDATIONS TO IMPROVE THE UTILISATION AND SUSTAINABILITY IN THE NATURAL PARK OF GORBEA
("ESTUDIO DE LA ESTRUCTURA Y PRODUCTIVIDAD DE LOS PASTOS DE MONTAÑA: PAUTAS PARA EL USO Y SOSTENIMIENTO EN LA ZONA DEL GORBEA")
Funding Body: DPTO. INDUSTRIA AGRICULTURA Y PESCA, GOBIERNO VASCO, y la ASOCIACIÓN DE AGRICULTURA DE MONTAÑA GORBEIALDE.
1994 - 1995

MOUNTAIN PASTURES: CONSERVATION AND UTILIZATION BY BEEF CATTLE
("PASTIZALES DE MONTAÑA: CONSERVACIÓN Y APROVECHAMIENTO POR EL GANADO VACUNO.")
Funding Body: DEP. INDUSTRIA AGRICULTURA Y PESCA. GOBIERNO VASCO.
1997 - 2000

THE DESIGN OF A FREE RANGE PIG PRODUCTION SYSTEMTO PRODUCE AND MARKET A NEW AND DIFFERENTIATED MEAT PRODUCT WITHIN THE CONDITIONS OF THE BASQUE COUNTRY.
(“PROYECTO DE ESTUDIO E IMPULSO DE LA CRIA Y COMERCIALIZACIÓN DE CERDO CRIADO AL AIRE LIBRE”)
Funding Body: DEP. INDUSTRIA AGRICULTURA Y PESCA. GOBIERNO VASCO
2000 - 2001

" MODELLING AND DECISION SUPPORT MAKING FOR DAIRY LIVESTOCK SYSTEMS"
Funding Body: QUALITY OF LIFE AND MANAGEMENT OF LIVING RESOURCES PROGRAMME, EUROPEAN COMMISSION
2001 - 2003

TOOLS FOR THE GRAZING MANAGEMENT OF PROTECTED NATURAL PARKS BASED ON LIVESTOCK-VEGETATION INTERACTIONS: AN ASSESSMENT IN THE NATURAL PARKS OF GORBEIA (Alava y Bizkaia), IZKI (Alava) AND SIERRA Y CAÑONES DE GUARA (Huesca)”
(“HERRAMIENTAS PARA LA GESTIÓN PASTORAL DE ESPACIOS NATURALES PROTEGIDOS BASADAS EN LA INTERACCIÓN ENTRE EL GANADO Y LA VEGETACIÓN. ESTUDIO EN LOS PARQUES NATURALES DE GORBEIA (Alava y Bizkaia), IZKI (Alava) Y SIERRA Y CAÑONES DE GUARA (Huesca)”)
Funding Body: INIA
2002 - 2005

CHARACTERIZATION OF THE MANAGEMENT PRACTICES IN THE DAIRY CATTLE FARMS OF THE BASQUE COUNTRY AND ASSESSING THE EFFECT ON MILK YIELD AND QUALITY
(“CARACTERIZACIÓN DE LOS FACTORES DE MANEJO DE LAS EXPLOTACIONES DE VACUNO LECHERO EN LA CAPV Y SU EFECTO SOBRE LA PRODUCCIÓN LECHERA Y SU CALIDAD”)
Funding Body: Departamento de Industria, Agricultura y Pesca del Gobierno Vasco
Entidades participantes: NEIKER A.B.
2003 - 2006

DEVELOPMENT OF A DECISION SUPPORT SYSTEM FOR THE SUSTAINABLE MANAGEMENT OF EXTENSIVE RUMINANTS SYSTEMS AND THE ASSESSMENT OF POLICY MEASURES IN MOUNTAIN AREAS
(“DESARROLLO DE UN SISTEMA DE APOYO A LA TOMA DE DECISIONES PARA LA GESTIÓN SOSTENIBLE DE SISTEMAS GANADEROS EXTENSIVOS DE RUMIANTES Y LA EVALUACIÓN DE POLÍTICAS EN ZONAS DE MONTAÑA”)
Funding Body: INIA
2003 -2006

A PROPOSAL FOR THE SUSTAINABLE MANAGEMENT OF LIVESTOCK IN THE NATURAL PARK OF VALDEREJO (ALAVA)
("ESTUDIO DE UNA PROPUESTA DE GESTIÓN SOSTENIBLE DE LA CABAÑA GANADERA DEL PN DE VALDEREJO")
Funding Body: Diputación Foral de Alava
2003 -2004

BEST LIVESTOCK MANAGEMENT PRACTICES.
("BUENAS PRÁCTICAS GANADERAS")
Funding Body: Departamento de Agricultura del Gobierno Vasco
2003 - 2004

ASSESSING PROPOSALS TO ENHANCE THE SUSTAINABILITY OF THE DAIRY CATTLE SECTOR IN THE BASQUE COUNTRY
("Evaluación de propuestas de mejora para la sostenibilidad del sistema de producción de vacuno lechero en la CAPV")
Funding Body: DAP-GV
2006

"DEVELOPMENT OF DAIRY AND DUAL-PURPOSE GRAZING SYSTEMS IN LATIN-AMERICA THROUGH SAFER AND HIGHER QUALITY FOOD CHAINS"
Funding Body: EU COMISSION, FP6-2002-INCO-DEV/SSA-1 Proposal Nº 517625
2006

GRASS-BASED ECOSYSTEMS IN MOUNTAIN AREAS: ASSESSING THE SUSTAINABILITY THROUGH INTEGRATED METHODOLOGIES WITH DIFFERENT TIME-SPACE SCALES
("ECOSISTEMAS PASTORALES EN ZONAS DE MONTAÑA: ANÁLISIS DE SU SOSTENIBILIDAD MEDIANTE METODOLOGÍAS INTEGRADAS EN DIFERENTES ESCALAS ESPACIO-TEMPORALES")
Funding Body: INIA, RTA2005-00234-C02-02
2005 - 2007

SUSTAINABILITY ASSSESSMENT OF CROP-LIVESTOCK SYSTEMS: INCLUDING SOCIAL AND ENVIRONMENTAL INDICATORS INTO THE TECHNICAL AND ECONOMICAL ADVISORY PROGRAMS.
("DIAGNÓSTICO DE LA SOSTENIBILIDAD DE SISTEMAS AGROGANADEROS. INCORPORACIÓN DE INDICADORES DE CARÁCTER SOCIAL Y AMBIENTAL A PROGRAMAS DE GESTIÓN TÉCNICO-ECONÓMICA")
Funding Body: INIA RTA2005-00174-C02
2006 - 2009

DESIGN OF TOOLS TO ASSESS STRATEGIES AND OPTIMIZATION OF SHEEP SYSTEMS
("DISEÑO DE HERRAMIENTAS PARA LA EVALUACION DE ESTRATEGIAS Y OPTIMIZACIÓN EN SISTEMAS DE PRODUCCIÓN OVINA")
Funding Body: INIA, RTA2006-00170-C03-01
2006 - 2010

APPLICATION AND SHOWING THE SIMULATION MODEL "NODRIZA" IN BEEF FARMS OF ARAGÓN, BASQUE COUNTRY AND CATALONIA
("APLICACIÓN Y DEMOSTRACIÓN DEL MODELO DE SIMULACIÓN NODRIZA EN EXPLOTACIONES DE VACUNO DE CARNE DE ARAGÓN, PAÍS VASCO Y CATALUÑA (NODRIZA-DEMO)")

Funding Body: INIA
2007 - 2009

OBJECTIVE AND PREDICTIVE ASSESSMENT OF THE QUALITY FEATURES OF THE MEAT PRODUCED WITHIN THE “EUSKO LABEL” FRAMEWORK
(“OBJETIVACIÓN Y PREDICCIÓN DE LAS CARACTERÍSTICAS DE LA CALIDAD DE CARNE EUSKO LABEL”)
Funding Body: FUNDACIÓN KALITATEA FUNDAZIOA
2007 - 2009

“KNOWLEDGE BROKERAGE TO PROMOTE SUSTAINABLE FOOD CONSUMPTION AND PRODUCTION: LINKING SCIENTISTS, POLICYMAKERS AND CIVIL SOCIETY ORGANISATIONS - FOODLINKS” (Contract N: 265287)
Funding Body: UE- FP7-ENV-2010
2011 - 2013

ASSESSMENT OF THE CARBON FOOTPRINT AND ECOSYSTEM SERVICES FOR THE DESIGN OF SUSTAINABLE STRATEGIES IN SHEEP PRODUCTION
(“EVALUACION DE LA HUELLA DE CARBONO Y LOS SERVICIOS ECOSISTEMICOS PARA EL DISEÑO DE ESTRATEGIAS SOSTENIBLES EN PRODUCCIÓN OVINA”)
Funding Body: INIA
2011 - 2015

AGRIPIR – A NETWORK OF EXCHANGE AND EXPERIMENTATION FOR THE REVALORIZATION OF MOUNTAIN AGRICULTURE IN THE PYRENEES.
(“RED DE INTERCAMBIO Y EXPERIMENTACIÓN PARA LA REVALORIZACIÓN DE LA AGRICULTURA DE MONTAÑA EN LOSPIRINEOS”)
Funding Body: POCTEFA
2012 - 2015

“REGENERATIVE FARMING PRACTICES: AN ALTERNATIVE FOR SUSTAINABLE AGRO-LIVESTOCK MANAGEMENT AND SOIL IMPROVEMENT”
(“PRACTICAS DE AGRICULTURA REGENERATIVA: DEMOSTRACIÓN DE UNA ALTERNATIVA DE GESTION SOSTENIBLE DE LOS SUELOS AGROGANADEROS”)
Funding Body: LIFE (LIFE12 ENV/ES/000232)
2013 - 2016

“INTEGRAL USE OF OILSEEDS TO REDUCE GREEN HOUSE GASES EMISSIONS ASSOCIATED WITH FARMING ACTIVITIES”
Funding Body: LIFE (LIFE12 ENV/ES/000590)
2013 - 2016

BASIS AND STRATEGIES FOR FORAGE CROP PRODUCTION ADAPTED TO THE AGRO-CLIMATICCONDITIONS OF THE CANTABRIAN COAST FOR AN IMPROVED MILK QUALITY IN SUSTAINABLE AND INTEGRATED DAIRYFARMING SYSTEMS AND ORIENTED TOWARDS THE REQUIREMENTS OF THE NEW CAP
(“BASES Y ESTRATEGIAS DE PRODUCCIÓN DE CULTIVOS FORRAJEROS ADAPTADOS A LAS CONDICIONES AGROCLIMÁTICAS DE LA CORNISA CANTÁBRICA PARA LA PRODUCCIÓN DE LECHE DE VACUNO DE CALIDAD DIFERENCIADA EN SISTEMAS SOSTENIBLES, INTEGRADOS EN EL TERRITORIO Y ORIENTADOS A LOS REQUERIMIENTOS DE LA NUEVA PAC”)
Funding Body: INIA (RTA2012-00065-C05-004)
2013 - 2016

SUSTAINABILITY OF GRAZING MANAGEMENT PRACTICES IN DAIRY SHEEP, TRADITIONAL FOOD QUALITY AND CONSERVATION OF MOUNTAIN ECOSYSTEMS.
("SOSTENIBILIDAD DEL PASTOREO DE OVEJAS LECHERAS, CALIDAD DE ALIMENTOS TRADICIONALES Y CONSERVACIÓN DE ECOSISTEMAS DE MONTAÑA")
Funding Body: MICIM
2014 - 2016

ANIMAL HEALTH

EPIDEMIOLOGY OF CAMPILOBACTER INFECTION IN BROILERS. (Epidemiología de la infección por Campylobacter en pollo de engorde)
Funding Body: MICIM
2014 – 2017

ASSESSING THE EVOLUTION OF THE INFECTION OF COXIELLA BURNETTI IN DAIRY SMALL RUMINANTS AND IMPACT ON FOOD QUALITY (ESTUDIO DE LA EVOLUCION DE LA INFECCION POR Coxiella burnetii EN LAS EXPLOTACIONES DE PEQUEÑOS RUMIANTES DE APTITUD LECHERA Y EFECTO EN LA CALIDAD DE SUS PRODUCTOS)
Funding Body: MICIM
2014 – 2017

RESEARCH ON ZOONOSIS CAUSED BY BACTERIAE TRANSMITED BY TICKS IN THREE PILOT AREAS: DETECTION, IDENTIFICATION AND PREVENTION (Estudio de zoonosis bacterianas transmitidas por garrapatas en 3 áreas piloto: detección-identificación-prevención)
Funding Body: MICIM
2003 – 2005

DEVELOPMENT OF IMPROVED TOOLS FOR DETECTION OF PARATUBERCULOSIS IN LIVESTOCK, M. PARATUBERCULOSIS IN FOOD AND FOR THE ASSESSMENT OF THE RISK OF HUMAN EXPOSURE
Funding Body: EU
2006 – 2010

ECOLOGY AND CONTROL OF Q-FEVER: MOLECULAR EPIDEMIOLOGY OF COXIELLA BURNETTI (CONTROL DE LA FIEBRE Q: EPIDEMIOLOGIA MOLECULAR DE COXIELLA BURNETII)
Funding Body: MICIM
2007 – 2010
DEVELOPING METHODS TO DETECT AND CHARACTERIZE FOODBORNE PATHOGENS OF ANIMAL ORIGIN: SALMONELLA AND LISTERIA MONOCYTOGENES (Desarrollo de métodos de detección y caracterización de los patógenos alimentarios Salmonella y Listeria monocytogenes de origen animal)
Funding Body: Basque Government
2007

DESIGNING STRATEGIES TO ERRADICATE BOVINE TUBERCULOSIS (Estrategias para la erradicación de la tuberculosis bovina)
Funding Body: MICIM
2008

ASSESSING THE INFECTION OF COXIELLA BURNETTI IN DAIRY CATTLE FARMS: IMPACT OF VACCINATION TO REDUCE ENVIRONMENTAL CONTAMINATION. (ESTUDIO DE LA INFECCION POR COXIELLA BURNETII EN EXPLOTACIONES DE VACUNO LECHERO. EFECTO DE LA VACUNACION EN LA REDUCCION DE LA CONTAMINACION MEDIOAMBIENTAL)
Funding Body: MICIM
2009 – 2012

EPIDEMIOLOGIC VIGILANCE IN THE ENVIRONMENT OF POTENTIALLY IMPORTANT HAZARDS FOR ANIMAL HEALTH AND PUBLIC HEALTH (Vigilancia epidemiológica en el medio natural de enfermedades de importancia en sanidad animal y salud pública)
Funding Body: Basque Government
2006

A PROGRAMM FOR THE VIGILANCE OF HIGH PATHOGENIC AVIAR INFLUENZA IN THE BASQUE COUNTRY (Programa de vigilancia de la influenza aviar altamente patógena en la CAPV)
Funding Body: MICIM
2006

INTEGRATED SOLUTIONS FOR TUBERCULOSIS CONTROL IN ANIMALS COMBINING VACCINATION AND MULTI-SPECIES DIAGNOSTICS
Funding Body: EU
2013-2015

EMISSIONS

OPTIMIZATION OF THE DIET OF DAIRY CATTLE FOR A SUSTAINABLE AND HIGH QUALITY PRODUCTION (Optimización de la dieta de ganado vacuno para una producción sostenible y de calidad)
Funding Body: INIA
2003-2007

UTILIZATION OF LIVESTOCK RESIDUES TO MAKE QUALITY COMPOST FOR ORGANIC AGRICULTURE (Utilización de residuos ganaderos para la elaboración de un compostaje de calidad destinado a la producción ecológica)
Funding Body: BASQUE GOVERNMENT
2008-2010

GREENHOUSE GAS EMISIONS INVENTORY FROM THE PRIMARY SECTOR – LAND USE, LAND USE CHANGES AND SILVICULTURE (Implementación del inventario de Gases efecto Invernadero del sector -Uso de la Tierra, Cambios en el uso de la Tierra y Silvicultura)
Funding Body: MICIM
2007-2008

DAIRY CATTLE EMISSIONS OF NH3, N20 AND CH4 FED WITH DIFFERENT LEVELS OF PROTEIN (Emisión de NH3, N2O y CH4 en dietas de ganado vacuno de leche con diferente aporte proteico)
Funding Body: BASQUE GOVERNMENT
2007

MITIGATION OF AMONIA AND GREENHOUSE GAS EMISSIONS FROM INTENSIVE RUMINANT PRODUCTION SYSTEMS (Mitigación de las emisiones de amoniaco y gases invernadero de rumiantes en sistemas de producción intensivos)
Funding Body: INIA
2011-2014

MANURE

EVALUATION OF ENVIRONMENTAL STRATEGIES TO CONTROL POLLUTION FROM LIVESTOCK (Evaluación de estrategias ambientales de control de la contaminación en explotaciones ganaderas)
Funding Body: EU
2010-2013

AN STRATEGIC RESEARCH TO PROTECT AND IMPROVE SOIL HEALTH AND QUALITY (Investigación estratégica para la protección y recuperación de la salud y calidad del recurso suelo)
Funding Body: Basque Government
2007-2009

A PILOT PROGRAMM FOR THE MANAGEMENT OF RESIDUES FROM LIVESTOCK AS FERTILIZERS FOR CROP PRODUCTION (Programa piloto para la gestión de residuos ganaderos como fertilizantes para los cultivos)
Funding Body: EU
2009-2012

STUDY ON VARIATION OF MANURE N EFFICIENCY THROUGHOUT EUROPE
Funding Body: Private Funds
2011-2014

ASSESSING THE MANAGEMENT OF MANURE IN THE FARMS OF THE AREA OF OROZCO: SURPLUS, AMOUNT AND LOCATION (Estudio de la gestión de deyecciones ganaderas en Orozko. Excedentes, cuantificación y localización)
Funding Body: Local Administration
2009

5. RESEARCH PRIORITIES IN SUSTAINABLE ANIMAL PRODUCTION IN THE BASQUE COUNTRY

Based on the prioritized national research gaps identified by INIA, we identify the following lines/topics:

1) Sustainable intensification in livestock farms:

   NEIKER works basically in every line pointed out by INIA (alternative raw materials, nutrition strategies, valorisation of residues, etc) except in automation. To do that, we collaborate with other organisms (mainly TRI) in order to adapt equipment and knowledge already existing (sensoric, data mining) and create new tools aiming to improve the productivity, efficiency and decrease production costs in livestock farms.

2) Enhancement of the sustainability of intensive and traditional/extensive production systems:

NEIKER does basically the same as INIA. We are actually working in a project to enhance the potential of grazing management for carbon fixation and improving the fertility of soil through the introduction of regenerative practices (holistic management, planned grazing, etc.).

3) Global determination of sustainability and environmental load of Animal production systems:

NEIKER works in the assessment of GHG emissions through the application of Life Cycle Analysis to reduce carbon footprint. Methodologies and tools (software) to assess the sustainability of farming systems based on (social, economic and environmental) indicators within a holistic approach have been developed. In particular (cheap and easy) methodologies to assess on-site the environmental impact of farming practices have been developed such as the Soil Health Cards.

6. THEMATIC SCOPE FOR THE ERANET ON SUSTAINABLE LIVESTOCK PRODUCTION

Taking into account the Basque expertise and current areas of research in Animal Production, Basque Country is particularly interested in working deeper on the following topics:

- ✓ ANIMAL BREEDING:
  - Large-scale methane measurements on individual ruminants for genetic evaluations
  - Innovation in breeding programs: new characters and tools (genomics)
- ✓ ANIMAL NUTRITION
  - New raw-materials and innovation in animal nutrition to decrease the current dependency on soybean, the competence with food for humans, reduce production costs, valorisation of residues, etc.
  - Development of more healthy food products through innovation in animal nutrition.
  - Meta-genomics to reduce enteric emissions of ruminants.
- ✓ ANIMAL WELFARE:
  - Assess the impact of farming systems and management practices on animal behaviour and welfare
  - Enhancing the productivity of intensive livestock farming systems through the assessment and improvement of animal behaviour
  - Introduction of environmental enrichment techniques in intensive farming systems
  - Deepen into the interactions between behaviour, nutrition, health and animal welfare status.
- ✓ LIVESTOCK FARMING SYSTEMS

- Sustainable or Ecological intensification of farming systems: low-input farming systems, organic farming, etc.

- Enhance the potential of crop-livestock or grassland based systems for carbon fixation through the innovation in the management of livestock and farming practices.

- Development of decision support systems based on the utilisation of high-technologies: sensoric, remote sensing, artificial vision, data-mining, dynamic modelling, simulation and optimization software, etc.

- Innovation in knowledge, facilities and equipment to enhance the role of livestock food products: short food supply chains, role of livestock in urban agriculture

- Assessment and valorisation of the ecosystem services provided by livestock

- Mitigation of GHG emissions from livestock (emissions)

- Valorisation of the residues generated by livestock (manure)

- Control systems for improving quality and traceability in European livestock production with special regard on fresh as well as processed products

✓ ANIMAL HEALTH

- Identification and detection of emerging foodborne zoonosis.

- Potential impact on the quality and safety animal products (eggs, meat, milk, cheese,...

3.2.16 Sweden

SWEDISH REPORT FOR CWG-SAP: CURRENT RESEARCH ACTIVITIES IN SUSTAINABLE ANIMAL PRODUCTION FUNDED BY FORMAS

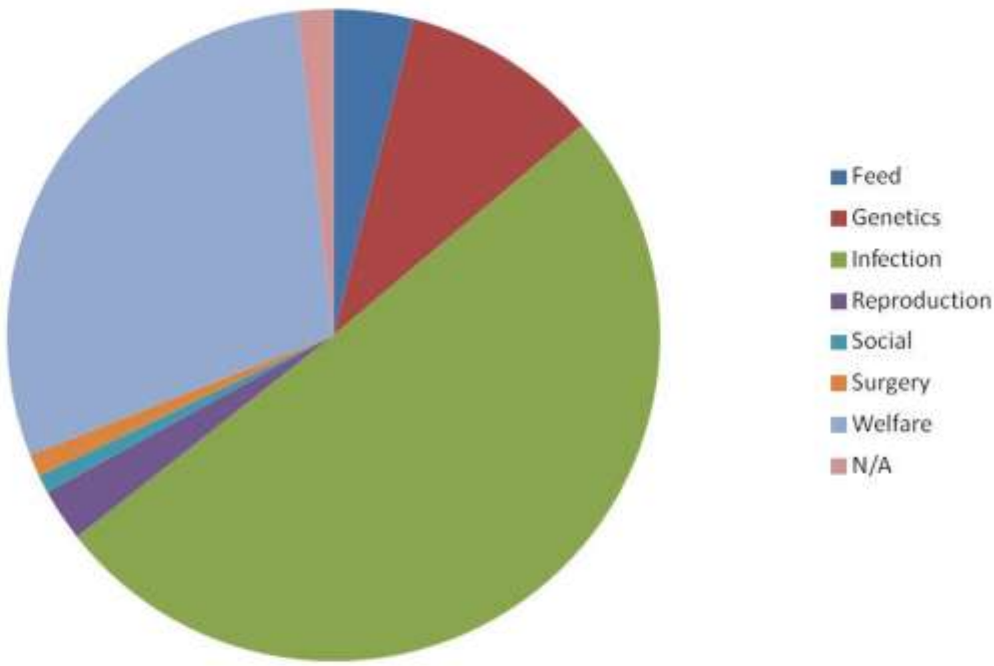
Background

- Formas is one of four research councils, the budgets and strategies in programs from the other councils is not a part of this short report
- Because the participation in, and the funding of, ERA-NET programs are decisions taken at each council, we only present data from Formas.
- In the report we have not separated projects from ERA-Nets, Open calls and targeted calls

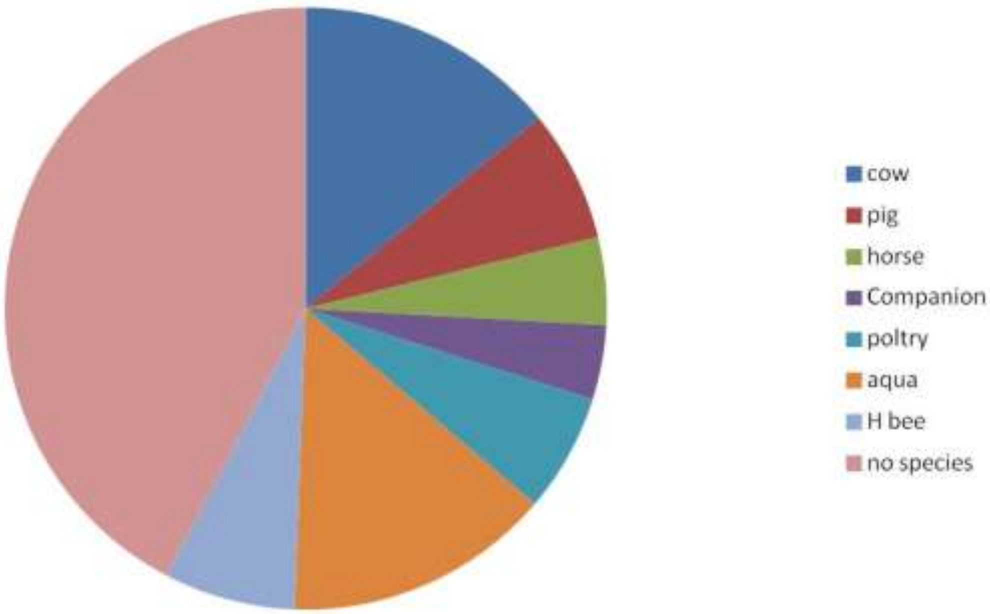
Funding 2010-2013

- Total funding in the area of animal science 2010-2013 were ~ 45 M€
- Programs in ERA-Nets (EMIDA & ANIHWA)
- National Open and Targeted calls
- Expected budget for 2014-2016 is ~ 35 M€
- The funded research shall be of highest scientific quality and of relevance to the Formas areas of responsibility.

Funding presented in areas



Funding divided between species



Swedish support ATFs White Paper

Sweden support ATFs White Paper but we have prioritized some of the bullet-points

- *Priority I: Fortify animal disease prevention and control*
- *Priority C: Robust and resilient animal production*
- *Priority D: Big Data; Phenotyping and precision livestock farming (PLF)*
- *Priority B: Feed security II: Alternative feed resources, non-competing with food*

3.2.17 Turkey

RESEARCH STATUS AND PRIORITIZED NATIONAL RESEARCH GAPS IN TURKEY

AGRICULTURAL RESEARCH AND FUNDING SYSTEM

Agricultural Research is considered essentially as a public duty which is mainly covered by the Ministry of Food Agriculture and Livestock (MFAL). The Ministry is mainly responsible for policy formulation, monitoring and inspections of implementations in the field of food, agriculture and livestock.

The mandate of MFAL is outlined in Strategic Plan for 2010-2014 as:

to guide agricultural production and provide security of supply; develop agricultural infrastructure and its services; protect and improve environment and natural resources; enable sustainability and take measures to reduce the effect of natural disasters; provide high quality and affordable supply of food and feed; eradicate epidemic diseases and pests; prevent product losses; develop human resources and organization level both at the Ministry and in the rural area; provide market integration; diversify the income of rural population; increase local self-development capacity and life quality of the farmers, and provide improved managerial and institutional capacity to offer efficient and qualified ministerial services.

MFAL implements and coordinates agricultural R&D activities through General Directorate of Agricultural Research and Policies (GDAR). GDAR has an experience in funding and managing research and development projects in the field of agriculture and food. GDAR is the headquarter of the national agricultural research system (NARS) and responsible for determining national research strategy, setting up research priorities and allocating available financial resources to the programs, providing scientific data to the government to be used in developing agricultural policy.

As of January 2015 under the administration of GDAR, there are 2098 researchers in 21 Central and Regional Research Institutes and 28 Subject Specific Research Stations spread throughout the Country and responsible for carrying out agricultural R&D activities in accordance with the national priorities.

Priority setting is one of the important tasks of GDAR to the distribution of government resources accordingly. A Research Master Plan was prepared in 1995, and has been implemented since 1996. The priorities of agricultural research areas have been re-determined in every **-** 5**-** year for the next 5 year period by representatives from universities, private sector, NGOs and other related institutions. In the Research Master Plan Areas of Research Opportunity (ARO) and Research Programmes (RP) within ARO's have been determined. ARO's and RPs are being revised and prioritised in every **-** 5 – year and research funds are allocated according to prioritised ARO's and RP's.

GDAR makes an annual call for the submission of research proposals, reviews those received through relevant evaluation bodies, and selects some of them to support.

In order to assess whether project proposals qualify for funding, GDAR follows the following evaluation criteria;

- The relevance of the proposed project to the area of research priorities,
- The originality of the project,
- The contribution of the project to fulfil the targets of the programmes,
- The characteristics in creating innovation,
- The multidisciplinary, problem solving, harmless to environment and sustainability characteristics of the project,
- The reasonability of proposed budget (cost/benefit ratio),
- The capacity and sufficiency of the institute that proposed project regarding to infrastructure and staff availability/qualification;
- The ability of transferring the results to the end users…

After the evaluation procedures are completed, the approved research projects are funded, monitored and the results disseminated. For the management all of these activities GDAR has an organizational structure consisting of **"Institute Research Committee", "Program Coordinators"**, "**Programme Evaluation Working Groups", "Research Advisory Committees"** and "**Agricultural Research Council"**, in bottom-up order. Every components of research management team meets ones or twice annually to take the decisions on research projects, funding strategy and policy related issues.

