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Draft national report



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List of abbreviations

AMI	Agricultural Market Information Service	HBV	Hesse Farmers' Union (Hessischer Bauernverband)
BMEL	Federal Ministry for Food and Agriculture (Bundesministerium für Ernährung und Landwirtschaft)	KULAP	Agri-environmental schemes in Bavaria (under the RDP)
BMU	Federal Ministry for the Environment (Bundesumweltministerium)	MR	Machinery ring (Maschinenring)
BLE	Federal Agency for Agriculture and Food (Bundesanstalt für Landwirtschaft und Ernährung)	Nawaro	Renewable raw materials (Nachwachsende Rohstoffe)
CAP	Common Agricultural Policy of the EU	NSS	National Sustainability Strategy
COM	Common Organisation of Markets	PGI	Protected Geographical Identification
DAFA	German Research Alliance for Agriculture (Deutsche Agrarforschungsallianz)	RAS	Recirculation Aquaculture Systems
DBV	German Farmers' Union (Deutscher Bauernverband)	RDP	Rural Development Programme
EEG	German Renewable Energy Law (Energie-Einspeise-Gesetz)	SPA	Special Protection Area
EFF	European Fisheries Fund	UFOP	Union for the Support of Oil- and Proteinplant Production
EMFF	European Marine Fisheries Fund	WAS	Agrarian service of Wetterau (Wetterau Agrar Service)
FAO	Food and Agriculture Organisation		

1 Introduction

Current agricultural, fishery and food policies and legal frameworks are often failing to effectively promote, and indeed sometimes even disadvantage, sustainable farming, fisheries and aquaculture practices. The purpose of SUFISA case studies is to identify sustainable practices, policies and markets in the agricultural, fish and food sectors that support the sustainability of primary producers. The in-depth analyses aim to support SUFISA's approach to go beyond the common understanding of market failure, legal and policy constraints.

The German case study analyses focus on the examination of market, policy and other relevant impacts for the commodities of fish from aquaculture and oilseed rape. These analyses are practice-based and aim to investigate farmers' conditions, strategies and sustainability performances (CSP) on a regional and (if needed) on the national level. The case studies will include the analysis of the drivers, conflicting interests and interplay between actors and/or institutions.

The selection of case studies was the first task of the SUFISA workpackage on practice cases (WP2). Jointly, SUFISA teams selected the following cases for Germany:

- A: Aquaculture production on the national level with a particular focus on traditional carp farming in Franconia. Trout farming in Baden and the potential of intensive fish production in circulation system are further aspects of this case study analysis.
- B: Oilseed rape cultivation for vegetable oil, bio-diesel and rape meal production - an area-based case study for the Wetterau in the Federal State of Hesse

On the global scale, aquaculture has been the fastest growing food industry. In European countries such as Norway, the UK (Scotland) or France, aquaculture is an important industry. In contrast, the German aquaculture industry stagnated on a very low level although conditions seem to be relatively favourable due to available water resources, technological capacities and the potential use of the exhaust heat from energy or other industrial plants. Experts assume that theoretically fish production in traditional and intensive aquaculture in Germany tends to be more sustainable than aquaculture in some of the Asian areas that show significant growth rates. Under these circumstances, the case study analyses aim to highlight the policy, regulatory, market and other relevant conditions that result in the apparently reduced competitiveness of a particular segment of the farming industry. Consequently, the German aquaculture case study will be of particular interest for the SUFISA project.

During the last two decades, German policy programmes and legal rules steered oilseed rape production and markets significantly. For that reason, rape is an excellent example for the analysis of the potential impact of new policy programmes and related direct changes in crop rotation on farm level and the development of food, feed and non-food processing industries.

The media analysis highlights major issues that general media in Germany are particularly interested. The key issues identified will influence the in-depth case study analysis in respect to direct concerns such as the Common Agriculture Policy but as well to crosscutting issues such as animal husbandry (ethics, sustainability of feeding regimes etc.)

The case study analyses are based on desk studies, stakeholder interviews and focus groups.

2 Media content analysis

2.1 Introduction of the media analysis

The aim of the media analysis is to detect the different positions and approaches in the respective national media with regard to the overall objective of SUFISA: to identify practices and policies that support the sustainability of primary producers in a context of complex policy requirements, market imperfections and globalization.

The research is based on both, the analysis of the general media and the specialised media for farmers and stakeholders. With the objective to identify the main topics discussed in recent years concerning agricultural sustainability in Germany, our methodical approach consists of different working steps. We started by searching for agricultural topics in national newspapers and magazines. The collected articles were analysed using a coding system in order to catch the main topics. Based on the identified keywords, we conducted an advanced search in order to detect relevant articles in the specialised press. In this way, we were able to identify key themes and conditions influencing farmers' strategies and performances.

The next chapter describes the methodological approach for the identification of main topics. Chapter 3 presents the results of the media analysis, followed by a discussion and conclusion.

This chapter shows the methodological approach of the media analysis. The working steps explained in the following sections are iterative and mutually influencing processes.

2.2 Selection of sources

The first step of the media analysis was the selection of relevant sources. We started by selecting **general media** sources. In order to represent the national debate, we decided to choose sources of the current leading media in Germany. These include the national newspaper *Süddeutsche Zeitung*, the magazine *Der Spiegel*, the most read newspaper *Bild* and the national radio programme *Deutschlandfunk*.

The objective for the selection of **specialised media** and **publications of government authorities and NGOs** was to identify sources, which represent different opinions, values, and political positioning. The specialised magazines selected for the analysis are the following: the farmers' magazine *Top Agrar* and the web-based platform for information on agriculture *Proplanta*. Publications of government authorities and interest groups were chosen from the *Federal Ministry of Food and Agriculture*, and the *German Farmers Association*. The selection of publications of non-governmental organisations (NGOs) is based on the development and environmental organisation *Germanwatch* and the *Critical Agricultural Report* containing contributions from a variety of NGOs. The annex for the media analysis shows a more detailed description of all selected sources.

2.2.1 Definition of the sample

In order to identify relevant texts for the analysis, we conducted a web search in the databases of the selected literature sources. The search focused on publications of the period of 2012 to June 2016. The text selection in general newspapers and magazines was based on the search terms 'agriculture' or 'farmers'. Since many search results appeared for the chosen keywords, we had to limit the selection. By analysing headlines and subheads, we were able to capture the key issues. Relevant texts were selected for a further analysis.

For the search in specialised media, the keywords 'agriculture' and 'farmers' were obviously redundant, therefore we had to choose other search terms. Based on the analysis of articles in the general press, we

were able to identify relevant themes, and thus keywords for the further search in professional media. These new keywords are the results of a coding process that the following section explains. Figure 1 illustrates the most important keywords of the media analysis of general media.



Figure 1: Catchwords in general newspapers and magazines

We used these keywords for the collection of relevant articles in the specialised media. Table 1 presents the total number of publications in the size sample. The annex for the media analysis shows the sources that fed into the German media analysis.

Table 1: Size of the sample for the German media analysis

Type of media source	Texts number
Specialised magazines / websites / blogs	35
General newspapers / magazines/ websites / blogs	65
Government, NGO, farmers' organisations	53
Scientific articles	2
Total	155

References of the media analysis are indicated by the abbreviation of the media and a figure such as SZ5. Table 2 shows the abbreviations for the media used for the media analysis.

