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Deutsche Agrarforschungsallianz

Livestock Expert Forum

Science, economy, society –
working jointly towards improvements in animal husbandry

Strategy of the German Agricultural Research Alliance

Impressum

Livestock Expert Forum

**Science, economy, society – working jointly
towards improvements in animal husbandry
Strategy of the German Agricultural
Research Alliance**

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Summary

The aim of the Livestock Expert Forum of the German Agricultural Research Alliance (Deutsche Agrarforschungsallianz - DAFA) is to enable a science-based and measurable improvement in livestock farming. The strategy outlined here sets out the basis of its work.

Technical trends in livestock farming

To develop a sound strategy, the Expert Forum began by examining trends in livestock farming. The results of this are summarized as follows:

- World-wide, livestock production has expanded in recent decades. Aquaculture, poultry and pig farming have grown substantially, especially in Asia, South America and Africa. These global trends are likely to continue.
- In contrast, European livestock production has been relatively stable over the same period. Trade flows are changing. European net meat imports have increased. German livestock production is expanding again after a period of decline following the re-unification in 1990.
- Livestock farming is economically important to the German agricultural sector. It accounts for about 60 % of the output of the agriculture and employs about 600,000 people in production and processing.
- The structures of production have changed rapidly over the recent decades. Animal performance and the size of production units have steadily increased, contract production (contract farming) has become common practice. Furthermore, production in Germany is characterized by regional concentration. There is also concentration at the farm level. More than 50 % of all pigs are on farms with more than 1,000 animals and more than 50 % of all broiler chickens and laying hens live on farms of more than 50,000 animals.

■ Surveys of public opinion show that the intensive production emerging from this structural change is viewed critically by a large proportion of the population. Criticism is focused on what is often called 'factory farming'. The animal welfare consequences of these developments are the subject of fierce debate.

Currently, it is not clear how the conflicts now evident will be resolved. The growing scarcity of global resources and the predicted increase in the demand for food derived from animals will encourage further intensification of agricultural production. The global trend towards larger livestock farms and more contract farming will continue. Products from alternative production systems are available in specific markets (e. g. products from organic farming). However, these higher priced products have not yet managed to gain a significant share of the overall market. Opinions differ greatly on whether a greater visibility and availability of products from alternative production systems would lead to a fundamental change in markets.

Conception and organization of the DAFA Expert Forum

Addressing these conflicts is very challenging in an open market-based economy. A more detailed analysis shows the limited effectiveness of 'simple solutions'. If solutions are to be found, there is no alternative to system change arising from the cooperation between science, business, public policy and society.

Science needs to address these challenges much more effectively than in the past, particularly with respect to applying an interdisciplinary approach to problem solving. In order to meet this challenge, the Livestock Expert Forum needs to (a) be science-based, (b) address the geographic dimension and (c) engage with a range of economic and social interests.

- The Expert Forum focuses on areas that are particularly relevant to the controversial debate about intensive livestock production. Consequently, it is not the Forum's intention to contribute to the coordination of the entire public livestock research effort. The majority of future livestock research will remain outside the scope of the Forum.
- Geographically, the Expert Forum will concentrate on Europe's main production systems. Change across Europe is required to consequently address the most important objective of the Expert Forum (a measurable improvement in livestock farming). Obviously, the DAFA will focus on change in Germany. However, it will seek alliances with similar associations in other regions of the EU to raise the impact of its work.

- The involvement of agricultural businesses, sector associations and NGOs is very important to the work of the Expert Forum. It is also necessary to ensure the scientific independence of the Forum's work. For this reason, the Forum's decision-making will be the responsibility of scientists from public sector research establishments and universities. An Advisory Council will be established to provide input from farming and industry, NGO and political interests.

The DAFA Expert Forum has identified six thematic areas (three general and three related to specific animal species) that make up the core of its work. In each of these Working Groups one or more research syndicates are assembled in order to address individual objectives. Their work will be complemented by ad-hoc projects.

Proposals for the focus of the Working Groups were developed during a meeting of the Steering Group and were subject to intense discussions at a strategy meeting in Hohenheim. Refinement of proposals was led by the Working Group spokespersons (up to 3 per Group). During this process, numerous ideas submitted in writing to the DAFA office were considered.

Research and research funding is scheduled to start at the beginning of 2013. The Expert Forum operates with a long-term perspective. The Working Group spokespersons are to report annually to the Steering Group which in turn is responsible for the coherence and progress of the whole effort. The Steering Group reports to the DAFA Managing Board.

The Steering Group and Working Group spokespersons cooperate closely with the research funders. In the event of disagreements, the Working Group and Steering Group spokespersons will report separately to the DAFA Managing Board and the DAFA General Assembly. The DAFA General Assembly is responsible for making final decisions regarding the overall approach.



The basis of the strategy was established at six thematic workshops at two events organised by the DAFA. Over 150 people from scientific organisations, business and wider society participated in each of these events in Hannover and Hohenheim.

The focus of the Working Groups

1. Society



This three-part Working Group will develop a research infrastructure to support the analysis of societal aspirations that are relevant to livestock farming. These results are required for the Working Groups addressing specific livestock species. Options for improved product labeling and food-sector voluntary standards will also be analyzed. The influence of national and EU policies on livestock production in a globalized market economy will also be examined with respect to the Expert Forum's goals.

2. Indicators



A system of indicators is required to enable a holistic assessment of the performance of the German livestock sector. This can be used to monitor progress in terms of the goal of the Forum (a measurable improvement in livestock production) and to identify where progress is being made and where further work is required. The indicators must be relevant to the socio-political objectives and be practical. This indicator system will be very relevant to the development of policies and to the provision of advisory services.

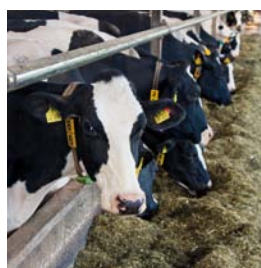
3. Rural Area



An assessment of the effects of the spatial distribution of livestock is required. Policy options for achieving changes in spatial distribution depend on an evaluation with emphasis on solving the problems arising from the regional concentration of livestock. This requires greater knowledge of the emissions from different livestock production facilities, the analysis of the effects of mitigation technologies, including effects on other emissions.

This Working Group is focused on milk production systems. In one sub-group, various approaches to improve animal health and fertility will be considered. A second sub-group will analyze and optimize the economic, environmental and social effects of production systems with high and average milk performance. A third sub-group will examine how automation can be used to improve dairy cow welfare.

4. Dairy cattle



This Working Group is focused on milk production systems. In one sub-group, various approaches to improve animal health and fertility will be considered. A second sub-group will analyze and optimize the economic, environmental and social effects of production systems with high and average milk performance. A third sub-group will examine how automation can be used to improve dairy cow welfare.

5. Pigs



One sub-group will address how current and widely used production systems can be modified to improve animal welfare. On-farm research conducted under commercial conditions is required. This needs public financial support. A second sub-group will plan research of fundamental system alternatives developed specifically to meet societal aspirations (see above).

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6. Poultry



One sub-group will examine how collaboration between different scientific disciplines may further the development and optimization of completely new production systems that can be implemented in practice with confidence. A second sub-group will look at the incremental improvement of production systems within the sector as it currently operates and how the use of antibiotics can be reduced as quickly as possible.

One sub-group will examine how collaboration between different scientific disciplines may further the development and optimization of completely new production systems that can be implemented in practice with confidence. A second sub-group will look at the incremental improvement of production systems within the sector as it currently operates and how the use of antibiotics can be reduced as quickly as possible.

Research funding requirements

It is estimated that the first phase of this research (2013-2015) will require an investment of 15 to 20 million Euros. The funding required may increase after this if the initial phase leads to expensive field testing and measures to support innovation in practice.

The strategy outline concludes with a discussion on public research policy and the rationale for public investment in this research. It is argued that, compared to other public expenditure to improve the social and environmental performance of agriculture, this investment in research is an effective use of public funds.

The success of the DAFA Expert Forum not only depends on the amount of financial support, but also on the longer-term security of funding. Financial commitment over an adequate time frame enables research teams to optimally design research projects in order to deliver the desired impact on innovation in commercial practice and public policy.

1 Introduction

In January 2011, the General Assembly of the German Agricultural Research Alliance (DAFA) decided to establish a Livestock Expert Forum. A Steering Group was set up in order to develop and support a research strategy.

During a two-day event in October 2011, a strategic foundation and preliminary proposals for research topics were determined. Subsequently, numerous other discussions took place with interested scientists from member research establishments as well as with representatives of the private sector, producer associations and public policy. Resulting from these preliminaries, a detailed strategy draft was published by the Steering Group at the end of February 2012. It was refined in March during a two-day strategy meeting in Hohenheim. Up until the end of March, a great number of written submissions by members of scientific establishments and associations reached the DAFA. After final amendments the strategy was passed by the DAFA members.

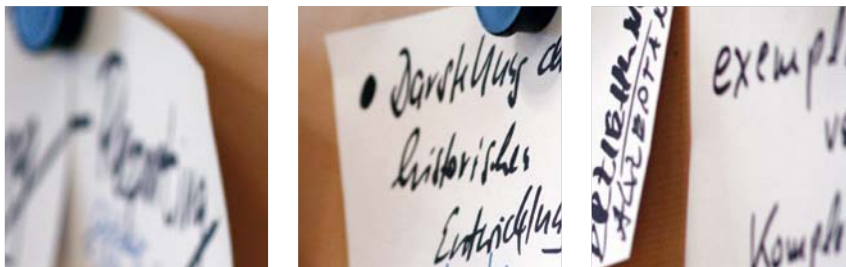
This strategy document analyzes the national and international trends in livestock production. In chapter 2, the prevailing challenges in Germany are pinpointed. The sources of the problems and possible solutions are analyzed (chapter 3) in order to identify the basis of a focus on one central objective and an appropriate organizational structure for implementing the Expert Forum strategy (chapter 4).

The contents of the six thematic areas of the planned research are shown in chapter 5. These areas are designed as three general areas (Society, Indicators and Rural Area) and three animal species related areas (Dairy cattle, Pigs and Poultry). This partitioning considers results from the two DAFA events in October 2011 and March 2012, from the BMELV (Federal Ministry of Food, Agriculture and Consumer Protection) workshops in August 2011 as well as additional expert discussions and written suggestions. Chapter 6 introduces the requirements for research funding needed for the realization of the of the Expert Forum's work.



About 170 people from scientific organisations, business and wide society participated in the first Livestock Expert Forum at the Faculty of Veterinary Medicine in Hannover where the first draft strategy was discussed.

2 Technical trends in livestock farming



Production and global trade

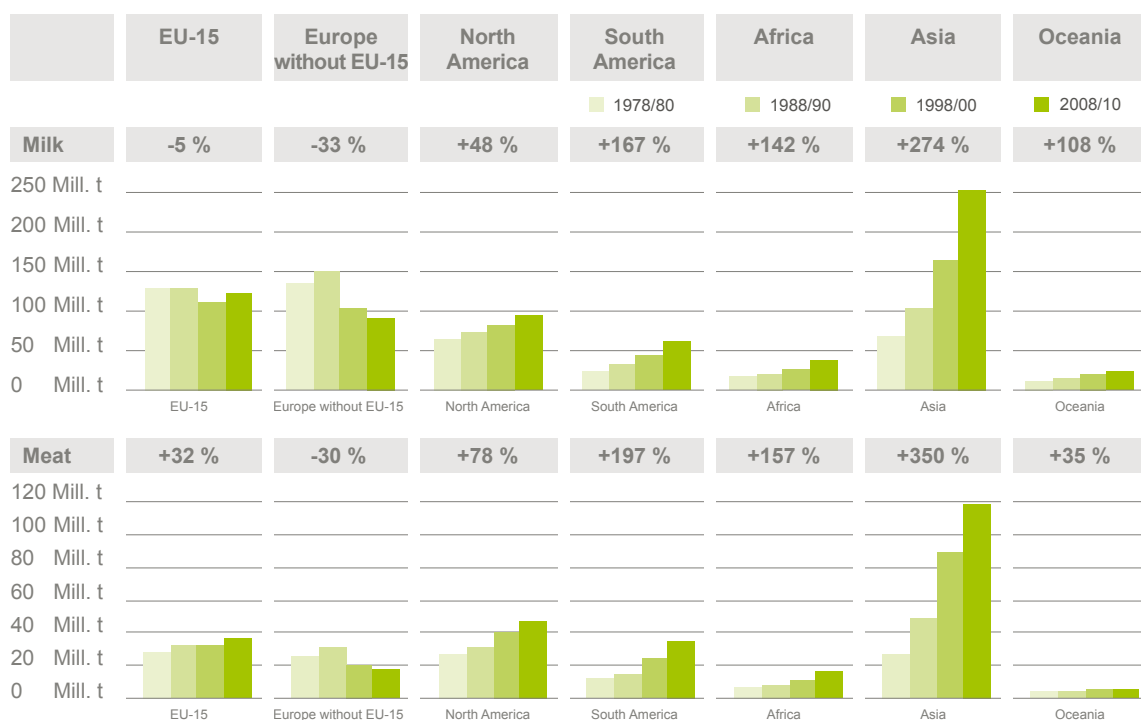
Livestock farming in Germany and the EU is part of a globally networked economic sector whose structure is changing radically. In consequence, the most important international trends are introduced at the outset.