In Brief Mandate of GDAR

- Prepare the National Agricultural Research Master Plan,
- Determine the research priorities and ensure the use of resources according to the priorities,
- Monitor and evaluate research programs,
- Carry out research to improve new technologies and applied end-user,
- Improve research system, human resources and capacity,
- Publish research results and provide the use of developed technologies,
- Assist the government in developing agricultural policy,
- Prepare reports for policy makers to prevent probable crisis…

Research Areas of GDAR

- Plant Breeding,
- Plant Health,
- Food and Feed,
- Animal Breeding and Husbandry,
- Animal Health,
- Aquaculture and Fishery,
- Postharvest Technologies,
- Natural Resources (Biodiversity and Genetic Resources),
- Organic Agriculture,
- Soil and Water Resources Management,
- Climate Change and Environment,
- Agricultural Economics and Bio-economy,
- Extension and Innovation.

GDAR's Responsibilities and Priorities in The Area of Livestock Production

- Increasing productivity, quality and diversity,
- Determination of suitable livestock breeds for different eco-regions,
- Collection, conservation, and evaluation and sustainable utilization of livestock genetic resources,
- Development relevant control and eradication methods for epidemic, parasitic and zoonotic diseases,

- Assessment of the effectiveness of medicines, vaccines, hormones and, like substances and their negative/harmful effects on the human and animal health and the environment,
- Extension of research results to end-users, and collaboration with domestic and foreign research institutions and universities…

<u>Institutions Responsible for Undertaking Animal Breeding and Husbandry Research</u>

- Livestock Central Research Institute, ANKARA
- Apiculture Research Station, ORDU
- Bahri Dagdas International Agricultural Research Institute, KONYA
- East Mediterranean Agricultural Research Institute, ADANA
- East Anatolia Agricultural Research Institute, ERZURUM
- Aegean Agricultural Research Institute, İZMİR
- GAP Agricultural Research Institute, ŞANLIURFA
- GAP International Agricultural Research and Training Center, DİYARBAKIR
- Fig/Poultry Research Station, AYDIN
- Sheep Breeding Research Station, BALIKESİR
- Middle Black Sea Transitional Zone Agricultural Research Station, TOKAT
- Poultry Research Station, ANKARA
- International Agricultural Research and Training Center, İZMİR
- Transitional Zone Agricultural Research Station, ESKİŞEHİR

<u>Veterinary Control Institutes undertaking Animal Health research under the management of GDAR</u>

- Ankara, İstanbul, İzmir, Adana, Elazığ, Erzurum, Konya and Samsun Veterinary Control institutes.
- Foot and Mouth Disease Institute, Ankara

Some Problems of Sustainable Livestock Production in Turkey;

- High cost of inputs,
- Big part of livestock population is consisted of native breeds and these breeds are poor yielded,
- Requirement of improving the breeders' awareness,
- Insufficiency of optimal sized livestock farms,
- Animal registration problems,
- Insufficiency of using digital data in livestock production,
- Inefficiency of high quality feed sources and pastures,
- Insufficiency of preventive veterinary practices,
- Challenges about controlling animal movements,
- Lack of adequate social security system and the low social status of shepherd,
- Lack of organizations for training shepherds,

- Lack of breeder associations' infrastructure and organization capacity,
- Insufficiency of studies about increasing of yield per bee colony,
- Lack of breeding researches in bee sector,
- Insufficiency of biotechnological administrations (artificial insemination to bees),
- Insufficient marketing chains and organizations,
- Requirement of effective support system to improve livestock sector.

National Development Plans and Livestock Production
The State Planning Organisation has been preparing development plans since 1963. The main objective of the Development Plan is to draw an outline of priorities for policies to be developed and implemented, as well as investments to be made over the seven years covered by the plan. One of the principal development axes of the plan is to ensure innovative production, stable and high growth. In this context, the government plans to increase the productivity of capital stock through use of innovative activities and full utilization of human and natural resources. The public support for R&D and innovation in priority fields will continue.
The Tenth Development Plan covers the 2014-2018 periods and draws an outline of priorities for improving of Turkey livestock production.

In this context to improve of Turkey livestock production;
- Monitoring and control system will be improved,
- Livestock policies will be regulated and developed,
- Animal registration system and databases should be improved,
- Measures will be increased for animal health,
- Animal health services will be developed,
- Production and marketing system will be improved,
- Effective training programs will be organized for animal breeders.

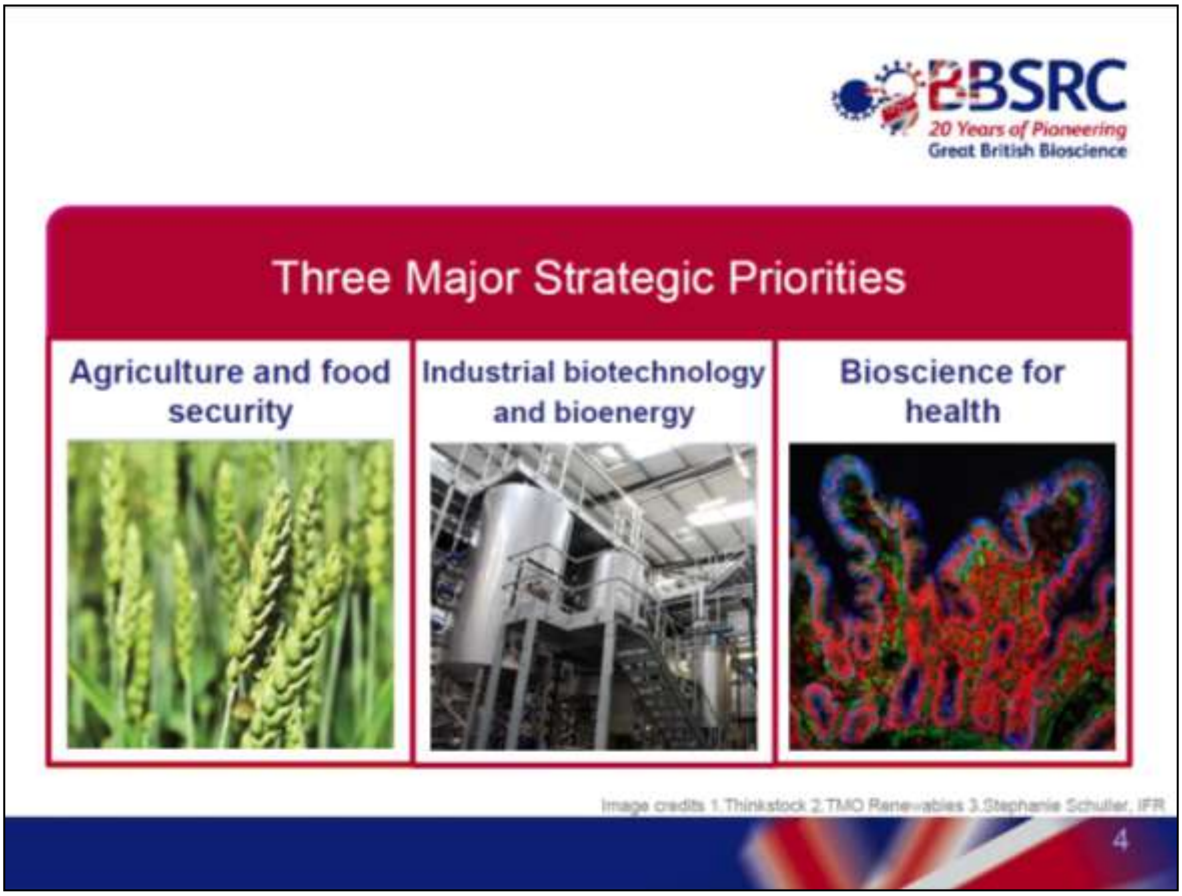
Turkey's Expectations from Sustainable Livestock Production Project
- Better integration into EU scientific communities through participation at meetings and project activities, sharing best practice, identifying priority topics of common interest,
- Establish partnerships with experienced partners of the project and benefit from their EU project experience,
- Encourage Turkish researchers to involve international collaborations and gain experiences by directing them to Sustainable Livestock Production project,
- Promote awareness of Sustainable Livestock Production practices among Turkish researchers, and extension workers,
- Play an increasing role in European ARD...

Research Programs & Available Funds
Program for Applied Research and Development in Agriculture for Livestock.
- 31 projects were finished in 2013 and total budget was approximately 4.9 million €
- 256 projects are ongoing and total budget is approximately 32.3 million €.

- The budget allocated for 2015 is 35.8 million €. (Budgets are calculated by published data from Turkish Official Gazette, 09.01.2015).

3.2.18 UK – BBSRC


BBSRC
20 Years of Pioneering
Great British Bioscience
BBSRC Strategic Plan:
The Age of Bioscience
World-class bioscience
Three major strategic science priorities
Three crucial enabling themes
The Age of Bioscience
Strategic Plan
www.bbsrc.ac.uk/strategy
3


BBSRC
20 Years of Pioneering
Great British Bioscience
Three Major Strategic Priorities
Agriculture and food security
Industrial biotechnology and bioenergy
Bioscience for health
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BBSRC
20 Years of Pioneering
Great British Bioscience
Three Crucial Enabling Themes
Enabling Innovation
Exploiting new ways of working
Partnerships
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BBSRC
20 Years of Pioneering
Great British Bioscience
Where does Animal Health and Welfare Fit?
Agriculture and Food Security
Animal Health & Welfare
Bioscience for Health
BBSRC will support research in areas that have profound implications for food security and food safety such as animal health and welfare, and genetics and genomics for improved production and disease resistance.
Encourage collaboration between experts in human and veterinary sciences to improve the health and wellbeing of animals and humans in the context of 'One Health', particularly in vaccinology, infections of zoonotic origin, vector borne diseases and understanding antimicrobial resistance
6

Animal Health

BBSRC
20 Years of Pioneering
Great British Bioscience

~£47M AHW spend pa

- Remit covers all managed animals species including companion animals
- Activities relate to animal health, welfare, disease and production

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Animal Health: Remit

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Great British Bioscience

Genetics and genomics (for production and disease resistance)	Endemic and exotic diseases (including vector-borne diseases and zoonoses)	Antimicrobial and antihelmintic resistance
Epidemiological approaches and diagnostic tools	Next generation vaccines	Aquaculture
Infection and immunity	Opportunities from 'One Health'	Gut health

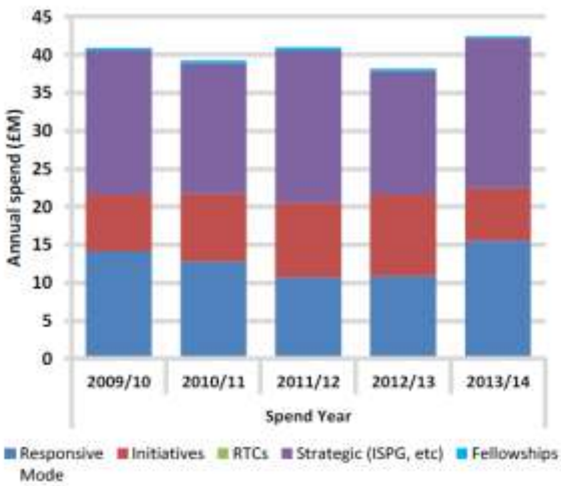
8

Animal Health

BBSRC 20 Years of Pioneering Great British Bioscience

Analysis by spend year (2009/10 - 2013/14):

		Annual spend (£M)				
		2009/10	2010/11	2011/12	2012/13	2013/14
HEI	Responsive Mode	9.7	8.8	8.0	7.6	11.6
	Initiative *	5.4	5.9	6.6	7.4	5.4
	RTC	-	-	-	-	0.1
	Strategic (ISPG, etc)	-	-	-	-	-
	Fellowship	0.3	0.3	0.2	0.1	0.1
	HEI TOTAL	15.4	15.1	14.7	15.1	17.1
Institute	Responsive Mode	4.5	4.0	2.7	3.3	4.0
	Initiative *	2.1	3.0	3.3	3.3	1.6
	RTC	-	-	-	-	-
	Strategic (ISPG, etc)	19.0	17.1	20.0	16.2	19.7
	Fellowship	-	0.1	0.2	0.2	0.2
	Institutes TOTAL	25.5	24.2	26.3	23.1	25.4
Overall TOTAL		40.9	39.3	41.0	38.2	42.5
All Research TOTAL		290.3	273.4	260.9	254.0	271.2
% of All Research		14.1	14.4	15.7	15.0	15.7



In 2012/13, there is reduction in the overall portfolio of 'Strategic' research reported against at the project level by Institutes. A consequence of changes in funding arrangements and subsequent reporting. The net effect being a slight reduction in strategic funding which will be more pronounced for those topics heavily dependent on Institute strategic funding (e.g. animal health (and associated with this, immunology and microbiology), plant and crop science, and diet and health.

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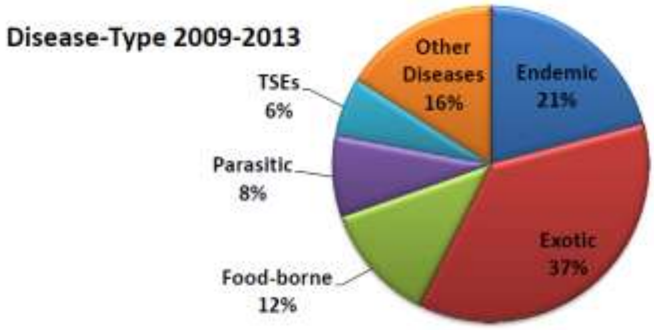
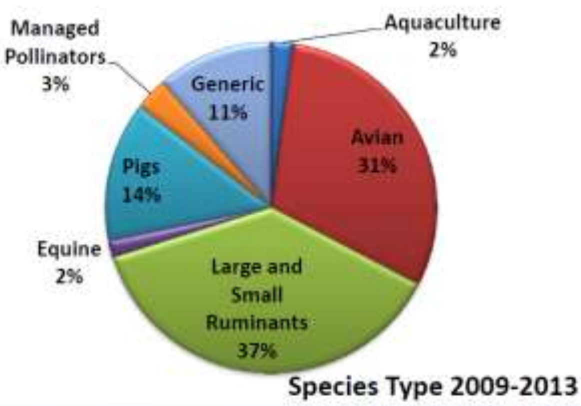
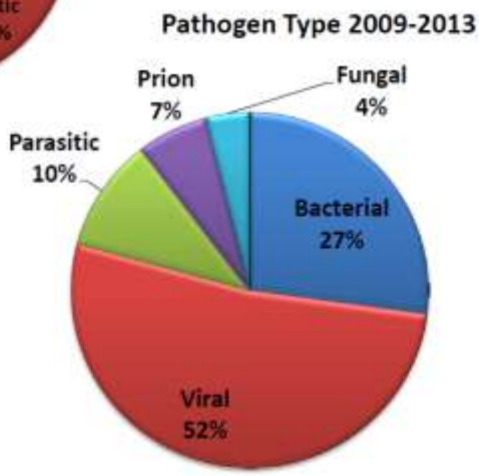






World class Institutes and Facilities

Agriculture and food security

BBSRC bioscience for the future

20 Years of Pioneering Great British Bioscience

The Pirbright Institute

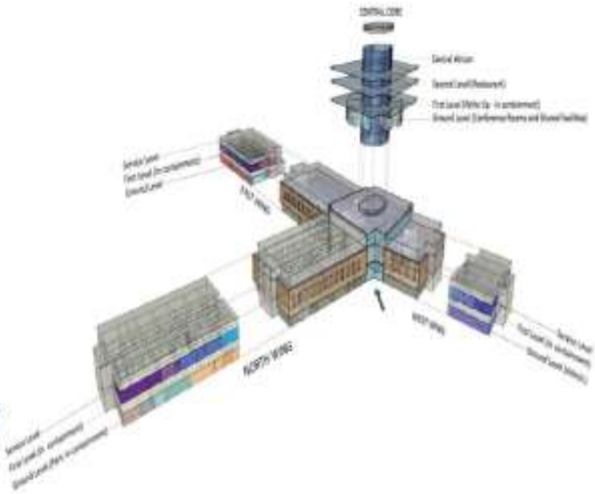
The Pirbright Institute — Preventing and controlling viral diseases

Development Phase 1 £130M+

- **Large animal high containment laboratory (2014)**
- One of the most technically complex projects of its kind in world

Development Phase 2 £100M+

- **Avian virology from Compton to Pirbright**
- Enhanced high containment laboratory and animal house
- Enhanced conference facilities



BBSRC 20 Years of Pioneering Great British Bioscience

BBSRC Veterinary Vaccinology Research Strategy: 2015-2020

World class Bioscience Underpinning Veterinary Vaccinology

Fundamental Bioscience Research	Disease/Threat Specific Research
Translational Research	
"One Health" Approach	
Networking & Coordination	

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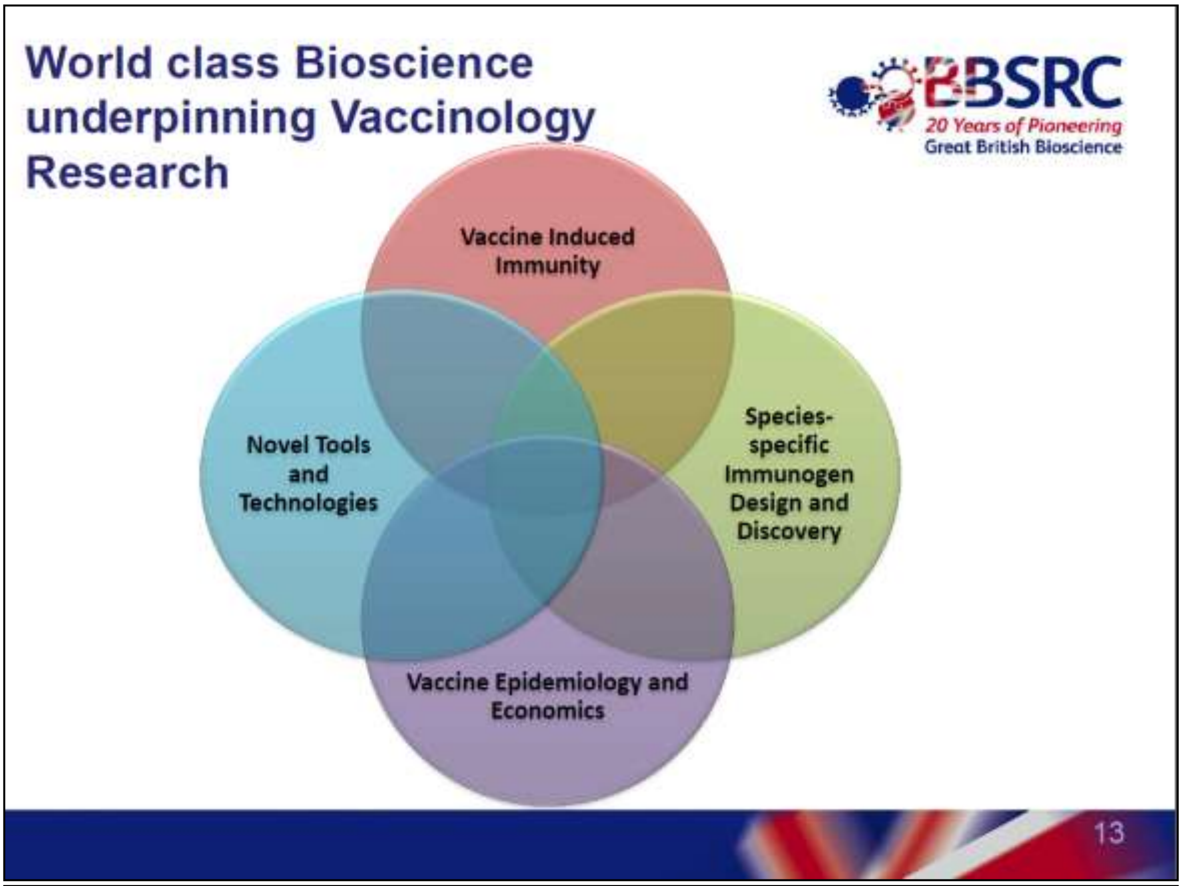
World class Bioscience underpinning Vaccinology Research
BBSRC
20 Years of Pioneering
Great British Bioscience
Vaccine Induced Immunity
Novel Tools and Technologies
Species-specific Immunogen Design and Discovery
Vaccine Epidemiology and Economics
13


BBSRC Veterinary Vaccinology Research Strategy
BBSRC
20 Years of Pioneering
Great British Bioscience
World class Bioscience Underpinning Veterinary Vaccinology
Fundamental Bioscience Research
Disease/Threat Specific Research
Translational Research
"One Health" Approach
Networking & Coordination
14

New Foot-and-Mouth Vaccine

BBSRC 20 Years of Pioneering Great British Bioscience

March 2013

- Synthetic vaccine made up of tiny protein shells designed to trigger optimum immune response, it doesn't rely on growing live infectious virus and is therefore much safer to produce
- Made in standard laboratories and resilient to heat – can be produced and transported in poor countries where foot and mouth is endemic, without refrigeration
- New approach could impact on how viruses from the same family are fought, e.g. polio.

Collaboration between The Pirbright Institute, Diamond Light Source, Oxford and Reading (funding from Defra, Wellcome Trust and BBSRC)

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UK Veterinary Vaccinology Network

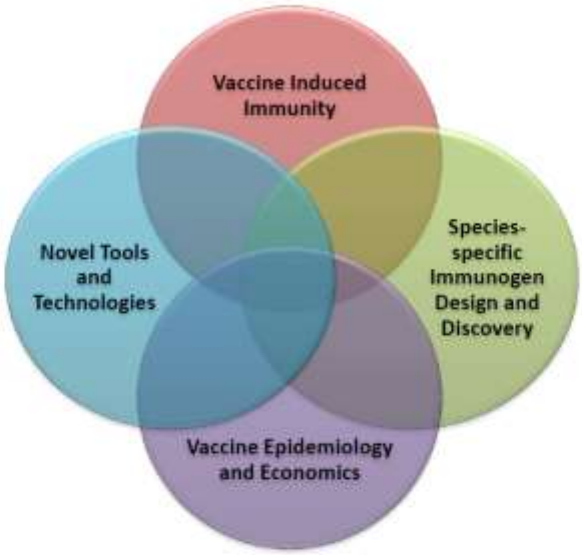
BBSRC 20 Years of Pioneering Great British Bioscience

Vision

To foster a **multi-disciplinary community** to enhance the development and uptake of novel **tools and technologies** as well as address the "unmet" needs in **protective immunity** in the field of veterinary vacccinology

Mission

To establish and sustain research partnerships that generates scientific knowledge and discovers the tools/technologies to develop next generation vaccines



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Sustainable intensification

BBSRC 20 Years of Pioneering Great British Bioscience

North Wyke Farm Platform *big questions need bigger experiments*

- Agri-environmental research hotel
- Lowland beef and sheep
- Three farmlets, 15 fields, hydrologically separate
- Addressing issues such as:
  - *Reducing inputs (N, P)*
  - *Soil health and resilience*
  - *Water use efficiency and pollution*
  - *Carbon cycling and storage*
  - *Reducing GHGs*
  - *Systems modelling for optimal production*

"bridging the gap between the lab and the farm"

Animal Welfare – key research areas

BBSRC 20 Years of Pioneering Great British Bioscience

- Measures of welfare, including developing and validating new measures
- Welfare related health/disease
- Housing, husbandry, agricultural intensification and environmental impacts on welfare
- Relevant behaviour, cognition and perception
- Pain and nociception
- The impact of early life challenges on development and long term health and welfare
- The influence of production traits on animal welfare

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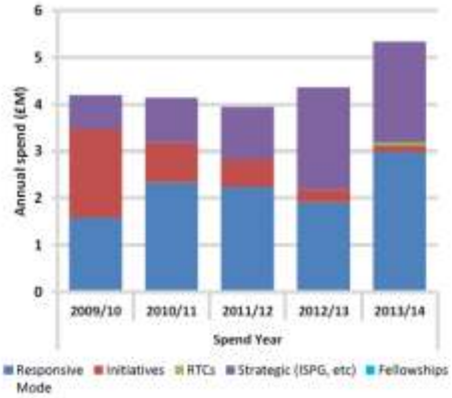
BBSRC 20 Years of Pioneering Great British Bioscience

Animal Welfare

Analysis by spend year (2009/10 - 2013/14):

		Annual spend (£M)				
		2009/10	2010/11	2011/12	2012/13	2013/14
HEI	Responsive Mode	1.5	2.0	1.9	1.7	2.9
	Initiative *	1.9	0.8	0.4	0.1	0.1
	RTC	-	-	-	-	0.1
	Strategic (ISPG, etc)	-	-	-	-	-
	Fellowship	-	-	-	-	-
	HEI TOTAL	3.4	2.8	2.4	1.8	3.0
Institute	Responsive Mode	0.1	0.3	0.3	0.2	0.1
	Initiative *	-	0.1	0.2	0.2	0.1
	RTC	-	-	-	-	-
	Strategic (ISPG, etc)	0.7	1.0	1.1	2.2	2.1
	Fellowship	-	-	-	-	-
	Institutes TOTAL	0.8	1.3	1.6	2.5	2.3
Overall TOTAL		4.2	4.1	3.9	4.4	5.3
All Research TOTAL		290.3	273.4	260.9	254.0	271.2
% of All Research		1.4%	1.5%	1.5%	1.7%	2.0%



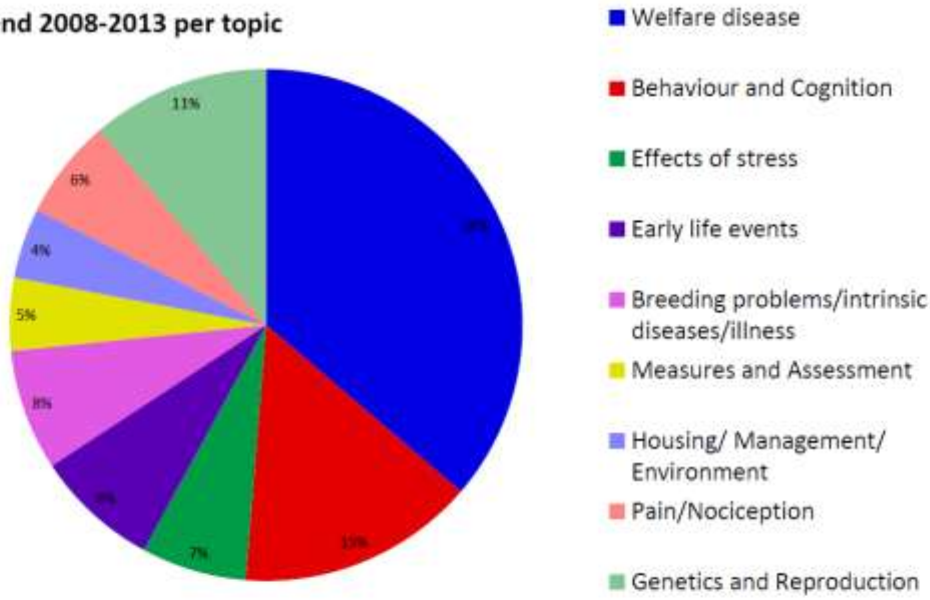
In 2012/13, there is reduction in the overall portfolio of 'Strategic' research reported against at the project level by Institutes. A consequence of changes in funding arrangements and subsequent reporting. The net effect being a slight reduction in strategic funding which will be more pronounced for those topics heavily dependent on institute strategic funding (e.g. animal health (and associated with this, immunology and microbiology), plant and crop science, and diet and health.

19

BBSRC Animal Welfare portfolio 2008–12 (approx £4M spend pa)

BBSRC 20 Years of Pioneering Great British Bioscience

Total spend 2008-2013 per topic



20

Animal Welfare portfolio review: some emerging observations

BBSRC
20 Years of Pioneering
Great British Bioscience

- The UK is well respected but needs a more cohesive and collaborative community
- Future priorities should include: measures and assessment, pain, and the environment (relevant to welfare and disease)
- Sustainable intensification and climate and societal change present both risks to welfare and opportunities for research.
- Fewer new academics coming into the area - need to develop the careers pipeline
- Aquaculture is underrepresented in BBSRC's welfare portfolio

21

BBSRC: Combatting Antimicrobial Resistance

BBSRC
20 Years of Pioneering
Great British Bioscience

Covering the antimicrobial resistance of **bacteria, viruses and fungi**, and includes animal, plant and human hosts.