Table 2: List of the sources for the German media analysis

Source	Abbreviation	Sphere	Type of Media	Type of content
Süddeutsche Zeitung	SZ	General	Daily newspaper	Facts, Opinions
Der Spiegel	SPON	General	Weekly magazine	Facts, Opinions
BILD	B	General	Daily newspaper	Factoids
Deutschlandfunk	DF	General	National radio station online	Facts, Opinions
TopAgrar	TOP	Farming	Monthly magazine	Facts, Opinions
Deutscher Bauernverband	DBV	Farming	Website of the German Farmers Association	Press releases, Opinions
Proplanta	PLA	Farming	Information portal for agriculture	Facts, Opinions
Bundesministerium für Ernährung und Landwirtschaft	BMEL	General	Website of the Ministry of Food and Agriculture	Press releases, Facts, political positions
Germanwatch	GER	General	NGO website	Facts, Opinions
Kritischer Agrarbericht	KA	General	NGO website	Facts, Opinions
Sachverständigenrat für Umweltfragen	SRU	Science	Council of experts	Evaluations report

2.2.2 Coding of selected texts

The aim of the coding process was to categorize the different concepts related to farmers’ sustainability. For the coding of the selected articles or paragraphs, we used the qualitative data analysis software NVivo. Coding is the association of text parts (single words, phrases or sentences) with nodes. In the NVivo terminology, a node is a keyword identifying “a collection of references about a specific theme, place, person or other area of interest”. By using a bottom-up approach, we started with the key terms identified in the selected texts. For this first step of the analysis (“open coding”), words or phrases related to conditions influencing farmers strategies are adopted as they appear in the text.

Table 3: Example for the hierarchy of thematic nodes

Thematic frames	Topics	Keywords	
	<i>(Theoretical coding)</i>	<i>(Substantive coding)</i>	
		<i>(Open coding)</i>	
Agricultural policy	Reform of the CAP	'Greening'-measures	Ecological focus areas
			Environmental services
			First pillar
			Conservation of permanent grassland
		Ceiling for direct payments	
		Rural development policy	
	Political influence of the farmers lobby		
	Revision of the European regulation on organic farming		

The example illustrated in Table 3 shows the key terms identified, which are e.g. ‘ecological focus areas’, ‘environmental services’ and ‘permanent grassland’. The second step is the “substantive coding”, which implies the clustering of nodes based on their conceptual closeness. In the given example, the identified key terms are clustered to ‘greening-measures’. The clustering of terms is followed by the third step of coding: the “theoretical coding”. In this step, the nodes are clustered into theoretical categories. Figure 2 presents the ranking of the most relevant topics after coding. In a last step, we clustered all identified topics and assigned them to different thematic fields.



Figure 2: Key topics in agriculture in German media

2.3 Main themes in general media in Germany (2012-2016)

The following sections present the results of the media analysis. The analysis highlights four thematic fields that regularly appear in general media articles:

1. Environmental and consumer protection
2. Animal welfare
3. Availability of agricultural production factors
4. Agricultural policy and markets for farm products

The articles cover a large variety of perspectives, analyses and opinions. As expected, they deal manifold figures and narratives related to conditions, farmers' strategies, changes in farming practices and the impact of farming – key issues for the application of the CSP-model. In the following, the focus is on the identified key topics found in the media.

For a better overview, each chapter starts with a table that summarises the results of the media analysis related to the theme. Since the detection of policy, regulatory and market conditions is of particular importance for the analyses of the SUFISA project, we will highlight the identified conditions within the texts.

2.3.1 Theme 1: Environmental and consumer protection

Table 4: Key topics related to environmental and consumer protection

Topics	Key terms		
Green gene technology	Economic importance for livestock production	Feed market Soya or maize Genetic modified plants Genetic modified organisms (GMO)	
	Labelling obligation	CRISPR-cas system CIBUS oilseed rape	
	Marketing initiatives for non-GMO	GMO-free	
	Use of antibiotics	Antibiotic resistances	
		Fattening farms	
Amendment of the German Medicines Law			
Strategy against antibiotics resistance			
Use of agrochemicals	Glyphosate	Re-authorisation of glyphosate Ban on glyphosate Herbicide	
		Loss of biodiversity	Bee mortality Use of pesticides Species protection
	Food scandals	Mislabelling	Organic certificates Sustainability certificates
		Food safety	Sustainability certificates Horsemeat EHEC or Dioxin in eggs
Free trade agreements	Market changes for German products	TTIP	
	Price developments		
	Quality standards	Food labelling Chlorine chicken or Hormone beef Pesticide load Genetic modified products	
		Export subsidies	

Topics	Key terms
	Use-by date
Food waste	Food law
	Marketing standards
	Food waste
	Curvy cucumber

2.3.1.1 Green gene technology

The debate about the authorisation or prohibition of genetically modified plants and products was a main topic in German media. The discussed issues include:

- the growing economic importance of GMO (DF5, PLA4, TOP5)¹,
- risks for consumers, environment and farmers (PLA4, SZ4, SZ5),
- labelling obligation (PLA4, PLA5, SZ5), and
- (support of) marketing initiatives for GMO-free products (PLA5, TOP3, TOP4).

Different articles in general and specialist media point out that – even though a majority of the population opposes genetic engineering – the economic importance of GMO in Germany is growing (DF5, PLA4, TOP5). Green gene technology is in particular important for the feed market, where the market share of genetically modified soya and maize is increasing (DF5). An agricultural magazine stresses this importance of GMO by pointing out that an authorisation of further GM soybean varieties is crucial to ensure market supply with certain foods and feeds (TOP5). Since the import of these genetically modified (GM) feeds is in legal terms not fully clear, livestock farming could be adversely affected by the use of GM feeds (TOP5).

The discussion about the potential risks for consumers, environment and farmers is very controversial in the media. Opponents of genetic engineering criticize in particular that genetic modified plants lead to a larger share of plant protection products and cause resistances against chemical plant protection (PLA4, SZ4). In addition to the negative effects for humans and environment, farmers would have to fear the potential contamination of non-modified seeds by GM-plants (SZ5).

Another aspect of green genetic technology debated in the media is the labelling obligation, which is related to consumer protection. In this context, the media discussion focusses on new procedures of genetic engineering like the CRISPR-cas system and the CIBUS oilseed-rape as well as on products of animals that ate GM-feed material (PLA4, PLA5, SZ5). Clear rules for approval procedures and labelling for GM seeds and products were still missing which leads to uncertainties among farmers and consumers (PLA4, PLA5).

A current topic within the GMO discussion is the rise of marketing initiatives proclaiming GMO-free products. Different sources from general and specialised press highlight that “GMO-free” is a relevant trend in food retailing (PLA5, TOP3). A farmers magazine stresses that it is “exemplary and anticipating” that more and more enterprises support the cultivation and feeding of local and GMO-free feedstuffs (TOP3). It is even mentioned that the German Land of Lower Saxony supports measures for the processing and marketing of GMO-free products (TOP3). Even though it is pointed out that GMO-free feedstuff would lead to higher production costs (PLA5, TOP4), other voices stress the opportunities of GMO-free production for farmers (PLA5). Especially milk producers could benefit by producing GMO-free milk (PLA5).

¹ The abbreviations are explained in the Annex – Media Analysis in the list of sources

2.3.1.2 Use of antibiotics

The intensive use of antibiotics in livestock production is a core issue related to animal welfare and consumer protection. The media discussion ranges about:

- conditions for livestock production (GER1, PLA1, SPON1),
- political strategies aiming at minimising antibiotics (DF1, BMEL2, DBV1), and
- success and failure of the measures adopted in this regard (BMEL2, DBV1, SZ1, GER1).