Worldwide, livestock farming is expanding. In recent decades (1978/80 to 2008/10) the production of milk increased by 54 %, the production of meat by 116 % and the production of eggs even by 155 %. At present, global agriculture produces approx. 300 million tons of meat (slaughter weight) annually, which corresponds to an average annual per capita production of

more than 40 kg. The production of different types of meat has grown at different rates: the increase in the production of fish and poultry meat is substantial, the production of fish in aquaculture has decupled and amounts to a total of approx. 80 million tons per year by now.

This rapid growth has taken place outside Europe for the most part. Asia has become the most important production site for meat and fish. South America and Africa also show high growth rates. The regional expansion essentially reflects the development of demand. It still applies, that the biggest part of additional production occurs at the source of the additional demand.

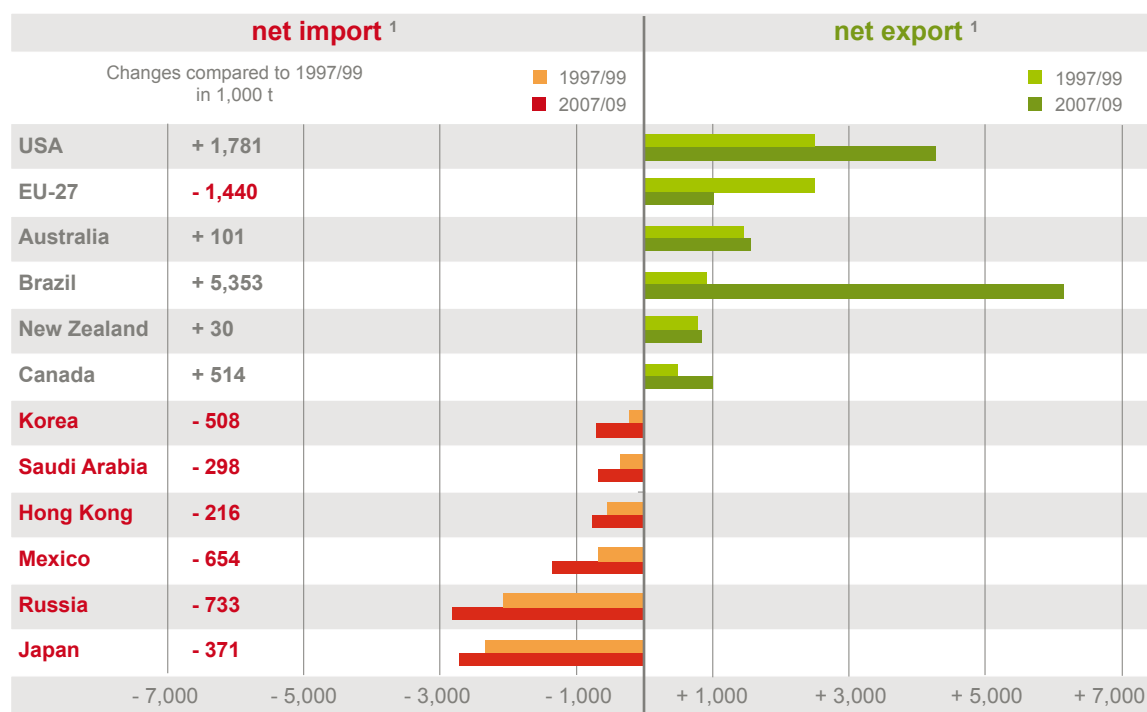
Figure 1: Regional trends in livestock production



Source: Calculations provided by Isermeyer based on FAOSTAT (2011)

Especially in the meat market, the international trade in livestock products has grown. Currently, 34 % of the global production is traded internationally (1979: 15 %). In contrast, the proportions of milk production (13 %) and egg production (3 %) traded across borders are significantly smaller. The structure of the global meat sector is changing rapidly. Because of Russia's strong demand for meat, Europe has become the biggest meat importer. The EU-27 still is meat exporter, but net exports are decreasing. With respect to milk production, the EU-27 and New Zealand are in the vanguard of the net exporters.

Figure 2: Net meat exports by region



Source: Calculations provided by Isermeyer based on FAOSTAT (2011)

¹ difference to the gross export

Production and foreign trade in Germany

In Germany, livestock farming has been increasing during the past decade, i.e. the development in Germany has opposed the European (contracting) trend. Following the re-unification in 1990, German production declined due to restructuring in Eastern Germany. Around the turn of the millennium, an equally strong growth phase took hold across the entire meat sector – with exception of the production of beef and mutton.

Table 1 shows that during the period 1997/99, German agribusiness was a net exporter of dairy products and beef, when all other livestock product sectors imported more than they exported. Since then, the situation has been changing significantly: the increase in pig and poultry farming switched the meat sector from net importer into a strong net exporter. To a certain extent, the increase in pig production is the result of increased live animal imports from other Member States of the EU (see footnote of the table). Among other things, this development is due to regulatory environment in Germany for abattoirs.

The production of dairy products in Germany was able to compete relatively well in the market. As a result of the milk quota, cross-border shifts of production in Europe have been limited so far, but this quota will expire in the near future. In Germany, dairy production is limited by the quota; in many other Member States of the EU, it has dropped below the level of the quota. A conclusion that can be drawn is that the international competitiveness of the German dairy sector is at a high level while the dairy

production in other Member States seems to be lacking momentum in the market.

The German laying hen population slumped in 2009 due mainly to the banning of cages for laying hens. During the years 2010 and 2011, the production recovered and has now reached its previous level again.

Table 1: The German livestock sector: production and foreign trade 1997/99 and 2007/09

	Production				Foreign Trade						
	2007/09		1997/99		2007/09				1997/99		difference net export between 07/09 and 97/99
	97/99	07/09	Difference		export	import	net export		net export		
1,000 t	1,000 t	1,000 t	%	1,000 t	1,000 t	1,000 t	% der IV ¹	1,000 t	% der IV ¹	1,000 t	
beef ²	1,396	1,192	-204	-15	451	280	+171	17	+233	20	-62
mutton	44	40	-4	-9	9	38	-29	(42)	-38	(46)	+9
pork ²	3,834	5,124	+1,290	+34	2,111	1,159	+952	23	-615	(14)	+1,567
chicken meat ²	439	740	+301	+69	362	458	-96	(11)	-211	(32)	+115
turkey meat	257	416	+159	+62	73	87	-14	(3)	-74	(22)	+60
ducks and geese	40	62	+22	+55	14	35	-21	(25)	-49	(55)	+28
sum	6,010	7,574	+1,564	+26	3,020	2,057	+963	15	-754	(11)	+1,717
milk ³	3,559	3,594	+35	+1	1,661	992	+669	23	+648	22	+21
eggs	860	758	-102	-12	117	419	-302	(28)	-215	(20)	-87

¹ IV: Domestic consumption (within Germany) estimated by production plus import minus export

² Including processing products and offal

³ Calculated with respect to the ingredients (blanket amount 12.5% per litre), trade data from FAOSTAT in milk equivalents

Source: Calculations provided by Isermeyer based on FAOSTAT (2011)

Explanation:

For reasons of consistency, the table was developed entirely from the FAO-statistics, so small differences to other statistical sources are possible. All data is displayed in tons. This might lead to variation from data sources that use different conversion factors for manufactured meat products.

These data overstate the growth in German pig production because the increase of live animal imports is not factored in (annual net imports increased from 1.4 million to 7.6 million animals). A rough estimate of the trends in live animal trade (cattle, pigs and poultry) immediately suggests that the foreign trade balance increased by 1.3 million tons instead of 1.7 million tons as shown in the Table

Technical trends

The rough draft of current development trends shows that German livestock farming has been remarkably steady considering in the increasing level of international competition - better than similar sectors in many other Member States of the European Union.

This tendency has contributed to the safeguarding of agribusinesses. Furthermore, it has set important economic impulses for the development of rural areas. Livestock farming is economically important to the German agricultural sector. It accounts for about 60 % of the value added by agriculture (BMELV 2010). According to estimates made by the German Farmers' Association (Deutscher Bauernverband), the sector employs about 600,000 people (production and processing). Most of these jobs are located in rural areas and are an important part of the regional economic structure.

Livestock farming delivers outputs which are not reflected in economic assessments. Especially in disadvantaged regions, where arable farming is impossible (e.g. on hills and uplands), livestock farming supports the preservation and care of the cultural landscape linked to the attractiveness and recreational value of rural areas.

The structural changes in agribusiness are reflected in both expansion and contraction. The following trends that have shaped this national and international restructuring for years have stabilized:

- the specialisation and rationalisation of production systems,
- the withdrawal of small farm businesses and the resulting growth of the remaining ones,
- the growth in vertical integration and
- the spatial concentration of livestock production.

The strong regional concentration of livestock farming in Germany is shown in map 1. Dairy farming in particular and the processing centres in the northern and (to a lesser extent) southern areas of Germany have developed animal populations that are regarded as presenting high risks to the environment and disease control challenges. In contrast, many other German regions have low animal densities. The outcome of the assessment of the implications of the regional concentration varies, depending on the criteria used. Research on the optimal distribution of livestock farming is required.

Map 2 shows the regional trends in livestock production during the past decade. It illustrates that livestock farming has been concentrating in regions where the animal density was already high. Livestock production is recovering in some regions in Eastern Germany.

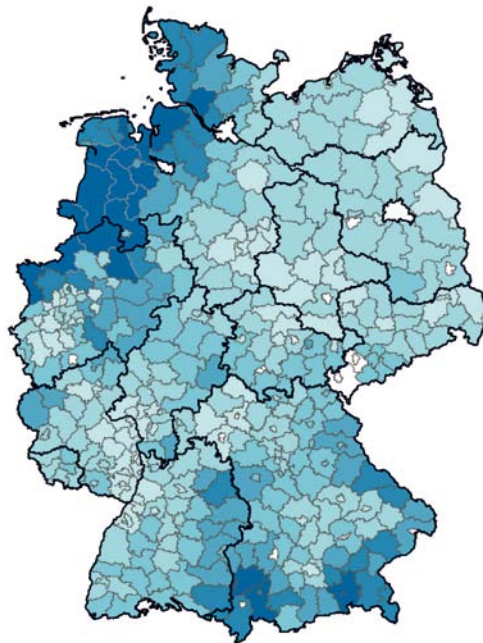
The timing of trends in production systems based on statistics is not shown here since the data are lacking. There is a lack of data especially in relation to those aspects that are the focus of critical debate.

Average livestock herd and flock sizes have increased continuously. This structural change has been proceeding relatively steady as shown in Figure 3 (example: German dairy production). Agro-political events (e.g. the introduction of the Common Agricultural Policy at the end of the 50s, the milk-quota regulation in the middle of the 80s) seem to have had little impact. This is a trend universal across the world.