- Understand the fundamental microbiology behind the development, and maintenance of resistance
- Selection pressures and the dynamics of transmission
- Development of mitigation strategies
- Underpin the development of novel antimicrobials and alternative approaches
- Development of novel diagnostics to enable rapid identification of organism or resistance genes

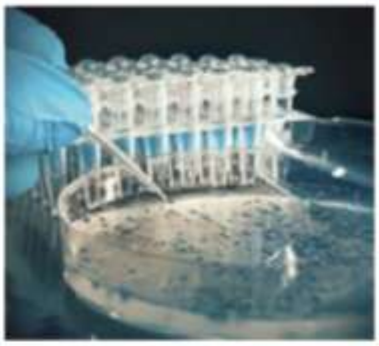


Image Credit: Thinkstock 2014


Image Credit: Thinkstock 2014


Cross-council call: Tackling Antimicrobial Resistance
BBSRC
20 Years of Pioneering Great British Bioscience
New cross-Council thematic call led by the Medical Research Council
• £5 million contribution from BBSRC
• Covers AMR in bacteria
• Supporting research through a range of funding mechanisms
AMR
Tackling Antimicrobial Resistance
Research opportunities
• Theme 1: Understanding resistant bacteria in the context of the host
• Theme 2: Accelerating therapeutic and diagnostics development
• Theme 3: Understanding real world interactions
• Theme 4: Behaviour within and beyond the health care setting

3.2.19 UK – Defra

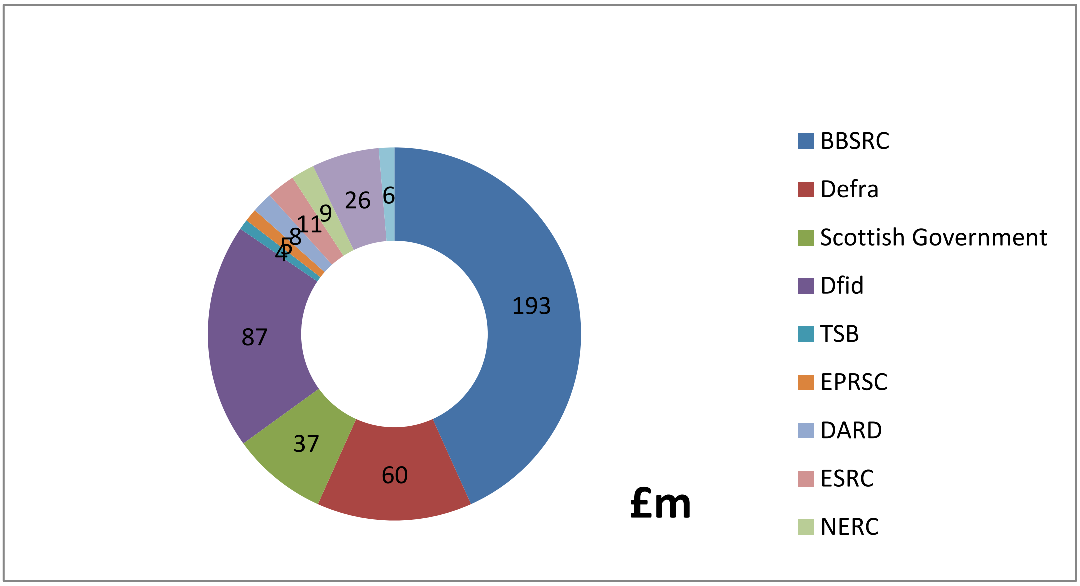
UK R&D Landscape, and current and future research needs on sustainable animal production SAP

The UK's food, feed and drink industry contributes around £96bn to the UK economy, or 7% of GVA, and exports are worth £18bn a year. The sector employs nearly four million people, with recognised centres of excellence across the agri-food supply chain.

FUNDING

Public sector research

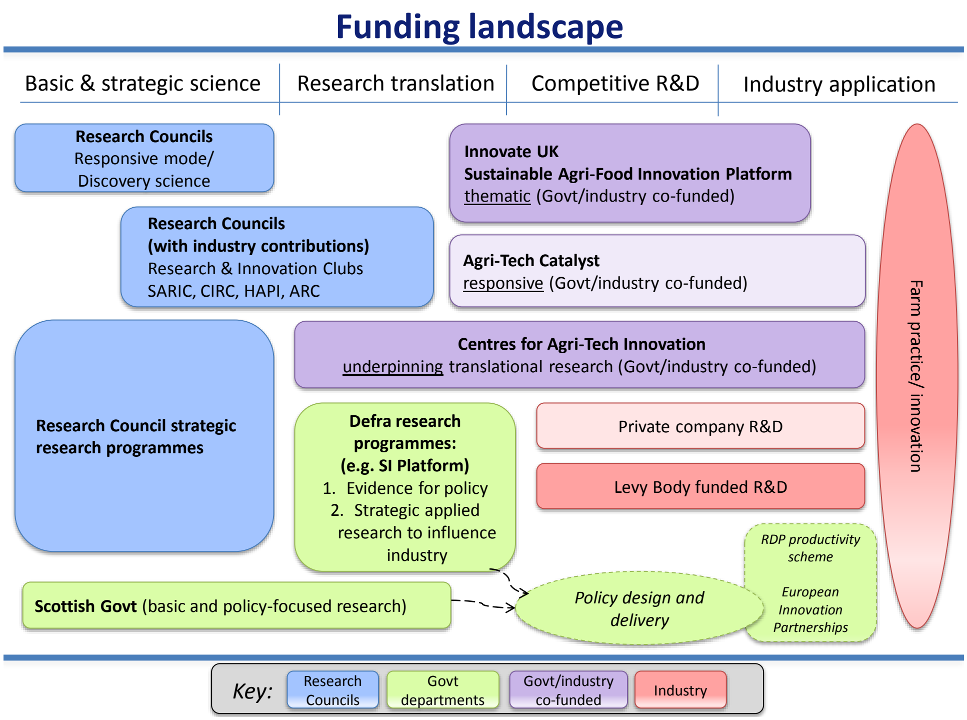
In 2011/12 the UK Government spent £450 million on R&D on agriculture and food combined (see Figure below for the breakdown of spend by public sector bodies). This includes substantial capital expenditure supporting research institutes and campuses and spans a number of different sectors.



Private sector research

There are no clear data on the levels of private sector investment in the UK. Conservative estimates of private sector investment in agricultural R&D suggest it is at least £100 million a year.

Different funding organisations fund different types of research spanning the R&D pipeline from basic to applied or near market R&D (see Figure below). Research councils such as BBSRC mainly invest in basic research conducted at institutes and universities, which flows into strategic research funded by Defra, other Government departments and the Devolved Administrations (Scotland and Northern Ireland), with Innovate UK in partnership with industry and government supporting research and innovation for commercial application.



Public and private sector partnerships

Innovate UK: Sustainable agriculture and food Innovation Platform[4]

The Sustainable Agriculture and Food Innovation Platform aims to stimulate the development and adoption of new technologies to help improve the productivity of the UK food and farming industries, while decreasing their impact on the environment. £90 million of government funding, plus matched funding from industry will be invested in projects over a five year period. The priorities for this innovation platform are:

- Crop productivity
- Sustainable livestock production
- Waste reduction and management
- Greenhouse gas reduction

Current research which is relevant to SAP includes £16M government investment into a research call launched in 2011 on sustainable production of plant proteins for animal production.

Agri-tech strategy[5]

The recently launched Agri-tech strategy will help the government to specifically address the need to commercialise more agricultural technologies in the UK by:

- investing £60 million through Innovate UK to establish an Agri-Tech Catalyst to support the 'proof of concept' development of near-market agricultural innovations

- contributing an additional £10 million through DfID to the Catalyst to support the transfer of technology and new products to developing countries

[4] https://connect.innovateuk.org/web/sustainable-agriculture-and-food-innovation-platform
[5] https://www.gov.uk/government/publications/uk-agricultural-technologies-strategy

- investing £90 million over 5 years to establish a small number of Centres for Agricultural Innovation to support advances in sustainable intensification

With the need to see more private sector investment, the Catalyst fund and the Centres for Agricultural Innovation will be developed and co-funded with industry either in cash, or in kind.

The first Centre for Agricultural Innovation will focus on big data, and establish the UK as a world class centre in agricultural informatics: the metrics and performance indicators needed at field, farm and landscape level to improve productivity and ensure a balance between efficiency and resource impact

CURRENT PRIORITIES

Biotechnology and Biological Sciences Research Council (BBSRC)[6]

BBSRC funds world-class bioscience research that helps to tackle major challenges such as the impact of climate change, a healthier old age, and sustainable food production, land use and energy production

BBSRC has a set of Council-wide strategic priority areas[7], described in their Strategic Plan[8]. The responsive mode priorities reflect topics or activities within these broader strategic areas which BBSRC particularly wish to encourage and promote. With respect to SAP, they include:

Animal health
Combatting antimicrobial resistance
Data driven biology
Food, nutrition and health
New strategic approaches to industrial biotechnology
Reducing waste in the food chain
Sustainably enhancing agricultural production
Synthetic biology
Systems approaches to the biosciences
Technology development for the biosciences
Welfare of managed animals

Defra[9]

Defra is the UK government department responsible for policy and regulations on environmental, food and rural issues. Departmental priorities are to grow the rural economy, improve the environment and safeguard animal and plant health.

Defra commissions evidence based research which supports the following policy priorities:

- Making the food and farming industry more competitive while protecting the environment
- Reducing and managing waste

Research and analysis undertaken by Defra[10]

Research and analysis provides evidence for decision-making, ensuring Defra's polices are based on a sound, comprehensive understanding of current evidence. It helps Defra find new policy solutions and identify and tackle future issues.

[6] http://www.bbsrc.ac.uk/home/home.aspx
[7] http://www.bbsrc.ac.uk/funding/priorities/priorities-index.aspx
[8] http://www.bbsrc.ac.uk/news/planning/strategy/strategic-plan-index.aspx
[9] https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs
[10] https://www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/about/research

Defra use the term 'evidence' to encompass material from a variety of disciplines – science research, statistics, economics, social research or operational research, and geographical information.

Current Defra funded research which is relevant to SAP includes:

- Measurement of agricultural GHG emissions for the development of the UK Agricultural GHG Inventory[11]
- Quantifying the impact of endemic diseases on GHG emissions from UK beef and dairy cattle
- Optimising the efficiency of dietary nitrogen use to reduce emissions and waste in high yielding dairy systems
- Development of selective breeding protocols to improve the long-term sustainability and competitive position of UK beef production
- Developing New Ammonia Emissions Factors For Modern Livestock Housing And Manure Management Systems
- Environmental and nutritional benefits of bioethanol co-products
- Sustainable Intensification Platform
- Promoting good health and welfare in European organic laying hens - Healthy Hens
- Analysing the characteristics of UK manures and slurries
- Determining typical UK livestock rations and their characteristics

Agri-tech strategy

The strategy[12] seeks to increase the productivity of crops and animals and simultaneously, decrease the environmental impact of the industry. It will focus on four interlinked areas:

1. Crop productivity

- Plant Breeding: Exploitation of modern breeding techniques and genomics technologies to deliver faster rates of productivity growth and improved crop resilience to biotic and abiotic stress factors
- Crop Protection: Solutions to threats posed to UK arable and horticulture output by withdrawal of plant protection products under EU legislation and by climate change including water stresses
- Crop Nutrition and Management: mechanisms and technologies for efficient establishment, provision of crops with nutrients without current levels of loss to the atmosphere and water and harvesting.

2. Sustainable Livestock Production - Development of livestock production solutions that improve the efficiency and productivity of animal protein (Meat, Milk & Egg) production, are environmentally and commercially sustainable and meet existing and anticipated future regulatory requirements.

3. Waste Reduction and Management - A whole-chain approach to waste reduction, from innovative technologies for pre and post-farm-gate storage to farm-scale waste management facilities, post-farmgate food processing and packaging for retail and food distribution.

4. Greenhouse gas (GHG) reduction technologies and methodologies - By far the biggest sources of GHGs in agriculture are nitrous oxide from microbial transformation of nitrogen fertilisers in soil and methane from enteric fermentation in livestock, whilst CO2 emissions from energy use constitute the major source of GHGs in downstream processing, manufacturing, distribution and retail. Programme activities across all the above themes will encapsulate and address these.

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[11] http://www.ghgplatform.org.uk/
[12] https://www.gov.uk/government/publications/uk-agricultural-technologies-strategy

POTENTIAL AREAS FOR FUTURE RESEARCH

Provisional consultation with some industry organisations (e.g. Pig- BPEX, Beef & Lamb - EXBLEX and Dairy Co. within AHDB[13], plus the poultry sector) identified the following areas for future research relevant to SAP:

Pigs

- Improve sow productivity
- Improve finishing pig growth and feed conversion
- Reduce endemic disease burdens
- Control salmonella and other zoonotic organisms
- Prevent the entry of new and emerging diseases (e.g. Porcine Epidemic Diarrhoea)
- Eliminate boar taint in meat from entire males
- Reduce emissions to the environment

Poultry eggs and meat

- Improve robustness and wellbeing of intensively managed poultry, with specific focus on litter quality and gut health
- Control campylobacter and other zoonotic organisms
- Reduce reliance on soya imports
- Reduce emissions and odours to the environment
- Vaccine development to treat Blackhead in turkeys

Dairy, beef and sheep

- Reduce disease burdens and improve welfare
- Improve fertility and reduce replacement rates
- Improve resources use efficiency (e.g. N, P and H2O)
- Improve productivity and utilisation of grass and forages
- Protect and improve soil health
- Reduce emissions to the environment

[13] http://www.ahdb.org.uk/

4 Discussion

4.1 Priority Topics in „Sustainable Animal Production“

4.1.1 Environment

by:

- Denmark: Helle Palmø, DAFA
- Finland: Roy Tubb, MTT
- Germany: Bernhard Polten, BMEL[14]

/01 Introduction

The environment is mainly characterised by the elements soil, water and air.

Farm animals have an influence on – and are influenced by – the following factors:

- climate change
- temperature
- soil
- water
- air
- emissions from animal farming
  - nitrogen
  - nitrogen compounds (NOX)
  - CO_2
  - methane

Available elements:

  - phosphorus

Climate change

With a view to mitigating the effects of climate change, various measures are laid down at international, EU and national level. This involves, for example, a 2-degree upper limit for the global temperature increase.

Soil

The availability of agricultural soil is limited. It is of essential significance to plant production and animal farming. The soil, or land, is an important factor for the animals' open-air access, but also for the application of farm manure and, as a consequence, for fertilisation and the utilisation of essential substances from animal farming. New methods are aimed at making the heat, i.e. the energy, and certain substances and elements available to the soil while at the same time avoiding contamination with certain substances (nitrogen and nitrogen compounds).

Water

[14] The findings and recommendations from expert talks carried out at the Thünen Institute (KTBL and vTI, 2011; KTBL and Thünen Institute, 2013) are included in this chapter to form a basis for the holistic approach on the subject of emissions from livestock farming. The talks focussed, alongside ammonia, on odours, dusts and bioaerosols. In this context, leading German experts on emissions had already formulated the need for research and action in the different subject areas, with a focus on livestock husbandry practices and the storage of livestock manure.

Water is of essential significance both to plant production and animal farming. It must be available in sufficient quantity and appropriate quality. But it can also become polluted by animal faeces.

Air

The air, too, is an essential factor for biological organisms. Pressures and threats caused by gases, bioaerosols, dust particles and smells should be limited or even avoided.

Much of the attention is currently focused on measures showing the developments in animal farming, e.g.

» with regard to noxious gases,
» for standardised measurements and thus for method development and application,
» for the calculation of the spread of noxious gases,
» for the mapping of critical regions.

Elements are reports at national, EU and international level.

Projects should therefore be aimed at developing appropriate measures to improve the situation.

Phosphorus

The known global phosphorus resources are concentrated in only a few countries. But as "energy carrier", phosphorus is of considerable significance to biological organisms and therefore also to farm animals. The increase of the global population and the rising level of prosperity will continue to be reflected in an increasing phosphorus consumption over the coming years and decades. The risk of sudden price increases and supply shortages cannot be excluded, however. The sudden, temporary substantial increase in prices in the year 2008 showed that rock phosphate can always become more expensive. In the medium to longer term, the EU's supply might therefore be at risk.

As there are no significant phosphorus deposits in the EU, we should aim at a targeted use of secondary phosphorus resources such as wastewater, sewage sludge or animal by-products in order to reduce the EU's dependency on phosphorus imports on a lasting basis. Efficient recycling methods and better distribution of farm manure can contribute to reducing the use of rock phosphates for the production of fertilisers.

In Germany, for example, the targeted funding of research projects in this field comes from the Federal Ministry for the Environment.

/02 Prioritisation of measures and need for research and data

Building on the preceding section, priorities with respect to emission reduction measures and the need for action and research should be set with, a distinction between different objectives:

» improving the know-how on the emission situation, development and application of measuring methods and models
  › in order to derive starting points for the development and improvement of mitigation measures,
  › in order to improve the bases for calculation for the mapping of emissions
    a) in international reporting on emissions
    b) for approval procedures under immission control law in order to develop and improve technological emission reduction measures.
» improving the data bases on the state of play in the application of emission ¬reduction measures in order to be able to display their impact in emission inventories
» enhancing the level of knowledge on the type, effect and hazard potential of emissions (especially of bioaerosols)

/03 National emission reporting and national emission reduction obligations ¬

- » Prioritisation of mitigation measures in animal husbandry, in descending order according to the specific potential for NH3 mitigation p. a. in relation to the current emission inventory (potentials for mitigation cannot always be combined):
  1. Exhaust air cleaning systems (approx. 60 Gg NH3)
  2. N-adapted feeding (on a scale of 20 – 30 Gg NH3)
  3. Optimising the spreading of farm manure and digestate (approx. 20 Gg NH3)
  4. Covering storerooms of farm manure from pigs and digestate (ca. 5 - 10 Gg NH3)
- » Need for action with regard to data collection (dissemination, parameters): in order to achieve an enhanced depiction for the above-mentioned mitigation measures of the already completed implementation in agricultural practice in the inventory (e.g. regular survey on the degree of separation and distribution of exhaust air cleaning systems in pig and poultry farming).
- » Need for research and action on emission factors: An ¬analysis of literature on emission factors for livestock husbandry has shown, inter alia, that key data on the framework conditions of tests and experiments have not been acquired or documented in many studies. In order to improve the usability of such data for emissions reporting, we should use a measurement report, that has been coordinated with emissions reporting, in future research projects and examinations, whilst calling for corresponding and complete documentation in publications.
- » Need for research and action on emission factors for dusts: According to EMEP (2009), 4.B-30, the currently available emission factors underlying the emissions merely represent an initial estimate.
- » Development and integration of methods and technology for measuring and documenting the actual emissions on farm level in order to enforce incentives to develop technologies and methods to reduce emissions.

Whereas technical measures have been developed for storeroom covers and spreading, with a need for research and development only on certain questions (solutions for low-emission spreading on grassland at lower cost, impact of slurry injection on nitrous oxide emissions), there is still a need for research and development regarding waste airpurification technologies (see section 1.4). As far as feeding is concerned, there is both a need for a better recording of the status quo and for the development of effective measures, notably in cattle feeding.

/04 Further development of waste air purification

Waste air purification helps to achieve the obligations of NH3 emission reduction, whilst ensuring mitigation of local and regional loads caused by air pollutants from animal installations. The following measures are considered priorities for waste air purification:

1. Reducing the airflow rates by preconditioning (heat exchange) and improving the routing of air flow in livestock housings by implementing waste air purification already at the stage of project planning

2. Enhancing the economic efficiency of waste air purification by reducing air volume flows, improving process technology (ammonia pre-separation, rinsing water circulation, reducing pressure losses, multi-stage process technology) and improving the transportability of separated products

3. Developing methods for dry dedusting and odour removal in poultry farming

4. Improving ammonia separation in biofilters

/05 Bioaerosols

In recent years especially, science and also the general public have increasingly turned their attention to bioaerosols from livestock husbandry. There is a need for action and research both with regard to recording and documentation, in terms of quantity and quality, and with respect to the health implications of bioaerosol immissions:

1. Studying the specific sources of bioaerosols and the factors influencing their creation and release in order to derive prevention or mitigation measures on the basis of these data.

2. Developing, evaluating and standardising collection and detection methods for bioaerosols, notably of systems that allow high-volume sampling and are able to record total masses of dust and conduct online-measurements.

3. Studying the structure and particle size distribution of bioaerosol particles and determining the tenacity of relevant micro-organism species for a more precise estimation of their distribution and environmental impact.

4. Compiling the results of bioaerosol measurements at national level in a database, with due regard to the methods used.

5. Clarification of risks emanating from the MRSA/ESBL load to local residents in the vicinity of livestock houses.

6. Molecular-biological methods should be developed further for the detection of bioaerosols.

7. Conducting epidemiological cohort studies on an adequate scale, bearing in mind the risk groups in the population, to lay the foundations for the health assessment of bioaerosol immissions.

/06 Emission factors

Emission factors with different timescales are needed for national /international emission inventories (LTRAP) and, at regional level also for authorisation or structural policy measures in rural areas. Reliable, differentiated emission factors are required in order to be able to reflect the influence of procedures and forms of husbandry on the national emission situation (inventories, authorisation). Otherwise, only the changes ¬in the livestock population are shown. Priorities for emissions reporting have already been touched upon in the first part of this subchapter.

The hitherto available data are incomplete in part and inadequately substantiated and too undifferentiated in terms of different husbandry practices and production stages. The need for research is as follows:

1. Evaluation of existing and identification of missing emission factors for ammonia, dust/bioaerosols and odour, with due regard to the time functions (diurnal and seasonal fluctuations, production-related dependencies). Our concern is, in particular, to identify the emission factors for open or naturally ventilated livestock housing in dairy cattle and poultry husbandry.

2. Development and standardisation of measurement systems for natural ventilation housing systems, such as, for instance, in cattle and poultry farming, where model-based measurement technology is being applied.

3. Collection of data for novel, alternative, low-emission production and husbandry practices.

4. In order to enhance the knowledge of emissions related to different husbandry practices and production stages there is a need to develop technologies capable of measuring and documenting emissions on farm level. In future these technologies should enable the farmer to measure and document that emissions from his farm haven't exceeded the permitted levels.

A better knowledge base on the emission situation cannot, in all cases, also be used for the development and implementation of mitigation measures. . For open or naturally ventilated livestock housing and free-range livestock production systems in particular there are only limited options for technological emission reduction. In these cases, the new findings primarily serve to better buttress the authorisation under immission protection legislation and to improve the national emission inventories.

A ranking across all above-mentioned fields of action and research cannot be made solely on a scientific basis. Such an assessment depends on political objectives and prioritisation between the following fields of action: emission reduction measures, improving emission inventories¬, broadening the know-how on the health impact of immissions and for the protection of the population, and a better substantiation of assessment procedures under approval law. These target areas are interrelated and build upon each other in part. Also in view of their importance in their own right, they are only exchangeable and negotiable to a very limited degree. Prioritisation is still necessary and has to be made by policy-makers

/07 Additional input from Roy Tubb, FI

I think that we would all agree with the need for a holistic approach to assessing emmissions to the environment from livestock production, and central to the challenge of constructing inventories, is agreement on, and standardisation of, (via development and testing) appropriate measurement methods and models which can be applied to different production systems and intensities. While there is seemingly much on-going work on manure handling, N- and P- leaching to water, greenhouse gases (Co2, N2O & methane) etc., the draft text also rightly identifies the question of aerosol emission, and the possible impact on animal and human health. It would be good to discuss the latter in Paris with Animal Health group, as to whether this should be taken as a clear "gap" in current efforts. However, even in those areas where much research is on-going, there need to integrate results to build the overall picture remains.

With regard to methodologies, we have earlier discussed in SAP CWG, the need for a standardised approach to life-cycle analysis related to livestock production (and consumption). While there is on-going work in this area, there remains (I think) a need for data/methodology sharing and integration of results to build the bigger picture. The question of carbon counting (as an important measure of environmental impact) should be kept in sight within our suggestions, as well as the need to take account of environmental changes (climate change; interaction with FACCE-JPI).

4.1.2 Animal Breeding

final

by:

- Denmark: Vivi Hunnicke Nielsen, Aarhus University
- Germany: Sabine Dues, Projektmanagement Jülich
- Germany: Bernhard Polten, Federal Ministry of Food and Agriculture

/01 Background

Traditional animal breeding based on phenotypic records and genetic relationship among animals has already led to successful improvement of sustainability in livestock production. The introduction of "omics" technologies allows a more profound understanding of the genetics of both traditional and new traits and inclusion of these traits in new "omics" based breeding programmes such as genomic selection. These new tools are useful for further improvement of sustainability to achieve a socially acceptable and economically viable livestock production with minimal impact on the environment.

/02 Selection goals for a sustainable livestock production

Sustainable livestock production requires efficient and robust healthy animals with good welfare providing high quality healthy products (meat, milk, eggs, fibers) produced with minimal resources and minimal impact on the environment. Genetic improvement should be obtained based on a holistic approach by viewing the animal *as a system in a (production) system*.

The expected future increased demand for animal products globally on the one hand and scarcity and increased costs of resources for animal production combined with the need for reduced emissions from livestock production on the other hand necessitate more resource efficient animals. Resource efficiency includes traits such as feed efficiency, nutrient utilisation and emissions. Feed efficiency has already been increased considerably by traditional selection. Improved feed efficiency contributes also to reduced emission of greenhouse gases (GHG). Combined use of the different "omics" tools will provide insight into the genetics of resource efficiency traits and the option of improvement by selection. New traits and indicator traits should be identified for easy measurement and valid identification of resource efficiency.

Robust animals are animals which are able to perform well under changing environmental conditions. This includes robustness to changes caused by climate changes such as coming extreme weather conditions or changes due to new feedstuffs e.g. feed with European produced protein as an alternative to protein imported from non-European countries. Knowledge of the genetic background which allows animals to produce efficiently under changing conditions enables breeding of animals for future environments. Attention should also be given to the identification of robust traditional breeds with the capacity to perform under marginal conditions.

Good health, reproduction and welfare are essential for the animal and have a public focus but healthy, fertile, thriving animals contribute also significantly to resource efficiency. Health includes production diseases, inherited genetic diseases and susceptibility to pathogens. Reproduction comprises fecundity, optimal litter size e.g. in pigs and good survival of offspring or litter. Specific efforts should be made at increasing survival in all stages of the animal reproductive circle. Genomic or phenotypic characteristics identified for health, reproduction and welfare should be included in breeding programmes together with other traits important for a sustainable livestock production.

/03 Conservation of genetic variation

Conservation of genetic variation is important not only in traditional genetic resource breeds but also in the large widely used international breeds. Conservation of genetic variation should be taken into account in optimal breeding plans.

/04 Tools

Hitherto, traditional animal breeding has been restricted to improvement of traits which can be recorded under farm conditions or on breeding stations e.g. daily gain and milk production. The development of "omics" technologies allow combined and innovative use of genetic, genomic, transcriptomic, proteomic metabolomic and phenotypic information for a holistic understanding of traits which cannot be dealt with easily in conventional breeding programmes such as the traits mentioned above. Practical options should be sought for combining "omics" and phenotypic information to improve selection decisions for a more sustainable livestock production.

Omics tools

Structural variation such as single nucleotide polymorphisms (SNP) or copy number variation (CNV) or other "omics measures" can be used as predictors for breeding values (expected genetic performance of progeny) for the traits to be improved. Results from a small reference population can be applied in large breeding stocks. Application of "omics" technologies in livestock breeding requires:

- "Omics" information as markers of sustainability phenotypes
- Development of tools to handle "omics" information
- Development of models for use of "omics" information in breeding programmes
- Development of system biology methodologies to link together information from "omics" technologies for a holistic understanding of traits related to sustainability

Phenotypes

Improvement of sustainability in animal production relies on selection of the animals as biological entities based on valid recordings of phenotypes. High throughput phenotyping needs to be further developed for farm animals. In "deep" phenotyping a large number of measurements are recorded on a sample of animals. Results from "deep" phenotyping can be implemented in new improved breeding programmes but need to be combined with "broad" phenotyping of often simpler measurements that are made on a large number of animals. Biomarkers, sensor information and recordings from Information Communications Technology (ICT) which are predictive of sustainability characteristics such as efficiency, robustness, health, reproduction and welfare and easily measureable should be determined for inclusion in breeding plans. The study of extreme phenotypes or divergent breeds using "omics" technologies enables the understanding of animal function with the potential of practical application.

4.1.3 Livestock production systems: conception, evaluation, assessment

final

by:

» France: Jean-Louis Peyraud, INRA
» Ireland: Laurence Shalloo, Teagasc
» Spain: Susana Astiz, INIA

/01 Background

While livestock farming systems generate valuable and desirable products for the human diet including some resources that cannot be otherwise converted into food (grass based systems, use of by-products) there are other desirable and sometime not so desirable outcomes. Positive outcomes include the development and growth of rural communities, increased ecosystem services including increased biodiversity in some cases. However there have also been some negative outcomes associated with gaseous emissions, pollution and ecosystem damage (as described in topic 1) as well as issues around human health associated with zoonotic diseases (topic 6) and animal welfare (topic 7). The animal production systems should be sustainable. In practice this means that the system should ensure

- competitiveness, high efficiency of land use and high efficiency of feed for production of human edible proteins,
- maximising resource efficiency for a given level of resources
- high quality and safety of livestock products,
- cautious use of natural and non- or poorly renewable resources (P, fossil energy, water)
- low emission to water (nitrate, pesticides, residue of drugs) and atmosphere (GHG, ammonia, pesticides),
- high level of acceptability for the society (especially high standard for animal welfare, preservation of the biodiversity) and for the farmer (quality of live).