A key condition influencing farmers strategies related to the antibiotic use was the amendment of the German Medicines Law (“Arzneimittelgesetz”) in 2014 (DF1). The new regulations oblige farmers to record each use of antibiotics in a national database (DF1). By means of a benchmarking, livestock farmers are thus encouraged to take appropriate steps to minimise the use of antibiotics on their farms (DF1). The revision of the German Medicines Law was a consequence of the so-called ‘strategy against antibiotics resistance’ (“Deutsche Antibiotikaresistenzstrategie” – DART). This strategy established in 2013 by the German government had the aim to minimise the use of antibiotics in animal husbandry and to prevent the development of antibiotic resistances (DF1).

With regard to the question about success or failure of the strategies adopted by farmers, the analysed media show a very heterogeneous picture. Whereas the German Farmers Association and the Federal Ministry of Food and Agriculture are very positive about the success of the implemented measures (BMEL2, DBV1), national magazines and NGOs highlight serious shortcomings. According to different media articles, government institutions withhold information on antibiotic use in livestock production (SZ1, GER1). It is criticised that the data bases are affected by significant weaknesses and that thousands of farmers elude the reporting obligation (SZ1, GER1). Furthermore, data on dairy cows and other animal species were not even registered (GER1). Another aspect is the increase of reserve antibiotics in dairy farming, which might lead to antibiotic resistances (GER1, PLA1). A general magazine even mentions a bonus system for veterinarians when purchasing large quantities of antibiotics (SPON1). Different articles in general magazines and NGO websites conclude that the government regulations will hardly change farmers performances related to the use of antibiotics while farmers are under economic pressure (GER1, SZ1).

2.3.1.3 Use of agrochemicals

Two topics dominating the media debate related to sustainable agriculture were:

- the loss of biodiversity through the excessive use of pesticides,
- and the possible risks to humans by the herbicide glyphosate.

The intensive agriculture is, according to different sources, seen as the main cause for the “alarming loss of biodiversity” in Germany (DF8, PLA7). The number of wild bees and bumblebees has been declining over recent years through the excessive use of pesticides (PLA7). With the objective to maintain biodiversity, several strategies were developed and different measures taken. The National action plan for sustainable use of pesticides was such a political strategy aiming to reduce chemical pesticides (DF9). Furthermore, different projects for maintaining biodiversity initiated in several regions were highlighted by the German Farmers Association, such as a cooperative project funded by state resources (DBV7). Nevertheless, the Farmers Association stresses that practical feasibility and economic efficiency are essential for the success of the measures taken (DBV7). Another political measure to preserve biodiversity in agricultural landscapes was an amendment related to the authorisation of plant protection products, the so-called EU Plant Protection Products Regulation (DF9). Farming organisations criticize these regulations on plant protection by arguing that the ban of certain plant protection products has serious consequences for agriculture (DF9). Certain plant diseases were difficult to control without effective agrochemicals (DF9). The German Farmers

Association underlines that, instead of banning pesticides, it would be more appropriate to remove barriers for the implementation of biodiversity conservation measures. They stress in particular deficits concerning the second pillar measures (DBV8).

The second relevant theme in national media related to the use of agrochemicals is the glyphosate debate. The media discussion concerns the re-authorisation of glyphosate, and thus the further use of the widely used herbicide in the EU member states. The consequences of a possible ban on glyphosate are controversially discussed. Related to the protection of consumers, the possible risk of cancer is a highly debated issue in different media (BMEL3, GER2).

However, while environmental organizations focus on the risks of glyphosate for human beings, animals and environment, farmer and government organisations refer to practical problems for agriculture in case of a ban on glyphosate (SPON3, GER2, DBV2). According to the German Farmers Association and the Federal Institute for Risk Assessment, a complete lack of active substances would lead to lower production, local failures, quality defects, and hence serious economic consequences (DBV2, SPON3, SPON2). They argue that instead of a prohibition, it was more useful to develop a national action plan on plant protection (DBV2). The German Farmers Association and the Federal Research Centre for Cultivated Plants (“JKI”) underline that in case of a ban on glyphosate, farmers would use other herbicides that have potential higher risks than glyphosate (SPON3).

Other voices point out that besides organic farming there also are alternative cultivation methods for conventional farming without glyphosate or other agrochemicals (SZ2). Nevertheless, they admit that the costs for plant protection as well as fuel consumption will increase if alternative measures for soil preservation are used (SZ2).

2.3.1.4 Food scandals

Food scandals present a dominating topic in the newspaper headlines. All kinds of media reported about food scandals such as the dioxin scandal, EHEC, horsemeat in beef lasagnes, and false ‘organic’-labels (TOP1, TOP2, DF10, SZ9, PLA3). The media discussion concentrated above all on looking for the guilty and on the inefficiency of the responsible authorities. It is pointed out that the controls on feed and food are within the responsibility of the federal states, which causes a lack of transparency (SZ3, DF10). It is also criticized that the traceability cannot be guaranteed, because rules on labelling for products were not well-defined (DF10). The consequence of this lack of transparency is an unfair competition between farmers, sales losses as well as an uncertainty amongst consumers (SZ3). Strategies aiming to create more transparency were limited to the development of a national action plan, which, according to the media, was hardly implemented (SZ3).

2.3.1.5 Free trade agreements

A relevant topic is the currently debated free Transatlantic Trade and Investment Partnership (TTIP) between USA and European Union (and CETA with Canada) and its impact on agriculture in Germany and consumer protection. The analysed texts discussed in particular:

- the potential market chances for German products in the USA,
- requirements of food labelling related to the import of genetic modified products,
- and the maintenance of European quality standards.

Concerning the market chances for German products in the USA, the German Farmers Association is optimistic that by removing administrative burdens and improving approval procedures there will be an easier market access for German products (DBV3). The market chances for organic products are also discussed. The analysis of media highlights that the US-market is already the biggest consumer of organic products from Germany. A market expansion might lead to an extension of organically farmed land in

Europe. (DF6). Other voices rather take a critical approach to the potential growth of organic farming in Germany. They argue that organic producers have problems to meet the demand of the growing market for organic products (DF6, SZ6).

Other debated themes related to TTIP are food labelling and the compliance with customer standards. The German Farmers Association underlines that the compliance with European quality standards and labelling requirements has to be respected (DBV3, TOP6). Another important issue in German media is the labelling of genetic modified products, because they have no access to the US-market (DF6, DBV3).

2.3.2 Theme 2: Animal welfare

The media coverage illustrates an ongoing discussion about animal welfare standards in livestock farming. This debate about the animal husbandry reveals a clear gap between the widely spread, often naive expectations of consumers, on-farm realities and policy and governance impacts regarding the potential improvement of animal welfare. The main topics presented in the media are

- the significant intensification of animal production systems,
- potential approaches of policy schemes, private enterprises or civil society initiatives, and
- changes or adjustments of laws aiming to improve animal welfare on the farms.