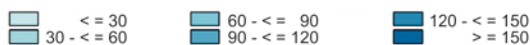
The idea of what constitutes 'large' in terms of farm size varies greatly. The German Federal Bureau of Statistics provides the following (rounded) data on the distribution of livestock in terms of farm size in 2010:

- 39 % of all cattle are kept on farms with 200 or more animals
- 33 % of all dairy cows are kept on farms with 100 or more animals
- 64 % of all fattening pigs are kept on farms with 1,000 or more animals
- 61 % of all breeding sows are kept on farms with 200 or more animals

Map 1: Livestock units per 100 ha agricultural area (LF)

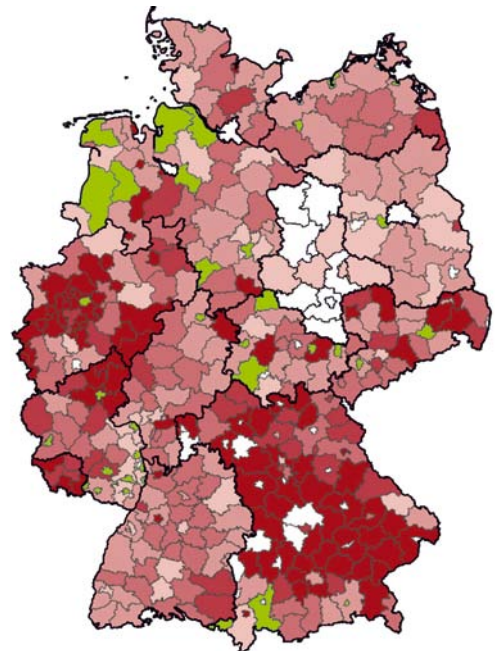


Livestock units per 100 ha agricultural area (LF)

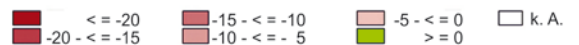


Source: Federal Statistical Office and the statistical Offices of the Länder

Map 2: Changes in livestock units (VE) per 100 ha of agricultural area (LF) 1999 to 2007



Changes in livestock units (VE) per 100 ha of agricultural area (LF) 1999 to 2007



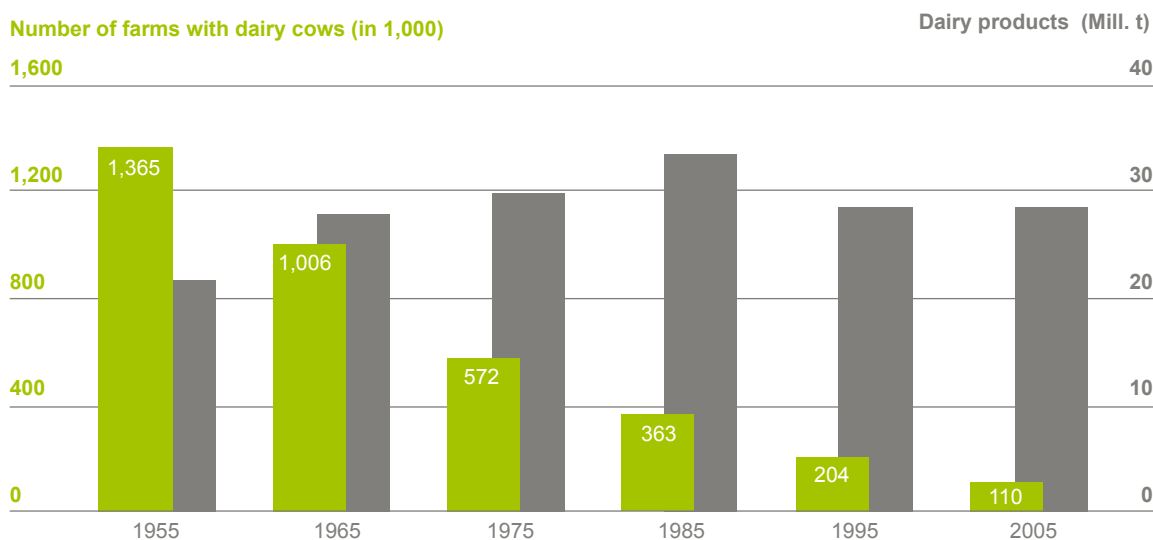
Note: the following counties in Saxony-Anhalt have been merged to enable the comparison between 1999 and 2007: Harz and Salzlandkreis, Anhalt-Bitterfeld and Wit-tenberg, + LK Jerichower Land + Stadt Dessau-Roßau
Source: Federal Statistical Office and the statistical Offices of the Länder

- 52 % of all laying hens are kept on farms with 50,000 or more animals
- 72 % of all broiler chicken are kept on farms with 50,000 or more animals

value creation chains a significant proportion of transactions are within businesses outside the farm. This gives the supply-chain operators greater control of the value chain than is the case where production takes place within independent farm businesses.

As the effects of vertical integration in supply chains are not considered, the official statistics do not show the full picture with regard to trends in sizes and economic concentration of livestock farms. Contract farming is of growing importance in poultry farming and to an increasing degree in pig farming. Key elements of the production system are fixed by central supply-chain players (e.g. meat processing businesses). These supply at least some of the inputs and control production. Consequently, in these

Figure 3: Dairy production and number of dairy businesses in Germany 1955 to 2005



Source Federal Statistical Office, different years

Evaluation of the social impacts of the structural change

In recent decades, the market-based structural transformation has resulted in a considerable increase in productivity and thus in lower production costs. This process is viewed critically by consumers and farmers.

■ **For consumers**, many rejoice in the wide range of high quality food available at low prices and act accordingly. However, many consumers state in surveys that they are very sceptical about current production systems and the structure of livestock production. Large herds and flocks, mechanized production methods, high animal performance, use of pharmaceuticals, amputation of body parts, regional concentration and the emissions from livestock farming are named and shamed. Many people view these things critically but these views are only partly reflected in the choices they make as consumers.

■ **For farmers**, the large increase in productivity and the growth of farms have enabled many farmers to participate in the general growth of income - better than they could have done within their former structures. However, the farmers compete with each other and are on the treadmill of the free market economy (as all other entrepreneurs). As soon as progresses in productivity result in 'higher than normal' benefits, new market entrants and an increase in production arise. This reduces prices and shifts the economic benefit towards the consumers. Farmers that neither can nor want to participate in this competition and leave business view structural change in a way that is different to those who stay. There is little reliable informati-

on on how active farmers and those who have given up their business evaluate the development of production systems.

The media criticizes modern livestock farming in particular. The expression 'factory farming' is well established as a symbol of a form of livestock production that seems to drive structural change and is classified as undesired.

Science struggles with the term 'factory farming'. It (a) has not been defined and (b) often the number of stock is a poor indicator of the real consequences of modern production. Some scientific opinions support a focus on the problems that manifest within systems (e.g. emissions, animal diseases, prophylactic use of pharmaceuticals). Production system modifications require assessment in how they align with wider societal aspirations. In contrast, other scientists consider it as important to deal directly with the phenomenon of resistance to 'factory farming' in society (in addition to the problem-directed measures).

The effects of production practice and systems on the behaviour and health of livestock require more attention. Recent 'Eurobarometer' surveys indicate that 66 % of all Germans rate animal welfare standards in livestock production as 'disturbing' – this percentage has increased in recent years. In the eyes of many consumers, the problem is not only animal welfare – there is also a close association made between animal welfare and human health. However, the consumption of livestock products has changed only slightly.

Most scientific studies of production systems conclude that common systems perform poorly in terms of animal welfare (see Nationaler Be-

wertungsrahmen Tierhaltungsverfahren – National Assessment Framework Livestock and diverse EFSA reports). This may be due to a focus on maximising productivity and hygiene at the expense of welfare.

Outlook: Is an intensification of the conflicts to be expected?

At this time, the conflicts around livestock production and the trends within the sector are causing anger, disappointment and frustration in the public and in the farming community.

These conflicts flare up on occasions of change, for example as a result of planning applications or as a consequence of television or magazine reports. On these occasions, the lack of consensus in society about the correct treatment of livestock is most apparent. Developing lasting strategies for fundamental changes in a globalized market-based economy is one of the challenges faced by the Expert Forum.

The growth in world-wide demand is expected to carry on into the future. The Food and Agriculture Organization of the United Nations (FAO) expects the annual production of meat to double within the next 40 years. There will be resource scarcity because of the increasing demand of the global agricultural economy for plant-based food commodities, raw materials and, especially, bioenergy. These tendencies will increase the economic pressure towards further intensification of production (more yield-increasing production means) and greater productivity (higher performances, better feed conversion).

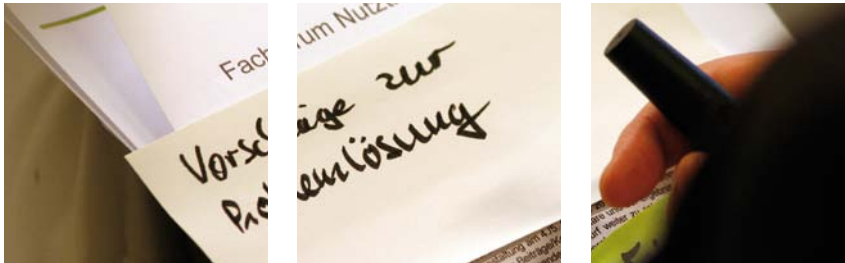
There are no signs, nationally or internationally, for a break in the trend towards larger production units and more vertical integration.

There are some indications of fundamental change in the food industry and retailing. Examples include consumer avoidance of eggs from caged hens and campaigns against the

castration of pigs. However, the majority of food advertising focuses on price. The current economic situation in Europe does not provide the prospect of strong income growth, so income-related changes in consumer choices favouring products from systems providing high animal welfare are not expected. It remains to be seen to which extent better consumer information regarding different livestock farming systems could influence purchasing choices.

It is unlikely that the conflicts around livestock production will be resolved without intervention. The difficult economic conditions and the growing scarcity of global resources could result in further worsening of the conflicts. The Expert Forum aims towards a lasting science-based approach so that livestock farming can be measurably improved and harmonized with the social-political aspirations and values (cf. chapter 4).

3 Problem analysis and conclusions for the Expert Forum



Problem analysis

There are several reasons and different drivers behind the current situation (cf. figure 4). Together, they form a complex network of effects.

Influenced by economic constraints, changes in livestock production have focused on 'rationalization' (production technology), 'increased animal performance' (livestock breeding and feeding) and 'specialization' (production management). This trend has resulted in lower costs, increased value for consumers and an improvement of competitiveness of the agribusiness sector. While public sector agricultural research has reinforced this development, the main driving force is the integration of livestock production in the market-based economy.

The existing trends in livestock farming will continue as long as consumers are focused on price. Better access to a wider range of clearly identifiable products with improved production quality from alternative systems could make a significant difference. The potential for change remains controversial. As more people become increasingly dissatisfied with the present trends (growth of the production units, specialization, performance demands on animals etc.) new products offering alternative purchasing options emerge. Up until now, these alternative segments have only gained significance in several niche markets.

The agricultural research community reacted to the growing social apprehension regarding the side effects of modern livestock production systems at an early stage many years ago. Numerous research projects have considered the improvement of animal health, animal pro-

tection, food quality and environmental effects of livestock production. However, most of the scientific results are focused individual system components. Approaches that integrate comprehensive system solutions, combining scientific-technical approaches with economic and public policy instruments have not been intensively investigated. Some drivers and incentives in the research system itself partly reinforce this situation.

In Germany, there are few inter-disciplinary research groups devoted to explicitly setting targets to improve the existing livestock production systems.

The few exceptions concentrate on farming systems (e.g. keeping laying hens in small groups). In contrast, there are few teams looking at livestock breeding, livestock nutrition and animal health that have the prospect of yielding realistic options that will result in strategic and fundamental change. There is even the small prospect of integrating technical, economic and legislative measures. However, the following analysis shows that without this integration there is little prospect of change.

Technical changes that improve animal welfare and environmental performance while reducing production costs are easily adopted because of the internal economic benefits. The best example is the move over decades from tie stalls to cubicle dairy housing systems. However, this combination of outcomes is the exception. The majority of modifications that are driven by public-good considerations increase production costs. Such systems will only succeed if

Figure 4: Aspects of the conflicts in modern livestock production



- the food business imposes increased standards (beyond minimum standards set by legislation) across the whole market, thereby creating a new market segment and consumers accept the resulting higher prices,
- or the government encourages producers to invest in the required innovation using financial incentives,
- or the government enforces legal obligations for producers to modify their production systems.

At first sight, the last option (tighter legislation) seems to be the obvious one. If the majority of the population desires a certain production system, the political system could react accordingly and the increased production costs would be passed through the market to the consumers.

However, there are difficulties as the open agricultural market threatens to shift the production to foreign sites that are not subject to German or European legislation.

The second option (financial incentives) is presently embedded in the policy practice as part of the supportive measures of the Second Pillar of the Common Agricultural Policy through the consideration of animal welfare and environmental objectives. The current debate about the reform of the Common Agricultural Policy does not yet indicate a major shift from Pillar 1 to Pillar 2 for the period 2014 to 2020. The proposals for the 'greening' of Pillar 1 have not led to an increased emphasis on livestock-related aspects within the Second Pillar. Therefore, there is little prospect of significant change arising from the Common Agricultural Policy reform.

Therefore, the most promising approaches are those at the interface between science and business, and, to a lesser extent, policy. These should cooperate in further development of the production systems in order to reduce the deficiencies in terms of climate protection, environment and animal welfare. Societal aspirations might be fulfilled without an increase in production costs that would undermine the competitiveness on international markets. Where this approach fails, the development of market segments that deliver higher process quality by means of higher production costs is required.