Generally research on production systems has traditionally focused on single aspects, without taking into consideration the interactions among different and several factors simultaneously (for example economy and GHG emission) and real holistic approaches are very rare. Therefore the first key issue of this research focus is to reinforce holistic approaches of sustainable farming systems. The second key issue concerns the change of scale in the research of sustainable solutions. In reality while one single technology might work well at one scale of a business it might not work well at a different one and multi scale analysis is required unless inefficient solutions might be proposed. The third issue concerns the choice of relevant indicators for the evaluation of the multi performances of the system. While production output is easy to monitor, environmental performances are sometimes far from easy to estimate (for example nitrate emissions, GHG emission, P runoff, species richness, etc.) and it is necessary to develop metrics and systems to quantify the environmental impact of various technologies and management practices.

The objective of this research focus is to develop and promote innovative livestock production systems taking into account the various interactions that can occur, reducing harmful emission to the environment, both locally and globally and taking into account current and future consumer demands as well as the general public's requirements for improved ecosystems services.

/02 Methodologies

Generally most research does not focus on a holistic view of the production, but only on certain aspects of the production system while systems research takes a more holistic view of the research being carried out through integrating technologies and practices within the whole system and evaluating the impact on the system.

Conception and evaluation of agricultural systems

Agricultural systems are more than just the sum of different single parts and practices. The system evolves as the result of the interaction among biological regulation, technical skills, societal expectations, unintended indirect effects, decisions from the farmers etc. Agricultural systems are usually represented by a number of interacting subsystems: the biotechnical subsystem to represent / model biological and agronomic processes and the decision-making subsystem to plan the operations on a long term basis (the area of forage required to feed the herd) and to take more tactical (from day to day) decisions based on the information received from the biotechnical subsystem. This allows to articulate different levels of action (plant/animal level; plot/herd level/ farm level/ territory level...). It is also necessary to cope with different environmental conditions (soil, climate, ecological vulnerabilities, availability of resources, local outlets...). Therefore, different modes of conception and evaluation must be applied:

» The design "step by step" gradually improves existing systems to adapt to new goals. The first step includes the diagnosis of the current systems, the definition of goals and ways of progress to reach the objectives; then, based on this diagnosis, changes in livestock systems are devised and implemented. Then a new diagnosis is performed, new developments followed, etc., constituting an integrated circular process with a step by step improvement of the original situation. This is well-adapted for commercial farms.
» Experimental approach for research on farming systems. The objective is to compare different "ways of producing" from a selected combination of different techniques or the integration of a new technology or management practice that would make an innovative, new farming system. The performances are evaluated and this approach allows gaining knowledge about production methods that do not exist on farms.
» The use of operational models for livestock is a very effective way to make the *de novo* design. It allows a wide exploration of combinations of techniques, the possibility of coupling models with automated multi-criteria analysis methods, the prediction of long-term effects of candidate systems and generation of estimates of difficult to measure impacts.

Modelling and life cycle analysis

Because the performances (both economic, environmental, social) of a system are the result of multiple interactions it is only when full systems are assessed that the consequences of changes (practices, new technologies) can be fully explored in a holistic way. While it is accepted that some of the unintended consequences will never be eliminated, evaluating at a system level will help to find the potential issues or problems and will help to understand the consequences of these problems. The trade-off between performances must be analysed in order to determine more win-win strategies.

Internationally there are many livestock production system simulation models which have been built to explore and to evaluate different aspects of the production systems with different levels of data availability. Modelling livestock farm systems allows the user to evaluate different aspects of production systems, for example the impact of farm expansion or a change in genetic potential of the herd without the completion of expensive experiments. Furthermore a model can provide more precise information for a specific farm than a non-tailored global study due to the potential to parameterise the model for individual farm situations. Actually the completion of experiments to evaluate every aspect of the production system can be difficult from both, a measurement and a cost perspective, and models provide opportunities to widen the scope of what is being evaluated without enlarging costs. It is important to enhance the research and development of models that try to cover as many approaches as possible with broad interactions among them.

Life cycle Assessment (LCA) is also a sound methodology for a complete chain analysis but requires further development and application to support scientifically sound methodological choices enabling a harmonised assessment of improvement options for social acceptability of livestock systems and environmental performance. This, and other methods for multi-criteria assessment of livestock systems and food chains, need to be refined and applied, alongside inventory data and other relevant statistics to provide robust analyses of current situations and how they have been changing. This includes novel research especially from the social point of view. Some key points are (i) standardization of the way to measure and establish indicators, that will allow the comparison among different systems, and the study of the same system over time; (ii) identification of relative efficiency indicators related to units of production, units of profit. (iii) harmonization of the approaches across region, across models and across products and to harmonise the data used to parameterise the models.

Demonstration

Beyond research, a key issue for the future is to convince farmers of new ways of thinking and new practices and to help their technical and economical progress. Therefore, a key focus livestock systems research centres on is also to demonstrate the potential from one system of production over another system. When people (farmers, veterinarians, consumers...) see a system working, they tend to have a stronger belief that this system can work in practice and are less likely to criticise it and more likely to adopt it (more effective knowledge transfer). Therefore, the research on production systems should add aspects and work dealing with demonstration of those systems delivering better results. Multi-stakeholder approaches aiming at informing farmers and all relevant stakeholders, and identifying, sharing and adopting innovations and proposing demonstrations to increase performances of animal systems and farmer will increase confidence in these systems. In this context, the networks of pilot farms are particularly relevant and some experimental farms have also the dual focus of research and demonstration.

/03 Outputs

Economic

There are many economic indicators that can be used to assess livestock production systems by return on investment, internal rate of return, net farm profitability, net cash flow, etc. The use of a number of indicators allows the overall financial health and sustainability of the farm to be determined using a comprehensive set of estimators. By using these estimators, a yield gap analysis could be completed which would identify the potential for improvement in efficiency of the whole system in different contexts. A key focus of the economic sustainability of the business centres on the business resilience in the context of moving commodity prices. Developing systems that are economically robust and resilient across periods of time where product price is low or adapted to yearly price fluctuations will be central to the success of the system. While accepting that volatility is a key feature of the production system, economic analysis can be used to develop tools and strategies at a policy level that allow different systems to cope with price volatility.

Social

It is crucial to better evaluate the social acceptance of different systems and products derived from livestock systems. Yet this is clearly a weak point of the research performed during the last decades. Research on the change and/or evolution of the social behaviour regarding acceptance and consumption of agricultural products (particularly meat) with time in different European regions and with regard to the general economic situations is required. It is also crucial to better determine the way to modulate and foresee these changes and to be able to adapt products and production systems to the social demand.

Research on the effects of livestock production systems on the development of areas, regions and countries is lacking, both for extensive (largely grassland based) and intensive and dense production territories: e.g. link of population to rural areas, enhancement of life standard under rural population, enhancement of employment in agricultural production chain (direct and related), development of economic parameters in the countries, level of supply of commodities and animal products.

European animal production systems should adapt rapidly to the demand of the public opinion in terms of fulfilling societal requirements for animal welfare (see topic 7). For a very long time, animal welfare has been considered incompatible with competitive animal production, and lowering the profitability of farms. We need to develop innovative win-win strategies where both, animal production efficiency and animal welfare are improved while at the same time the emissions from different aspects of the production system are minimised.

The reduction of the use of antibiotics is of utmost importance for reducing risks of development of drug resistance (see topic 6). Besides research on disease, drug resistance and selection of more robust animals, research is also required to better understand and predict the decisions and actions of stakeholders (breeders, professional breeding organisations and policy makers) in health management to be able to estimate the effectiveness of intervention measures and to adapt productive systems to new regulations..

Another issue concerns the research on methods, strategies of information and communication to the population to improve the information level regarding production systems (more transparency) and improve the image of farmers and of livestock production, especially of intensive systems.

Ecological

The previously described life cycle assessment (LCA) allows for the analysis of the complete food chain and therefore the focus on specific environmental impacts that may be important at a global scale (for example warming potential) or more locally (for example eutrophisation). The LCA approach reduces the potential for negative impacts from the production systems through a better prediction capability. For example, assessing GHG emissions from a national inventory approach may encourage practices at farm level to reduce these emissions. Mitigation can be linked to the production of feed, reducing enteric methane production, reducing manure production, optimizing energy consumption and carbon sequestration in pastures and maximizing in general the efficiency for the system per unit of material invested to produce. At the same time the system must be robust facing more extreme climatic conditions that can be anticipated.

Specifically in intensive livestock production, a more effective manure management is a key area to reduce its impacts on the environment and offer tremendous opportunities for closing nutrient cycles, and restricting pollution and eutrophication of ground waters as well as ammonia emissions. Manure (especially solid manure) is a unique source of carbon for soils and in addition, integrated manure management offers new solutions for on farm energy production when the price of fossil fuels is expected to increase.

In less favoured areas, animal production systems based on permanent grassland and rangelands play a key role for biodiversity preservation and maintaining open landscapes. The integration of for example clover with perennial ryegrass offers the possibility to increase herbage production, reduce chemical nitrogen levels while potentially increasing the farm carrying capacity and reducing methane production.

/04 Holistic approaches

Meeting the joint challenges of maintaining global food security in the frame of human population growth while reducing the environmental footprint of livestock production and improving welfare and health of farmed animals requires to reshape the view of livestock system performance by integrating at the same time all of the targeted objectives, and not only the productive performance. To include societal concerns in addition to economic goals has long been considered an aim of the livestock sector. However, the reality is that this aim is difficult to achieve. Addressing this challenge requires bringing together animal science, modelling and systems research, mechanical and electronical engineering, and social sciences. The overall goal is to strengthen our knowledge base and substantially improve the application of tools to improve long-term efficiency of animal production by 1) promoting tailored management strategies that would go beyond the "one size fits all" approach and include animal health and welfare and the environmental footprint together with production performance and 2) by providing end-users with tools to achieve integrated farming performance goals in differing local contexts. This implies the development of sensors, sensor networks and communication platforms that measure in real time, are integrated with centralised data frameworks, that enrich the data with external databases, and through using complex computational biology and machine learning provides real time solutions to the end user in a usable format in a timely fashion. The technology must be affordable, robust and easily usable if going to be used by the end user.

Toward efficient livestock production systems and livestock food chains

To find ways to enhance food security in a sustainable way, it is required to pay greater attention to the efficient use of all resources. The objective is to develop knowledge-based innovative systems that are following the requirements to:

(1) Improve the efficiency and robustness of animals and to reduce direct livestock losses (clinical and sub-clinical disease, reproductive and metabolic failures, post-natal losses, premature culling or exposure to critical transition periods) and thereby also contribute to reducing GHG emissions involved in livestock production and improving animal welfare and ethical issues as well
(2) Develop more efficient feed chains and alternative feed resources which neither compete with food for humans nor have a large impact on land-use change. This covers utilisation of by-products of the food industry, finding alternative crops, better use of local resources, development of alternative protein supply strategies minimising reliance on imported soybean. This also involves socio-economic aspects as new business models and management systems are needed.
(3) Close the mineral loops through the efficient recycling of nutrients in manure with a better control of the entire storage and manure application chain to preserve nitrogen (and P), by assessing the efficiency of different products from manure (from pure minerals to organic matter fractions). The exploration of the value of the manure/waste components applying new technology could lead to the production of new standardized fertilisers that could be exported from high density livestock territories to arable land. This will also contribute to reduce energy costs across animal farming and would turn animal waste from a problem into a valuable product.
(4) Optimise the opportunities that precision livestock farming has to offer for increasing efficiency by adapting feed needs to individual animals. Monitoring of components of integrated farming performance requires high frequency recording of robust indicators or biomarkers of productive functions, health, welfare as well as waste emissions, over long term and in different environments including harsh conditions. The methodologies and on-farm technologies for the assessment and monitoring of different components of production, health, welfare, and environmental impact have been significantly improved. However, although there are increasing numbers of monitoring systems, there are some crucial gaps notably in being able to measure production efficiency and too many of these methods and technologies are stand-alone, therefore a major challenge is to overcome the significant

hurdles to achieve data integration due to different frequencies, precision, and reliability of measures to be combined.

Climate smart livestock production systems

Climate change will result in more extreme climatic conditions with more extreme weather events, such as prolonged droughts, extreme ambient temperatures or periods with high and intensive precipitation. The climate change issue requires an integrated approach taking simultaneously into account food security and increased productivity, adaptation to climate change and mitigation of emissions. Research in this area is required, focused, for example on mitigating GHG emissions, as previously described (see also topic 1 & 7). Following strategies could be followed:

(5) Development of animals, animal production systems and production chains that are more robust and resilient to large variations in feed supply. This requires to find solutions at different scales (farm, regional, EU) and to integrate strategies of adaptation and mitigation by technical adaptation of crop and forage production, herd and manure management
(6) Develop technical solutions for high ambient temperatures and emerging diseases for livestock management and plant production systems as well,
(7) Reduce the emission of methane by ruminants due to new smart breeding and feeding strategies and propose new manure management approaches aiming at limiting the GHG emission (see also efficiency).

4.1.4 Animal nutrition

by:

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- France: Jean-Louis Peyraud, INRA

/01 Background

Animal production systems with increased efficiency of resource used enable a shift towards more sustainable intensification of food production and competitiveness of EU animal production chains. Animal feeding and management as well as animal capabilities play an important role in livestock production systems. Feeds and feeding are means to influence animal performance, production costs, product quality, environmental impact, animal health and welfare, and food security. More efficient feed chains are needed to ensure future resource efficient livestock systems. This requires that a larger fraction of the feeds produced is converted into human edible food, that losses in the feed and livestock industry are minimised. Efficient feed chains also involve alternative feed resources, while not competing with food for humans or having a large impact on land-use change. The also involve efficient animals and herd to avoid livestock losses. This covers utilisation of by products of the food industry, finding alternative crops, better use of local resources, including grasslands for ruminants. For Europe the development of alternative protein supply strategies that minimise reliance on imports (i.e. soybean and fishmeal) is also of strategic importance. This also involves socio-economic aspects as new business models and management systems are needed and social acceptability of the new feed chain and animal management should be evaluated.

/02 Improving the efficiency of feed conversion to animal products

Two key elements must be considered. Animal feeding plays an important role in livestock production systems. Feeds and feeding are means to influence animal performance, production costs, product quality, environmental impact, animal health and welfare, and food security. Efficient feed chains also involve alternative feed resources, while not competing with food for humans or having a large impact on land-use change.

The other aspect is to improve the animal itself and its feed efficiency (FE: amount of feed needed to produce one unit of animal product. The FE has already significantly decreased in the past years by successful breeding strategies and more efficient feeding. Further improvements are to be expected by combined breeding and feeding efforts for all species (dairy, beef, pigs, poultry) and considering an holistic approach of feed efficiency. However, selecting animals primarily on productive performance criteria (quantity of milk per lactation, average daily gain) has led to animals becoming more specialized which was accompanied by a degradation of breeding performance and inefficiencies. An efficient animal is an animal which produce more with less during its all live. Thus robustness should be considered as part of feed efficiency. Health (including fertility issues) and welfare aspects play a role in resource efficiency. Resource and nutrient efficiency in robust, healthy animals is higher than in animals with health problems. Resource efficiency is thus also enhanced by reducing direct livestock losses originated from clinical and sub-clinical diseases, reproductive and metabolic failures, post-natal losses, losses during critical transition period (weaning in pigs, onset of lactation in dairy cattle, early post incubation period in poultry).

Until now, these aspects have been considered separately although it is clear that robust and efficient animals are required that fit within feed chains to be able to fully benefit from the opportunities for resource efficiency. To make progress, we propose an integrated approach to create more robust and efficient animals within systems, combining feeding strategies, genomics and health and welfare aspects.

From the feed chain side

- Exploring better use of unused by-products of food production chains through development of novel and existing technologies. This includes specific processing technologies and technological treatments for meeting the EU feed safety requirements (e.g. for food products no longer destined for food use); to research the response and possible efficiency effects on animal performance to these products. This also involves socio-economic aspects as new business models and management systems are needed for specific production systems which allow for the demand for feed of individual genotypes and allow for variations in feed supply. The variability of the nutritional quality of the by-products should also be addressed. Risk assessments and life cycle assessments (LCA) play a key role in the evaluation of the potential of the new resources. Socio-economic studies are needed to lay out the economic, social and geographical viability, to determine the trade-offs in environment-socio-economic impact when decisions are made concerning the use of alternative resources and the social acceptability, the resilience and robustness of these new systems.
- Research on the interaction between genetics and nutrition, and exploiting the differences between the individual animals in 'feed efficiency' to match the input to needs as these change with time (and the animal's physiological state), will generate new possibilities for improved feed utilisation.
- Precision feeding offer new opportunities for increasing feed efficiency by adapting feed needs to individual animals. Better support tools that combine information on individual animals with ration formulation and management routines should be developed to achieve optimal productivity and simultaneously avoid wastage. Physiological models must be developed to better interpret and use sensors data. The objective is to convert data from these tools into useful information and decision support systems for farmers and service providers like veterinarians to better manage the individual animals and the herd both on a short term basis (early detection of infections or metabolic disorders, precise feeding considering animal responses, regulation of environmental condition in building) and a medium term (improving the practices from clear historical information).
- New and innovative models on the nutrition of farm animals, including dynamics and kinetics in digestion and metabolism are expected to significantly contribute to a further reduction of energy and nutrient losses, better quality of animal product and better use of alternative resources. Current animal feeding systems are based on the concept of 'feed values' and 'nutritional requirements' but ignore that the animal responds to the nutrient supply in a dynamic way (both at short and long term according to the species), and that this response needs to be considered in a multi-facetted manner (e.g., animal performance, emissions, tissue and product composition, health and behaviour).
- With ruminants, research should be directed on an integrated approach of identifying the best genetic potential for low energy loss and simultaneously developing diets that lower energy losses as methane. This approach will result in combined management strategies with genetic selection for improving efficiency of nutrient use that will also lower the incidence of metabolic diseases and increase fertility (including reproductive failures, post-natal losses and 'failure to thrive')

From the animal side

- Appropriate phenotypes and appropriate indicator traits that reflect improved resource-use efficiency need to be identified. Selection using genetic, genomic, metabolomic and phenotypic information will allow gains in efficiency, GHG emissions, health and welfare. This includes the identification and implementation of welfare indicators that are animal-centred. The combined use of genetic, genomic, metabolomic and phenotypic information is innovative and provide a profound knowledge and holistic understanding of improving resource efficiency - e.g. feed efficiency - in animal production combined with other gains.
- Appropriate genotype and feeding management can substantially contribute to robustness and resilience of animals and thus to efficiency. A systematic approach to identify key factors that hamper robustness during critical transition periods (nutritional pathology in early lactation, numerical

productivity, precocity of the breed, new born mortality etc.) is needed to find new approaches to cope with these transitions.

The stake of data

The big potential gain from pooling resources at the European level would be to make sure that data and information from practice is gathered in a standard systematic way from the diversity of production systems. (Ruminant production systems are particularly challenging because of the wider diversity of genotypes, feed sources and husbandry practices).

Improved breeding programmes for robust animals should include systems of feedback of information from the production chain into the breeding programmes through novel means such as automated data collection and genetic linking through genomics tools. Trade-offs between environmental, economic, health and welfare must be made visible

/03 Reducing the dependencies of imported protein sources

For Europe the development of alternative protein supply strategies that minimise reliance on imports (i.e. soybean and fishmeal) is of strategic importance. Recent Communication on the CAP towards 2020 mentions that the CAP should encourage synergies between crop and livestock farming, e.g. in proteins. Potential lies in the in the valorisation of forage legumes and crops and unused residues and existing ingredients in the food production chain through development of novel and existing technologies. This search for higher self-sufficiency can help to strengthen the traceability of livestock products. The question often is: what geographical scale is needed to improve efficiency and acceptability and to close the N and C cycles. New opportunities can be found when livestock and crop production will reconnect, together with biotechnical and social sciences.

» Legumes (forage and grains) allow at the same time to save oilseed meals (soybean in particular) in the diet and mineral N fertilizer for crop and forage production. Legumes also contribute to reducing dependence on fossil energy thanks to the economy of mineral fertilizer they provide. The protein nitrogen and autonomy of systems can be considered across the farm or small regions by exchanges between livestock and grain farms (where the two types of operations exist) which could also in future have an interest in the introduction of legumes, including alfalfa in rotations to reduce their dependence on nitrogen fertilizers, better manage pests and reduce their greenhouse gas emissions.
» Alternative protein sources (e.g. insects, micro algae, macro algae and biorefinery co-products and former foodstuffs) need to be evaluated in practice as well as new technologies to improve yield for feed production.
» The genetic background and potential of animal production based on more variable quality diets needs to be examined in order to be able to breed animals that can produce efficiently under future production circumstances.

/04 Optimising production and use of forages and grassland

Grass and forage based systems allow ruminants to produce very high quality proteins for human consumption from resources that are not in direct competition with humans. Such systems have mixed benefits with regards to the delivery of environmental goods. Additionally, grassland-based systems promote a clean, animal welfare-friendly image for ruminant production, and open landscapes with grazing ruminants are highly appreciated by the public. Increased attention should be given to maximising the 'ruminant advantage' by developing grassland and forage based systems for ruminants, including improved crop rotational systems (depending of the local conditions), that are cost effective, environmentally sound, manageable and having a reduced demand on land that can be used for other purposes. Instability of the prices of animal product and the projected price increase of non-renewable energy and mineral fertilizers will reinforce the necessity to develop innovative systems using less purchased inputs. It is here essential to consider 2 extreme contexts: the development of large-scale dairy enterprises with highly productive animals and remote rural areas that need to be grazed for landscape maintenance with extensive systems (sheep, beef and dairy cows). Among the priorities we consider:

» Quantification of the importance of grassland and forage based systems for the production of ecosystem services and biodiversity according to their management, and evaluate and develop effective grazing strategies.
» Development and test of new plant production systems and new multispecies grassland with a water use efficiency and higher resilience to drought. Some Mediterranean species/cultivar might be considered. Close collaboration of animal scientists with plant breeding research and agronomists is necessary.
» Adjustment of the management of the herd might be required to maximise the use of forage. The development of integrated approaches that combine improved management skills, innovative management systems and techniques, feeding and nutrition practices and genetic improvement through selection for robust adapted breeds or genotypes should be evaluated in the context of different systems of production. For example it is possible to better match the phases of high needs with periods of availability of quality resources, to extend the duration of lactation, to shorten the duration of rearing to reduce the need for forage.
» Appropriate animals are also required. In intensive grassland based system, it is demonstrated that breed/genotype has a significant impact on the sustainable intensification. To maximise the profitability and sustainability of a forage based systems requires an animal with relatively good milk production, as well as high capacity to convert forage into milk, excellent fertility, good longevity and survival. In less favoured regions with permanent grassland extensively managed, we need to exploit the adaptive capacity of herbivores to make better use of marginal land (land on which the only thing that will grow is grass). This would mean a better understanding of adaptive capacity (genetics, early life experience, ability to cope with environmental fluctuations). Also, the need to manage this adaptive capacity, i.e. matching animals to environments, getting the right blend of animals with different capacities in a herd (leads to the notion of the adaptive capacity of a farm), and tailoring management to best exploit adaptive capacity.

4.1.5 Collaboration and knowledge exchange

by:

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- Germany: Elke Saggau, BLE

Some attempts have already been made, or are in progress, to establish networks of demonstration/experimental farms, or agricultural innovation centres, or "test beds" that can serve both as (a) knowledge transfer centres for outreach to their local community of stakeholders, and (b) nodes within a Europe-wide context to promote collaboration and co-learning processes based on exchanges of experience (both good and bad).

The endorsement of such an approach is expected to be continued, for example, in developing Thematic Networks under the EIP-AGRI and under the FACCE-JPI Core Theme 2: "Environmentally sustainable growth and intensification of agricultural systems under current and future climate and resource availability". However, a SAP ERA-NET provides opportunity to deepen further this approach in an integrative, trans-disciplinary manner focusing perhaps on the following main areas:

- Data sets for farm management systems: Gathering together a broad range of data sets into a uniform frame (with common methodologies) which can then be used to develop precision methods for the monitoring and assessment of efficient use of resources, and for overall management of farming operations.
- Large-scale genotyping and phenotyping experiments: Enabling long-term experiments by promoting access to large numbers of animals and the use of precision monitoring methods (laying the basis for the breeding of more efficient and robust animals)
- Integrating food chain actors to reduce adversary effects in the food chain and (by bringing together local transdisciplinary groups, including consumers, and identifying good practices) promoting greater efficiency in food chains through transnational collaborative actions. At the same time the generation of common methodologies, joint actions and data pooling across a range of "reporting" centres with wide geographical spread will lay the basis for generating an "upper tier" of centres which could then pool resources (as shared infrastructures) to carry out more ground breaking scientific investigational work.

/01 Knowledge exchange with farmers and industry towards innovation [15]

ATF (draft) 8.1: Background: Enhanced innovation through improved access to and use of data on livestock farms

Methods to acquire and use ever greater volumes of data have expanded rapidly in recent years. From GIS systems to high-throughput technologies for accessing biological information the potential for amassing and, potentially, using high volumes of data is now greater than it has ever been.

For agricultural applications at least some of this potential is now being realised. For example precision farming techniques in crop production and management now make widespread use of GPS, and for some livestock breeding genomic technologies are now in use.

To a large extent, though, the livestock sector is less well advanced than cropping in the use of 'big data' for farm and business management and this is particularly so for extensive production systems such as those used for cattle and sheep. Across all systems of production there are few, if any, examples of integrated uses of 'big data' to monitor, analyse and assist with the management of farming businesses

[15] from ATF submissions (draft) to DG-Agri regarding possible new Focus Groups

as a whole. This inhibits the use of innovation to evolve precision management approaches that take account of the multi-dimensional demands on modern farm businesses. The private and public benefits from more precise management of farming enterprises and the land and other resources that they use might include:

- More efficient use of resources (through monitoring of resource use)
- Reduced wastage and improved animal welfare (eg through remote and early warning of disease (crops and livestock); automated monitoring of reproductive status of breeding animals))
- Healthier environments (through effective monitoring to minimise pollutants and emissions)
- Continued improvements of genotypes (through broad-based phenotypic ('performance') monitoring and genotyping)
- Improved use of labour
- Better 'fit' of products to markets (through feedback on end-product quality and market information)
- Better overall business management

ATF (draft) 8.2: Problem description

Whilst the opportunities to achieve greater innovation and precision in livestock farming through better access to and use of data appear to exist (from 'research push') adoption (via 'user demand') is limited. This is the case in many (most?) EU member States. The reasons for this 'failure to adopt' include:

- Reduction of labour on farms resulting in farmers spending more time on physical tasks and less time thinking and planning. Time restrictions are a significant demotivator when attempting adoption of any new technology that involves significant change.
- Prioritisation of time and effort on subsidy management rather than technical improvement. This has become ingrained into the culture of farmers and their advisors in the past 20 years.
- Lack of focus on the needs of the whole food chain. Between farmers and other players in the food chain the lack of awareness of and feedback from market chains results in poorer fit between product presented to the market and the expectations of that market.
- Lack of information on animal performance – few farmers have measurements of beef and sheep performance; the situation improves progressively through the dairy, pig and poultry sectors – many state that they find it too difficult or too expensive to measure Farmers find it difficult to quantify the benefits of new technology and those promoting new ideas are hampered by lack of evidence on farm.
- Adversarial supply chains –current trading models can be adversarial in nature with each part of the chain trying to achieve the best deal for itself at the expense of someone else.

One approach to improve the situation would be to make readily available and easily accessible data that can highlight each farmers livestock performance and compare it with others in the population to encourage a drive for continuous improvement.

Big data livestock projects can achieve this by gathering a mass of relevant data and using software to interrogate the data in ways that highlight key performance indicators.

ATF (draft) 8.2.1: Focus of the proposed FG

- Across member States within the EU ideas of this kind are progressing to differing degrees. Progress in some sectors (eg pigs and poultry) is more advanced than in others (perhaps especially beef and sheep).
- The pressure is on European livestock production to be more competitive and less environmentally damaging. It is timely to focus attention on the opportunities that 'big data systems' might offer to the industry to accelerate its progress towards these goals. Advisors, producers, food processors, retailers and researchers could usefully share their experiences, expectations and needs/wishes to

evolve guidelines for achieving real improvements in the precision and efficiency of delivery of livestock products into the European food chain and the associated export markets.

ATF (draft) 8.2.2: Identifying state-of-the knowledge, gaps and research questions

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ATF (draft) 8.3: Key output of the FG (deliveries)

- A clear understanding on the state of play on collection, management and use of data and data-bases relevant to livestock production sectors in the EU
- A shared view of trans-national approaches that will accelerate innovation and competitiveness of the EU livestock sectors (this is likely to include consideration of compatible standards of recording that will facilitate trans-national use of data)
- Identification of major barriers to the use of 'big data' for 'smart farming' that need to be overcome
- Clarification of key benefits to be gained (ie actions that will yield greatest reward for investment over realistic time scales)
- Definition of key targets for action (ie top targets for operational implementation)

/02 From ATF White Paper: 4a. Knowledge exchange with farmers and industry towards innovation

Background

It is generally recognised that the barriers to implementing new technologies or new management methods are best overcome by involving the end-user (the farmer in this case) in the research and development activities, and/or in defining the objectives in the first place. Agricultural innovation (i.e. the translation of research results into practical socio-economic benefit, added-value or profit) thereby moves from the traditionally linear innovation model to an interactive and participatory process of knowledge exchange, involving farmers, together with other intermediaries and stakeholders (e.g. farm advisors, NGOs) to create new knowledge and innovation. Approaches that may work in one area (geographical or sectoral) may not work in others. While it cannot be expected that adoption of new or different approaches will ever be uniform across the wide spread of cultural, regional and other backgrounds that are such a rich source of diversity in Europe, there are likely to be significant opportunities for better promotion of 'best practice' or more effective local adoption. The challenge is to identify hurdles to adoption and to explore opportunities to overcome them.