Table 5: Main issues related to the thematic field of animal welfare

Topics	Key terms	
Intensification of animal production systems	Factory farming	
	Mega-stables	
	Fattening farms	
	Fattening pigs	
	High stocking densities	Fattening installations
	Use of antibiotics	
	Chick culling	
	Falling meat prices	
	Increasing export orientation	
	Market concentration of processing industry	
Loss of consumer confidence		
Animal welfare law		
Animal Welfare Initiative	Economic support from consumers and markets	Low price policy
		Willingness to pay animal-friendly products
	Deficiencies in the implementation	Insufficient funds
		Inadequate criteria of animal welfare
Legal regulations and political measures		Lack of transparency for the consumer
	Animal protection law	Chick culling
		Small poultry flock management
		Tail docking
	practicability and implementation	Alternative solutions
		Outsourcing of livestock production

2.3.2.1 Intensification of animal production systems

The intensification of animal production systems and its impact on animal welfare is the key topics related to farming. Discussions are very controversial in German media. Terms like ‘factory farming’, ‘extreme stocking densities’, ‘chick culling’, ‘castration of piglets without anaesthesia’, ‘meat factories’ emerge regularly in the media (SZ11, SZ12, DF12, GER3, SPON5). General media and NGOs criticize the increasing meat production and the local concentration of animal husbandry in particular areas in Germany (GER3, SZ12). According to a variety of sources, Germany, which had been a net importer of pork for a long time, became a net exporter over the last years. This increasing export orientation is accompanied by an expansion of animal production and thus falling meat prices (GER3, SZ12). The media underlines the issue of price pressures that is seen as a result of the strong market concentration within the processing industry (SZ12). Based on the example of the poultry sector, this means that only four enterprises share the poultry market in Germany among each other (SZ12). Another issue criticised in the media is the public payments for further constructions of stables (SZ12). Critical voices in general media point out that the governmental approval causes the increasing number of so-called ‘mega stables’, which resulted in an increase of fattening places of up to 60 % (SZ12, SPON5).

Farmer organisations and interviewed farmers denounce the one-sided representation of animal husbandry by the media and in the public discourse and point out that the media coverage leads to a loss of consumer confidence (DF10, SZ10, DBV10, DBV11). According to the German Farmers Association, animal welfare and health are not depending on the farm size, but on the farm management e.g. feeding, vaccinations and hygiene (DBV11, PLA10). Larger farms have also to comply with the Animal Welfare Law, the Order on the protection of animals and the keeping of production animals (“Tierschutznutztierhaltungsverordnung”), or the Medicines Law (DBV11). Animal welfare even benefits by modern stable constructions, because they involve the most modern technologies (DBV11). The Farmers Association stress furthermore that modern agriculture is committed to develop animal husbandry, as different measures implemented over the last years have shown (DBV11).

2.3.2.2 Approaches for the improvement of animal welfare

Media articles related to animal welfare and livestock productions discussed different approaches aiming to improve animal welfare. Among these strategies and measures debated are different activities supported by policy, farmer organisations, economy, and legal regulations.

Measures presented in the media are e.g. the development of a consulting network for farm businesses, the support of different model projects, the implementation of quality management systems in dairy farms, the establishment of Animal Health Monitoring Systems, as well as the Animal Welfare Initiative (DBV9, BMEL5). While farmer organisations and government agencies highlight their willingness to enhance animal husbandry, they stress equally that the required measures have to be economically sustainable, practicable and scientifically based (DBV9, BMEL5). Farmer organisations also point out that an essential condition for the success of such measures is the economic support from consumers and markets (DBV13).

The measure, which the analysed media highlighted and discussed in particular, is the establishment of the ‘Animal Welfare Initiative’ in Germany. The Animal Welfare Initiative is supported by an alliance of agriculture, food trade, and the meat industry. The idea of the initiative is to improve animal welfare by refunding the investment costs for animal-friendly systems to farmers participating in the initiative (DF13). Although there was a very positive response from farmers, media cite various deficiencies in the implementation of the measures (DF13, GER4, SZ11). The criticised aspects range from insufficient funds, inadequate criteria of animal welfare, and a lack of transparency for the consumer (SZ11, DF13, GER4). With regard to the insufficient funds of the initiative, it is clarified that less than half of the farmers who invested

in animal-friendly conditions for livestock get reimbursed (SZ11). Nevertheless, the most important point of criticism expressed by the media is that the initiative does not address systemic questions (DF13, SZ11). They point out that, among other things, the retail sector had to abandon its low price policy (PLA4, GER4, DF13, S11).

Other sources also highlight the significant role of the retail sector related to its potential influence on production conditions. They give the example of a sales stop for cage eggs by two large retailers in Germany, few years before cage-systems were prohibited by law. Within one year, this led to a change in egg production in Germany (PLA9). However, they also stress the importance of the consumers' willingness to pay more for animal-friendly products (PLA9.) In order to convince consumers to pay an adequate price for higher animal standards, the establishment of an EU or national label for animal welfare is required by different actors (DF15, PLA11). It is pointed out that it is the responsibility of the State to ensure consumers' confidence in animal welfare by setting animal welfare standards and monitoring them (PLA11, DF12).

2.3.2.3 Legal regulations and political measures

Legal regulations for animal welfare and related political measures are mainly criticised in the analysed media. The debate about practicability and implementation of animal welfare requirements concerns in particular the animal protection law with regard to tail docking, chick culling, and the small poultry flock management (DF15, BMEL5, BMEL4, DF11, DBV10).

General media criticise that the culling of day-old male chicks is permitted under animal protection law (DF14). Government sources justify the current practice by the fact that the rearing of male chicks is not economic for businesses (BMEL 4). However, they also point out that the animal protection law will prohibit chick culling as soon as an alternative solution has been developed (BMEL4). An interdiction without offering an alternative to farmers would outsource poultry farming to other countries with other production methods and animal welfare standards (BMEL4). Other sources also stress the need for research into practicable alternative farming or rearing methods (in particular with regard to the prohibition of tail docking) (DF11). It is clarified that legal regulations are often adopted without appropriate recommendations for the implementation of alternative measures (DF11). This could lead to an abandonment of farming activities if farms are not able to adapt fast enough to the new requirements (DF11). The German Farmers Association underlines as well the threat of an offshoring of animal husbandry (DBV11, DBV13). While environmental or animal welfare organisations argue for legal provisions (DF12), the Farmers Association take the view that an improvement of animal welfare and societal acceptance cannot be ensured by regulatory law (DBV13).

2.3.3 Theme 3: Availability of agricultural production factors

Table 6: Main issues related to the thematic field of agricultural input factors

Topics	Key terms		
Competition for land	Increase of rental and purchasing prices	Land grabbing Support of bioenergy	
	Impact of supra-regional investors	Land grabbing Land speculation Large companies	
		Loss of agricultural land	Construction of roads and settlements Nature conservation measures
			Diversity of varieties
	Seed saving	Reuse of seeds Certified seeds Royalty for seeds	
		Approval of new varieties	
Labour shortage			
	Shortage of skilled workers	Retirements Technological improvement	

2.3.3.1 Competition for land

The lack of available agricultural land is a highly relevant theme in the media debate on sustainable agriculture. Topical issues related to the availability of farmland are:

- the strong increase of rental and purchasing prices for agricultural land (SPON6, DF15, BMEL9, TOP9)
- the impact of non-agricultural and supra-regional investors on the land market (SPON6, DF15, BMEL9)
- the competition from the support of bioenergy production (TOP9, SZ14)

- and the loss of agricultural land due to the construction of roads and settlements as well as nature conservation measures (SZ10, DBV15).