It is not clear which aspects of production process quality concern the public most. This opens up a new area of research. Critics of intensive livestock production rarely present a consistent or coherent model of the desired form of livestock production. There may be conflicts between the emission reductions and the maintenance of traditional forms of livestock production. An emphasis on emissions means a focus on the performance of livestock in housed systems with mechanical ventilation, air scrubbing and slurry processing. Considering animal behaviour, these livestock production systems are often rated as less desirable and they do not fulfil the expectations of many people regarding livestock production.

There is another serious conflict concerning the growth in the size of production units. Agriculture in most developed economies complies with the principles of the market economy. Decisions regarding the allocation of resources are made privately. Permanent change and a shift in the factors of production are subject to expectations of economic returns. But many people – including outside Germany – challenge the growth in the size of production units that arises from these market forces. There are indications that negative perceptions would remain even if research showed that large-scale production performed better in terms of animal welfare, livestock health, food quality and the environment.



150 people from scientific organisations, business and wide society discussed the revised strategy at a second meeting in Hohenheim.



The basis of the DAFA strategy was discussed in workshops.

Conclusions for the DAFA concept

■ Development and realization of a long-term comprehensive strategy

As the problem is very complex and has various causes, fundamental change will not be achieved with research focused only on system components. It is necessary to create a long-term overall concept that can guide both the short-term and medium-term activities. That overall strategy has to be supported by the DAFA member research establishments and its external communication needs to be clear and convincing.

■ Incorporation of analyses of societal aspirations into the scientific concept

It is important to involve people that do not have any specialist knowledge of livestock production. They enable the incorporation of societal considerations and values in the further development of production systems and commercialisation structures. With this, it is possible to identify and elucidate inconsistencies and conflicts in public opinion and to develop strategies for communication. This engagement will not be achieved by individual ad-hoc polls. A research infrastructure allowing long-term analyses of public opinion will be required.

■ **Establishment of sustainable cross-disciplinary cooperation**

To refine livestock production systems and breeding concepts, the interaction between production and socio-economic research must be improved. In some cases new research activities have to be established. Elaborating a concept to involve certain publicly desired aims in livestock breeding will only prove useful if there is also research about the development of consumer demand for the resulting products. This involves a whole range of questions for socio-economic research: How to develop a particular market for livestock products that align with public goods? What are the additional costs and what market share can be expected? How much are farmers willing to pay for 'improved' genetics? How could such a concept be successfully realized in an environment dominated by strong international competition? What role could public policy play?

■ **Travelling the 'last mile'**

The chosen example illustrates the importance of following research through in order to refine outputs to meet the practical needs of production in Germany. Experience has shown that applied sciences considered practical application not always sufficiently. Conventional academic papers are not aimed at supporting public policy and commercial efforts to change complex systems (e.g. reducing the spatial concentration of livestock farming). Research results adopted by these users need further refinement and analysis.

■ Adapting research funding to new challenges

The call for more cross-disciplinary work, relevant to practice, is not new. Existing deficits can be attributed to the fact that the incentives operating in the scientific community do not adequately reward applied inter-disciplinary research. By focusing on the 'scientific impact' and on publication performance, questions of social relevance or social benefit remain unanswered. This handicaps especially those sectors of applied sciences built on inter-disciplinary activity that are relevant to protecting or enhancing public goods (rather than private goods in a commercial setting). Because research results relevant specifically to the structure of the industry in Germany are not easily published in international scientific journals, such research might be treated as only supplementary to research more suited to producing conventional research outputs. Furthermore, three-year project funding is not optimal for addressing systemic and structural questions.

■ Developing and implementing monitoring

Public opinion is a hugely important factor in the conflicts around livestock production. The disconnection between farming and society means that fewer people have views based on first-hand experience. In addition, the media focus mostly on scandals. Frequently, interest groups (trade associations, NGOs) adopt ideological positions in public debate. The arguments are often 'individual black sheep are to blame' vs. 'more evidence that the whole system is fundamentally flawed'. As a result, the conclusions reached with respect to any one incident are diverse and often polarised.

The resulting task for science includes establishing an objective audit of the performance of livestock production in relation to these public questions. Based on clearly defined criteria and societal viewpoints, the performance of the livestock sector can be continuously monitored. Such monitoring can inform and direct public debate. It is the only way to determine whether the situation is improving or deteriorating, what kind of success has resulted from the different strategic approaches, and which consequences have to be drawn for refinement of the strategic concepts. A properly designed monitoring system may involve additional costs for livestock farmers and their business partners, but these may be more than compensated by the numerous synergetic effects (e.g. QM systems, tracing, labeling, hygiene programs and livestock breeding).

4 Objective and overall concept of the Expert Forum

The central objective of the Livestock Expert Forum is to bring together and align German research establishments in a long-term research strategy in order to measurably improve and harmonize livestock farming with the societal aspirations.

Alliance of science, economy and society

To achieve the central objective of the Expert Forum, it is necessary to involve economy, policy-makers and social groups from the beginning.

- Economy has to be involved if people from the agro-food economy are to implement science-based changes in their businesses.
- Policy-makers must be involved because laws and regulations frame many decisions made by businesses and consumers. A fundamental improvement of the situation is unlikely without regulatory or legislative change.
- Different societal groups have adopted critical positions on livestock farming and attract the attention of media and population. Because of the power these groups have, they have the responsibility to participate constructively in the development of sustainable solutions.

It is expected that business, policy and societal groups will be involved at two levels. First, within a wide range of projects, and second, involved strategically in the overall planning in such a way that potential conflicts are identified and addressed early.

The integration of these parties in the strategic overall planning is to be organized in such a way that the scientific work remains independent. For this reason, decision-making will be the responsibility of the DAFA General Assembly and the DAFA Managing Board based on the contributions of the Steering Group of the Livestock Expert Forum. The General Assembly, the Managing Board and the Steering Group comprise only scientists from public sector research establishments and universities. The complementary Steering Group and Advisory Council will discuss the development of the livestock sector, the results of the research, the conclusions and the further refinement of the concept.

Geographical focus

At the outset, the Expert Forum will concentrate on Europe's prevailing production systems. This approach is appropriate, as the central objective of the Forum is not only to contribute individual scientific papers to leading policy questions, but to find solutions to enable a measurable improvement in livestock production through cooperation between producers, business and societal groups.

To identify, pursue and monitor performance in relation to objectives, individual Member States will have to act. Such action is difficult enough at the level of countries, and even more difficult at the level of the EU or the world. Considering this, the DAFA is initially focused on Germany. However, it will seek alliances with similar activities in other regions of the EU to raise the impact of its work.

It is to be expected that the results of the research will spread over the borders of Europe. International alliances should be formed from the very beginning to solve national problems in order to conduct the best possible research. The formation of effective international research alliances is an important sub-objective of the Expert Forum.

Science

At the outset, the Expert Forum will focus on aspects of particular relevance to sustainable livestock production and make the biggest possible effort to achieve the central objective – a measurable improvement in livestock farming.

This focus on long-term central objectives also means that the Expert Forum does not see its role as coordinating or steering all German livestock research. Although the established structures of research and research funding will be central to the progress of the Expert Forum's work, the greater part of the livestock research effort will proceed independently from the Expert Forum.

There are several reasons for this. First, experience shows that the best ideas and the really pioneering innovations develop in rather unplanned and unexpected ways. This is fostered by a pluralistic research organization rather than centralized planning. Second, it is known that integrated or collaborative research has great advantages but is costly in terms of coordination and transaction. Third, it should not be forgotten that the DAFA concept is relatively young and that there will be modifications to its way of working, especially during the start-up phase.

The considerations above point to (a) establishing a focused programme, particularly at the outset which (b) gives priority to the integration of those scientists that are convinced of the DAFA concept and (c) to developing a focus on few important central and long-term based objectives.

Subdivision into six Working Groups

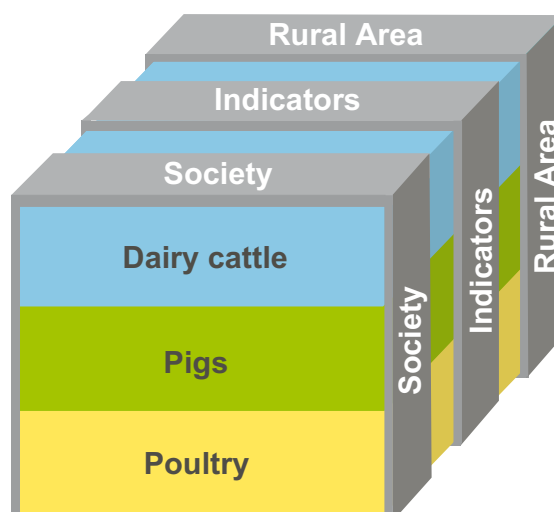
In view of the wide-ranging overall problems it is appropriate to form content-based Working Groups within an overarching strategic framework. Resulting from the discussions about the content of the Forum's work, six Working Groups have emerged (Figure 5).

At first, the central aims for each Working Group are to be defined and a decision has to be made which research and development strategies will be used to approach these central aims. Central objectives may be for example the development of improved production methods, mitigation technologies to reduce emissions or a new information system within the food chain – there are many other possible examples.

It is foreseeable, that such central objectives will not be accomplished during the usual three year project life-cycle. Therefore, they need a longer-term perspective with sub-objectives included and refined if necessary, depending on research progress.

There is a risk that the participants (scientists, advisors, research sponsors, policy-makers) will lose sight of the central objective and deal with individual aspects that will result in research publications but do not contribute effectively to real system solutions. This danger is particularly significant for large, complex themes such as the improvement of livestock farming that are strongly influenced by economic and policy developments. This complexity exceeds the capacity of even large-scale science projects such as that for decoding the cattle genome.

Figure 5: Inter-relationships between the six Working Groups



Organization of the Working Groups

To maintain sight of the central objective and to maintain the connection to the central objective of the DAFA, each Working Group will have up to three spokespersons who are willing to provide strategic leadership. The Working Group spokespersons will be responsible for leading the strategic development in their Group and representing it within the DAFA as well as in front of business partners, policy-makers and wider societal groups.

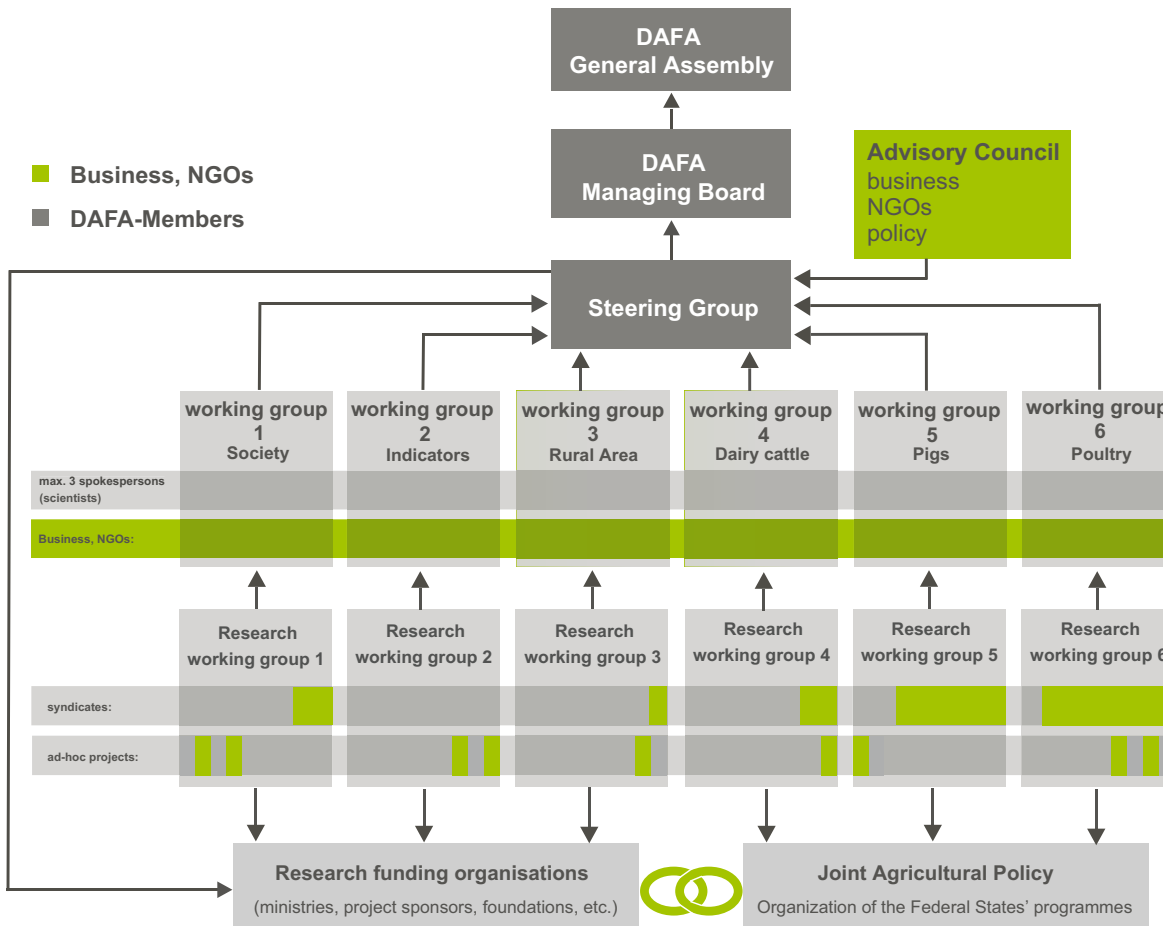
To protect the coherence of the approach, it has been proposed that at least one member of each Working Group should also be a member of the Steering Group. In detail, the Working Group spokespersons will fulfil the following tasks:

- Organization of workshops where sub-objectives will be discussed and refinements of the strategic orientation of the Working Groups will be prepared.
- Central coordination of proposals regarding the further development of the Working Group activities and collaboration in the initiation of research consortia.
- Reporting to the Steering Group and collaboration in meetings of the Steering Group regarding the development of the Expert Forum.
- Advising research funders prior to the calls for tenders (together with the Steering Group).
- External representation of the Working Groups towards third parties.