Since new technologies and new types of information also open up new ways of doing things, it is important to evaluate (a) how new developments impact on existing business practices and (b) what new opportunities arise for developing more competitive and sustainable business models, considering the individual farm, the local society and the food chain or sector as a whole.

Goal

To ensure that new technologies are developed in a context which improves the uptake of research results into practice, and allows for (a) a positive impact on farm incomes and (b) the exploration of new business models within systems of production and consumption

How to achieve this

The Animal Task Force endorses the approach of the European Innovation Partnership to support the establishment of multi-actor groups. Such groupings acting in a coordinated manner across Europe provide an excellent opportunity to act as 'test beds' for new technologies, on-farm management methods and new business models, taking account of the full range of livestock production systems (including multifunctional approaches), different geographic settings and bio-diversity. 'Test beds' can be realised for example as 'focus groups', as on-farm participatory research or as experimental or demonstration farms with outreach to farmers. The integration of various data and information streams into practical decision support systems is seen as a key enabler to the uptake of new business models combining social (health and welfare), environmental (emissions, waste, resource efficiency) and economical gains, of new technologies, particularly considering remote sensing, measuring and recording, and making full use of robotics and the future internet. The linkage of facilities which are appropriately equipped to accurately monitoring resource inputs and animal performance will be necessary to carry out measurements on a large number of animals in order to derive relevant phenotypes and to take full advantage from the 'genomic revolution'.

Expected impact

Better cooperation between agricultural research organisations and farmers, improved uptake of new technologies and methodologies, improved farm incomes and more sustainable systems of production and consumption.

4.1.6 Economy

by:

- Germany: Bernhard Polten, BMEL

/01 Classifying current livestock production in economic terms

Worldwide, animal husbandry has expanded significantly over the last decades. There are particularly high expansion rates for aquaculture, poultry and pig production, with the strongest growth taking place in Asia, South America and Africa. It is to be expected that these global trends will continue.

Over the past three decades, livestock production in Europe as a whole has not expanded further. Nevertheless there are product-, country-, and region-specific deviations. For example, with the exception of France, poultry production has grown in all important producer countries. Pork production has expanded primarily in Germany and Spain. Germany has switched roles from formerly being a net importer of pork to now being a net exporter. As regards beef, a decline in production has been recorded in all important countries with the exception of the United Kingdom (recovery from BSE and foot-and-mouth disease). This is mainly due to the reduction in stock of dairy cows, related to milk-production quotas.

As an average of the years 2011-2013, the EU-27 were one of the world's largest net exporters of meat, especially pork, poultry and offal. With regard to beef, the balance is even; as regards mutton, the EU is a net importer.

According to the last published data in 2012 the EU-27 exported 234.1K tons of milk to China alone; a total of 101K tons and 73K tons of beef were exported to Turkey and Russia, respectively: 681K tons and 266 K tons of pork to Russia and Japan, respectively; a total of 149K tons and 137K tons of poultry meat to Saudi Arabia and Benin, respectively and during the last 5 years, the EU exported more than 8.5K tons of small ruminants meat to countries such as Jordan, Turkey, Vietnam or Lebanon (all data Eurostat, COMEXT, 2014). These are remarkable figures for the European economy, that are of highest relevance for certain countries within the EU (Spain, Germany, Denmark...) and for the economical and societal sustainability in some European agricultural production regions. These data underline the need for competitiveness of the products and of the production systems in Europe, when compared to other non-EU producers with not so high requirements, and highlight the need to strengthen the research that help to fit animal welfare, animal health, environmental and societal requirements into compatible animal production systems in a globalised market.

On the other hand, with a leading research and developing position in the world, Europe should assume the challenge of exporting sustainable systems to the developing countries, in order to avoid past mistakes made in European agricultural systems being copied abroad, as well as to achieve the commodities production level that the world population currently demands and will demand in the future, and that probably will be produced outside Europe.

For decades now, the production structures have been undergoing very rapid changes. Output per animal and stock sizes are continuously increasing, and contract farming is gaining in significance. In Germany, for instance, one third of the dairy cows are kept in herds over 100 animals; over 50 % of the pigs are kept in stocks over 1,000 animals, and more than 50 % of the chickens for meat production and also laying hens kept in unities with more than 50,000 animals.

At the same time, there are major regional concentrations, especially in Brittany (FR), in north-western Germany, in the Veneto region and the Po valley (IT), and in Catalonia (ES). In part, the regional concentration has led to stock-density levels that experts classify as critical with regard to nutrient deposits and ammonia emissions. In contrast, there are locations, for example the East of Germany, without noteworthy animal husbandry. Therefore, ubiquitous livestock production is a regional phenomenon.

/02 Evaluation within society

Opinion surveys show that the intensive production systems that have evolved in the process of structural change are viewed critically by a growing proportion of the population. The criticism is mainly directed against certain production systems referred to in the public debate as ”mass animal production". In this context the question of animal welfare is the first and foremost matter in the controversial discussions.

From today's perspective it is not evident that in the future the conflicts that have emerged will "solve themselves", so to speak. Indeed, if anything, given the expected growth in demand for animal-based food, increasing scarcity of global resources can be expected to give impetus to further intensification in agricultural production. Likewise, the trend towards larger individual stocks of animals and to a greater degree of contract farming will continue globally. Though animal products from alternative farming systems are available on the market (e.g. organic), these in general more expensive products have not succeeded in gaining larger market shares across the consumer landscape as a whole yet. There is no agreement if this changed when alternative products would be more readily available and recognisable.

The structural change is the subject matter of discussions of various societal groups. On the one hand, many consumers welcome to be able to choose from a broad offering of food products at low prices. On the other hand, surveys reveal that consumers are at least sceptical, to a large part even opposed to practices in livestock production. More or less everything associated with “mass animal production” is unwanted: large animal stocks, technical production methods, high output per animal, use of medication, amputation of animals' body parts, regional concentration, and also the emissions resulting from animal husbandry.

However, despite this criticism consumer change their behaviour only gradually and for the most part, still buy those products from the predominant and criticised production systems. This largely unexplained contradiction notwithstanding, it is predictable that the criticism will increase rather than disappear, if livestock production continues along the development paths taken up to now. Politics and research need to take up this matter and act accordingly.

/03 Resulting need for research

In the past, the research in the area of farm animals concentrated primarily on questions that, to a greater or lesser degree, addressed aspects that were either technological, natural sciences related (e.g. physiology, breeding) or economical. Societal expectations with regard to sustainable animal production were taken into consideration, if at all, only in research programming. As a result this ever increasing highly-efficient sector of the economy, above all in European regions and countries where intensive production systems play a major role, has become a target for growing societal concern about the production system as a whole. Therefore, the focus should no longer be on individual aspects, when solutions may give rise to problems in other areas. Instead it is necessary to consider agricultural livestock production systems as a whole and, by matching and coordinating as many fields of interest as possible, to make substantial improvements towards sustainability of the system.

The aim of combining animal-welfare and sustainability aspects in livestock production systems while minimising constraints on competitiveness, of combining both protection of animals and environment while maintaining prosperous and attractive rural areas leads to a whole range of conflicts of interest. So as to level out interests against causes for conflict, research approach must target a whole range of objectives at the same time. In this context, the following aspects are of vital importance:

» the overall economic and the regional-economic assessment of livestock production systems

- the integrated economic research to accompany approaches pursued to improve these systems and
- the analysis and impact assessment of governmental rules and regulations on animal and environment protection or respective incentive systems.

Thus, in the context of sustainable animal production the following fields of action should be taken into consideration:

- Up to now, indicator systems to record the level of animal welfare have not proved practicable, too expensive or have not been accepted. Projects are currently in progress for developing valid overall-assessment systems, with coordinated indicators for animal husbandry in agriculture and in aquaculture. These activities should be supported with the aim to lead to a structured reporting system on the status-quo of animal-welfare in livestock production systems ("Animal Welfare Report").The report can be used by policy makers, business and society as tool for measuring, as objectively as possible, the actual progress.
- An existing and substantial obstacle to new and more sustainable forms of animal husbandry is the lack of rigorous data regarding the economic effect of
  - animal welfare (e.g. investments in buildings and technology),
  - management and
  - consultancy concepts implementing animal welfare objectives.

  In this context both, the direct economic consequences at individual farm level and scientifically sound assessments as to how governmental rules and regulations and / or different financial support measures influence competitiveness at various levels (individual enterprise, region, etc.) need to be explored.
- In connection with the above mentioned, it is worthwhile to follow research approaches on results-oriented measures that increase animal welfare.
- Advances in animal and environment protection do not take effect automatically: free-range outdoor-keeping of livestock, demanded by many societal stakeholders, usually comes along with emissions to soil, air, ground and surface water which can be avoided or at least controlled by technical means in animal housing systems. Thus research should focus on this important aspect and develop innovative and practical options to reducing the negative side-effects on the environment from free-range outdoor-keeping. The rigorous assessment of both costs associated with such livestock production systems and costs for reducing respectively avoiding nutrient contamination and emission of bio-aerosols, above all in regions with high livestock density, requires the integration of economic expertise into all research approaches concerning the process technology.
- Environment-relevant emissions are generated by livestock farming both directly and indirectly and they have an impact on various common assets. In connection with the need for action as described above, it is important for economic research to be linked to the monitoring of emissions and the subsequent technological process optimisation to estimate the cost-benefit ratio and, where applicable, to critically question it. To this end, research approaches should be developed that consider all relevant paths of emissions across different farm sections (i.e. not only emissions from animal housing but also from the application of manure and the dispersal of fermentation substrate on agricultural land, etc.), allowing investments in emission control to bring the greatest return (in terms of efficiency) at farm level and also with regard to public support measures.
- Livestock production systems in Europe are not located evenly across all countries but are highly concentrated in certain regions, as a consequence such are the nutrient surpluses. How to deal with them, how to treat and make use of them is no longer a logistical and technological challenge alone but requires an economic analysis and assessment. Moreover, it seems to be reasonable to examine current regulations on agricultural and environmental topics, including relevant support measures, with regard to their effectiveness, e.g. to improve protection of water bodies and to highlight

economic options how to use public funds as efficiently as possible to achieve the set targets (key words: EU Water Framework Directive, compliance with regulations).

- Livestock production is of great economic importance for the agricultural sector; in addition, the whole associated value-added chain secures employment and income. In Germany for example, around 60 % of agricultural revenue comes from animal production. The whole sector incl. production and processing accounts for round about 600,000 jobs. Therefore, an important economic research focus should be the analysis and assessment of the consequences for regional economies from more stricter environmental and animal welfare rules and regulations in value-added animal production chains.
- Crucially important for consumer protection in terms of health, trust and acceptance within society is a transparent and readily traceable meat production. Failures of the recent past and in some instances Europe-wide show the need to further develop control systems along transnational trade flows and value-added chains. The focus should be redirected from the sheer examination of technical details of control systems or similar issues to the development and assessment of governance formats that facilitate control systems that rule out errors and abuse and yet can be put into practice by independent supervisors or inspection bodies.
- The goal of sustainable animal production is a European challenge. Nevertheless, various studies show, firstly, that the requirements and expectations are not consistent but vary between different regions and countries. Secondly, the developments on the markets bring about complex and differentiated reactions in terms of adaptation. Therefore it is reasonable to have (a) a robust comparison of societal expectations across Europe in relation to sustainable animal production (primarily with regard to pig and poultry farming) and (b) an examination of the consequences that regional differences have on the sustainability of animal husbandry (for instance, with regard to future developments on the European milk market).

Economic research in livestock production should focus on the following aspects:

(1) Identification of environmental implications of regionally concentrated / dense livestock production
(2) Impact assessment of export-orientated livestock production in some Members States
(3) Analysis of different expectations of society from livestock production in some Member States
(4) Analysis and impact assessment of governmental animal and environment protection rules and regulations resp. incentives
(5) Economic evaluation of Zero emission approaches for livestock production
(6) Economic evaluation of decentralised livestock production
(7) Economic evaluation of extensive livestock production incl. organic production systems
(8) Evaluation of EU policies to change from intensive animal production
(9) Assessment of slurry as commodity which can be marketed internationally

4.1.7 Social issues of livestock production systems

by:

» France: Jean-Louis Peyraud, INRA with the contribution of Benoit Dedieu (INRA)

/01 Background

The development of more sustainable farming systems requires the implementation of innovative practices seeking at the same time reducing the use of non- or poorly renewable resources, developing a better use of animal and plant biodiversity but should also include social processes. These depend on the productive choice of farmers which are highly variable across European regions and even between neighbouring farms, organisations of the actors of the food chains and to the increasingly critical view of society to livestock farming enterprises.

/02 Management of livestock production systems at farm scale

Adaptive capacity of farming systems and potential of innovation are two essential qualities of livestock production systems (LPS) facing a future full of uncertainties

Drivers of adaptation can be defined as "all of the complex mechanisms involving movement" or "all of the changes (internal or external) requiring the capacity of the system to be maintained over time". Three families of drivers are frequently mentioned in literature: global change, the family/farm dynamics, and territorial dynamics. At the short term, the changes generate hazards (climatic variations, price cycles, sanitary events) which can be predicted (estimated, projected). At the mid-term, internal tensions (economical / workload…) and the global context evolution may require profound changes in livestock farm dynamics. At the long term, the way all these drivers will influence farm, food chain and territories dynamics is rather unknown. To face this uncertainty the research priorities are:

» Develop research to analyse and simulate the trade-offs between efficiency and adaptive capacity at the livestock farm scale;
» Explore the interest of different concepts and frameworks (resilience, flexibility, vulnerability, risk assessment, long term path of development) to characterise adaptive levers and evaluate adaptive capacity at different time scales for different scenarios;
» Integrate adaptive capacity indicators in multi-criteria assessment of sustainability of livestock farms / livestock production systems;
» Develop framework to analyse deep / radical changes in farms that involve more than a change of practices through mid-term processes: changes in norms and references guiding the decision system, in management entities. A portfolio of changes should be identified to cover the radical innovations in debate for the future driven by precision livestock farming, industrial ecology and agro-ecology.

Attractiveness of the profession, transmission and settlement

Livestock production suffers from a low attractiveness compared to cropping systems when both activities can be managed on the same territory. This is the case both for farmers and for employed trained livestock farm workers. Settlements are rapidly decreasing and early abandonments of livestock farming activity (i.e. before retirement) are increasing. The potential for non-family businesses is important but in reality very few non-originating from the agricultural community people settled in livestock farming. Low income, heavy workload with a high dependency on animals, criticism from society on livestock farming, high level of capitalisation that make the succession especially on livestock farms more difficult are suggested reasons of that lack of attractiveness.

- Analyse early abandonment and non-existent succession for different livestock farming systems. Analyse successful process of succession and settlement,
- Compare settlement policies within the EU, either financial, advisory role, mentorship and specific measures to non-family businesses,
- Develop a transversal approach of brakes and levers to settlement from the young (students') perspective,
- Analyse the "livestock salary men" profession: diversity of skills, activities, responsibilities, context of employment and of wages. Identify the brakes to the development of the increase in the number of employed professionally trained livestock farm workers.

Workload and organisation

Workload and work organisation are major issues for livestock production systems and attractiveness of the profession in three ways: (i) work productivity is a major factor of the competitiveness of LPS, (ii) work organisation is the side of the LPS-coin. Any information, decision and practice system leads to a set of tasks having different rhythms and weight that should be connected in a work system for organising and distributing the tasks between family and non-family workers (employees, mutual help, volunteers – elders) and equipments. Moreover these tasks are very diverse and sometimes complex in LPS. Work organisation should be efficient but also flexible to deal with climate variability, workers absence, occurrences of period with high level of concurrence between seasonal (i.e. sowing, silage making…) and daily tasks (i.e. herd management). (iii) The sense of working contributes to human wellbeing. In livestock farm, human wellbeing refers to contacts and relations with animals, independent entrepreneurship, mastering capacity of a highly complex system which requires very specific skills. Numerous questions are raised by these social views on LPS :

- Analyse connections between LPS and work organisation profiles,
- Develop work indicators (characterisation and evaluation) including the 3 dimensions previously mentioned for multi-criteria assessments of LPS,
- Develop framework to simulate the impact of change / innovations in LPS management into work organisation duration, efficiency and flexibility,
- Deepen the specific impact of precision livestock farming and innovative practices (agro-ecology for example) to different dimensions of work, including new skills, management of complexity and the differentiation of the information systems (captors and software vs increased direct observation of nature and ecosystems).

A particular form of integration: mixed farming systems integrating crop and livestock production

In response to increased market demand and economic pressures, agricultural systems and territories have become increasingly specialized; productivity of the agricultural sector has increased essentially and mixed farming systems integrating crop and livestock production have strongly declined in many countries or regions. These developments were greatly favoured by an era of cheap energy encouraging high inputs of fertilisers and pesticides and the development of animal housing systems that do not need cereal straw and during which negative impacts of agriculture on the environment were largely ignored. In 2007, 52% of European farm holdings were specialised in crop farming (20% annual crops, 22% perennial crops and horticulture and 12% different crops), 34% of farm holding were specialised in livestock farming (17% ruminant, 5% monogastrics and 12% different types of livestock). Only 14% of farm holdings are mixed farming of livestock and crops (Eurostat, 2010). Some territories are highly specialised in animal production (West of France, Netherlands, Denmark, Po Valley) while other are specialised on crop production (South West and Central France, East of England, East of Germany). However, mixed farming systems appear to be one major support of ecologically friendly and efficient LPS as they allow to develop complementarities between LPS and crop systems and to improve management of manures. The mixed farming can be practised, not only at the level of a farm but also through collaborations between neighbouring farms that are themselves specialised.

» Develop integrated models of mixed crop-livestock systems and explore their benefits
» Develop lock-in approaches to innovation to identify brakes and levers of development, including new organisation between neighbouring farms

Extension services: from prescription to accompanying farmers decisional autonomy

Three major changes have occurred to the rural extension service system: (i) the development of private (industrial) consultants while public and/or professional extension services experienced financial difficulties or almost disappeared, (ii) the demand for less compulsory solutions but for accompanying methodologies, enabling farmers to make their own decision, (iii) the necessary renewal of the back office of the extension services (the permanent updating of information and knowledge the extension officers can rely on), to develop more holistic approaches of LPS and because livestock management is more and more complex and requires an extended expertise.

» Analyse and compare extension services, back office, consultancy methodologies and their connection to research. Explore the interactions and modalities of development of private extension services (with or without link to industry)
» Explore the information systems the farmers are using (social networks, information and communications technologies) and their influence on farmers decision making
» Identify new professions that analyse and master the profusion of knowledge for livestock development (innovation brokers).

Design and transition towards innovative systems

Methodologies for designing innovative systems combine system experiment, modelling, exploration of real situations (farmers being inventive as well) and participatory approaches. De novo and step by step innovations differ either in the process of design, or in the place of experience and learning. In both case, practitioners, chain operators and researchers become partners to design an innovative collective operation, milestones being different in all cases. In farms the adoption of innovation means, when the change is radical, a process of redesign of objectives, evaluation criteria, norms and references, management entities. The process is rarely linear and requires learning from experience, creation of new knowledge, mobilisation of adequate instruments to face the problems.

» Develop and compare exemplary design methodologies and processes, and the ways research partners are involved.
» Analyse the process of radical change, and within it, question the needs and contributions of specific engineering research of adequate instruments of transition that help the farmers to master the step by step redesign process and to build their autonomous information and decision system
» How to explore the organisational and institutional innovations that need to be associated with technological innovations for their success? Can the lock-in theory (it is difficult to think and act out of the main stream) be of interest to analyse unsuccessful innovations?

Public policies

Public policies to improve the environmental performance of LPS have so far mainly been based on obligations of means and not on obligations of results. However evaluation of the results raises the question of performance indicators (see topic 6 “economy”) and is a major critical point of the design and evaluation of these policies. In particular, the construction of agri-environmental policies on the basis of a monetary evaluation of the positive and negative services provided by the livestock systems refers to the question of valuation of non-market goods produced by farming activities. It also raises the question of prioritization and balance between objectives that may be contradictory. The answer to this question must take into account the different territorial contexts (see above) which refers to the question of the scale on which must be defined and calculated results indicators and the targeting of public policies.

It seem essential to define the mechanisms of remuneration of non-market goods, not only to assess properly, but also to assess the willingness of consumers to pay for their production. The design and evaluation of public policies require the development of bio-economic models (coupling economic operating models with biotechnical models) territorialised to take into account the effects of the spatial organisation and concentration of farms on the environment.

/03 Integration of livestock production systems into food chain and territory

Consumers' and citizens' perceptions and expectations about LPS

Livestock production is being scrutinised by European society, with several arguments being developed against meat production and consumption (and milk consumption to some extent). Ethical considerations ("humans don't have the right to kill animals"); rejection of so-called "industrial" livestock production systems assumed to be adverse to animal welfare; environmental considerations which have been raised with the FAO document "livestock long shadow" and human nutrition equilibrium in relation to health are some of the major challenges for livestock production. Tackling these challenges requires

- To understand the various controversies related to livestock systems, society's attitudes and new demands towards LPS, livestock opponents' arguments and innovative options that are put into debates (i.e. mega farms, cloning)
- To evaluate the animal status in our society
- To evaluate consumers habits with special attention to meat consumption
- To evaluate to which extent livestock contests can lead to the co-design of innovative systems

The territorial scale of LPS: a new perspective

The territorial / local scale appears more and more as a pertinent scale for reasoning the sustainable development of livestock systems. Wider geographical or economic entities than farms open new possibilities to find a better balance between inflows and outflows (effluent management / fertilisation needs, ...), to play more effectively the synergies between production systems and farms and it is also at local scale that can be highlighted eco-systemic services procured by livestock. Four categories of services can be identified: the production services, environmental quality, cultural and heritage services and those of territorial vitality. The latter category includes jobs and rural dynamics generated by LPS. There is a high need to develop trade-off approaches of ecosystem services. But the territorial scale also opens the questions to what the different stakeholder (farmers, chains, local authorities, variety of land users and environmental bodies) are expecting from livestock farming, what kind of future they want to build for livestock production, including which objectives, which possible contribution to the livestock production development.

- quantify services with relevant indicators and analyse the correlations between types of services to define the main types of "package of services" provided across EU regions and food chains,
- develop modelling approaches of eco-systemic services from livestock production at the territorial level and explore the trade-off and synergies between different types of services,
- develop companion modelling for common understanding of livestock between stakeholders, concerted scenarios and action for a sustainable development at the local level,
- explore the employment impact of livestock activity as one of the major criteria of evaluation of livestock contribution to local development.

Models coexistence and transitions within chains and within territories

The development of different and contrasted models of LPS and food systems will occur within chains and within territories in the different EU regions / countries. The way these models co-exist, compete, or interact become a new way of thinking, development and competitiveness in relation with the transition of socio-technical regimes approach.

» Develop a framework of co-existence: how to characterise and measure the benefits and risks of the coexistence of a diversity of systems and the impact on socio-technical regimes dynamics
» Analyse the co-existence of LPS models, the co-existence of food systems (local / global) within intensive / extensive territories, and their consequences on livestock development

Collective action for developing higher price segments

The mainstream commodity system favours work productivity as an essential criteria of competitiveness. Some collective actions and chain operators have chosen a different path of development, with a differentiation founded on the high quality or the origin of the product supported by a list of specifications. The objective is not to gain large market shares but these alternative farming systems are of particular importance for less-favoured areas which will not be able to compete with more favourable regions / systems and will provide a broader diversity of products for the consumers. Local food is also becoming a new market of differentiation. Here the questions are

» How can certified quality be a path for development of livestock production systems nowadays? With what allegation (human nutrition, origin – know-how included)?
» What are the adaptive capacities of these LPS to face the global change? What are the debates on the list of specifications to face climate change, increasing size of farms, robot and once-a-day milking innovations?
» What are the perspectives of local food development for livestock?

Urban livestock

Urban agriculture will be one of the new frontier of European agricultural development in the future. Is livestock considered at all or will it be an integrated part of it? How is it maintained in peri-urban areas?

» What are the characteristics, models of development (production – consumption) and territorial forms of inclusion of peri-urban and urban livestock?
» What are the services livestock provide to urban people?
» Is livestock (and in what way) included in the increasing movement of agriculture planning within big cities?

4.1.8 Bees

by:

- Germany: Bernhard Polten, BMEL

Due to their pollination services to arable crops and other entomophile flowering plants, honey bees are indispensable both from an economic and ecological point of view. They provide these services in passing when they search for and collect their food (a supply of approx. 40 kg of pollen and 120 kg of nectar are required per colony and year).

The number of bee colonies depends on the activities of beekeepers. Without beekeepers, their number would decrease dramatically, or they might even disappear completely. Both the very high number of hobby beekeepers and the significantly smaller, but just as important, group of professional beekeepers will only maintain their economically important activities if there are no or at least only minor bee colony losses and if they obtain good honey yields and adequate prices. All other apiculture products, including processed products, and economic links among beekeepers are in the final analysis dependent on the above mentioned parameters. Sustainable beekeeping is characterised by good honey yields and no bee colony losses. Sustainability also depends on a sufficient supply of bee food (nectar, pollen, honeydew), good bee health, good apicultural practice, good agricultural practice taking into account the protection of bees from pesticides, as well as on applied research in all these fields; this research is turned into practical experience through training and consulting.

To this end, specific research and collaborative projects have been supported and have given important insights.

This has led to greater understanding of bee diseases and their development, and successful targeted control strategies have been developed on this basis. In addition, it was possible to clarify the interrelated nature of site, food situation, active pesticide substances and bee diseases.

/01 Need for research

Because of funding structures, all these important results have been limited to certain fields and regions, however. Wild bee species, in particular, have only rarely, if at all, been taken into account.

A meta-analysis combining the results and research data of various already existing EU member state studies would be helpful. This particularly applies to studies of complex landscapes and their factors, e.g.

- food supply (nectar, pollen, honeydew),
- spread of bee pathogens causing various diseases (e.g.. virus infections, varroasis, American foulbrood, European foulbrood, nosemosis, amoebiasis),
- impact of agricultural measures (e.g. pesticide application, treatment / protection of field margins and ecotones, blossoming areas) on the abundance of wild bee species and honey bees, as well as on the conservation of plant species and biodiversity.

When it comes to choosing flowering plants, honey bees are considered generalists, applying their "quality management" by concentrating on certain abundant honey plants. They therefore differ from some very specialised wild bee species that exclusively gather pollen from one plant genus or species for the supply of their offspring. This specialisation, which is known as oligolecty, guarantees the pollination of the relevant plants but also creates mutual dependencies. Honey bees are considered to be 'loyal' to certain flowers; this increases the probability of a successful pollination of the target plants as the pollen is transferred to the stigma of an identical plant. If there is no flower constancy, stigmas are contaminated with pollen of other flower species which reduces the reproductive success of the plants.

The pollination services of honey bees have an economic value. In comparison with other production animals, honey bees range third behind cows and pigs. Due to the availability of relevant studies, the main focus here is on arable crops. In this context, it is often referred to the pollination services of honey bees to wild plants and, for example, formulated as follows: "the benefits of pollination for agriculture and fruit cultivation are 50 to 100 times the honey yield – quite apart from the importance of the pollination services to wild plants." It is uncontested that honey bees are valuable pollinators of these plants, too, and contribute to the preservation of their species and to biodiversity in general. With their pollination services, they also assume the function of ecosystem service providers. But unfortunately, we have only rudimentary knowledge of the actual contribution of honey bees to the pollination of wild plants.

These open questions could be answered by several European institutions in a collaborative project combining the review of existing literature, the evaluation of existing databases, e.g. on the analysis of honey and pollen, and the targeted compilation of data with the help of field studies.

A major challenge lies in providing a deeper understanding of the complex interactions of

» diseases,
» bee-keeping effects,
» nutritive/plant factors, and
» sublethal exposition to pesticides

to the health and productivity of bee colonies.

In view of the high colony losses in many European countries and the temporary EU moratorium on certain neonicotinoids, such questions also meet with great public interest and are of considerable political importance.

A wide variety of findings on the impact of individual stress factors or specific interactions are already available, not least thanks to the BMEL-funded FitBee project.

But we lack a sufficiently complex bee colony model, verified under field conditions, to better describe existing interrelationships and simulate the effects of changes to individual factors to the bee colony as a whole.

The development of such a model requires the international cooperation of various research institutions to consolidate already existing data, identify knowledge gaps and close them through targeted studies. The project objective "bee colony model" could therefore serve to synthesise the knowledge gained from the various individual studies.

The possible applications of the model would be manifold and touch on all individual aspects involved (pathology, toxicology, bee-keeping practices, ecology, land use, etc.). The improved evaluation of toxic effects on bees, envisaged by the EFSA as part of the approval of plant protection products, could be of particular importance in this context.