Especially, the phenomenon of “land grabbing” and its consequences for local farmers is a main topic in all kinds of media. The media coverage illustrates a connection between the rising prices for agricultural land and the actions of investors buying up farmland, especially in East Germany (SPON6, DF15, BMEL9,KA2015). According to a study, between 20 and 50 % of farm land was sold to non-agricultural and supra-regional investors (DF15). Agricultural subsidies and the support of bioenergy production contribute to this development (DF15, SZ14, TOP9). It is criticised that the biggest agricultural businesses receive two thirds of farmers’ total direct payments, even though they constitute only two percent of all farming enterprises in Germany (DF15).

The strong rise of rental and purchasing prices for farmland caused by the increasing competition for land is considered to be responsible for the difficulties of small-scale farms aiming to acquire or maintain farmland (SZ10, SPON6, TOP9, BMEL9, KA2015). It is argued that smaller local farmers are not able to compete with big investors (SZ10, SPON6, TOP9, KA2015). Thus, the existence of small-scale farms might be endangered (SZ10, TOP9, KA2015). A specialised magazine underlines this conclusion by pointing out that the percentage of organic farming is lower in states with high rental prices (TOP9).

The public discussion about the sale of state-owned agricultural land to large investors led to a revision of legal aspects for the privatisation of farmland. The measures implemented in 2013 concern the national Land Utilisation and Management Company (BVVG), which is responsible for the administration and sale of state-owned land in East Germany. In order to secure a fair competition for all participants in tender calls, the BVVG has to comply, inter alia, with the following rules: implementation of an upper limit of 25 hectares per lot size and facilitation of access to young farmers (BMEL8). Nevertheless, it is criticised in the media that the Federal Ministry of Food and Agriculture does not consider further measures to support pre-emption rights for farmers (SPON6). An obstacle for the implementation of suitable measures, according to The Critical Agricultural Report, is that the instruments of the agricultural structural policy do not concern the problem of land purchase by holding companies (KA2015).

Media also highlight alternative strategies by farmers aiming to secure a fair land distribution. An example presented in the media is the establishment of an alliance between farmers and ecologically-oriented investors. Due to this cooperation, an agricultural land fund buys and leases land to farmers aiming to use the land for organic agriculture (SZ14). Another project was initiated by a provider of sustainable finance products (GLS-Bank), who founded a cooperative with the objective to buy farmland and to lease it to organic farmers (SZ14).

2.3.3.2 Diversity of plant varieties

The availability of crops and varieties suitable for local requirements is considered as an essential factor of sustainable farming. The related media discussion highlights different aspects indicating a decrease in the genetic diversity of plants. The discussed topics are:

- the approval of patents on conventionally bred seeds, the so called biological patents (SZ19, DBV18)
- legal restrictions related to the acceptance of varieties and the marketing of seeds as well as the maintenance of local varieties (SZ20, DV19, DV20, DBV19, KA2015)
- and farmers’ opposition to pay royalties to breeders for seeds saved on farm (SZ18, DF18)

A topic strongly criticised in the media is the patenting of plants. Media point out that, over the last years, multinational agricultural corporations such as Monsanto or Syngenta have filed more than 1,000 patents

for conventionally bred seeds (SZ19, DBV18). So far, approximate 120 patents were granted, in particular for the breeding of vegetables (SZ19). It is argued that these biological patents contradict the *European Patent Convention* and the *German Patent Law*, because they do not go beyond traditional breeding (SZ19, DBV18). General newspaper and the German Farmers Association disapprove the patenting of conventionally bred seeds (DBV18). They underline that legal uncertainties have to be removed in order to protect farmers and seed producers, and to prevent a monopolisation of the seed market (DBV18, SZ19). The Ministry of Food and Agriculture also stresses a revision of the *EU directive on the legal protection of biotechnological inventions* (BMEL10). It is pointed out that the access to genetic resources is a basic condition for the activity of farmers and thereby to ensure food security (BMEL10).

Another condition influencing the diversity of seeds are legal restrictions related to the acceptance of varieties and to the marketing of seeds. General media and NGOs criticise the current EU directives for the bureaucratic, complex and expensive approval procedures for the registration of varieties (DF20, KA2015). These regulations constitute a significant barrier for farmers and breeders to cultivate and maintain local and rare varieties (DF20). From their point of view, the EU legislation for the acceptance of varieties authorises the conservation and marketing of local varieties only on an exceptional basis and, thus, is adapted to the interests of the seed industry (KA2015). It is explained that the directive on conservation of varieties only permits the cultivation and breeding of local varieties, but do not allow the marketing (DBV19). The consequences of the legal restrictions for the acceptance of varieties described in the media are a gradual disappearance of small breeders and thereby a loss in the diversity of plant varieties (DF19, DF20, KA2015).

The last topic related to seed diversity is the ongoing conflict about the reuse of seeds. Media highlight the refusal of farmers to pay an additional royalty to breeders for seeds saved on the farm (DF18, SZ18). The conflict pointed out in the media is that a majority of farmers does not pay the required royalties for the reuse of certified seeds (SZ18, DF18). It is estimated that, e.g. in the cultivation of potatoes, farmers use approximately 80% of farm-saved plant material without paying licence fees (SZ18). The resulting damage for breeding companies is calculated up to 13 million Euros per year (SZ18). Whereas the German Farmers Association hardly comments the present problem (DBV20), general media stress the consequences for breeders. They argue that the 58 breeding companies in Germany make an important contribution to crop productivity, pest control and maintenance of varieties (DF18). It is stressed that the breeders rely on the royalties for the reuse of seeds in order to continue with the costly and time-consuming breeding of plants (DF18). It is therefore concluded that farmers have to pay the fees for seed saving of certified seeds in order to ensure the existence of SMEs and to prevent a strategic focusing on hybrid varieties (DF18).

2.3.3.3 Labour shortage

The media coverage about agricultural sustainability takes up the question of the availability of workers. In this regard, the discussion highlights an increasing labour shortage influencing agriculture in Germany, and thus jeopardising the local production. The topics discussed related to this growing labour shortage are:

- the impacts of the recently introduced minimum wage on employment and competitiveness in agriculture and horticulture (BMEL7, DBV17, SZ16, DF17), and
- causes for the shortage of skilled workers.

Especially the statutory minimum wage introduced in 2015 is a widely discussed topic in the German media. The debate focuses on the possible consequences for the agricultural sector. It is expected that the increased labour costs will lead to competitive disadvantages compared to other countries (DBV17, BMEL7, SZ16, DF17). Media highlight that all market participants have to meet the challenge of increased producer

prices due to the minimum wage (DBV17, DF17). The main problem presented in the media is that the retail sector and consumers have a clear preference for low prices (SZ16). If consumers and food businesses are not willing to compensate the increased producer prices, there is a risk that German producers are not able to compete with other countries (DBV17). Especially fruit- and vegetable firms are confronted with the increased salaries. According to a study carried out by the Ministry of Food and Agriculture, the minimum wage will have negative effects on the employment of permanent employees and seasonal workers, because agricultural businesses will try to reduce labour input (BMEL7). In order to compensate the labour shortage, farm businesses are either planning to reduce labour-intensive cultures such as strawberries and asparagus or to invest in necessary technology (BMEL7). General media also underline the risk of an outsourcing of production of special crops to lower-costs locations (DF17, SZ16). The German Farmers Association points out that German producers will continue to implement high standards, but these have to be applied to all competitors on the market (DBV17). Otherwise, an unequal competition will drive the German production of special crops out of the market (DBV17).