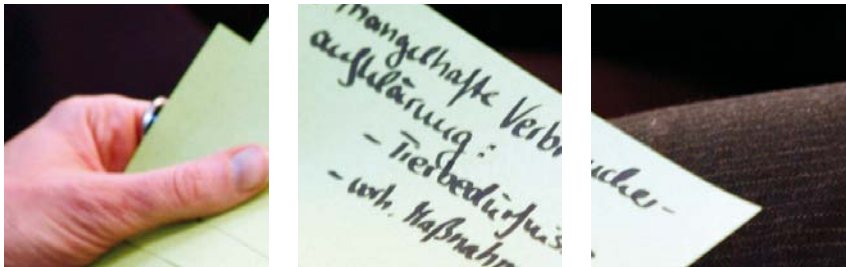
The spokespersons should only come from public sector research establishments in order to protect the scientific independence of the Forum's work. The collaboration of interest groups, businesses and individuals in the Working Group's content-oriented work is not only foreseen, but greatly encouraged. Appropriate event for this could be the workshops of the Working Groups and the whole Expert Forum, where approaches to and results of the research are discussed. Tangible private sector participation in the work of research consortia is also possible.

The Working Group spokespersons will report to the Steering Group which in turn will be responsible for reporting to the DAFA Managing Board and the DAFA General Assembly. In the event of disagreements between a group of spokespersons and the Steering Group, both will report individually to the DAFA Managing Board which will then decide how to proceed or submit a proposal for decision to the members of the DAFA General Assembly.

Figure 6: Organizational structure of the Expert Forum



5 The Working Groups



The description of the scientific and technical focus of the Working Groups results from (a) meetings of the Livestock Expert Forum in October 2011 and March 2012, (b) workshops related to the BMELV (Federal Ministry of Food, Agriculture and Consumer Protection) in 2011 (e.g. Charta-process), (c) discussions within the Steering Group and (e) discussions with scientists that have shown their interest in joining and participating in meetings of the Working Groups.

Based on the central objective, two to three approaches with the best prospects for achieving the aim which could not be realized with conventional means of funding will be identified. These should be the focus of the work of the Expert Forum.

This focus must (and will) not result in a situation that would exclude all other approaches from research funding. Only parts of the total research funds will be directed towards the DAFA projects so the majority of funds will be available for other projects.

It would not make sense to establish all research within the DAFA framework. It is our aim to support long-term projects of practical relevance that draw heavily on interdisciplinary work and are of particular importance for the central objective of the Expert Forum.

Figure 7: Overview of research approaches / Working Groups



Working Group 1: Society

- expectations
- market segmentation
- action for policy



Working Group 2: Indicators

- evaluation
- development of new indicators
- implementing of a system



Working Group 3: Rural Area

- regional concentration
- emissions from different livestock production facilities



Working Group 4: Dairy cattle

- improvement of animal health
- optimization of differently intensive systems
- automation and animal welfare



Working Group 5: Pigs

- designing fundamental system alternatives
- improvement of existing systems



Working Group 6: Poultry

- designing fundamental system alternatives
- improvement of existing systems



Working Group 1: Society

Objective

Analysis of societal expectations, labeling concepts and options for policy

Many Germans are critical about the development of modern livestock farming even though they are largely uninformed about production methods. Reservations are often expressed in phrases such as ‘agribusiness’ or ‘factory farming’. Even many people familiar with agriculture think that certain forms of livestock farming are problematic. Depending on their system of values, the reservations refer for example to deficiencies in animal welfare, use of pharmaceuticals, the effects of large scale farming, geographical concentration or emissions from livestock farming. These criticisms and the debate around them are the central reasons for setting up the DAFA Livestock Expert Forum.

Since scientific and policy communities want to direct the limited resources towards an improvement of the situation, it is necessary to set priorities. These are set for example in relation to the foci of public debate. But this is where the research must start.

First, an analysis of how people form their opinions about livestock farming and how they want these opinions to be represented in society is required. What sources of information do they use? How much do they want to get involved in addressing the problems of livestock farming systems? To what extent do they want to delegate responsibility for resolutions and to whom? Are different social groups willing and able to prioritize the individual problems?

Second, citizens’ preferences regarding different target conditions of livestock farming need clarification. Which grievances are judged as most critical? How are principles and target states compared? How should priorities be set in the event of trade-offs (e.g. production cost versus animal welfare)? These scientific analyses of social expectations regarding livestock production are expected to result in insights that will be important for further refinement of concepts in the other Working Groups.

In developing concepts for improving performance, it is not only important to know the expectations of people, but also to clarify how to convert these expectations into changes in purchasing behaviour and lifestyle. Measures for further development of product identification (labeling) can be drawn from this as well as indications of how and up to which degree stipulations within the food chain (e.g. voluntary agreements of businesses or the whole sector)

could be an appropriate approach for addressing societal concerns.

Market transparency and segmentation (e.g. using labeling, voluntary agreements) are likely to result only in partial successes. In this event, additional policy measures (e.g. statutory requirements for animal welfare) are required to secure the desired social outcomes. In this context, the following questions arise: What policy options are available? What would be the impacts of the different options? What are the recommendations for the policy community?

Research approach 1A

Interdisciplinary development and sustainable operation of a research infrastructure to analyze societal expectations and aspirations

As the topic livestock production is very complex, ad-hoc surveys will not provide all the evidence required to answer these questions and result in guidelines for a refinement of the production systems. This Working Group needs to focus on collaboration between the scientists, other individuals and focus groups. Additionally, representative surveys with large sample sizes could be conducted.

Semi-structured interviews of individuals and analyses of focus groups will help to investigate (a) the formation of opinions about different aspects of livestock production and (b) how different social groups rate different target conditions. In relation to (b), the assessment of the characterization of livestock production systems is required before examining how

opinions are formed. This is the only way this work can provide the results needed by the other parts of the Expert Forum.

Further analyses will examine how focus groups modify their rating in response to an increasing level of information about livestock production. The ratings of 'learning' and 'previously not informed' focus groups will be compared. These analyses will help to recognize the impact of information and its editing and will be the basis for a refinement of communication.

The focus groups will represent a broad spectrum of the population and will be manned in a way that enables clear answers regarding the forming of opinions in different social groups. There will be some focus groups whose members work in livestock production. The collaboration of these groups will increase the awareness of different improvement strategies and their possible impact.

As the results of this Working Group are an essential basis for the scientific orientation of other Working Groups, it is necessary to refine its organization. It is far from enough to limit work to methodical basics and selected case studies. The aim is to create a sustainable and versatile research infrastructure that can produce ad-hoc results if required.

Research approach 1B
Analysis of concepts for product identification and market segmentation

The results of the focus groups and additional surveys will be analyzed to ascertain how the government and/or the private sector should inform consumers about process quality and how this might influence their purchasing behaviour.

The resulting insights can influence concepts aimed at an increase of the role of consumers in achieving desired production systems. The basis of such concepts can be either seeking the highest possible transparency of individual products (e.g. an animal welfare-label for each product) or aiming for voluntary agreements of individual businesses or even the whole food sector to sell only products whose production has fulfilled certain minimum criteria.

The development of such concepts and the assessment of their impacts are not trivial. Numerous legal and economic aspects have to be taken into account - especially if quality standards are to increase over the course of time. Prices of products produced under improved welfare conditions will have an increased difference to the prices of standard products. Therefore, consumers and food retailers will not drop the standard product segment completely.

In an open market, this process can result in confusing product ranges and label competition. As a consequence, progress in improving animal welfare may slow down and controversy could arise between representatives of different segments of the food chain. The definition of terms such as 'animal-friendly' and the ac-

cusation of trading with false promises would become more common. Experience shows that as a last resort, policy will intervene to develop binding rules. Supporting this intervention is a task for agricultural research.

In supporting these developments and debates, research focused only on system components and their resulting individual scientific questions is not sufficient. Research establishments supporting DAFA need to address (a) the development and refinement of basic concepts for successful labeling, (b) the drafting of options for the implementation and assessment of impacts and (c) the development of advice and identification of (new) research fields. Based on these first-level steps, further research approaches for a second phase can be developed.

Research approach 1C

Analysis and evaluation of courses of action for policy regarding animal welfare, environment and agriculture

It must be assumed that an improvement of livestock production needs policy action in diverse fields such as consumer policy (see labeling and prevention of marketing fraud) and the classic fields such as animal welfare policy, environmental policy and agricultural policy (restrictions, taxes, subsidies).

Many important questions requiring answers (especially regarding restrictions) will be addressed in the Working Groups 3 to 6. It makes sense to have research consortia examine how the legal framework needs to be changed in order to be able to introduce evidence-based and socially-accepted solutions as quickly as possible. Against this background, this subgroup focuses on two higher-ranking fundamental questions that are important for all animals.

The first fundamental question is how an international open market economy can succeed in the implementation of higher standards for process quality for one economic region (e.g. EU, Germany) without a resulting shift of production to regions with lower standards. Basically, the available policy options are known (e.g. consumer-orientated policy approaches, the purchasing of public goods through the Second Pillar of the Common Agricultural Policy, or modifications of foreign trade policy, see chapter 3). But many research questions relevant to policy development are not answered yet, so policy relying heavily on evidence cannot be developed.

In investigating science-based solutions, economic and legal aspects are in focus. Is it possible to protect EU animal welfare standards in foreign trade? Is it possible to 'purchase' particularly animal-friendly production forms (e.g. investment incentives, continuous aids)? What would be the impact of the different options and how can they be compared? Which options do German or EU policies have to influence production methods in third countries that aim to deliver for the EU market?

The second question concerns advantages and disadvantages of the international separation of feed production and use. Mainly social, economic and environmental research topics will be analysed here: How can feed production systems and livestock production be compared internationally? Which social, economic and environmental effects does the international trade in feed have? How can the trend towards international specialisation along the value chain be reversed? What would be the impact of a substantial limitation of feed import into the EU?



Working Group 2: Indicators

Objective

Overview of positions, trends and options in livestock production

The DAFA Expert Forum aims to achieve a measurable improvement of livestock husbandry in the view of society. This is very ambitious.

To monitor the progress in terms of the comprehensive goal and to identify where further refinement is required, the progress (in regard to the terms of Working Group 1) has to be observed continuously. Therefore, it is necessary to develop a system of indicators. These indicators must be relevant to the socio-political objectives, be practical and enable a holistic assessment of the situation.

To verify progress in terms of the strategic objectives, especially those of the animal species

related Working Groups, the Indicators Group is of central relevance. The importance of indicators lies far beyond their use for the DAFA strategy. In the future, indicators will gain relevance for various fields. The current draft for the modification of §2 of the German animal welfare act (TierSchG) implies operational self-monitoring. Indicators can support the management of businesses (e.g. benchmarking systems), provide clear information for consumers about the status quo in livestock production and allow an integration of animal welfare into the quality management of the food chain (including support of risk-orientated analyses of meat). They help to realize and control the implementation of animal welfare and to develop target-orientated supporting measures for improvement of animal welfare and their control.

Even though these fields of use are very distinct, the use of methodology has to be harmonized in order to be able to use it in different fields of application.