4.2 Contributions from other initiatives

4.2.1 Animal Health and Welfare ERA-Net (ANIHWA)

Contribution from Animal Health & Welfare ERA-Net (ANIHWA):

» France: Abdenour Benmansour, INRA; Coordinator
» ANIHWA ERA-Net

Representing ANIHWA:

» Denmark: Kristian Møller, Technical University of Denmark
» Italy: Marina Bagni, Ministry of Health

/01 Summary project description

The ANIHWA ERA-Net is a strong network of 30 partners from 19 Member States and Associated countries. It is structured into five Work Packages (WP), which aim to deliver the objectives of this coordination action. Work Package 1 (WP1) takes charge of the overall coordination and management of the project, including communication. Three special Tasks are also included with WP1 coordination activity. The first one will aim at opening the network to new participants from new member states and associated countries. The second one will take charge of the dissemination of knowledge gathered by the different Work Packages to relevant stakeholders. The third one will contribute to increase the synergy between Animal Health and Animal Welfare communities both at the research and program funding levels.

Four subsequent Work Packages aim to deliver the central objectives of the ERA-Net in a straightforward fashion. Work Package 2 (WP2) will set a system and develop the tools to perform a systematic compilation of information and the mapping and analysis of research activities and facilities including information on national research funding and commissioning mechanisms. From the set of compiled information from WP2 and a thorough review of pathogen biology and animal science research trends, and a review of other scientific disciplines linked to Animal Health and to Animal Welfare, Work Package 3 (WP3) will perform a gap analysis focused on Animal Health and Animal Welfare research needs. New research needs and research opportunities will be identified from the activity of this WP and the short and medium-term research needs will be considered and recommended for joint trans-national activities to be developed, based on a joint research framework and shared priorities. Taking advantage of the existing activities developed in EMIDA, and the area identified in WP3, the work-plan will be fed into Work Package 4 (WP4) with the objective to implement a range of trans-national activities including joint funding of collaborative projects. The work plan will then move to establish the sustainability of the processes developed during ANIHWA. The establishment of a network of livestock industry funding organisations involved in funding research on Animal Health and Welfare will also be facilitated during WP5 activity to deliver a transnational vision for collaborative and coordinated research and integrating this in a sustainable way with the activities of the Collaborative Working Groups of the SCAR.

/02 Where we are

» Several coordination and management online tools were developed and should be sustained in the future :
  › http://www.anihwa.eu ;
  › https://www.anihwa-submission-era.net ;

  - https://workspaces.inra-transfert.fr/LotusQuickr/anihwa/Main.nsf?Login&RedirectTo=%2FLotusQuickr%2Fanihwa%2FMain.nsf

- The mapping of existing research structures and programs is done.
- Elaboration and implementation of the Animal Welfare Archive (AWA')
- The final database was delivered on May 2014 and is available at http://awa.anihwa.eu/. A report, describing the AWA' structure and implementation process, was delivered in June 2014 (D 2.3).
- Elaboration and Implementation of the AHW **research production database** (PubAnihwa). The open resource was created. It allows for multi criteria and multi scale analysis. We are now developing a web-based tool for datamining this DB.
- A gap analysis was performed and a number of **research topics** were **prioritized** with particular emphasis on **production diseases**.
- The results were discussed within scientific workshops. The outcomes were integrated into a **Joint Research Framework** providing the basis for future research calls from ANIHWA and for contribution to the community research programs such as Horizon 2020.
- Topics highlighted in the ANIHWA **Joint Research Framework**
  - Pathogen variability and evolution
  - Pathogen-host interactions
  - Disease control and prevention
  - Alternatives to biocides/pesticides, antimicrobials, antiparasites
  - Tools for (early) detection and surveillance, including early warning systems
  - Epidemiology
  - Disease modelling
  - Parameters for welfare assessment
  - Use of existing data(bases) to assess welfare
  - Housing requirements
  - Feeding requirements
  - Behavioural requirements
  - Physiological requirements
  - Cannibalism
  - Human-inflicted mutilation
- 1st ANIHWA call: 2012/2013
  - 10 projects were funded with a volume of ~11.5 Mio €
- 2nd ANIHWA call: 2013/2014: 101 pre-proposals were received by the 19th December 2013 and after the eligibility check, 77 pre-proposals were assigned to external reviewers. 36 were finally invited to submit a full proposal. 12 selected for funding.
  - 10.5 Mio € corresponds to available funding for 2nd call.
- 3rd ANIHWA call 2014/2015: The Road map and topics were approved. Call will open on November 2014.
- **Synergies and the potential for coordination outside Europe were identified**: relevant international ERA-Nets and INCONETs were identified and research institutes and funding bodies were mapped.
- **Coordination with livestock industry sector funding**
  - Links with the pig sector has been established (EuroPIG), details were received from 10 member States.
  - The European Cattle Innovation Partnership has been hosted on the AHW CWG website with their projects included on the CWG project database (11 Partners from 7MS).

- 20+-years outlook on animal health and welfare issues: a long-term Strategic Research Agenda for animal health and welfare is being developed, preparing to meet future challenges to Animal Health and Welfare.

/03 Where we want to go

Sustainable livestock production, with healthy animals reared under high welfare standards, disease minimised or rapidly contained, ensuring a safe and secure food supply and economic development.

Where 'sustainability' refers to livestock production, which is economically viable, socially acceptable with minimal impact on the environment

Infectious diseases of animals impact dramatically the growth rates of the livestock and so compromise the general objective of feeding the growing world population securely. By reducing infections in animals caused by viruses, bacteria, parasites and fungi, agricultural productivity and thus sustainability in a whole would be significantly increased, and the welfare of animals will be improved accordingly. Moreover, the usage of antimicrobials and anthelmintic would be reduced substantially with the consequence of a reduction of the onsets of resistance to antimicrobials and anthelmintic. Risks to human health, including those due to zoonosis, would be also reduced significantly. Thus, this approach would also well fit within the 'one-health' concept.

Foresight studies performed under EMIDA and ANIHWA ERA-Nets and the Star-IDAZ global network, identified vector- borne diseases, antimicrobial and anthelmintic resistance, gut health as well as the continuing challenge of epizootic diseases as areas which will need to be addressed over the next twenty years. The need for improved coordination and collaboration on research activities and improved focusing of research through gap analysis were also identified as priority areas.

One key research areas identified is in the better knowledge of the biology and evolution of microbes and parasites with the objective to control their virulence and propagation with less recourse to chemical compounds and more recourse to biological resources.

For infectious diseases in production animals a number of major knowledge,- research and technology gaps are identified to detect, prevent, reduce, control or eradicate the disease fast and cost-efficiently. The importance of the mentioned topics depends on the particular disease:

Pathogen characterization and detection (virulence factors, host specificity, persistence mechanisms, high throughput- and on-farm diagnostics), Prevalence studies (spatial spreading, climate and global change, trading patterns, epidemiological modelling), Identification of reservoirs (wildlife reservoirs, asymptomatic carriers, true vectors, mechanical vectors); Transmission (infectious dose, incubation period, shedding pattern, transmission between farms), Disease resistance (genetic factors, genomic selection), Vaccine development and refinement (tailored attenuated vaccines, recombinant or sub-unit vaccines, DIVA vaccines, better adjuvants and delivery systems), Surveillance (harmonization and rick based surveillance systems, wildlife and vector surveillance, risk analysis), Control (efficacy evaluation of preventive measures, outbreak simulation studies, vaccination coverage needs, bio-economic modelling, compliance among stakeholders); Zoonotic potential (predisposing factors, virulence mechanisms, genetics – drift/mutations, transmission routes), Therapeutics (new antibiotics, antibiotic resistance, alternative to antibiotics (peptides, plants, phages, siRNA), probiotics, prebiotics).

Production diseases are defined by being multifactorial. They may include one or more microbial pathogens, and may be of a more chronically nature compared to infectious diseases caused by an exotic/major pathogen. The need for low carbon and short chain delivery systems regarding animal feed is challenging the GI health of a number of animal species and calls for increased research using alternative feed products (waste products etc.) without affecting the GI health and the productivity. Moreover it is often production diseases that cause increased usage of antimicrobials, and may have great impact on animal welfare. Following specific research- and technology gaps are identified :

Risk/pathogen detection (cost efficient detection systems, on-farm detection, IKT/precision farming systems, alternative sampling methods), Disease dynamics (risk-factor analysis, agricultural economics, multiplex analysis, Immunity / vaccines (cross-protection, herd immunity, quality of colostrum, innate immune responses, early responses), Microbiota (probiotics and prebiotics, maturation of GI-system, downgrading of inflammatory responses) and Antimicrobial resistance (evolution of antimicrobial resistance, emerging resistance profiles, alternatives to antimicrobials); Outdoor rearing / organic farming (transmission of pathogens from wild animals, anthelmintic resistance), Interaction with animal welfare (interface between disease, welfare and economics)

/04 Examples of integrated animal health research call formulations

Health, Well-being and Disease

Research in the area of integrative animal health to understand how and why individuals and groups of animals react differently to biotic aggressors, abiotic stressors or changes in ecosystems. Research in this area occurs in field, laboratory and experimental facilities and covers a wide range of scientific fields and levels of analysis from genomes to ecosystems to describe the homeostasis of health and study the development, mechanisms, and evolution to disease.

The network will encourage species specific and comparative studies as well as modelling and theoretical approaches that use animal as a system to discover and explore overarching principles to advance a fully integrated understanding of the healthy animal under high welfare standards and also disease-generated deviations from this status. Systems approaches that predict or reveal the nature of coordination among functional processes as a means to further the understanding of organismal integrity and resilience will be particularly encouraged.

Aggressors, Host defences and Ecosystems

Hypothesis- and discovery- based research to understand pathogen biology, host defences, and host-pathogen interactions. Research should encompass a wide range of approaches and including all levels of biological organization, from molecules through populations. The network will encourage submission of proposals aimed at identifying fundamental design principles of physiological and structural systems and at understanding why particular patterns of functional and physiological mechanisms react to pathogens, abiotic stressors or ecosystem disorders. Multidisciplinary research at the interfaces of biology, physics, chemistry, mathematics, computer science and engineering will be encouraged. Systems approaches that predict or reveal the nature of coordination among functional processes and/or structural components as a means to further the understanding of Host/Aggressor interactions will be particularly encouraged.

Pathogen genomics and evolution

Research in the area of pathogen biology, pathogen genetics and pathogen evolution to understand how and why infectious agents often evolve from symbiotic state to highly virulent entities is still needed. Infectious pathogens of livestock and poultry present exceptional opportunities for applying a genomics-based approach for understanding host-pathogen interactions and the genetic variations associated with infection, replication, tissue tropism, host-range specificity, transmission, and innate and adaptive immune responses. Broad thematic areas include pathogens genome studies, dynamics of their evolution and propagation, sensing and signalling mechanisms. Hypothesis - and Discovery Based Systems -approaches that predict the nature of the biological, structural and evolutionary features contributing to the virulence and propagation of microbes, viruses and other infectious organisms will be encouraged.

The augmented genome: Gut micro biota and health

There is a growing body of evidence showing that the microbial community in the gut helps balance the immune system and influences its host's development, fitness, and metabolism. Research on processes mediating both antagonistic and beneficial symbiotic interactions, as well as mechanisms of self/non-self recognition within and between species is needed. The network welcomes proposals on the dynamics of initiation, transmission, maintenance and dissolution of these complex associations, including studies of metabolic interactions, immune defences (especially involving comparative studies, new systems or novel mechanisms), host-symbiont regulation, and recognition, signalling, communication, and reciprocal responses among interacting species. Integrative approaches and attention to emergent effects of symbiotic interactions are encouraged. All aspects of symbiosis are supported, including commensalism, mutualism, parasitism, and host-pathogen interactions. Holistic approaches leading to new bio-based concepts in combating microbial infections and nutrition disorders will be particularly encouraged.

4.2.2 CWG Animal Health and Welfare: Animal Welfare Subgroup

Contribution from Collaborative Working Group on Animal Health & Welfare, Welfare Subgroup (CWG-AHW Welfare):

- France: Alain Boissy, INRA
- UK: Merewyn Loder, BBSRC

Representing CWG-AHW Welfare:

- France: Alain Boissy, INRA
- UK: Merewyn Loder, BBSRC

Animal welfare (AW) is the well-being of animals and is a cross-cutting issue throughout the animal production system. AW is connected not only with animal health (AW and AH interface, see the contribution of the Anihwa ERA-Net) but also with animal breeding (already claimed in the chapter 2), animal nutrition and livestock production systems (already claimed in the chapter 3). The intensification of farming and the drive to maximise production from animals was accompanied by technical choices that limit the natural behaviour of animals, provide constraints and affect their well-being. Consumers in developed societies are increasingly questioning the ethical acceptability of some livestock production systems and now include animal welfare as a benchmark for assessing standards. Major meat and food processing companies are starting to take a lead in AW issues, particularly by developing welfare guidelines of practices for their supply chain. Many of these multinational companies are working more and more with animal welfare groups.

The Terrestrial Animal Health Code of the World Organisation for Animal Health defines animal welfare as "how an animal is coping with the conditions in which it lives. An animal is in a good state of welfare if it is healthy, comfortable, well-nourished, safe, able to express innate behaviour, and not suffering from unpleasant states such as pain, fear, and distress. Good animal welfare requires thus appropriate breeding, disease prevention, appropriate shelter, social contacts, management, nutrition, humane handling and humane slaughter/killing. The assessment of the AW state is based on the physical and mental health status of livestock and individuals (see for instance the European Welfare Quality Project [Welfare Quality]). Improving AW in the various farming systems is a major challenge to overcome. The objective here is to encourage high-quality research to assess and improve AW and to promote innovative strategies taking into account the AW issues in all forms of livestock production in order to contribute to the development of sustainable animal production.

/01 Background

Intensification and the drive for maximum production places animals under significant stress and causes health problems. Cows, for instance, kept under intensive production conditions can suffer diseases of the feet from standing on concrete or in their own manure. Focus on high milk yields can increase levels of mastitis. Broilers bred for fast growth have a high incidence of leg deformities because the large breast muscles cause distortions of the developing legs and pelvis, and the birds cannot support their increased body weight. As a consequence, they frequently become lame or suffer from broken legs. The increased body weight also puts a strain on their hearts and lungs. Confining as many animals indoors as possible might maximize efficiency and profits, but it may also expose the animals to high levels of pathogens and toxins from decomposing manure and can create ideal conditions for diseases to spread. Feeding animals an “unnatural” diet can also add to their health problems. Procedures used to counteract these unhealthy conditions (e.g. increased use of antibiotics) can create other problems such as the development of antibiotic-resistant bacteria and treat only the health not welfare issues.

Previous European initiatives such as the Welfare Quality, WelNet, AWIN and AWARE projects and the ANIHWA ERA-net have advanced the AW field with a focus on measuring welfare. Individual member states (MS) also have research programs and interest in this area. The field has progressed a lot in the last ten years however much remains to be done. The application of technological progresses in livestock farming to ensure AW is a relatively new and promising area. Many of the remaining problems in the area are relevant across the EU and often best addressed by multi-disciplinary research. Bringing together individual MS expertise and knowledge in technology development, animal behaviour, animal management, animal breeding, animal health and economics to address the issues currently faced by the agricultural industry and the need to feed a growing human population in a changing environment is essential. The need for sustainable production- producing more food, economically and with minimal environmental impact- is a major issue for all and the biggest risk in sustainable animal production in terms of days at risk is on the welfare of animals. Although a single disease outbreak can be devastating in the short term improved biosecurity available in intensive farm situations mitigates the risk, whilst the loss of control, natural behaviour and environmental stimulation will be continuous issues. Better understanding animal behaviour to provide recommendations and interventions for improving AW is therefore essential and no changes in management should be considered without also considering the actual, measurable effect on welfare.

/02 Outputs

AW assessment and improvement

As welfare is a multidimensional concept (see above), its assessment should be a multidisciplinary process: providing a comprehensive overview in any given system. Rigorous assessment of welfare may combine both resource-based indicators and more and more animal-based indicators. Most animal-based welfare indicators have the advantage that they can be measured whatever the production system. Further research is needed to confirm the reliability of the measures and their robustness to ensure valid welfare assessment, through a science-based management approach. Further activities aiming at making the measures practically applicable are also needed.

At the same time, basic research has to be encouraged: the assessment of farm AW requires a good understanding of the animals' affective experiences, including their emotions. Research into affective states of animals is progressing rapidly and the ability to scientifically access animal feelings should contribute to the development of innovative farming practices based on the animals' sentience and their cognitive skills in order to really improve their welfare. The relevance of behavioural strategies to improve AW has to be studied by taking into account the cognitive skills of the farm animals. Specific cognitive processes and behaviourally strategies eliciting positive emotions should be emphasised in order to ensure good welfare and not only to reduce stress.

AW and animal health

See the contribution from ERA-Net ANIHWA that focuses on the interface between AW and AH.

Health status is defined beyond a single situation of absence of disease or infirmity and may refer to the criteria of physical, mental and social well-being mentioned in the definition of health established by the OMS. More particularly, issues of animal welfare / ethics in livestock can be identified because diseases or certain technical decisions lead to pain and suffering. In addition, the social acceptability of some farming practices has become an issue. For instance, the report of the MEP Marit Paulsen, upstream of the 2011-15 Community Action Plan for EU animal welfare, reflects the willingness of stakeholders to involve AW with health, safety and quality of food after farming. It calls for the integration of such standards in a global context and encourages WTO agreement. The report points to the need for joint research.

AW issues have not been sufficiently taken into account in animal health research, which would benefit from better integration of knowledge of the behaviour and welfare of production animals. Conversely, research on welfare would benefit from further integration of the health component particularly the effects on welfare of production diseases under different management conditions.

AW and animal breeding

The rapid progress in genetic selection of production traits may adversely affect AW by provoking anatomical and metabolic problems. The current selection programs now acknowledge the need to consider the welfare consequences though it is difficult to assess how much current breeding programs take animal welfare into account and what metrics should be used it is widely acknowledged that over selection for single traits has become a welfare issue as for example in the broiler industry where breeding for rapid meat has resulted in bone weakness, fractures and gait problems. Genetic selection for higher productivity may also have adverse consequences for stress susceptibility. For instance, Brown Swiss cows, a breed selected for high milk production, are more reactive to various alarming events than Hérens cows, another alpine dairy breed empirically selected for social dominance ability and in which the selection pressure for milk production has been less potent. Such negative consequences on emotional reactivity could question the ethical basis of selection strategies currently realised for higher productivity. The increases in problems with highly reactive cattle are the result of an over-selection for leanness and rapid growth.

The possibility for including welfare criteria in current selection programs in livestock has to be considered. For instance, a genetic selection program for reducing aggression and stress responsiveness to handling could be implemented since it appears that it will not affect adversely other desirable productive traits but could possibly improve some other adaptive behavioural traits such as maternal behaviour. An alternative approach to long-lasting conventional selections based on phenotype could be to identify individual genes or markers for these genes that are known to quantitatively influence welfare traits. Selection would be performed directly for these genes, rather than relying on behavioural phenotypes. However, before welfare traits can be incorporated into selective practical breeding programs, research is necessary to better evaluate the impact of interactions between genetics and farming systems that can limit the effectiveness of the selection.

AW and animal nutrition

The relationships between animal nutrition and feeding behaviour with AW in farm animals have recently come to the forefront and provide a possible 'quick win' in the protection of AW during intensification. This is in line with many studies carried out in rodents and humans, which have shown that gut microbiota influence not only immunity, but also metabolic diseases, behaviour and stress, leading to the gut-brain axis concept. In some farm animals, the gut-brain axis is beginning to be investigated in depth and a link between digestive discomfort and inflammatory processes has been shown in various monogastric animals such as pigs, poultry and rabbits. In ruminants preliminary experiments in young animals before weaning have also shown strong interactions between gut microbiota and digestive disorders / stress and health and productivity in adult life. Likewise, in weaned animals, many disorders are related to rumen microbiota, such as acute acidosis SARA (Sub-Acute Rumen Acidosis- due to high concentrate diet designed to maximise growth performance) which not only increases risks of metabolic disorders but also induces changes in behaviour and diet composition. Research on the gut-brain axis in ruminants should be enhanced. In addition research on probiotics and their provision can improve digestive balance and behavioural comfort.

Many fields have to be investigated, especially the factors that may make animals more susceptible to fermenter dysfunction. Likewise, research has to be developed on the potential links between gut microbiota and infectious contamination or inflammatory processes, such as leg joints in poultry, and mastitis and lameness in dairy cows or respiratory disease in pigs.

AW and livestock production systems

Livestock kept under intensive husbandry conditions benefit from protection from environmental extremes and predators, and better nutritional and health management. However, there are also disadvantages for the animals, such as impaired social behaviour, limited choice of living environment or pen mates, poor environmental stimulation, and behavioural restrictions. In addition, the intensively housed animals are reliant on the stock keeper and therefore inadequate care and husbandry practices of the stock keeper may be a major welfare risk. If intensive animal production is likely to expand in order to cope with the world's growing population, ethical considerations surrounding intensive farming practices will become more and more prominent. Although animal welfare is often considered as opposed to animal production, recent studies show that both AW and animal production can be improved at the same time.

Precision livestock farming (PLF) -the continuous, automated measurements directly on the animal or in its environment- is now possible due to the development of new technologies. The analysis of how PLF technologies can create a plus-value at farm level by improving animal welfare, health, environmental impact and productivity, requires extensive field tests with research in collaboration with industrial partners and high tech SME's.

Besides intensive livestock management systems, many animals will be farmed under extensive conditions in order to meet societal expectations or to utilise less accessible farmland not suitable for crop production. This has different welfare implications, related to extreme weather conditions: the occurrence of hot weather conditions and heat waves during summer has clearly increased over the last decades in Europe. Throughout Europe, cattle are kept on pastures for at least some part of the year including the hot summer months. Global warming and the cattle's decreased capacity for thermoregulation caused by selection for high productivity will increase the risk of heat stress in farm animals in the future. Heat stress causes animals severe problems such as abnormal breathing, increased body temperature, lower ruminal pH, loss of appetite and decreased forage intake and consequently weight loss and reduced milk yield. New research is needed on the possibilities to mitigate climate change and environmental conditions and the negative effects on animal production and AW.

Analysis of husbandry systems to identify areas of common ground and conflicts between animal welfare, productivity and environmental impact and improving knowledge flow (including spreading best practice) between science and producers including bottom-up approaches to solve real problems is required in all production systems.

Finally, reducing stress during transport and at slaughter has to be considered in view of ethical aspects in addition to meat quality, security and working conditions. Here too there is a need to focus research on the various ways to reduce stress and pain during transport and at slaughter.

/03 Key Message

Including animal welfare research in sustainable livestock production is essential and addresses three key issues:

(1) We will build on recent technological advances to address key animal welfare knowledge gaps,
(2) In addition to the first issue, research to improve animal welfare will encourage research to investigate the possibilities to contribute to ensure animal health and to improve the efficiency of productivity by ensuring a better welfare of animals,
(3) Embedding welfare within the new ERA-Net proposal ensures that all research and interventions on animals are ethically acceptable and thus truly sustainable.

4.2.3 Joint Research Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI)

Contribution from FACCE-JPI:

- France: Jean-François Soussana, INRA; Chair FACCE-JPI Scientific Advisory Board
- France: Heather McKhann, INRA; FACCE-JPI Secretariat

Representing FACCE-JPI:

- France: Heather McKhann, INRA; FACCE-JPI Secretariat

FACCE-JPI is an intergovernmental initiative, started in 2010, that aims to foster collaboration among national research actors to work toward alignment of research programming. It brings together 21 countries that are committed to build an integrated European Research Area addressing the challenges at the crossroads of agriculture, food security and climate change. In 2012, FACCE released its Strategic Research Agenda (SRA) describing its five core research themes and proposals for short-, medium- and long-term actions. Subsequently, FACCE has elaborated a first Biennial Implementation Plan (IP), describing its proposed actions for 2014 – 2015.

FACCE-JPI has four complementary and interactive goals:

i) Provide new approaches for the sustainable growth and intensification of agriculture in Europe including transformational adaptation and increase the resilience of food systems to deliver European food security, feed, fuel, fibre as well as other ecosystem services under current and future climate and resource availability;

ii) Provide an integrated impact assessment of climate change throughout the whole food chain, including market repercussions;

iii) Contribute to direct reductions of greenhouse gas (GHG) emissions through carbon sequestration, fossil fuel energy substitution and mitigation of N_2O and CH_4 emissions by the agriculture and forestry sector, while reducing GHG emissions per unit area and per unit product associated with land use change;

iv) Sharply reduce trade-offs between food production and the preservation of biodiversity, ecosystem functions and services.

To meet these goals, five core themes are addressed:

(1) Sustainable food security under climate change, based on an integrated food systems perspective modelling, benchmarking and policy research perspective.
(2) Environmentally sustainable growth and intensification of agricultural systems under current and future climate and resource availability.
(3) Assessing and reducing trade-offs between food production, biodiversity and ecosystem services.
(4) Adaptation to climate change throughout the whole food chain, including market repercussions.
(5) Greenhouse gas mitigation: N_2O and CH_4 mitigation in the agriculture and forestry sector, carbon sequestration, fossil fuel substitution and mitigating GHG emissions induced by indirect land use change.

It is important to note that the primary emphasis of FACCE is addressing the future demands on agriculture in light of climate change and climate variability. Both core theme 2 on environmentally sustainable growth and intensification of agricultural systems and core theme 5 on mitigation of climate change are of particular relevance to sustainable animal production.

Core theme 2 includes:

» Providing new approaches for improving farm management and for the sustainable intensification of agricultural systems, but also for low-input high nature value systems in Europe under current and future climate and resource availability;
» Understanding recent yield trends in Europe, taking into account changes in costs and prices and research investments as well as changes in environment, management and genotypes;
» Benchmarking efficiencies of resource use (water, land, nitrogen, energy) according to Genotype x Environment (including climate) x Management combinations across Europe;
» Assessing and raising biological resource use efficiency of crop and livestock systems; increasing total factor productivity;
» Combining crop, livestock and bioenergy systems for sustainable intensification;
» Low input, higher efficiency seeds and breeds;
» Knowledge based IT innovations in agriculture;

Core theme 5 includes:

Contributing to direct reductions of GHG emissions through carbon sequestration, substitution of fossil-based energy and products, and mitigation of N2O and CH4 emissions by the agriculture and forestry sector, while reducing GHG emissions associated with indirect land use change;

» Developing monitoring and verification methodologies of field, animal and farm scale GHG budgets, including, or not, indirect land use and cradle to grave life cycle;
» Developing verifiable GHG mitigation and carbon sequestration measures in farming systems.

As part of the first IP, a number of actions are proposed with direct links to the question of sustainable animal production. These include a Knowledge Network on development of options for sustainable intensification of European crop and livestock systems. This would aim toward the combined development of breeding (and multiplication of locally adapted seeds and breeds), plant/animal health, mixed farming systems, agro-ecological engineering, precision (livestock) farming, ecotechnologies and biotechnologies for increased environmental sustainability, increased feed efficiency, resource efficiency and conservation, productivity and competitiveness in the context of climate change.

A second action with direct relevance to sustainable animal production is the proposed ERA-NET on agricultural greenhouse gas research which will emphasise monitoring and mitigation. This will look at the technical and economic potential of CH_4 and N_2O mitigation, carbon sequestration and reduced emissions from energy use and pre-chain inputs for GHG mitigation in European agricultural systems using life cycle assessment. It will also consider the role of climatic variability and agricultural practices for GHG emissions and reducing uncertainties and improving national agricultural GHG inventories. Finally, it will assess new tools for emissions/removals certification, economic and policy measures.

FACCE-JPI has also organised a workshop on the links between animal health and disease and greenhouse gas mitigation. This emerging area is thought to be an important subject to be treated by the ERA-NET on sustainable animal production and/or greenhouse gas research.

In general, as an initiative aimed at alignment of European research and bringing greater efficiency to research funding, FACCE-JPI seeks to bring greater data access and standardisation in methodologies as well as harmonisation of approaches. This is illustrated by the Knowledge Hub MACSUR that brings together the modelling community to assess and optimise models and data for predicting the effects of climate change on European agriculture.

In conclusion, FACCE covers all the main aspects to be addressed by the SAP ERA-NET: environment, animal breeding, livestock production systems, animal nutrition collaboration and knowledge transfer, the economy and animal health and welfare. For this reason, a close coordination through strong dialogue with FACCE-JPI is essential to avoid overlaps and to create added value in addressing our intertwined challenges.

5 Annex

5.1 Meeting reports

5.1.1 Kick off meeting in Bonn, Germany – January 2014

Report of the Kick-Off Meeting Bonn, Germany

Venue: Federal Ministry of Food and Agriculture, Bonn, Germany

Date: 29th – 30th January 2014

The meeting was hosted by Chair Dr. Bernhard Polten, BMEL

Annexes:

(1) Summary of the open discussion
(2) National priorities
(3) Timeline
(4) List of participants

The Chair of the Collaborative Working Group on Sustainable Animal Production (CWG-SAP), Bernhard Polten, from the Federal Ministry for Food and Agriculture welcomed the participants. He gave some background information on the development of the CWG-SAP and explained the role of the Chair, the Co-Chair and the Head Office at the Federal Office for Agriculture and Food in the CWG-SAP.

Since Jean-Charles Cavitte from DG Research (EC) was not able to participate at the Kick-off meeting, the Chair also gave an introductory overview on the importance of the livestock sector in Europe.