Another topic related the labour shortage is the lack of skilled workers. The reasons pointed out by the media are the depopulation of rural areas, imminent retirements as well as the increasing level of technology (DF15, DF16).

2.3.4 Theme 4: Agricultural policy and the development of agricultural product markets

Table 7: Policy impact on agricultural product markets and land use

Topics	Key terms
Decreasing producer prices	Farm incomes
	Economic losses
	Rice crisis
	Survival
	Farm closures
	Competitiveness
	End of the milk quota system
	New markets
	Expansion
	Export focus
	Value-added products
	Role of dairy and retail companies
	Supply chain
	Oversupply
Concentration in processing and retail	
Purchasing power	

Table 7 continued

Topics		Key terms
Decreasing producer prices	Policy interventions	Economic dependence of farmers
		Market interventions
		Financial support
		Aid package
		Quantity regulation
		Reduction of milk-deliveries
Reform of the CAP	Greening'-measures	First pillar
		Environmental services
		Ecological focus areas
		Permanent grassland
	Ceiling for direct payments	Reduction of direct-payments
		Cap the basic payments
		Redistributive payment for the first hectares
	Rural development policy	Rural development programmes
		Support of organic agriculture
		Agri-environmental measures
	Rural development policy	Funding programmes
		Conversion aid
Political influence of the farmers lobby	Interest of large farmers	
	Weakening of ecological reforms	
Revision of the European regulation on organic farming	Derogations	Mixed-farming
		Non-organic seeds
		Non organic breeding-stock
		Regional food sourcing
	Residue levels in food and feed	Product quality
		Process quality
	Conversion to organic farming	Conversion period
		Marketing
	Inspection system	Control provision

2.3.4.1 Decreasing producer prices

Since the media analysis only covers the last five years, the topic of increasing producer prices until 2007/08 does not appear. In the period 2012 to 2016, the impact of decreasing producer prices on the agricultural sector is a recurrent issue in the public debate about sustainable farming. It is in particular the milk crisis, which is recently dominating the media coverage. The main topics discussed are:

- the current economic situation of farmers and their strategies in view of decreasing (milk) prices (SPON9, SZ25, SZ26, DF27),
- the impact of global trade on producer prices (DF27, SZ26, KA2016)
- the role of dairy and retail companies (SZ25, SPON9, TOP19)
- and the suitability of policy interventions (DBV25, SZ27, SPON9, TOP20).

General newspapers are reporting that the decreasing producer prices for pig meat, milk and grain have reached a limit where farmers have to fight for their survival. It is pointed out that farm incomes have decreased drastically in recent years and that the number of agricultural producers deciding to go out of business is growing (SZ26, DF27, SPON9). The media coverage highlights different causes for this current economic crisis of farmers, especially for the dairy sector.

The first condition highlighted in all analysed articles is the end of the milk quota system in 2015. While firstly different media highlighted the chances for growth and competitiveness of the German milk sector (DBV26, DBV27, SPON10, B1), the media coverage became more critically afterwards. In the beginning, it was in particular the German Farmers Association, which emphasized the economic opportunities of “new markets” and encouraged farmers to expand their production and dairies to increase export activities (DBV29, TOP21). Meanwhile, the abolition of the milk quota is considered being a catalyst for the price crisis (SZ27, KA2016).

One of the main threats for the economic situation of dairy farmers, according to different media sources, are the falling and volatile world market prices (SZ25, DF27, TOP21). It is explained that due to the strong export focus of the German dairy industry large quantities of milk are brought to a market, which is currently influenced, by the Russian trade embargo and an unstable demand by China (DF27, SZ25, SZ26, SPON9). Thus, the majority of the milk produced in Germany has to be exported at low prices, which lead to a further decrease of national producer prices.

In addition to these unstable conditions on the world market, the lack of value-added products for the export is considered another factor for the low export prices (KA2016, DF27). It is argued that standard products such as skimmed milk powder and industrial cheeses are not able to withstand the international competition (KA2016). Thus, the increased milk production does not lead to higher profit margins of farmers. Instead, the oversupply of milk is responsible for a further decline in prices. Different sources describe a “vicious circle” of decreasing milk prices and, at the same time, farmers trying to compensate the falling prices by increasing the milk production (SZ27, DF27, KA2016). Nevertheless, there are also farms which have chosen the instrument of a declining milk production by reducing cows or concentrated feeds in order to keep production costs down (KA2016). Another strategy to offset price pressures is to build up financial reserves (TOP21, KA2016). However, it is criticised by different media sources that the Tax legislation does not consider price volatilities (KA2016).

The media coverage related to the conditions influencing the current economic crisis of farmers is not only focused on world market and policy conditions. It also regards national market failures. In this context, the increasing concentration in processing and retail is discussed by different media (SPON9, SZ25, SZ27, TOP21). It is criticised that this concentration entails the risk to weaken the position of farmers in the food

chain (SPON9, SZ25). The German Farmers Association underlines that the food processing industry and retailers are able to dictate prices due to their large purchasing power (SPON9). This strong economic dependence of farmers to the processing and retail sectors is an issue brightly discussed in the media. Different sources highlight the responsibility of consumers and retail stores to stop the low price policy (SZ25, SZ27, KA2016).

The media coverage also points out marketing strategies of retailers and dairies related to the decreasing milk prices. Whereas some retailers decided to lower their sales prices for competitive reasons (SZ27), other companies are trying to develop new marketing channels in order to escape the dumping prices (SZ27, TOP19). These include e.g. the strengthening of regional brands, the introduction of new products such as pasture milk or the marketing of GMO-free milk (SZ27, TOP19). Due to these alternative approaches, farmers get a better payment than the usual market price (SZ27, TOP19).

The last issue debated in the media is the suitability of policy interventions. The media coverage focuses on the “aid package” from the European Commission. The financial support offered to farmers aims to mitigate the impact of the milk crisis and to keep farmers in business. However, the media analysis shows different opinions about the adequacy of the financial aids and the recommended measures (DBV25, SPON9, SZ27, TOP20). One of these proposed measures, the voluntary reduction of EU milk deliveries, is subject to a controversially discussion highlighting proponents and opponents of market interventions. It is pointed out that the agriculture ministers consider a milk quantity regulation as necessary (SZ27), whereas the German Farmers Association criticise this measure (DBV25). The latter argue that a mandatory quantity reduction would lead to “deadweight effects” and market distortions as well as increasing bureaucratic costs (DBV25).

Another measure currently discussed in the media is the legal possibility to make written contracts between farmers and processors compulsory (TOP20). According to the supporters of these measures, this would help farmers to negotiate contract terms and thus attenuate the effects of future crisis (TOP20).

2.3.4.2 CAP reform: direct payments with ‘greening’ and rural development programmes

The recent reform of the Common Agricultural Policy (CAP) and its implementation in Germany is subject of a controversial debate. The main aspects discussed are:

- the implementation of ‘greening’ measures in national law (DF22, DF23, DBV9, DBV21, SZ22, SZ23, SPON7, KA2016)
- the (untapped) potential to reduce direct payments according to the size of farms (KA2015, KA2016, SZ22, SZ23)
- the support for organic farming through agri-environmental programmes (BMEL13, PLA15, PLA16, TOP12, TOP13)
- and the influence of the agricultural industry on policy decisions (KA2015, SZ23, DF21, SPON7, SRU2016).