Research approaches in Working Group Indicators

Development and implementation of a system of indicators that is connected to social expectations and can be used to produce reasonably priced food

World-wide, indicator-related research is at an advanced stage of development. The challenge of this Working Group is to refine and integrate these approaches in order to develop indicator systems for different areas of application (national coverage, rating of policy, management consultancy).

This objective will not be easily achieved. Developing a system of indicators that can be synergistically used for different fields of application entails addressing the challenge of jointly meeting the requirements for validity, reliability and practicability. Practicability means that the system can be used at reasonable cost to producers. This can only be achieved through close interdisciplinary cooperation between business, policy-making and society.

As this task is very complex, priority in this early stage needs to be given to indicators for the most important livestock species or production units. These include dairy cattle, beef cattle, pigs, fattening turkeys, laying hens, and broiler chickens.

Basically, the required research can be organized in three interlocking fields that build upon each other.

Research approach 2A Evaluation of existing indicators

Many different indicators and systems of indicators already exist. Research projects constantly use indicators to monitor the effects of husbandry techniques on livestock. But these indicators are mostly customized for the respective projects and their use can be very sophisticated. During the official meat inspection, indicators of animal welfare are gathered. Different producers' associations have developed benchmarking systems that consider animal-specific indicators. In the European Welfare-Quality® project, survey protocols for animal specific indicators have been developed. The resulting indicator systems are mostly output-oriented, i.e. indicators based on the animal are used. There are also concepts that use resource- and management-specific indicators in addition to animal-based indicators or others that only refer to resource-specific indicators. Examples are Animal Welfare Indices (TGI), parts of which are used for some labels, or HACCP-concepts that have been developed for hazard analysis and critical control points regarding the impacts of husbandry systems on animal welfare. The National Assessment Framework for animal husbandry (Nationaler Bewertungsrahmen Tierhaltung) is a concept based solely on resource-related indicators.

These existing concepts are a good starting point. It is important to gather and analyze them systematically. The analysis must consider the basic suitability, the validity and reliability, the practicability and efficiency of the indicators in regard to their refinement. Another aim for this sub-group will be the identification of key indicators with sufficient significance for their respective use.

Based on the efforts to establish a coordinated animal welfare network within the EU whose aims include the harmonization of indicators concerning animal welfare, it is necessary to cooperate and feed the research of this sub-group back to research groups and research users in other European countries.

Research approach 2B

Development of ground-breaking species-related indicators

This sub-group will analyze how to automate the gathering of data used in indicators. It aims to optimize the efficiency and reliability of indicators. The analyses will cover different possible collection-sites e.g. surveys of abattoirs, on-farm, and during transport.

Furthermore, the range of indicators is to be enlarged. Presently, most indicators aim to identify negative effects on livestock. However, indicators should also address positive effects. Terms such as 'animal protection' or 'good animal welfare' are relevant here. Research regarding positive emotion is relatively new, but promising. Therefore, they will be covered by this sub-group.

Another innovative and promising approach is the investigation of biological markers that can be used as indicators for animal welfare.

Research approach 2C

Implementing a system of indicators

This sub-group will develop methods and procedures for an implementation of the indicators. It will investigate which indicators can be integrated into and moved within the value-chain in order to enable their use in different fields of application.

An important research topic is the concentration of information by combining data related to different indicators for a range of applications. Furthermore, the feasibility and need to weigh different indicators needs to be taken into consideration. The comparability and rating of indicators for different aspects (e.g. behaviour, animal health) are part of this research.

To facilitate the acquisition of data in implementing indicators, barriers to the use of indicator systems have to be analyzed. In this context, systems of incentives to support the use, funding possibilities, management and protection of the resulting data, and legal questions regarding the acquired data have to be considered.

Additionally, the communication of results to the respective users (producers, the trade, and consumers) has to be taken into account. A close connection to the research of Working Group 1 (Society) is appropriate here as the expectations of society for transparent communication have to be considered.

In view of the aim to comprehensively cover livestock farming conditions, the system of indicators has to be extended beyond the immediate environment of the farm animal. Means of integrating environmental indicators will be provided from the very beginning. It is planned to cooperate closely with Working Group 3B that identifies emission values for different livestock farming facilities.



Working Group 3: Rural Area

Objective

Reduction of environmental impacts and optimization of spatial distribution

Livestock farming is part of the rural areas and contributes to a socially desirable development of these areas (regional economy, landscape, etc.). Livestock production is often in competition with other land uses (e.g. residential use, tourism). Production units emit nutrients, dusts, odours, sounds and germs which can interfere with people, businesses or habitats. This can occur even over distances beyond the immediate vicinity of production. Closer analyses show that there are two categories of problems that have different sources and therefore require different solutions.

The first issue is the spatial distribution of livestock production. In recent decades, concentration of production in some areas has continued. Production is now highly concentrated in some areas while other areas contain very little livestock. In view of nutrient loading and animal disease risk, high spatial concentrations are viewed critically. The challenge is to develop a legal framework that results in an improved spatial distribution of livestock production.

The next question concerns livestock production units and their emissions – independent from their location in areas of highly concentrated livestock farming or an even spatial distribution. The challenge is to refine the production systems in order to minimize emissions and undesired effects in their neighbourhood.

Research approaches in Working Group Rural Area

Obviously, these issues need completely different research strategies and different research consortia. Regarding the first, the research questions are primarily spatial and related to organisational planning with an important focus for example on the spread of infectious agents. The second area requires research in production technologies involving a close cooperation between livestock producers, technicians and management experts.

Research approach 3A Supervision of spatial distribution in sustainable livestock farming

Presently, there are three types of problems that arise especially in areas with high densities of livestock production: the oversupply of organic nutrients, the high risks of epidemics, and the emissions from large-scale livestock farming (for the latter see sub-group 3B). However, the spatial concentration of livestock farming has advantages (e.g. positive cluster-effects, regional value chains). The challenge is to balance advantages and disadvantages of different distribution patterns. The different levels of policy (from the municipality up to central government) could act to archive optimal distribution results over time.

The rating of different spatial patterns must consider the variety of regional frameworks so that the indicators can be feasible. The indicators should (a) show the economic, environmental and social effects of a spatial concentration of livestock production, (b) be transferable to a consistent system of evaluation and (c) consider interactions between livestock production and alternative land use (e.g. bio-energy, tourism). The overall result should be a rating framework for comprehensive use and the evaluation of different livestock concentrations as an element of multifunctional areas.

This research approach will explicitly consider the question how to rate different spatial distribution patterns of livestock production in regard to the control of epidemics and disease prevention. In this context, past experiences must be analyzed, taking into account the design of different spatial constellations, animal

species, epidemics and control strategies. On a short-term basis, the results can be used for the evaluation of prophylaxis, to develop control strategies and to advise the business and policy communities with respect to spatial planning.

Findings from the above-mentioned analyses will (under consideration of results from subgroup 3B, see below) conclude that certain modifications to the spatial distribution of livestock farming make sense in the long run. This raises questions about possible courses of policy action and the evaluation of different options.

A wide range of policy fields need to be taken into consideration (e.g. construction law, spatial planning, agricultural policy, animal epidemics policy, environmental policy). For each of the policy options, the responsible agents on the regional level (e.g. municipal, district, state, federal) need to be identified. Economic, environmental and social effects should be taken into account when rating the numerous options. The regional impacts of the different approaches will be analyzed on the basis of selected areas (e.g. areas of high concentration of livestock farming or areas with low animal concentration and spatial potential).

Research approach 3B

Minimizing environmental impacts of livestock production facilities

At national and European scales, livestock production is an important source of airborne emissions (ammonia, gases with climatic effects, odours, dust and biological aerosols) that have an impact on the environment. These arise from the application of animal manures as well as the housing systems.

Environmental pollution by livestock production is subject to national and international regulations for air pollution control and climate protection. These imply a transformation of scientific results into policy interventions. For many areas of livestock production, there are already reliable data. However, there are also significant gaps in data regarding new livestock production systems and certain parameters (especially biological aerosols). This insufficient evidence base hinders the advance of animal- and environmental-friendly production systems. Furthermore, it results in different applications of emission control and environmental law in different federal states. For example, the lack of data complicates an appropriate evaluation of the environmental impacts of open barns, surfaces and diffuse sources. The insecurity in the evaluation of emission behaviour in open coverage type results in lower acceptance among the population and partly among approval authorities, and therefore in non-approvals. Furthermore, the lack of data hinders the approval and spread of animal- and environmental-friendly forms of production at a European level with respect to the exchange of information on Best Available Technologies

(BVT) within the IED directive, the discussions regarding the UN/ECE emissions reduction protocol and the NEC directive for the reduction of ammonia emissions.

The following important research topics arise from this analysis:

It is planned to develop nationwide harmonized measurement methods for emission factors of various new higher welfare husbandry systems (e.g. ambient air and naturally ventilated housing systems with runs and/or straw). The selection and prioritization of the processes must be defined in collaboration with the other Working Groups. In advance, basic methodical research is required especially regarding the emissions of biological aerosols and germs. The impact of different measures will also be analyzed based on nationally and internationally harmonized measurement methods and evaluated with regard to state of the art techniques and new requirements.

The models for the calculation of transmission and emissions are not sufficiently validated for specific near-ground and diffuse sources and are therefore often challenged. The same applies to the transport of gases and odours and even more for the transport of particulate substances or biological aerosols. Regarding the latter, the knowledge base is weak. The existing scientific models must be analyzed regarding their practicability.

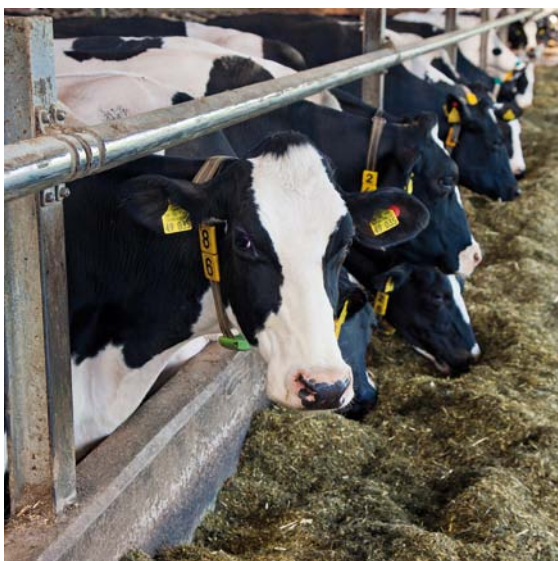
The effects of gaseous emissions and dust on health have already been analyzed. Regarding biological aerosols especially outside the housing facilities (low concentrations), the health risks are not yet known. There are neither thresholds nor limits. It is impossible to draft

legal frameworks while lacking evidence about the effects of the relevant emissions on health.

The consideration of scientific evidence in developing legislation is problematic. Local officials need access to methods that support them in managing the planning process.

A visionary aim could be the development of the so-called 'zero-emission-housing system'. This does not signify that the animal house itself does not emit, but that the balance of the whole process chain does not result in net emissions.

This Working Group needs to cooperate closely with the Working Group 2 (Indicators) as well as with the animal species related Working Groups 4 to 6 (Dairy cattle, Pigs and Poultry). The calculated factors of emission are also input parameters for a system of indicators that rates the environmental effects of livestock production units. The data that have possibly been acquired during the measurements of emissions are indicators of animal protection in livestock production systems.



Working Group 4: Dairy cattle

Objective

Improving animal health by optimization of milk production systems

As both dairy and beef production are facing big challenges, it would be justifiable to develop research strategies for the two of them in this Working Group. However, the comprehensive aim of the Expert Forum is to combine forces for a measurable improvement in livestock farming which requires focusing. This means that some degree of concentration is required. Three sub-groups are therefore working on dairy cattle.

Contrary to pig and poultry farming, dairy farming has not yet been the focus of the same degree of public criticism. But the restructuring of agriculture is also rapidly advancing in the dairy sector and at least a part of the population will critically evaluate the resulting forms of production and herd sizes. The main focus – as with other livestock species – is on the sizes of herds, animal health, automation and animal performance.

From a scientific viewpoint, the problems of many dairy farms with respect to animal health and fertility cause some concern. The advancing mechanization of dairy farming could aggravate these problems if business management cannot keep pace. However, with modern technology, production systems can be adapted to the animals' needs, the care for livestock can be intensified and comprehensive data sets can be used to support preventive animal-health management. This rapidly changing sector is faced with the challenge to use the technological possibilities and to limit the risks.

Research approaches in Working Group Dairy cattle

To approach the main objective of this Working Group, different research strategies have to be followed simultaneously. These considerations have resulted in three sub-groups. The main idea of this research approach is the improvement of animal health and the animal protection within production systems. The approaches are (a) the development of animal health concepts, (b) the development of alternative production systems and (c) the use of technologic improvements, especially sensor technology.