Elke Saggau, Member of the Standing Committee for Agricultural Research (SCAR) and Chair of its Foresight Group gave a presentation on the work and organisational structure of the SCAR outlining the relevance of the new CWG on Sustainable Animal Production. She also pointed out the expectations by the SCAR to the CWG-SAP which among others is the preparation of a proposal for a new ERA-Net under Horizon 2020. The deadline for the call for proposals for the ERA-Net Cofund on "Sustainable livestock production" is 11.06.2015 and some background information on the Cofund was given. In case the Cofund application is successful, a call for project proposals will be co-funded and countries will have to make budget commitments accordingly with budget provisions for 2017.

Susana Astiz, Co-Chair of the CWG-SAP from INIA Spain, introduced the potential scope of the CWG-SAP and presented an overall approach for the work of the CWG-SAP.

In an open discussion the participants had the opportunity to point out relevant topics in the context of sustainable animal production. All issues were gathered regardless of whether the topics may already be dealt with in other groups such as the CWG-AHW or FACCE-JPI.

The participants then had the opportunity to identify national priorities.

The topics discussion was followed by defining "sustainability" for the group.

Spain and Germany presented an overview of the national agricultural sector and livestock production. The participants agreed to provide a similar status quo report by 10th April 2014 to the CWG-SAP Head Office. The Head Office will provide a report template.

Alex Morrow from DEFRA, UK and Chair of the CWG on Animal Health & Welfare (CWG-AHW) gave a presentation on the CWG-AHW and collaboration options with the CWG-SAP.

The timeline with a view to preparing the application for the ERA-Net Cofund was discussed.

The next meeting in May will be hosted by the Co-Chair in Madrid, Spain.

The follow-up meeting in September will be hosted by INRA in Paris, France. If possible, a joint meeting with CWG-AHW will be organised in Paris.

Annex 1: Open discussion "Sustainable animal production"
final: 25.02.2014

1. Definition of Sustainability

Sustainable Animal production is

"economically viable, socially acceptable, with minimal impact on the environment"

("p-approach": people, planet, profit)

2. Topics in the context of sustainable animal production

Livestock system

› focus on farmed species: cattle (beef, dairy), pigs, sheep, goat, farmed fishing / aquaculture, poultry, bees, minor species: rabbits, mink, foxes, reindeer, farmed game (?)
› better integration of farms in the production / food chain, different levels (farm, regional, cross-sectoral)
› integrated sustainable livestock systems at farm level: combination of different aspects (welfare, input, waste management, emissions, transport)
› improve resilience (viability) to national, European, even to global impacts, greater independence from market fluctuations, how to face / deal with market crisis (alternative products & systems)
› competitiveness must be assured
› prepare extensive systems, particularly with a view to extreme weather events (too much rain / water, extreme drought, too much snow)
› new management tools, precision livestock farming incl. early warning tools for animal health, to improve efficiency ("produce more with less"), reduce workload
› increase productivity on fewer & bigger farms
› husbandry systems for the future including focus on environmental, climate friendly and efficient stable technologies and system; further minimal odor inconvenience for the local community and if possible more intelligent regulation of the animal production, based on factual emission on site
› ensure sustainability with regard to tradition: traditional knowledge (passed on from generation to generation = increase attractiveness for (young) farmers), maintain farms with special role in society

Animal Health & Welfare

› healthy animals with(out) (less use of) antibiotics
› abandonment of antibiotics: new management plans & training of farmers ("living without antibiotics"), even compensation of farmer for trying alternatives (loss of income, risk)
› new challenge: how to keep high level of animal health and welfare in systems without antibiotics resp. less treatments
› disease resistance and robust animals
› integrated animal health management
› multi-resistence and problems for human health ("one health")

Animal Nutrition

› differentiate the feed topic between monogastric livestock / ruminants

- alternative feeding systems
- new feed sources e.g. byproducts (esp. for pig, poultry), algae, insects
- feed innovation to improve animal welfare and reduce emissions
- improve protein autonomy
- less feed waste in animal production

Resources

- human resources: employment opportunities in the livestock sector (rural development)
- green growth – competition between feed food fuel fibre, profitability of livestock vs. multiple use / benefits and higher revenues of biomass – how to improve competitiveness of the livestock sector in the growing bioeconomy
- increase production from grasslands
- animal genetic resources, search for special traits
- take into consideration “nature’s capital”: genetic resources / biodiversity without exhausting them
- consider the carrying capacity of environment / natural resources / incl. carbon etc. footprints
- efficient use of resources, alternative input, less fossil fuel & more renewable resources
- efficient use of resources/improved feed efficiency (genetic tools)

Waste management

- explore possibilities to exchange “leftovers” at farm level between different production systems, at market level between farms and processing plants
- too many animals or shortcomings in waste management
- definition of the problem with waste (e.g. not manure but ammonia, is GHG the most important, what other issues)
- minimising effects on humans and environment
- innovative approaches for alternative uses, solutions, (e.g. mineral exports after processing, connect “production site” to processing plants)
- recycling of nutrients
- GHG emission (selection to decrease emission)

Livestock products / in relation with consumers

- evaluation and production of benefits from livestock systems
- new market share internationally / globally, competitiveness with overseas, effects on agriculture in developing countries
- effect of meat exports to developing countries
- review and change dietary recommendations
- improve poor image of animal products (e.g. eggs)
- alignment of food production to consumer demand (allergies, antibiotics)
- more attractive production for the community
- evaluate and stress contribution of livestock products to global food security

› information of consumers to improve the image of the livestock sector and consumer acceptance (positive example: environment lobby)
› niche value focus: quality, specialities (e.g. lactose free)
› develop new products: beneficial for human health, with added value = human or animal benefit (welfare added value e.g.)
› use of biotechnology to introduce added value (special fatty acids e.g.)
› genetic improvement of product quality (milk, meat, eggs, fibre)
› definition of animal protein quality
› reduce the risk of food scandals (with a view to increasing consumer acceptance / trust)
› quality assurance, trustability [reliability], transparency (traceability) of the whole food chain [failure in one segment leads to loss of trust in the whole chain]
› how to respond to increasing demand for food and livestock products (globally) while guaranteeing or improving quality in terms of protein, etc.
› nutrient cycle of the whole production chains, reduce food waste
› synthetic food

Evaluation / assessment

› evaluate efficiency: what are the criteria to classify an efficient system, which parameters (e.g. protein intake by animal, protein & energy efficiency)
› measure sustainability: what are the criteria to classify a sustainable system, how to measure systems with differences between but also within countries, breeds, etc.
› increase resource efficiency, use natural resources in the most efficient way incl. most efficient use of limited or even decreasing availability of land (competition with industry & urban growth, deterioration) i.e. sustainable intensification
› evaluation of benefits from livestock systems
› evaluation of transaction costs
› livestock systems now and in future, scenarios, what can we do about it (modelling)
› links to governance, policy, regulations
› guidance needed for politics with regard to sustainability (review of law & regulations)
› lifecycles (e.g. dairy products), - assessment, incl. the tools in quality programmes
› new indicators to measure new systems in terms of improvement
› new evaluation tools e.g. to measure carbon footprint (who will use it)
› why are new systems, tools, etc. not put into practise
› analyse consumer acceptance or lack thereof (e.g. neighbourhood vs. production site)
› better understanding of farmer / consumer / stakeholder behaviour

Collaboration, transfer of knowledge

› data sharing, common databases
› common (shared) infrastructure

- innovations = (research) outputs (from other regions, countries) put into practice
- share or exchange experience and new ideas (following the idea of EIPs) between countries with a view to (adapt and) apply national / regional know-how to different production systems across Europe

Organisation

- cooperation with existing initiatives [what of CWG-SAP topics do they have on the agenda, what do we think they (should) have on the agenda]
- coordination of different activities on different subjects between different [European] initiatives / countries
- what are the existing topics with a sustainability approach
- what is the timescale / "deadline" for solutions
- what rules needs changing – what is the scientific background to reason for changes (or new rules) e.g. land use change towards sustainable production (UK: e.g. action needed for land use in highlands to prevent flooding of lowlands)

Annex 2: National priorities
final: 25.02.2014

Belgium

- autonomy in animal nutrition
  - clear differentiation between ruminant vs. monogastric production systems:
    focus monogastric livestock: solve problem of competition between food – feed
    focus ruminants: improve grassland management, better / more efficient utilisation
  - alternative feedstuffs, innovative feed with regard to wellbeing of animals / welfare, health, emissions
- communication of benefits of livestock systems to consumer and so improve acceptance

Denmark

- sustainable breeding incl. genomic selection, keep genetic variation within breeds (GHG, health, fertility)
- resource efficient feeding chain: new protein sources, better way of feeding (to demand, with help of precision livestock farming & biomarkers) with a view to different production systems
- increasing the efficiency of intensive animal production systems
- innovative management of emission and waste: control emission from stables (GHG, N, P), efficient use of manure

Finland

- **Development of Common Tools** (& Common Understanding of use of existing tools) – including data-sharing. e.g. (a) LCA (b) sustainable assessment methods (c) phenotyping ontologies
- Development of **shared – or connected – infrastructures** that promote exchange between regions of good (promising) sustainable solutions (including management methods and technologies) and enable piloting of these at different scales or production systems
- Analysis of **pathways of sustainable INTENSIFICATION**, including the competitive effects of different uses of land and biomass.
- (systems approach; policy support)

France

- take into account regional differences in the country
- environment vs. competitiveness
  1. nitrate
  2. GHG emissions (trade off GHG – land use)
- attractiveness of livestock farming for young farmers (work against closing down livestock farms): income vs. workload & investments (e.g. generate 6 times more income with cereal production than with any livestock species)
- maintain livestock in less favourable areas
- increase resource use efficiency: "precision livestock farming" and definition of efficiency (kg produced protein / invested kg of protein)
- indicators of sustainability: including social effects (number of working places/system?)

- increase resilience / robustness of livestock farming systems
- integrated management of animal health (antibiotic, resistance)
- increase autonomy / self-sufficiency in protein and energy (through grassland intensification)
- better combination between livestock and crop systems
- enhancement of research efficiency: transfer to the sector
- integration of the products in the food chain: high quality products, nutraceutics...

Germany (BMEL)

- consumer acceptance: production sites in close proximity to neighbourhoods, ethical issues
- conflict between welfare and environment issue (trade-offs)
- use of technology in management, biotechnology (with negative image / unknown side effects e.g. cloning)

Germany (BMBF)

- innovative, competitive animal production systems
- improved production of alternative protein sources (artificial meat, new sources e.g. insects)
- change consumer behaviour to choose higher quality, more awareness of good products / better produced ("consume less but better for fair prices")

Ireland

- economic viability and social acceptance
- focus ruminants: sustainable intensification of grassland systems that are economically viable, their environmental performance
- distribution of nutrients on farm, avoid nutrient surpluses on the field and deficiency for animals, especially in grassland systems
- traceability of food ("from farm to fork"), improve regulations and information of consumer
- communication of livestock sustainability

Italy

- definition of sustainability, common method for its assessment and prediction
- improve efficiency of traditional (extensive) livestock systems to secure their existence because of their importance to rural areas / society
- efficient use of by-/coproducts of livestock systems (manure) which now have no great value
- outweigh / alleviate the side effects / trade-offs of intensification (e.g. high performance vs. reproduction performance of cows) with further research in genomics, nutrition

Luxemburg

- improve feed resource efficiency (incl. protein / energy self-efficiency)
- development of livestock precision tools as management aids for farmers
- improving quality and value of livestock products, with higher added value and increased consumer acceptance

- improve waste management
- reduction of GHG emissions
- protecting animal genetic resources
- further research in genomics

Netherlands

- Challenges for sustainability differ from livestock type and for livestock productions systems and the local environment where the production takes place:
  - species: pig or poultry or dairy cattle ...
  - and depending on type of farm, farmers organisations, region, country....
- System innovation (from farm level to value chain)
  - Integral sustainable livestock systems and stables
  - Welfare, emissions (ammonia, fine dust, methane, endoxines)
  - Farm management (education and training)
  - Strong value chain approach (farm – industry/processors – retail – supermarket - consumer) – private chain quality systems (contracts)
  - New product – market combinations
  - High quality monitoring
  - Biotechnology
  - Reallocation of proteins (food, feed, fuel, fibre chemical (also medicines)
- Animal welfare and health
  - Stimulating natural behaviour
  - Preventing interventions (cutting beaks and tails)
  - Reducing use of antibiotics (and other structural medication)
  - Minimal and high quality transport
  - High quality feed (welfare and health, reducing gas emissions)
  - Biodiversity – species - genotypes

Spain

- enhancing the efficiency of the animal production system with all aspects: sustainable intensification, (social) impact (not always the most intense is best for the region), water use, precision farming
- (regional) sustainability indicators to evaluate the systems
- transfer of knowledge into the sector: why are good research results not put into practice
- improve social acceptance of livestock farmers incl. increase attractiveness of work with livestock

Sweden

- increase feed efficiency
- improve management, husbandry systems (e.g. buildings)
- chain of value: livestock production is an integrated part of the whole chain

- [public opinion: more and more vegans bringing in points of discussion on animal welfare]

UK

- resilience: extreme weather (“natural” production = outdoor vs. protection), other threats (e.g. new emerging diseases)
- biotechnology and new tools for sustainable intensification: boost productivity (forage, feed (increase yield of feed), livestock), healthy diet for consumers
- harmonise crop and livestock production
- achieve optimised balance of food - feed - fuel - fibre
- alternative feedstuffs from other production sectors

ATF

- Implementation of knowledge & technologies (innovations)
- resource efficiency (use of resources / land / animals)
- healthy livestock & people (antibiotics, zoonosis)
- responsible livestock farming (credible from societal and economic perspectives)

5.1.2 2nd Meeting in Madrid, Spain – May 2014

Report of the 2nd Meeting Madrid, Spain

Venue: Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria (INIA), Madrid, Spain

Date: 5th – 6th May 2014

The meeting was hosted by Co-Chair Dr. Susana Astiz, INIA

Annexes:

(1) list of participants
(2) results from break-out session: framework of ERA-Net; work packages & timescale

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The Chair of the Collaborative Working Group on Sustainable Animal Production (CWG-SAP), Dr. Bernhard Polten, from the Federal Ministry for Food and Agriculture opened the meeting and thanked CWG-SAP Co-Chair Dr. Susana Astiz from INIA for hosting the session.

The Director of INIA, Dr. Manuel Laínez, welcomed the participants to Madrid. He pointed out the importance of the livestock sector in Spain and the research for future sustainable animal production in Europe.

The Directors from the livestock departments on Animal Reproduction, Biotechnology, Genetics, Animal Health and Environment each gave an overview of the work of the departments and pointed out the relevance of the respective fields to a sustainable livestock production. As an introduction to the meeting, Dr. Isabel Vazquez, INIA summarised the needs in research on animal production in Spain and presented the participants the results of INIA's foresight projects.

Co-Chair Susana Astiz presented a wrap-up of the results from the Kick-off meeting held in Bonn, Germany at the end of January 2014.

The members of the CWG-SAP presented status quo reports on their respective national livestock production sector. To further substantiate research gaps and future needs, participants agreed to prepare the 2nd part of country reports including:

» an overview on national research on sustainable animal production incl. projects
» identified and prioritised national research gaps (incl. topics that cannot be covered by national funding).

A report template will be provided.

Jean-Charles Cavitte from EC DG Research gave an overview on animal production research under FP7, i.e. resulting projects, ERA-Nets and initiatives. An overview of initiatives under FP7 on animal health can be found in the publication "A decade of EU-funded Animal Health Research" (2012) and on animal production in "A decade of EU-funded animal production research" (2013). He explained that results from projects have not been analysed yet. However, while animal health has been a topic for many initiatives and projects, other topics were missed out or at least not covered to a larger extend, incl. resilience of livestock systems and innovative animal breeding as well as sustainability with a special emphasis on societal and economic aspects. Regarding the societal aspects the CWG-SAP should consider how solutions to meet consumer demands can be changed from a challenge or even competitive disadvantage for livestock production in Europe into competitive advantage or even cutting edge technologies worldwide.

J.-C. Cavitte further explained the new funding instrument under Horizon 2020, the so-called "ERA-Net Cofund". He pointed out that though additional activities in the ERA-Net are optional, the organisation of other joint calls should be given serious consideration and possibilities to include further partners, ideally including international partner organisations, should be explored. Also, the mapping exercise should go on beyond the organisation of joint calls and additional activities, since results presented by the CWG-SAP will be used by the Commission for guidance in future common European research policy planning. As a final remark he emphasised to consider the holistic view of livestock production, which should include animal health and welfare aspects. Further the context of the CWG-SAP should take into account Europe's responsibility in terms of the future nutrition of the increasing world population.

With regard to the ERA-Net Cofund "Sustainable Livestock Production", Babette Breuer, CWG-SAP Head Office, presented further proceedings and suggested that in addition to the topics discussion the CWG-SAP should also have a writing team to draft the proposal text.

Based on the list of topics from the kick-off meeting, the CWG-SAP members discussed gaps and future research needs. All participants agreed to **prepare drafted texts** including a rationale and further explanations based on the topic headings and subheadings. The following "topic teams" will work together:

(1) **Environment:** Denmark, Finland, Germany
(2) **Animal breeding:** Denmark, Germany
(3) **Livestock production systems:** France, Ireland, Spain
(4) **Animal nutrition:** Finland, France
(5) **Collaboration and knowledge transfer:** Finland, Germany
(6) **Evaluation and assessment:** France, Ireland

In a break-out session, the "writing team" (DE, SE, UK) led by Babette Breuer focussed on drafting a framework for the proposal with regard to the distinct work packages. The tentative timeline was discussed as well with regard to financial commitments for the cofunded call.

The CWG-SAP members agreed to on the following **action points**:

- The "topic teams" will provide the **first drafted texts for the research topics** to the other CWG-SAP members **by 15th July 2014**, taking into consideration the prioritisation of research topics from the Animal Task Force's (ATF) "White Paper". A consolidated draft will be prepared for the meeting in Paris in September.
- The "writing team" will provide a **first drafted text** for the ERA-Net **proposal by 15th July 2014** to the other CWG-SAP members. A revised draft will be prepared for the next meeting.
- Member States should state their **financial commitment** to the cofunded call (yes/no):
  - CWG-SAP members incl. other national funding organisations currently not represented in the CWG-SAP
  - from other countries currently not represented in CWG-SAP.
- Members will provide **part #2 of the country reports** on research activities in sustainable animal production and research gaps incl. national priorities until the next meeting.
- Members will explore options for **collaboration** with the animal production community and options for **coordination** with existing research agendas and gap analyses (especially CWG-AHW, ANIHWA, FACCE-JPI).

- The CWG-SAP Head Office will provide information on relevant research activities in FP6 and FP7 including Animal Health & Welfare ERA-Net (ANIHWA), Joint Research Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) as well as a summary for Horizon 2020.

The next meeting of the CWG-SAP will take place in Paris, France in September 2014 and will be hosted by INRA. The final date and venue information will be communicated to the participants.

participants: Elke Saggau, BLE Germany, Babette Breuer, BLE Germany, Sabine Dues, PTJ Germany, Matthias Norrby, FORMAS Sweden, Pinder Gill, DEFRA UK

Annex 2: Framework of ERA-Net

Framework of Workpackages

workpackage no	title
1	Management
2	Preparation and launch of the co-funded call
3	Evaluation and proposal selection for the cofunded call
4	Follow-up and monitoring of projects resulting from the cofunded call
5	Communication, Exploitation and Dissemination of the results
6	Additional activities » research call(s) (without EU funding) » other activities (without EU-funding), e.g. Knowledge Hub » cooperation with other initiatives (mainly FACCE-JPI, CWG-AHW; others to be determined) » continuation of mapping exercise (towards strategic research agenda) » monitoring & evaluation of ERA-Net

The workpackages are outlined in the "standard proposal template". Details of procedures as required in the template and annexed guidelines will be taken up into the "Description of work". Workpackages 1 – 5 are mandatory. The additional joint activities listed under workpackage 6 are optional activities for further consideration.

Tentative timescale

The ERA-Net Cofund has a duration of 5 years (60 months). Within this timeframe the cofunded call has to be published, research projects have to be finished and a final report has to be sent to the Commission.

With a project duration of 36 months, the cofunded call needs to be published with the start of the ERA-Net, that is the call incl. tools and documents needs to be prepared until the actual start of the ERA-Net. The organisation of this work will have to be discussed.

The evaluation of the ERA-Net Cofund proposal can take up to 5 months and, in case of a positive decision on the proposal by the Commission, the signing of the grant agreement can take up to another 3 months. The cofunded call may therefore start no later than February 2016, 8 months after the submission deadline for the ERA-Net Cofund proposal in June 2015. Budgetary commitments for the cofunded call have to be provided by the partners with the submission of the ERA-Net Cofund proposal already, but funds for the research projects need to be allocated in 2017 only.

Additional funding partners to those currently present in the CWG-SAP should be invited to participate in the ERA-Net in the cofunded call and its other activities. However, while additional partners are welcome, given the progress of work, the thematic scope can most probably not be changed much.

5.1.3 3rd Meeting in Paris, France – September 2014

Report of the 3rd Meeting Paris, France

Venue: 1st day: French Ministry of Agriculture
2nd day: French Ministry for Higher Education

Date: 25th – 26th September 2014

Annexes:

(1) List of participants
(2) Timescale CWG-SAP / ERA-Net Cofund
(3) Presentations (available for download)
(4) Distribution of work packages (V1)

The Chair of the Collaborative Working Group on Sustainable Animal Production (CWG-SAP), Bernhard Polten, from the Federal Ministry of Food and Agriculture opened the meeting and thanked Bernard Esmein from INRA, France for organising the sessions in Paris and the French Ministries for hosting. New members to the CWG-SAP from Lithuania (Dr. Violeta Juskiene, LUHS) and Spain (Dr. Estefania Alves, INIA) were welcomed and introduced themselves to the group.

Cyril Kao, Director for Education and Research of the French Ministry of Agriculture welcomed participants to Paris. As a member of SCAR Foresight and the CWG on Agricultural Knowledge and Innovation Systems (AKIS), he emphasised the need for collaboration in Europe on the important topic of animal production and expressed his hopes that CWG-SAP will be followed up by an ERA-Net.

Philippe Chemineau, Director for Regional Policy, Higher Education and Europe at INRA and President of the European Association for Animal Production (EAAP) presented INRA and gave an overview of INRA's objectives, projects and organisation with a focus on research in animal production.

Michel Beckert, Project Manager Research and Innovation Strategy, Directorate General for Research and Innovation at the French Ministry of Research welcomed participants and pointed out the interest of the Ministry in agricultural research.

Alex Morrow, Head of the Collaborative Working Group on Animal Health and Welfare from Defra, UK gave an overview on vision and foresight activities of the former ERA-Net on "Emerging and Major Infectious Diseases of Livestock" (EMIDA), the ongoing ERA-Net on "Animal Health and Welfare" (ANIHWA) and the "Global Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses" (STAR-IDAZ). He pointed out that with regard to sustainability not only of the sector but also in terms of long-term strategic research planning, foresight activities are necessary and should aim to prepare for future challenges and opportunities due to different, new technologies. The two described methodologies were on the one side, the "Scenarios building", which includes the identification of drivers, their categorization and prioritization, the development of scenarios with 2x2 grades of uncertainty of selected situations and the final analyses of the Scenarios The other methodology is the Backcasting exercise, where a preferred Scenario is selected, and a back way is identified, which should be the selected route to achieve the preferred future. Foresight activities should focus less on what is possible but what is a preferable future scenario.

Elke Saggau, CWG-SAP Head Office at BLE, Germany stressed the importance of the input into SCAR Foresight and referred to the current 4th SCAR foresight activity on main dilemmas (trade-offs). The expert groups met and prepared a questionnaire which will be sent out to stakeholders. Follow-up workshops are planned for November and December 2014 and in February 2014. Foresight Expert Group will make contact with the CWG SAP and CWG AHW on Foresight aspects.

Susana Astiz, Co-Chair of the CWG-SAP from INIA, Spain presented a brief summary of the last meeting in Madrid. She then presented a draft for the final report of the CWG-SAP and pointed out the importance of information from the countries, especially on research in the field of animal production pointing out future needs and gaps. The members then presented their overviews on the status of national research and their national research priorities, when possible:

- » Sabine Dues on behalf of the Federal Ministry for Research and Education, Germany
- » Bernhard Polten from the Federal Ministry of Food and Agriculture, Germany
- » Jean-Louis Peyraud from INRA for France
- » Pinder Gill from Defra for UK
- » Jeanne Bormann from ASTA for Luxemburg
- » Martijn Plantinga from Min EZ for the Netherlands
- » Pierra Rondia from CRA-W for Walloon Region of Belgium
- » Violeta Juskiene from LUHS gave on overview on animal production in Lithuania incl. research needs in animal production
- » Susana Astiz from INIA for Spain.

As was agreed in Madrid, members worked in teams to draft texts on the scientific scope in sustainable animal production. The topics were presented as follows:

Environment (DE, DK, FI; presented by Bernhard Polten)
(5) Animal Breeding (DE, DK; presented by Vivi Hunnicke-Nielsen)
(6) Livestock Systems: conception, evaluation, assessment (ES, FR, IE, presented by Jean-Louis Peyraud)
(7) Animal Nutrition (FI, FR; presented by Jean-Louis Peyraud)
(8) Collaboration and knowledge exchange (DE, FI; presented by Elke Saggau) [note: change of title from "transfer" to "exchange" to stress networking with other initiatives and international collaboration. Knowledge exchange is an instrument and should be used regarding the implementation of other joint actions.]
(9) The topic "economics" was introduced by B. Polten, BMEL and added to the scope for the CWG-SAP.

B. Polten presented a BMEL paper on "bees" given the importance of bee production for agriculture. Though bee production was acknowledged as one of Germany's national priorities.
Alex Morrow pointed out that the effect of animal health on the reduction of the emissions and load of footprint should be a point in topic (1).

Participants agreed that the topics summarised in the meeting and drafted in the document "Results from the topic teams" are major issues describing the scope of sustainable animal production as defined by CWG-SAP. The topics will not necessarily become ERA-Net call topics but research projects will have to cover several aspects of sustainability in the frame of its definition: economically viable, socially acceptable, with minimal impact on the environment.

Two important European initiatives that cover animal production cross-cutting issues are the ANIHWA ERA-Net with a focus on animal health and welfare and the Joint Research Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) with a focus on climate change relevant topics. Both coordinators were therefore invited to the CWG-SAP meeting in Paris to present ANIHWA resp. FACCE-JPI and point out possible overlaps, gaps and collaboration opportunities with the CWG-SAP.

Abdenour Benmansour, INRA, coordinator of ANIHWA presented the achievements of the ERA-Net since its establishment in 2012. ANIHWA will come to an end in December 2015 and will publish its 3rd and last research call in November 2014. However, since research gaps in the field of animal health & welfare have been identified but not yet closed in the project, the integration of those topics in the future ERA-Net on sustainable livestock production was discussed as an option.

Isabelle Albouy, INRA, coordinator of FACCE informed participants on the actions of the JPI since its establishment four years ago. Since the JPI covers a wide area in agriculture also related to animal production she pointed out overlaps, gaps and possible joint activities with a view on the planned ERA-Net on sustainable livestock production.

Jean-Charles Cavitte from DG AGRI gave a presentation on strategic programming in livestock research with regard to Horizon 2020 and European Innovation Partnerships (EIP).

Babette Breuer from CWG-SAP Head Office at BLE presented a draft outline for the ERA-Net proposal and pointed out the work that needs to be accomplished until the submission deadline in June 2015.

In a tour de table participants were asked by the Chair to express their countries' interest in participating in a future ERA-Net Cofund on "Sustainable Livestock Production" *[__note:__ the call title under WP2014-2015 differs from the CWG-SAP name in "livestock"; however, regardless of the term used, both the CWG-SAP and the future ERA-Net will focus on farm animals used for food production]*. Heather McKhann from FACCE-JPI Secretariat at INRA informed participants that FACCE Governing Board members, too, were asked to indicate their countries' interest in participating in a future ERA-Net.
Interest of representatives for taking over work packages and tasks in the ERA-Net were also noted. Spain recommended BLE to coordinate the ERA-Net (WP1).

Jean-Louis Peyraud presented a preliminary overview for the scientific scope of a future ERA-Net outlining main issues for sustainable livestock production systems and possible areas of research. Participants discussed the importance of an integrated approach instead of a set of disciplinary topics. Martin Scholten from Animal Task Force stated that the ATF White Paper also supports an integrated approach regarding priority issues in research and innovation from an animal production industries' perspective. CWG-SAP representing government and research (= public) together with ATF representing business and research (= private) could therefore form a triple helix of government – research – business following a similar integrated approach and join efforts to strengthen European livestock research in order to improve sustainability and increase productivity of the livestock production sector in Europe. Participants agreed to follow up on the presentation of Jean-Louis Peyraud to further develop the scientific scope of the future ERA-Net including the topics discussed by CWG-SAP and additional input from Animal Health and Welfare and FACCE-JPI.

The CWG-SAP members agreed on the following action points:

1. External input to the scope

ANIHWA will provide a draft to CWG-SAP for the topics "animal health" and "animal welfare" and nominate a representative for each topic to discuss the scope within CWG-SAP on behalf of ANIHWA.