The EU basis regulations of the new CAP have the objective to allow a better balance between the two pillars in order to make the European agriculture greener and fairer (BMEL14). The most discussed instrument in the media is the linking of agricultural direct payments to the compliance of specific environmental services, the so called “greening”. The national implementation of these environmental measures, e.g. crop diversification, preservation of permanent grassland and provision of ecological focus areas, is mainly criticised. The media coverage reflects the different perceptions of the stakeholders involved. Whereas environmental actors consider the interpretation of the EU environmental requirements by German authorities as insufficient (SPON7, DF24, DF23, SZ23, KA2015), farmer organisations describe the legal demands as “obligation to set-aside” (DF23, DF24).

The German Farmers Association and other representatives of farmers take the view that the demanded ecological focus areas and the preservation of permanent grassland imply a loss of agricultural land, and thus economic disadvantages for farmers (DF23, DF24). It is criticised that in Germany the requirements for the protection of grassland are stricter than demanded by the EU (DBV21). Furthermore, many farmers are discouraged by the complex legal restrictions and possible sanctions (DBV21). They stress the need to simplify the greening requirements in order to ensure their implementation (DBV21).

Other voices argue that current implementation of the greening measures in Germany is rather a “compromise for farmers than a benefit for the environment” (DF23). They underline that Germany does not seize the opportunities offered by the European policy for a more sustainable agriculture (KA2015, DF24, DF23, SZ23). The greening-measures actually implemented in Germany are even described as ‘greenwashing’ (DF23). It is criticised that the German law do not use the possibility given by the EU to go beyond the minimum requirements (KA2015, DF24). It is stressed that the national rules require only 5 % of ecological focus areas and that they permit furthermore the use of pesticides and fertilisers on these areas (DF24, DF22). Finally, it is summarised that due to this weak implementation of the CAP instruments, the EU will miss the target to enhance biodiversity (DF23).

Another key element of the GAP discussed in the media is the legal possibility to reduce direct payments according to the farm size. It is pointed out that the EU regulations provide a reduction of the basic payments exceeding EUR 150,000 by a minimum of 5 % (KA2015, SZ22). Whereas other Member States, such as Ireland, Austria and Poland, have opted to cap the basic payments at 100 %, the possibility to apply a maximum payment is not used in Germany (SZ23, SZ22, KA2015). However, in order to support small-scale farms, the national implementation includes a redistributive payment for the first 30 hectares (SZ23, SZ22). According to the ‘critical farming report’, a maximum amount of direct payments and redistribution in favour to small farms could be an adequate measure to limit the land concentration, and thus the increasing rental and purchasing prices (KA2015).

The last topic related to the CAP reform is the implementation of the rural development policy in national rural developments programmes. Political representatives highlight the decision of the Federal Government to support agri-environmental measures by shifting 4.5 % of the direct payments into rural development programmes (TOP13, BMEL13). They point out that the current funding programmes, such as the support of organic farming, are well received by the farmers (PLA15). However, representatives of non-governmental organisations and other actors emphasise that Germany do not take full advantage of the second pillars’ funding programmes (KA2016, TOP12). They stress furthermore that in some federal states the funds are exhausted, and thus rural development programmes have to be reduced (TOP12, DF21). An example, pointed out in the media, is the financial aid for the conversion to organic farming. These subsidies varying between federal states as well as funding periods present a risk for farmers (DF21). This politically uncertainty for organic farmers is also underlined by the German Farmers Association (TOP14). Nevertheless, they pose the question if a shifting of direct payments in order to support organic farming is fair for all farmers (TOP14).

The strong influence of the lobby of farmers’ organisations and agribusinesses on agricultural policy is a sensitive issue in the media discussion on sustainable agriculture. Different sources assume a relation between the interests of the agricultural lobby and the less stringent national regulations (KA2015, SZ23, DF21). The recent expert report of the German Council of Environmental Advisors considers the German agricultural policy as inadequate (SPON7, SRU2016). They criticise that Germany “has set negative examples by working to weaken the European Commission’s efforts to bring about ecological reform and by failing to

leverage the room for manoeuvre that was available domestically for a more ambitious implementation” (SRU2016). They highlight the need for a broader consensus for a sustainable agriculture.

2.3.4.3 Revision of the Regulation on organic production and labelling on organic products

The proposals for a Regulation on organic production published by the European Commission in 2014 were subjects to strong criticism in the public debate. The analysis of the media reveals a general rejection of the legislative proposal for a new organic regulation (DF21, DBV24, TOP15, BMEL14, SZ24, KA2016). The discussed aspects of the Commission draft are:

- the removal of derogations (mixed-farming, non-organic seeds, non-organic breeding-stock, regional food sourcing),
- residue levels in food and feed (process quality versus product quality),
- barriers for the conversion to organic farming (marketing during conversion period), and
- the inspection system (externalisation of controls).

It is criticised that the implementation of the proposed amendments will lead to significant barriers related to production, processing and marketing of organic products (BMEL14). The Federal Ministry underlines that the approach is not suitable to overcome the current weaknesses in organic production (BMEL14). Other voices also disagree with the proposals developed by the Commission. They emphasise the risk for a survival of organic farming in Europe (DF21, TOP15, KA2016). Latest media reports point out that, due to the strong criticism by various member states, the reform of the regulation on organic farming is currently renegotiated (BMEL14, KA2015).

2.4 Summary of the media analysis

The results of our analysis show a wide range of topics covered by the national media. Key issues discussed over the last five years are e.g. the milk crisis, factory farming, the reform of the Common Agricultural Policy, the diversity of seeds, land shortage, organic farming, green gene technology and the ban of glyphosate. The media coverage illustrates the interrelations between the protection of consumers, environment and animals, the economic situation of farmers and agricultural policies. Sustainability of agricultural production is discussed from different point of views, depending on the analysed medium.

We analysed various media sources in order to reflect the different perspectives of farmers, consumers, governance, science and non-governmental organisations. Whereas the general media mainly reflected the opinions of diverse stakeholders and thus a differentiated approach, specialised media normally take up a firm position. By analysing the media articles of the different sources, we were able to identify a range of conditions influencing farmers' strategies and agricultural sustainability. Depending on the theme addressed, media discussed about actual conditions (e.g. in the case of the ban of certain pesticides or the decreasing producer prices) or possible impacts of forthcoming decisions (e.g. free trade agreements). In some of the cases analysed, it was not even possible to distinguish clearly between conditions, strategies and performances. An example for such complex cause-effect correlations is the price crisis in the milk sector. In this case, the end of the milk quota system was the starting point for an increasing milk volume, leading to an oversupply of milk on the market, causing decreasing producer prices, which finally resulted in a further expansion of the milk production and lower prices. This simplified example of an interrelation of conditions, strategies and performances aims to show that farmers' performances or political measures may be the basis for new conditions.

3 DE Case study A: Aquaculture in Germany

3.1 Case study introduction and context

3.1.1 Inland fish production in Germany

Aquaculture is the global food industry's fastest growing sector. The total quantity of farmed fish produced will soon exceed the output of wild fisheries. Approximately 90 % of global aquaculture production is in Asia. International experts see further growth potential in many countries worldwide. In Europe, aquaculture is expanding only in Norway (salmon and salmonids production). Annual production in Europe (including Norway) is less than 3 million tonnes. (DAFA, 2014)

The development of aquaculture in Germany has stagnated even though the country's water resources and technological capacity provide the foundation for a competitive sector. Currently, Germany accounts for less than 0.1 % of global fish production. Small fish farmers dominate within the German aquaculture industry. Most of them produce fish alongside with other agricultural or non-agricultural activities. In total, the number of these 'part-time' fish producers numbered approximately 12 300 in 2003 (Brämick, 2004). Additionally, around 700 businesses farm exclusively fish. (FAO 2007; for more details on statistics, see section 3.2.2.3)

A number of barriers such as legal framework, regulatory and market conditions hamper the development of the industry (DAFA, 2014).