Research approach 4A

Concepts for the improvement of individual and herd health, particularly in problematic areas

The ultimate aim of this sub-group is to generate scientific evidence for a sustainable improvement of animal health through the intensive use of data in the provision of advice. Extensive animal- and business-specific data that have not been used sufficiently yet and new developments in technology are good pre-conditions to develop the fundamental data bases for such advisory systems. However, these data will have to be updated with new phenotypes of animal health. Therefore, generating the necessary data is an important task for this sub-group. In view of the required data, the sub-group will have to cooperate closely with the sub-group 2A.

The development of animal health concepts in this sub-group is based on three basic approaches:

- Basing concepts on the indicators developed in close cooperation with sub-group 2A (e.g. claw-diagnoses, specific causes of premature culling, disease diagnosis etc.). Management concepts for a sustainable improvement in animal health will be developed and tested (e.g. animal health plans). This is the basis of a close cooperation with sub-group 2B.

- Simultaneously to this approach focused on management-associated problems of animal welfare, factors can be identified that are more closely connected to husbandry-related aspects and feeding. Those should also be refined and improved.
- By finding the genetic and physiologic reasons for individual differences in animal health, biological markers will be identified in order to contribute to a breeding-related improvement of animal health and used as a basis for the development of new indicators in cooperation with sub-group 2B.

This sub-group is considered a necessary individual research field, as the past has shown that problems of health and fertility are often caused by deficiencies in husbandry, feeding and management. The high individual and herd variability in animal health is of high relevance for animal welfare, especially for farms that are positioned at the lower end of the spectrum regarding mastitis incidence, metabolic and fertility problems. Therefore, the approach is primarily focused on the question how to identify problem animals or problem facilities and which information, incentives or sanctions are most suitable to convince managers to modify their livestock production, feeding and management in regard to optimal animal health conditions. The target audience for analyses and measures for herd health should be the lowest third of farms that have been resistant to using advisory services in the past. Direct compulsory measures should only be used for very substantial deviations as ultima ratio. Therefore, the refinement of concepts for motivation and advice should be an important task for this sub-group. Past experiences with animal health plans can

be used as methodical support. Nevertheless, different methodical options should be analyzed.

For the practical implementation of the task, it is necessary to start with a consistent merging of data sources regarding animal welfare and the organization of comprehensive data acquisition. However, this approach will not result in adequate coverage of all areas. There is a particular need for further indicators regarding metabolic stability and clinical fertility problems. For example, cell count data are not an adequate indicator of the incidence of mastitis. Priority should be given to the analysis of genetic and physiologic reasons for in-herd variability in animal health status. This could lead to the development of innovative biological markers.

In addition to the immediate effects, this sub-group can contribute to the basic principle of the new animal welfare act. This principle implies that each livestock farmer should establish and operationalize monitoring systems to permanently monitor animal health and fertility in dairy farming. Successful implementation needs an adequate legal framework. In this respect, countries such as Denmark, Sweden and Austria are ahead of Germany. Therefore, this Working Group will develop the scientific fundamentals needed to shape the legal framework by the policy community. This needs to comprise the legal prerequisites for merging the data that has been acquired in different locations into a central database. The framework has to prepare an obligatory and comprehensive acquisition of health information as well as to determine aims for animal health that will be the basis for sanctioning problem farm businesses.

Research approach 4B

Optimization of production systems with high and average milk performance

It is most likely that the general trend towards increasing milk performance per cow will continue – nationally and internationally. The recent developments have shown that well-managed farms can use the steadily increasing genetic potential of high-performance cows without increased animal health problems. Nevertheless, the requirements in feeding, husbandry, breeding and management of livestock are increasing so that the development of optimized management concepts for high performance herds is an important research target.

An emphasis on high milk yields is not suited equally to all sites, managers and marketing channels. Comparative analyses of German production regions illustrate that high milk yields are to a certain degree an indicator of economic effectiveness. International comparisons show that different local conditions result in differences in the optimal intensity and the optimal milk performance per cow. To date, the optimal yield level as affected by local circumstances has not yet been the subject of research.

Farmers considering new approaches to managing their dairy herds need guidelines (a) for the optimization of extensive production methods and (b) on their optimum economic performance compared to maximum-performance production. Economic analyses will consider the effects of agri-environmental policy measures and special marketing programs (e.g. pasture-milk). Finally, different production sys-

tems (intensive and extensive) and concepts of management and marketing will be compared.

This sub-group aims to (a) develop customized systems, (b) analyze their economic, environmental and social impacts and (c) support local and knowledge-based advisory systems. Three areas of research are planned:

- Pilot farms (or pairs of pilot farms) will be established where the two different concepts will be simultaneously run, individually optimized and compared. These farms will be used for demonstration purposes.
- There will be systematic comparisons between farms in Germany and other countries that work with one of these two philosophies under comparable local conditions. These comparisons seek to deliver large data sets to support assessments of competitiveness, animal health and environmental effects.
- The development of breeding programs considering economic and animal-welfare aspects in order to establish an optimal genetic basis for herds with high and average performance levels.

Research approach 4C

Shaping automation for the benefit of dairy cows

The automation in dairy farming is advancing rapidly. Fully automated milking systems are state of the art. Feeding and manure removal can be mostly automated. Depending on the way it is implemented and managed, automation can either be positive or negative for animal welfare. Fully automated milking enables each dairy cow to be milked at her demand. At the same time, there is the risk that animal observation may be neglected and animal health can be affected.

The data generated in these systems are very relevant to economic performance. Data that are individually acquired by diverse sensors can be used to shape the process of production individually to the benefit of each animal. This application ideally requires that the data sets are reasonably compressed, analyzed and prepared for process control (automated or to support the manager's decisions). With such large data sets, there is a need for research on the internal and external merging of data from different systems.

This sub-group will conduct the research required for the development of rules that are primarily needed on research stations in close cooperation with the industry. The etho-physiological responses of animals is the main research area involved in optimizing automated systems for the benefits of the animals. Simultaneously, associated teams will be established wherein farmers and advisors (a) rate the research approaches and contribute their ideas and (b) compare the interim results of the exper-

imental research to the experiences from their farms. This will rapidly create a wide-ranging knowledge base to help farmers use automated production processes.

One focus of this sub-group will be the merging and analysis of automatically acquired data. The new technologies will provide milk producers with significant autonomy. Thus, traditional ways of performance assessments and analyses of farm businesses will be challenged. In the past, these were important elements of management, advisory services, animal breeding, agricultural statistics and policy advice. In future, central data gathering will still be required. For this reason, new concepts will be developed that can offer attractive data analyses as a reward for the data supply. In view of a possible use of the newly acquired data as indicators, there will be a close cooperation with Working Group 2 (Indicators).

Parallel to this research, Working Group 1 (Society) will analyze the social acceptance of automated husbandry systems. The focus will be on the correct representation of the advantages of automated processes to people without expert knowledge. The limits of acceptance of automation will be assessed as an input into research strategy development.





Working Group 5: Pigs

Objective

Improvement of pig production systems

Following the numerous expert discussions in 2011, it is clear that production systems that cannot ensure the physical integrity and the welfare of livestock will not be accepted by large parts of the population. There are already methods of pig production with better welfare outcomes, known for example from organic farming, but they have not gained significant importance in main-stream agriculture. Therefore, it is not a question of 'if' but 'when' and 'how' pig producers will be forced by changing frameworks to stop the castration of piglets without anesthesia, the amputation of tails and maybe further manipulations of the animals (e.g. teeth clipping).

Farming is therefore facing the question whether future expectations for animal care and welfare will be met by refinement of current production systems or if fundamental change is required. Answers to this question differ greatly. In addition, further negative aspects of the current development of pig farming have to be considered in the following areas: breeding (litter performance), animal nutrition (stomach ulcers), animal health (antibiotics) or production economics (farm size). These different problem areas are closely connected.

Should policy consider fundamental modifications of the production systems, it can be realistically expected that the sector will be granted long adaptation periods. However, under pressure from public debate, the pig sector may be required to change faster and introduce – as has already happened with shell eggs – the higher requirements for husbandry systems in advance of the normal fixed asset replacement cycle.

Research approaches in Working Group Pigs

The starting situation depicted implies a two-fold research strategy: First, science should plan ahead and try to scrutinize production systems as a whole and develop completely new approaches that meet the expectations of especially critical demographic groups. This can but will not necessarily mean that these systems will only have the capacity to compete in small niche markets. Second, science should also work on gradual improvements of current production systems so that they remain competitive in the global (mass) markets and simultaneously deliver measurable improvements in animal protection and animal health.

Research approach 5A Development and analysis of new pig production systems

The development of fundamentally different husbandry systems is a big challenge for science. The first question will be how to prioritize the weaknesses of the current systems. This is of importance if it should prove impossible to develop a production system that is better in meeting the requirements for animal and environmental protection than current systems or if conflicting goals between animal and environmental protection arise. A complete evaluation of current and future systems considering all relevant aspects is desired. There will be further analysis whether advantages in one sector (e.g. animal welfare) will have to be traded against disadvantages in other sectors. In such situations, the rating of production systems will depend on public judgment.

It is important for the success of the Expert Forum to address aspects not only abstractly (What is more important for you, animal welfare or emission reduction?), but to have substantial references to the planned or analyzed production systems (How do you evaluate the introduced alternatives based on the following information?). Therefore, a close interplay between Working Group 1 (Society) and this subgroup is required.

The innovations arising from this work can only be developed through interaction between technical and farm business research. In the past, interdisciplinary approaches with the aim of developing new production systems have been rare. Therefore, an innovative approach to research funding is sought within the Live-

stock Expert Forum. It is proposed to begin with a competition of ideas based on concept notes (in the style of architectural competitions in the building sector). These would be based on outlines of impacts. The selected concepts would be taken forward for development, trials and impact assessments. Should it become clear that – despite optimization based on scientific and economic analyses – the alternative production of pigs would be impossible without a significant increase in costs, the question of marketing potentials would have to become an important part of the research strategy. The concepts put forward should set out market effects and how these will be achieved. The scientific analyses that will be required over the course of research have to include the question of international competitiveness and should be closely harmonized with food system economics.

Research approach 5B

Improvement of existing production systems

While the results of the sub-group 5A will presumably change agricultural practice only in the long-term, the research approach of sub-group 5B is oriented towards continuous gradual improvements of the current production systems. Sow longevity and comfort, sustainable high animal welfare systems, work management and husbandry will be considered in particular. The research approaches will also consider experiences with the advantages and disadvantages of already existing alternative production systems.

The establishment of farm comparisons with the participation of several hundred businesses is expected. The choice of businesses will be designed to result in homogenous groups of businesses. Within these groups, specific variations of the adaptation measures will be introduced. Depending on the funding of the Working Groups, it may make sense to establish several of these large groups from the very beginning to better cover different starting positions (regarding housing, production system and farm size).

The main focus is to create sub-groups within the homogenous groups of businesses that can thoroughly trial different adaptation strategies and probe their impacts. These analyses require deeper data sets than are usually available (e.g. slaughtering results, possibly the acquisition of data on animal behavior). In harmonization with Working Group 2 (Indicators), the comparative analysis of the results will support conclusions regarding the modification of experimental approaches that will be – again comparatively – analyzed during the following periods. Additionally, certain questions can be identified and scientifically analyzed at research centers.

To secure business participation in examining these concepts, additional expenses will have to be reimbursed. Various additional costs include supplementary data acquisition, the adaptation measures in the production systems, and the risk of reducing economic performance. The prerequisite for this concept is that individual federal states take part which can fix appropriate objectives of funding in the program planning that they are required to do within the framework of the Second Pillar of the Common Agricultural Policy. The innovation partnerships that have been proposed by the EU commission may offer a promising new approach.



Working Group 6: Poultry

Objective

Improvement of the production of eggs and poultry meat

Poultry farming in particular is in the focus of public discussion. Regarding laying hens, this has already resulted in extensive changes in the husbandry of the animals and the labeling of foods.

The social debate about the production of eggs is not only focusing on cage system housing. Practices such as de-beaking or systematic killing of male day-old chicks are challenged. But it is foreseeable that even alternative husbandry systems (free-range and barn) will be challenged. Currently, these systems still have relatively good reputations, as the debate has been focusing on 'cage vs. alternative'. However, many fundamental problems (sexing, de-beaking, feather pecking, cannibalism, broken

bones, use of pharmaceuticals, and risk of epidemics) have not yet been solved in current alternative production systems.