Emilie Gätje from PtJ, Germany forwarded the offer from the Animal Welfare Subgroup of CWG-AHW to contribute to the scope especially on animal welfare issues and to establish an information exchange between the CWG-SAP and the Welfare subgroup.

- CWG-SAP Head Office will send an email incl. draft CWG-SAP topics to ANIHWA.
- ANIHWA will give feedback until 10th October 2014.
- CWG-AHW Welfare subgroup invited to draft a contribution to the scope.

FACCE-JPI will provide a summary on possible overlaps between both initiatives, point out gaps in terms of sustainable livestock production not yet covered by FACCE-JPI and nominate a representative who can discuss the scope within CWG-SAP on behalf of FACCE-JPI.

- CWG-SAP Head Office will send an email incl. draft CWG-SAP topics to FACCE-JPI.
- FACCE-JPI will give feedback until 10th October 2014.

2. Expression of interest in participation in ERA-Net Cofund "Sustainable Livestock Production"

CWG-SAP country representatives will be asked to express their country's interest in participating in a future ERA-Net Cofund and also indicate their interest in leading the work packages presented by Babette Breuer in the meeting in Paris.

- CWG-SAP Head Office will send an email to CWG-SAP country representatives.
- Country representatives will give feedback until 10th October 2014.
- CWG-SAP Chair will invite interested partners to an ERA-Net Cofund pre-meeting in Bonn 20th October 2014.

FACCE-JPI GB members will be asked to express their country's interest in participating in a future ERA-Net Cofund and also indicate their interest in leading work packages as presented during the meeting in Paris.

- FACCE-JPI Secretariat will provide the feedback given by Governing Board members.
- CWG-SAP Head Office will send an email to FACCE-JPI GB to request confirmation of expression of interest in participation until 10th October 2014.

3. Final report from the CWG-SAP

The final draft report will be the basis for ERA-Net Cofund proposal. In order to consider national priorities and fill in gaps through European cooperation, countries are requested to complete their national reports accordingly.

- CWG-SAP Head Office will provide a draft report.
- Country representatives will deliver missing reports before the next meeting in Berlin in December.

4. Foresight studies

In order to decide whether or not the CWG-SAP or the future ERA-Net needs its own foresight exercise an overview on available studies in the context of sustainable animal production should be given.

- Task to be discussed in the context of one of the ERA-Net Work Packages.

The Chair thanked all participants for attending the meeting and their contribution during the sessions. He announced that the following meeting will be held in Berlin in December.

Collaborative Working Group on Sustainable Animal Production

Year	2013		2014												2015												2016		
Month	June	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
[start of ERA-Net Cofund]			sigining of grant agreement: max. 3 months after information of outcome												start date: usually 1st day of month following the entry into force of the GA earlier start of ERA-Net before possible														?
[ERA-Net Cofund grant agreement]		information of outcome: max. 5 months after final submission date																										tbc	
evaluation of ERA-Net Cofund-proposal																									tbc				
duration of CWG-SAP																												?	
preparation of co-funded Call																												tbc	
finalisation of ERA-Net Cofund proposal																				11.									
follow up meeting, Berlin														16.-17.															
revise draft ERA-Net proposal & topics													14.																
finalisation of country reports													14.																
ERA-Net preparatory meeting, Bonn												20.																	
3rd meeting, Paris											25.-26.																		
scientific scope & draft ERA-Net proposal											19.																		
preparation of country reports 2										29.																			
2nd meeting, Madrid							5.-6.																						
preparation of country reports 1						10.																							
Kick-off meeting, Bonn			29.-30.																										
establishment of new SCAR CWG-SAP		4.		reported to 19th SCAR Plenary																									
proposal for a new SCAR CWG-SAP by DE & ES	6.		18th SCAR Plenary																										

update 09.10.2014

Annex 2: Distribution of Work Packages

[Note: Expression of interest in tour de table during the meeting in Paris on 26th September 2014.]

Work Package no.	Work Package title	Lead Participant	deputy	remarks
1	Management	BLE, Germany	INIA, Spain	
2	Preparation and launch of the co-funded call	INRA, France		
3	Evaluation and proposal selection for the co-funded call	INIA, Spain ANR, France		
4	Follow-up and monitoring of projects resulting from the co-funded call		Defra, UK	
5	Communication, Exploitation and Dissemination of the results			
6	Other joint activities	MINEZ, NL	BLE, Germany	
7	Short and long-term strategy	MINEZ, NL		

5.1.4 4th Meeting in Berlin, Germany – December 2014

Report of the 4th Meeting in Berlin, Germany on

Venue: Federal Ministry of Food and Agriculture, Berlin, Germany

Date: 16th & 17th December 2014

The meeting was hosted by Chair Dr. Bernhard Polten, BMEL

Annexes:

(1) List of participants
(2) Presentations (download)
(3) Participation in Work Packages

The Chair of the Collaborative Working Group on Sustainable Animal Production (CWG-SAP), Bernhard Polten, from the German Federal Ministry of Food and Agriculture opened the meeting explaining its main aims. As a follow-up of the 3rd meeting of the CWG-SAP in September in Paris, the Chair invited CWG-SAP members and potential partners in a future ERA-Net on Sustainable Livestock Production together with representatives of ANIHWA ERA-Net and CWG-AHW Welfare subgroup to discuss the ERA-Net Cofund proposal.

Maria Flachsbarth, State Secretary to the German Federal Minister of Food and Agriculture, welcomed participants to Berlin and acknowledged the continuation of multilateral research cooperation between European countries following ANIHWA ERA-Net. She underlined the importance to broaden the scope to meet the new challenges animal production has to cope with such as climate change, emissions and animal welfare. She pointed out that research is indispensable to generate the knowledge which will give Europe a head-start in sustainable animal production.

The Chair of CWG-SAP invited participants to introduce themselves and present their organisation's ambition for participation in a future ERA-Net on Sustainable Livestock Production (SLP).

Susana Astiz, Co-Chair of the CWG-SAP from INIA, Spain presented the CWG-SAP, its organisation, proceedings and results achieved in their previous meetings and by the topic teams.

The Chair of CWG-SAP gave an overview on the final report which is being prepared by CWG-SAP. The document will include the national reports on animal production and research needs and will serve as a reference document for the ERA-Net SLP. Countries formerly not represented in the CWG-SAP presented a short report on national animal production and research needs:

» Austria presented by Hermann Schobesberger, Federal Ministry of Health
» Belgium – Flanders presented by Bert Beck, Institute for Agricultural and Fisheries Research
» Greece presented by Loukia Ekateriniadou, Hellenic Agricultural Organization DIMITRA
» Spain – Basque region presented by Mónica de Prado, Basque Government
» Turkey presented by Handan Erkan Şahin, Ministry of Food, Agriculture and Livestock.

Babette Breuer, CWG-SAP Head Office from BLE, Germany presented background information on the Call for the ERA-Net Cofund on "Sustainable Livestock Production" and pointed out the work that needs to be accomplished until the submission deadline in June 2015:

» clarification and wording of the scientific scope of the future ERA-Net (re. clarity and pertinence of the objectives)
» summary of topics for co-funded call
» funding commitment to achieve critical mass for co-funded call
» work package leader, work package deputies, task leader and contributors
» acronym.

The rules for participation in an ERA-Net Cofund changed and it is possible to join an ERA-Net Cofund only as programme owner or programme manager, either of which will have to contribute to research funding in the cofunded call. Bernard Esmein, INRA France therefore explained that though France will support the cofunded call with funds made available by ANR, INRA will most probably not be able to make a financial contribution and thus be unable to lead work package 2.
Anne-Laure Quettier from ANR France, presented details of work package 3 "Evaluation and proposal selection for the co-funded call" incl. the 2-step evaluation procedures established by the Commission and an estimation of costs.
Susana Astiz from INIA, Spain, presented details of work package 5 "Communication, Exploitation and Dissemination of the Results" of the research projects funded under the cofunded call. Special emphasis should be placed on how to fill the gap between availability of research results and their practical application. However, given the project duration of max. 36 months this cannot be a prerequisite but will depend on the project aim. With regard to technical assistance, both Bert Beck from ILVO Belgium and Vivi H. Nielsen from Aarhus Denmark offered support for the webpage and submission tool to avoid subcontracting and thus reduce costs. Merewyn Loder from Defra UK raised.

With regard to previous experience, Marina Bagni from Ministry of Health, Italy and Hermann Schobesberger from Federal Ministry of Health, Austria offered to lead the task "Joint Research Agenda" in work package 7. With regard to the research agenda for sustainable livestock production, participants agreed to consult existing research agendas of other relevant initiatives including ANIHWA. Marina Bagni offered to provide the prioritisation exercise results from ForeMed to the Chair of CWG-SAP.

Since representatives of research organisations were present, participants agreed that their participation in the following discussion of the ERA-Net scope does not constitute a conflict of interest with regard to their institutions' participation in the joint calls of the ERA-Net SLP. Rules concerning conflict of interest will apply for the members of the scientific committee designated to finally draw the scientific scope and define the call text.

Jean-Louis Peyraud from INRA, France presented a roadmap to the co-funded call under the future ERA-Net. Based on Jean-Louis Peyraud's draft proposal for the scientific scope the following outline has been discussed:

Ambition (result of the ERA-Net):

» Efficiency, resilience and prudent use of resources (incl. genetic, natural, land, water, etc.): economy and environment (incl. use of land and water)
» Feed Security & Feed Safety: environment and human health
» Social and economic acceptability: environment, animal welfare, profession
» Holistic, interdisciplinary, multi-actor approach

Priority research topics within the ERA-Net scope

» Protein availability (note: "local protein production" is a topic in FACCE SURPLUS)

» Animal / herd efficiency (including animal robustness as part of efficiency and part of integrated health management)
» Waste products from livestock production systems: safe management and added value
» Integrated management of animal health & welfare and animal robustness (incl. fertility, reproduction, breeding, feeding, nutrition, housing)
» Adaptation of livestock production with benefit for animal health & welfare taking into account potential impacts on the quality of products (eggs, meat, milk) to ensure market acceptance both by consumers (regarding organoleptic quality) and by industry (regarding process quality)
» Are efficient systems also resilient / adaptable?
» Attractiveness of the profession: work productivity and sense of working

Participants did not reach an agreement on the scientific scope of the ERA-Net but emphasised that the draft needs to be advanced from the presented list of topics into a conclusive approach which will include all species important in livestock production (note: the importance of species may vary between countries). Countries where aquaculture (incl. marine aquaculture) plays an important role pointed out that though integration of livestock and fish farming in one research agenda seems challenging the topic with regard to reduce dependence of imports needs to be included in the scope as one main priority. It was suggested that countries' prioritisation of different topics will be acknowledged by drawing a ranking list allowing for one vote per country. Irrespective of the topics that will be chosen for the calls, the projects will have to include the sustainability aspects environment – society – economy as a prerequisite.

Overlaps with other initiatives were identified:

» FACCE GHG Mitigation: emissions (*note: ERA-Net Cofund in preparation, see below*)
» FACCE SURPLUS ("Sustainable and resilient agriculture for food and non-food systems"): availability of (local) proteins; feed safety & feed security incl. mycotoxins in food and feed (*note: pre-announcement of 1st cofunded call*)
» JPI AMR (Joint Programming Initiative "Antimicrobial Resistance"): antimicrobiotics in manure
» ICT Agri: livestock precision farming
» SWG SCAR-Fish / COFASP: aquaculture.

Gary Lanigan from Teagasc, Ireland presented the draft scientific scope for the ERA-Net Cofund "Monitoring and mitigation of agricultural and forestry greenhouse gases (GHG)" for the ISIB-12c-2015 Call. The proposal will be submitted by June 2015. Since livestock production accounts for a large part of GHG emission from agriculture, there will be overlaps between both ERA-Nets most of all with regard to mitigation measures in livestock and tillage, understanding and reducing GHG emissions from animals and livestock production systems by breeding, vaccine, nutrition and management procedures. Mitigation of GHG by animal health measures should be considered for the ERA-Net SLP scope.

Countries were requested to give an indication on the funds available for the cofunded call. The figures stated in the meeting are not binding and subject to finalisation of the ERA-Net scope and availability of funds:

country	minimum (€)	maximum (€)
Austria	200.000	200.000
Belgium (ILVO)	50.000	100.000
Belgium (IWT)	500.000	1.000.000
Denmark [1]	1.000.000	1.000.000
Finland	200.000	200.000

country	minimum (€)	maximum (€)
France (ANR)	1.500.000	1.500.000
Germany	2.000.000	2.000.000
Greece	tbc	
Ireland	800.000	1.000.000
Italy (MIPAAF	100.000	100.000
Italy (MoH)	500.000	1.000.000
Netherlands	400.000	400.000
Poland	500.000	500.000
Spain (ELIKA)	50.000	150.000
Spain (INIA)	300.000	300.000
Sweden	1.000.000	1.500.000
Turkey	150.000	150.000
UK (BBSRC) [2]	2.000.000	2.000.000
UK (Defra)	tbc	
sum:	11.250.000	13.100.000

[1] Availability of funds depends on the scope for the cofunded call which needs to be in line with the strategy of the "Danish Green Development and Demonstration Programme".
[2] BBSRC's contribution is based on the fact that there will be animal health and welfare priority for this ERA-Net and the cofunded call.

Since environmental issues are a main focus of the scope participants raised the question whether environment programme owners/managers need to be contacted as possible funders, too, as has been done for FACCE GHG.

Nicolas Tinois, Coordinator of FACCE SURPLUS ERA-Net from PtJ Germany, presented the ERA-Net Cofund scheme. This new financing instrument combining elements of ERA-Net and ERA-Net Plus has been introduced under Horizon 2020. He reported on the application procedure.

Participants agreed on the following action points:

5. CWG-SAP: final report

Countries were requested to send missing or additional reports by 10th January to the CWG-SAP Head Office.
Countries priorities should be summarised in the final report.

6. ERA-Net SLP: scope

Jean-Louis Peyraud provided a scope text. The document will be revised with regard to the discussions, national priorities and taking into consideration the Cofund call text and H2020 principles.

Options to further cooperate with other initiatives to avoid overlaps and close gaps need to be explored.

7. Further proceedings

Partners will check resources for work packages, especially those missing a leader. All contributors will form a working group. The working group will meet before the next plenary to work on the scope and the ERA-Net proposal.

8. Next meeting

Helle Palmø from the Ministry of Food, Agriculture and Fisheries, Denmark offered to host the next plenary in Copenhagen. The date was set for 4th and 5th March 2015.

The Chair of CWG-SAP thanked all participants for joining the meeting and contributing to the discussions.

5.1.5 5th Meeting in Copenhagen, Denmark – March 2015

Report of the 5th Meeting in Copenhagen, Denmark

Venue: Ministry of Food, Agriculture and Fisheries of Denmark, The Danish AgriFish Agency (DAFA)

Date: 4th – 5th March 2015

Annexes:

(1) List of participants
(2) Presentations (download)
(3) ERA-Net Proposal discussion paper – chapter 1: Excellence
(4) Summary from Core Group meeting

The Chair of the Collaborative Working Group on Sustainable Animal Production (CWG-SAP), Bernhard Polten, from the German Federal Ministry of Food and Agriculture opened the meeting and thanked Helle Palmø for organising and the Danish AgriFish Agency for hosting the meeting in Copenhagen. He welcomed new partners from Hungary, Dora Gróo and Turkey, Sezer Öz. The agenda was accepted.

Helle Palmø, DAFA, welcomed the participants to the Danish Ministry of Food, Agriculture and Fisheries.

The Co-Chair of the CWG-SAP, Susana Astiz from INIA Spain, presented results from previous meetings and progress made so far.

Inge Arents from IWT Belgium presented potential issues regarding Conflict of Interest and suggested solutions. The EU apparently does not have a standard procedure. She pointed out that involvement of researchers in drafting the call text, handling or evaluating submitted proposals should be avoided and a CoI procedure will have to be established in order to assure that the Consortium avoids any conflict of interest. The Call Steering Committee should not include researchers either. Involvement of researchers at a later stage as soon as the ranking list is established is acceptable.

Babette Breuer, Head Office of CWG-SAP at BLE Germany, presented the structure for Chapter 1 "Excellence" which will describe clear, measurable, realistic and achievable objectives of the ERA-Net including research coordination, new approaches for research in sustainable animal production and the focus of research; the relation to H2020 Work Programme; concept and approaches and the ambition including the scientific scope.

S. Astiz thanked Pinder Gill from Defra UK for his work on the scope paper and introduced the latest draft of the scope. She emphasised that the focus of the ERA-Net is to be on sustainable animal production and not on any subtopic, exclusively. Participants were invited to comment the current version. P. Gill made clear that the two generic themes named in the scope, 'resource use' and 'societal challenges', are addressing the three pillars of sustainability. Jean-Louis Peyraud from INRA France, noted that integration in and evaluation of the system was not included in the scope. Elke Saggau from BLE Germany will check the link to HDHL JPI since this is explicitly mentioned in the Cofund call text. Mattias Norrby from Formas Sweden and Vivi H. Nielsen from Aarhus University Denmark as well as H. Palmø observed that the current text emphasises the benefits of ruminant production but production increase, intensive production systems and monogastric production are equally important. The topics need to be included in the scope to make clear that these systems can be included in research projects. They pointed out that more about animal production should be stressed in the text.

B. Breuer presented the plans for work package (WP) 1 which will be lead by BLE as Coordinator and gave an overview over the proposed ERA-Net project plan, its structures and procedures. With regard to the budget she explained that WP leader were invited to make a calculation of total efforts as a basis for deciding on the internal distribution of EU funding for administration. Participants agreed to calculate with PM average costs for all WP to calculate the complete ERA-Net budget.

Katerina Kotzia from PT Jülich Germany presented the plans for WP2 and offered for PTJ to lead this WP which was, however, subject to rules for participation of PTJ in this ERA-Net. With regard to the financial commitments, participants stressed the importance that the cofunded call will have to be finalised in 2016 and therefore to put an effort in starting the call process asap. Participants decided that there will be no MoU for the call as details will be laid down in the Consortium Agreement. With regard to discussions on CoI P. Gill offered to lead Task 2.1 (call group). An open discussion focussed on the decision of which webtool should be implemented with both systems offered by ILVO or PTJ having benefits. The tool should cover the whole call process from submission of proposals, evaluation to monitoring and should be easily inserted in the ERA Net website. The decision will be taken in close collaboration with ILVO. This WP will run until the research projects start, including the grant negotiation phase between selection and final commitment.

Inge Arents from IWT Belgium presented the plans for WP3 on behalf of WP leader Anne-Laure Quettier from ANR France. Evaluation committee members and referees shall not be involved in the call, have no link to applicants and not evaluate proposals from the organisation they work for. For consistency, the same experts shall evaluate pre- and full proposals. Applicants may provide a negative list of experts they do not want to be evaluated by. Guidelines have to include an explanation of the concepts for research in this ERA-Net which will also serve as additional selection criteria in step 1. All selection criteria will have to be prepared to be available with the call announcement. Pre-proposals will be selected following the ranking list as far as possible. A factor 3 of available national contributions will be aimed at. National regulations have to list a maximum budget which shall not exceed total national contribution to the call. Budgets can be debated with applicants in the pre-proposal phase before selection. However, the failure of one partner will exclude a proposal from the call.

S. Astiz presented the plans for WP4 which will be lead by INIA, describing briefly the organisation of the monitoring and evaluation activities, including the evaluation of the impact of the funded projects. One reference person per research project (with maximum of three projects) will assess the progress of the funded projects and will be the main contact with the researchers. Close coordination with other WPs is foreseen: with WP2 to include monitoring and evaluation prerequisites in the call text, with WP3 to contact the IEC for the final evaluation and with W5 to hold personal interviews and present previous results and final reports at the seminars organised in WP5. The final evaluation report will be an input for WP7.

Jürgen Vangeyte from ILVO Belgium presented the plans for WP5 which will be lead by ILVO, Belgium. He suggested to name one responsible task leader. Some output will have to be reviewed with regard to cost : benefit ratio. Project result dissemination should be included in the ERA-Net communication strategy but only to be monitored by the ERA-Net. The task itself should be fulfilled by the research project coordinator and be laid down in the research proposal outlining target groups for the project results. He suggested to develop a basic website which is available already with the launch of the call and to further progress functionality with progress in the ERA-Net. J.-L. Peyraud suggested to produce a booklet for students and policy makers that sumarises the results of the ERA-Net. Heather McKhann from FACCE-JPI further recommended to inform stakeholders incl. applicants and evaluators on country level at a very early stage in the process and pointed out the brochure from BioDivERsa ERA-Net as a good example.

Arnd Baßler from BLE Germany presented the plans for WP6 which BLE offered to lead. Laurence Shalloo will link to the Teagasc Team which is coordinating the FACCE GHG Cofund with regard to the envisaged joint call. Heather McKhann, INRA (FR), Laurence Shalloo, TEAGASC (IR) and Dóra Groó, NAIK (HU) offered to lead tasks in WP6.

Marina Bagni, Ministry of Health Italy , presented the plans for WP7. The expert database has been removed from the work package and participants agreed that efforts should be made to use and adjust to purpose existing databases. She informed participants that while she can support the WP and give input to other WPs in this ERA-Net the lead should be taken by another organisation. With regard to former discussions that this WP best be lead by a research organisation, J.-L. Peyraud offered to take over the WP. I. Arents informed participants that ILVO is interested to be the Deputy.

B. Breuer presented organisational and financial questions with regard to the new ERA-Net Cofund instrument. She asked participants to forward open questions to BLE to be discussed with representatives of the EC, Jörg Niehoff and Luis Vivas-Alegre (DG Research) and Jean-Charles Cavitte (DG Agri) on 13th March 2015. She stressed again the point that reimbursement of any input from partners until the start of the ERA-Net is subject to a successful proposal, negotiations with EC on the Grant Agreement and rules for reimbursement to be laid down in the Consortium Agreement.

Participants agreed on the following action points:

1. ERA-Net SAP scope

Pinder Gill will revise the scope document. ERA-Net partners will then have the opportunity to provide feedback within 10 days upon receipt of the final draft.

2. Conflict of Interest

BLE will provide rules of procedure for the call group (Task 2.1) and Inge Arents a document for all call group members.

3. Next meeting

The next meeting will be hosted by BMEL in Bonn. It will be organised as a two day back-to-back meeting of ERA-Net and CWG-SAP between 27th and 29th May 2015.

4. 4. ERA-Net proposal

Preparation of the proposal will proceed in the work packages and draft text for missing sections will be provided by BLE.

The Co-Chair of CWG-SAP thanked Helle Palmø for hosting the meeting and all participants for contributing to the discussions.

Annex 4: Summary of Core Group meeting

Annex:

(1) List of participants

WP and Task Leader as members of the ERA-Net SAP Core Group were invited by the Coordinator BLE to discuss further progress of work.

Pinder Gill from Defra UK will lead the call group with Jean-Louis Peyraud from INRA France and Laurence Shalloo from Teagasc Ireland. A first draft for the cofunded call will be circulated to partners at the end of June, before the summer breaks.

With regard to ERA-Net SAP preparations, BLE will take care to separate ERA-Net partners from CWG-SAP member in further proceedings. In order to clarify participation, BLE will have a meeting with the Commission the following week. BLE will request partners to enter the ECAS system to make sure all partners are in the proposal.

WP leader will proceed with work package description, circulate the revised drafts to contributors in all WPs and produce a final draft to be circulated to partners at the beginning of May. The final draft for the WPs will be presented in the May meeting.

A time table for each task from each WP leader will be decided and sent to the partners.

If necessary, meetings of the core group or of WPs will be organised on an ad hoc basis.

The necessity for a permanent Scientific Advisory Board was discussed. Partners agreed that no external expertise for drafting the scientific scope of the ERA-Net and later the cofunded call topics is required at the moment. With regard to the broad topics and various objectives of the ERA-Net it was decided to nominate experts on an ad hoc basis only. Experts already contacted in this respect will be informed accordingly.

5.1.6 6th Meeting in Bonn, Germany– May 2015

Report of the 6th Meeting in Bonn, Germany

Venue Federal Ministry of Food and Agriculture, Bonn, Germany

Date: 29th May 2015

The meeting was hosted by Chair Dr. Bernhard Polten, BMEL

Annexes:

(1) List of participants
(2) Presentations (available for download)

The Chair of the Collaborative Working Group on Sustainable Animal Production (CWG-SAP), Bernhard Polten, from the Federal Ministry of Food and Agriculture opened the meeting and laid out the aims of the meeting.

The Chair welcomed Bianca Lind and Inga Schiefler from the German Animal Breeders Federation. As a keynote speaker, Bianca Lind presented the organisation and research work of the German Cattle Breeders Federation and Umbrella Association of German Pig Production. Two open questions for the future are: "What should animals perform?" and "What will be the system of husbandry?"

The Chair summarised the achievements of the CWG-SAP, pointing out that the two main aims of the CWG-SAP set at the start are now achieved: the final report on animal production and research priorities was presented to SCAR and the ERA-NET proposal is to be submitted.

Elke Saggau, BLE, Germany, explained that as one of the instruments of the SCAR beside the Foresight and Strategic Working Groups, the Collaborative Working Groups will in general come to an end with the start of an ERA-NET. However, the CWG-AHW is a good example of how the coexistence can add benefit to the ERA-NET on a strategic political level, for example in topic setting for Horizon 2020, in consultation by EC, as advisory body for the livestock sector or strategic guidance to national stakeholders.

In the following tour de table all participants supported a possible continuation of the CWG-SAP:

- The CWG-SAP and the ERA-NET add up to represent the sector to help shape policy and support science. Results from the ERA-NET can feed into strategic work of the CWG-SAP, e.g. SusAn's WP7 can prepare a platform for the CWG-SAP. The focus of both instrument should be clearly distinguished: the CWG-SAP focus is broader with a long term vision connecting to policy makers. The ERA-NET's focus is more detailed with a focus on short-term research results.
- CWG-SAP should be the platform to improve representation of the animal production sector which has a poor image with poorly funded research. Since there is already a strong group focussing on the animal health and welfare issues, the CWG-SAP's core focus should be on the sustainability priorities.
- The CWG-SAP can be the think tank, it can look into the future and it can interact with relevant stakeholders in the sector. Preparing a common vision with main players will give greater impact and

exploit synergies. Moreover, it is also a valuable forum for small countries which can achieve more with the collaborative effort in the CWG-SAP than on country level.

» The CWG-SAP can also be the platform to discuss new developments on European level along with challenges from Horizon 2020.
» However, an active continuation of the CWG requires financial means. Along with the business case prepared in the ERA-NET it may be possible that EC will fund CWGs in the future (e.g. workshops or conferences). In terms of (financial) resource efficiency it was recommended to take stock and keep using established tools beyond the lifetime of the ERA-NET.

The CWG-SAP members agreed on the following action points:

1. Comments to the 4th SCAR Foresight report

All CWG-SAP members are asked to comment the 4th SCAR Foresight report. The document is not meant for the public as yet. The CWG-SAP Head Office will send the document to the members requesting feedback by 11th June and file all comments to the SCAR by 15th June. Jean-Louis Peyraud, INRA offered to send his comments on the Foresight paper as a first draft.

2. Paper on continuation of CWG-SAP

Bernhard Polten, will write a draft paper of max. 2 pages explaining the rationale for continuation of the CWG-SAP. The CWG-SAP Head Office will send the draft to the members by 19th June requesting feedback within 4 weeks upon receipt. The paper will include statements of how the CWG-SAP and ERA-NET will run in parallel using e.g. output of ERA-NET WP5 and 7.

3. Explanation of the final report of the CWG-SAP

Bernhard Polten will write a draft of approx. 4-5 pages as a preface to explain the report ("Survey and Analysis") of the CWG-SAP. The CWG-SAP Head Office will send the draft to the members by the end of June, requesting feedback within 4 weeks on receipt.

4. Editorial finalisation of the report of the CWG (Survey and Analysis)

CWG-SAP Head Office will edit the report of the CWG-SAP, with the aim to be finished by 11 November 2015.

The Chair thanked all participants for attending the meeting and their contribution during the sessions.

The next meeting will be held back to back with ERA-NET SusAn after the outcome of the proposal by EC.

5.2 CWG-SAP members

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5.3 Timeline

Year	2013		2014												2015											
Month	June	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec
[start of ERA-Net Cofund]																										
[ERA-Net Cofund grant agreement]																										
preparation of co-funded Call																										
evaluation of ERA-NET Cofund-proposal																									tbc	
finalisation of ERA-NET Cofund proposal																				11.						
duration of CWG-SAP: to be continued																										
6th meeting, Bonn																			29.	reported to SCAR						
5th meeting, Copenhagen																	4.-5.	reported to SCAR								
4th meeting, Berlin														16.-17.	reported to SCAR											
revise draft ERA-Net proposal & topics													14.													
finalisation of country reports													14.													
ERA-Net preparatory meeting, Bonn												20.														
3rd meeting, Paris											25.-26.	reported to SCAR														
scientific scope & draft ERA-Net proposal											19.															
preparation of country reports 2										29.																
2nd meeting, Madrid							5.-6.	reported to SCAR																		
preparation of country reports 1						10.																				
Kick-off meeting, Bonn			29.-30.																							
establishment of new SCAR CWG-SAP		4.	reported to SCAR																							
proposal for a new SCAR CWG-SAP by DE & ES	6.	18th SCAR Plenary																								