The legal framework has changed less for broiler chickens than for laying hens. But there is critical discussion here, too. Criticism is focusing on the use of antibiotics that are, according to latest analyses, still widely spread. Conditions that increase the use of antibiotics such as small spaces, big group sizes, but also economic demands, supply requirements in contract farming and regional concentration are subject to discussion. It is also supposed that animals suffer from the impact of performance breeding and cannot behave naturally as a result. This is especially relevant in the production of turkeys and Muscovy ducks and especially valid in the later phases of production. De-beaking as is currently practiced is criticized, especially for turkeys and Muscovy ducks.

Research approaches in Working Group Poultry

The starting conditions for the development of a research strategy are very complex, so that interim strategies are orientated towards different timelines.

- The development and trial of alternative systems is required. The results will need some time to develop practical impact.
- Because of this long time span and the undeniable problem pressure (under the influence of the present debate regarding the use of antibiotics in poultry farming), simultaneous development of the current production systems is required and can enable at least an interim solution for current problems.

Both approaches require interdisciplinary cooperation between animal ethologists, veterinary scientists, epidemiologists, production technicians and economists. Furthermore, the integration of the various actors along the development chain is required to ensure that development meets the practical needs of economic production.

Research approach 6A New production systems for eggs and broilers

This sub-group is designed in the same way as sub-group 5A. Therefore, it will also rely on a close cooperation with Working Group 1 (Society). Even without anticipating the work there, the research planning has to begin with the assumption that parts of society will demand a radical change in poultry production systems. Therefore, the challenge will be to develop alternatives that address societal expectations, but at the same time have the prospect of supporting economically viable poultry farming.

At the outset of this long-term work, the sub-group will focus on laying hen and broiler production. Later, turkey and duck production can be involved in the work, based on the experiences with hens and chickens.

The whole value chain needs to be analyzed. This includes, apart from the vertical chain (grandparents' line, generations, laying hens and fattening poultry), the hatcheries, the transportation and the process of meat production.

An important prerequisite for the improvement of poultry production systems is to include scientific research on animal behavior. This involves the animals' interaction with light, structural elements and space. Without expert knowledge regarding flock dynamics, new approaches in poultry farming cannot be developed with confidence. Modifications of time- and space-structure in poultry farming that can contribute to animal welfare and will not adversely affect food quality and safety are required e.g. structural engineering (space and activities,

structured days, different activity and climate areas), the question of the size of individual animal units (flocks) within the barns and feed management (contents, structure, rhythm).

Biosafety and animal health are particularly important. How the production units should be arranged in the (local) area and in the housing system need to be analyzed. Considering this, important epidemiologic questions have not yet been answered properly. These relate to partitioning of space. The issues include optimal prophylactic strategies in houses or in outdoor systems, controlled ventilation for protection from germ entry, and (in cooperation with Working Group 3A) the spatial distribution of production units for the prevention of diseases spreading in wild and pet populations. Furthermore, it needs to be investigated how preventive measures can be adjusted to the individual animal or the herd and possibly be complemented with alternative prevention measures. That would for example include analyses of the use of pre- and probiotics that aim at stabilizing the natural defense and intestinal flora as a barrier against entering pathogens.

Within a fundamentally new approach the question of appropriate genetics has to be analyzed thoroughly. Facing the strong economic concentration in poultry breeding, especially this part of the research strategy relies on the cooperation with the business sector. Eventually, the breeding of dual purpose lines will be considered as a possibility to render the killing of male day-old chicks unnecessary. Furthermore, analyses are required of (a) how de-beaking (prevention of cannibalism) could be made obsolete by choosing other lines and (b) to what extent breeding lines that are less vulnerable to certain infections and illness-complexes than current lines can be developed.

New production systems can be economically viable if businesses have an economic advantage from investing in them. For this reason, the involvement of economic research is required from the outset. Production sector economic analyses have to (a) estimate the additional costs of alternative systems along the food chain and (b) analyze which locations (in Germany and internationally) are more or less appropriate for the developed production systems. Market analysis is required to estimate (a) the dimensions of the willingness to pay for certain product and process qualities and (b) which market organization is most appropriate to harmonize consumer demands and food production.

Research approach 6B

Improvement of existing production systems

The development of system alternatives that will take place in sub-group 6A requires long development and testing time-spans and eventually bigger investments in the farm-level development. New production systems will be established only in small markets at first, especially if they involve substantially higher production costs. Because of these facts, agricultural practice will be based on the current production structures for many years.

For this reason, sub-group 6B is oriented towards the short-term modification of broiler production to deliver a substantial decrease in the use of antibiotics without having to wait for fundamental system changes. The reduction of the use of antibiotics is important to mitigate resistance development, therefore it is necessary

to intervene in relation to those production problems that have required the use of antibiotics.

The first challenge is to improve data resources relating to the use of antibiotics and to process them in the best possible way for scientific analysis. The aim is to combine these data (which can be centrally acquired) regarding the use of antibiotics with additional information in order to be able to compare the different farming systems (including the vertical distribution) under the aspects use of antibiotics, their causes and effects. This corresponds to the work of Working Group 2 (Indicators).

It is planned to enlarge the range of production systems in a further level of research which will result in improved findings about the impacts of individual factors. For example, it will be investigated how a decrease in flock sizes (with the help of partitions within a unit) can positively influence the problems that can arise from illnesses and limit the necessary treatment to smaller animal groups. These studies require sufficient numbers of cases to deliver statistically reliable results. Such a range of cases can be acquired only through the involvement of commercial farms.

It will be necessary to grant financial compensation for additional costs and risks to those farmers that take part in the investigations. For this, the European Innovation Partnership instrument might be available as a new element of the EU agricultural policy.

Another challenge is the analysis of the effects of contracts used in poultry production. In view of the strong vertical integration, questions about information, training, and the effects of communication along the supply chain are of great importance. In regard to the antibiotics

problem, the question of optimization of veterinary treatment with advice and preventative approaches arises. Furthermore, research will examine how management that is flexible regarding delivery dates could allow reductions in antibiotic use and how these can be implemented by modification of contracts.

The question how the government can influence production systems by modifying prices is of particular interest in connection with contract-based production. It is to be expected that farmers that are under considerable competitive strain will use more antibiotics when they are cheaper and when the economic damage in case of illnesses or subclinical illnesses is large (decrease in performance, increased use of feed). For this reason, it makes sense to analyze the effect of policy on the cost-effectiveness of the use of antibiotics considering how such an approach could be implemented without adverse effects on the competitiveness of German poultry production.

In case an analysis of the effects of such contractual-organizational innovations in broadly established field studies is planned, it would be required to prepare a financial compensation for the farmers' additional costs and production risks.

6 Requirements for research funding



At present it is very difficult to make statements about the financial need of the different Working Groups. A first evaluation of the Steering Group led to the estimation that during the first phase (2013 to 2015), each of the 15 Working Groups or sub-groups will require about 1 million Euros per year. Some sub-groups could require higher sums. That would result in total requirements of 15 to 20 million Euros per year during the first phase.

Longer-term security of funding and appropriate research funding are as important for the success of the Expert Forum as the total amount of the funding.

■ **Longer-term security of funding:** Public research establishments are unlikely to adjust their overall research strategy to meet the needs of the DAFA Livestock Expert Forum if the planning horizon is limited to 2 to 3 years. Instead of a strategic change in research program direction, they are likely to regard shorter-term project funding as a welcome addition to existing research activities and direction. That would be contra-productive for the success of the Expert Forum. Therefore, research policy should, as far as it considers the basis concept reasonable, orient research funding towards longer project cycles and clearly communicate that.

■ **Appropriate research funding:** Research funding should be flexible and focused on the need of the research rather than be burdened by set funding criteria, especially with regard to contributions from institutes or contributions from the private sector. For example, the applicants should not be required to associate with businesses or individuals that do not actively support the research goal.

If the initial phase (2013 to 2015) is successfully accomplished, the annual need for funding of the strategy may increase remarkably as several Working Groups will enter into an expensive trial and realization process. This perspective may seem unrealistic or even presumptuous, but the following shows that the use of public funding at this scale can be appropriate:

- The research funding of the DAFA Livestock Expert Forum does not only aim to support scientific activity. Furthermore, it will enable a complex network of science, business and policy actors to accomplish an improvement of livestock production and its social acceptance. All actions will be oriented towards this aim.
- Should the DAFA concept not result in an achievement of the above mentioned goal, even 10,000 Euros of research funding would be too much. It would be unacceptable to misuse the present debate about livestock farming to direct research funding in a direction that will not result in progress and wider impact.
- Should it become apparent that the strategy will lead towards the desired results, it would be worthwhile for Germany to invest up to 20 million Euros per year or more to move consequently towards the goal.

Research policy will have to decide which amount of funding will be granted and how the organizational structure of the research for improvement of livestock farming should be developed. The following might be useful for this discussion:

- Livestock farming accounts for about 60 % of agricultural output.
- German agriculture receives substantial direct payments from the Common Agriculture Policy (more than 5 billion Euros per year) that are oriented towards agriculturally utilized areas and bear only little reference to livestock farming.
- The funding of biofuels through blending obligations has reached remarkable dimensions (more than 2 billion Euros per year) with most of this sum flowing into crop production.
- The national research strategy BioÖkonomie 2030 represents a commitment of 400 million Euros per year.
- As a 20 million Euros per year program, the DAFA Livestock Expert Forum represents about 3 cents per farm animal kept in Germany.

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DAFA thanks all persons who made posts and comments to the draft version and shaped by the lively discussion the DAFA Livestock Strategy.



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Other Research Institutes

-  Deutsches Institut für Ernährungsforschung Potsdam-Rehbrücke German Institute of Human Nutrition Potsdam-Rehbrücke
-  DITSL where science meets people German Institute for Tropical and Subtropical Agriculture
-  ZB MED Wissen für Mensch & Umwelt German National Library of Medicine
-  Fraunhofer IGB Fraunhofer Institute for Interfacial Engineering and Biotechnology
-  Fraunhofer IVV Fraunhofer Institute for Process Engineering and Packaging
-  ifl Institut für Ländliche Entwicklungsforschung an der Universität für Bodenkultur Wien Institute for Rural Development Research
-  KTBL Kanton für Technik und Bauwesen in der Landwirtschaft The Association for Technology and Structures in Agriculture
-  IAMO Leibniz-Institut für Agrarwissenschaften in Mittel- und Osteuropa Leibniz Institute of Agricultural Development in Central and Eastern Europe
-  ATB Leibniz-Institut für Agrartechnik Potsdam-Bornim Leibniz Institute for Agricultural Engineering Potsdam-Bornim
-  IGZ Leibniz-Institut für Gemüse- und Zierpflanzenbau Leibniz-Institute of Vegetable and Ornamental Crops
-  IGB Leibniz-Institut für Gewässerökologie und Binnenfischerei Leibniz-Institute of Freshwater Ecology and Inland Fisheries
-  FBN Leibniz-Institut für Tierproduktion Leibniz Institute for Farm Animal Biology
-  IPK GÄTTERLEBEN Leibniz-Institut für Pflanzenzüchtung und Kultur Leibniz Institute of Plant Genetics and Crop Plant Research
-  zalf Leibniz-Zentrum für Agrarlandschaftsforschung Leibniz Centre for Agricultural Landscape Research

Federal Research Institutes

-  BfR Bundesinstitut für Risikobewertung Federal Institute for Risk Assessment
-  DWD Germany's National Meteorological Service, Centre for Agricultural Meteorology Research
-  JKI Julius Kühn-Institut Federal Research Centre for Cultivated Plants
-  FLI Friedrich-Loeffler-Institut Federal Research Institute for Animal Health
-  MRI Max Rubner-Institut Federal Research Institute of Nutrition and Food
-  vTI Johann Heinrich von Thünen-Institut Federal Research Institute for Rural Areas, Forestry and Fisheries

Research Institutes of the States



Bavarian State Research Center
for Agriculture



Education and Knowledge Centre
Boxberg, National Institute for pig
breeding LSZ



Geisenheim Research
Center



State Education and Research
Center of Viticulture and Horticul-
ture and Rural Development



State Office for Rural Develop-
ment, Agriculture and Land
Reallocation (Brandenburg)



State Institute for Agriculture,
Forestry and Horticulture
Saxony-Anhalt



Hessen State Agricultural Office
(LLH)



State Research Institute for
Agriculture and Fisheries
Mecklenburg-Western Pomerania
(LFA-MV)



Agricultural Technology Centre
Augustenberg (LTZ)



Chamber of Agriculture Lower
Saxony



Chamber of Agriculture North
Rhine-Westphalia



Saxon State Agency for Environ-
ment, Agriculture and Geology
(LfULG)



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