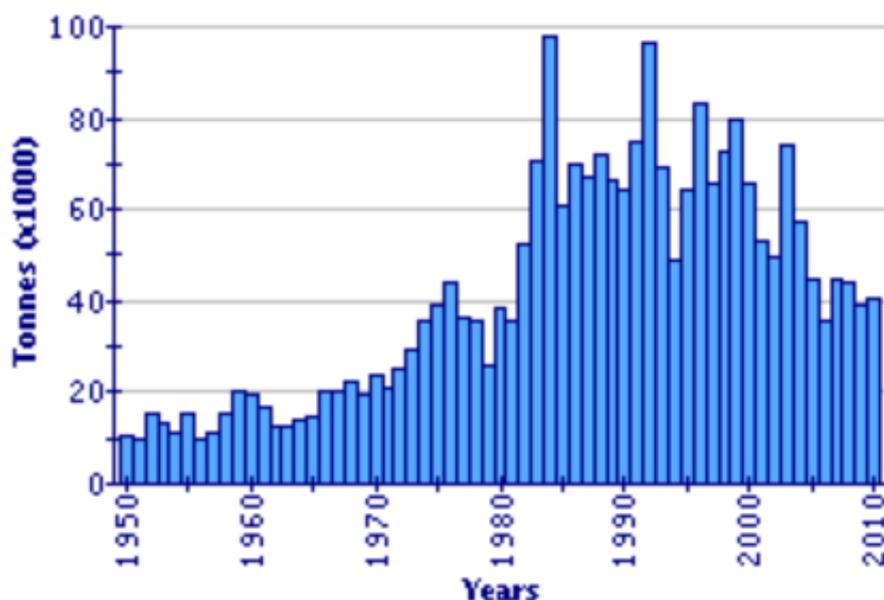


Figure 3: Reported aquaculture production in Germany (1950-2010)

Source: FAO Fishery Statistics, Aquaculture production

Annual aquaculture production in Germany is, according to official statistics, approximately 40,000 tonnes. Stakeholders expect national production to be actually higher (see section 3.2.2.3). By comparison, the German fishing fleet lands about 70,000 tonnes per annum. In addition, the fleet also lands 170,000 tonnes per annum in neighbouring countries such as The Netherlands. Fish consumption in Germany is almost 1.3 million tonnes per annum. (DAFA, 2014)

Aquaculture in Germany is a small industry, practiced only in a few specifically suited areas. Trout farming in freshwater flow-through-systems is the most profitable branch of production, both in terms of quantity and the revenue generated. The design and construction of production units as well the production densities vary widely, in some areas in the south of Germany in particular, earthen ponds with a low stocking density are still dominant. At the same time, some companies are operating modern farms equipped with tanks or raceways and high production densities. The main production regions are situated in the south of Germany and in the foothills of the mountains. (FAO, 2007)

Traditional aquaculture species cultivated in Germany are common carp and rainbow trout, which are farmed in earthen ponds, raceways and other modern indoor and outdoor facilities (Bräwick, 2015).

History of fish farming in Germany

Pond culture of fish and carp in particular has a long tradition in Germany; the first records of common carp (*Cyprinus carpio*) culture in Bavarian ponds date back to the eleventh century (see section 3.1.3) and reached an initial peak during medieval times. Between the seventeenth to nineteenth centuries, the importance of carp pond culture decreased, at that time the fast growing human population led to an alternative usage of former pond areas for the production of cereals. Following a second peak between 1880 and 1980 carp pond culture has been under consistent pressure over the last two decades mainly as a result of unfavourable economic conditions e.g. the high costs for energy, manpower, nature conservation constraints, low priced imports and a decreasing demand by consumers. Carp systems always provide coupled fish products from other species such as pike (*Esox lucius*), zander (*Sander lucioperca*) and tench (*Tinca tinca*).

Today, the most important cultured species in Germany is the rainbow trout (*Oncorhynchus mykiss*), which was introduced to Germany from North America in 1880. Over the last 30–40 years, production figures for this species have increased significantly. Milestones in trout aquaculture in Germany have been the development of artificial feed (1970–1980), the construction of flow-through-systems, artificial oxygen enrichment of production water and effective disease control. Because of these developments, production systems have evolved from earthen ponds to flow through units of different shapes made of concrete or plastic. At present, some small-scale producers still operate earthen ponds but the vast majority of trout are reared in flow through units at a much higher density level. In addition to rainbow trout, other salmonids such as sea trout (*Salmo trutta trutta*) and brook trout (*Salvelinus fontinalis*) also grow in these units.

Aquaculture in brackish and marine waters mainly focuses on blue mussel (*Mytilus edulis*). From this species, 9 300 tonnes were harvested in 2006 mainly from special aquaculture sites in the North Sea. The production volume of this species varies to a large degree between years. Harvests depend on the strength of seed mussels in nature. Some other finfish species like turbot (*Psetta maxima*), European seabass (*Dicentrarchus labrax*) and Macroalgae like *Laminaria saccharina* are cultured in recirculation systems. Recirculation Aquaculture Systems (RAS) are not defined by typical species but by the reuse of the water with limited additional fresh water input. Several of these plants are still on an experimental scale. (FAO, 2007)

Mussel farming is a marine aquaculture system. Blue mussel (*Mytilus edulis*) represents the most important marine species cultured in Germany. Although fishing on natural mussel beds in the German Wadden Sea along the Schleswig-Holstein coast has taken place for centuries, an extensive, combined fishery-culture system developed after World War II. Production of blue mussel is characterized by high fluctuations of output that are mainly caused by changes in seed availability. Today, hatchery production is based upon the conditioning of adult mussels by using algal food and temperature control. The natural maturation cycle is

actually mimicked at the hatchery. Mussel farmers clean up the mature mussels and hang them as a group in larval tanks. For the cultivation, farmers use on-bottom or, more frequently, longline techniques.

3.1.2 *Trout production in Germany*

Two thirds of all flow-through-systems used for trout production are situated in the southern part of Germany in the States of Baden-Württemberg and Bavaria, other important regions using these systems can be found in the States of Lower Saxony, Hessen, Nordrhein-Westfalen and Thüringen. Construction of these production units, the technical equipment used and the intensity of production varies widely. In terms of the feeding regime, trout farmers usually use pre formulated artificial feed. (FAO, 2007)

Rainbow trout used in German aquaculture have undergone a selection process in some regions. However, today a growing number of trout farmers are importing eggs or seedlings from abroad. More intensive trout fishers import eggs that are triploid and of female sex.

Trout are cultured in a large variety of production units at different levels of intensity with small-scale farmers often operating earthen ponds stocked with fry from specialised fry producers. Stocking densities are low and artificial feed is given, a marketable size of approximately 300 g is reached after 15–20 months and harvest is sold directly to individual consumers or restaurants in the region. This system is still of high importance for trout production in some areas of southern Germany. (FAO, 2007)

At the same time, some company's farm trout in modern flow-through-systems equipped with tanks, computerised feed systems and water oxygenation systems. Farmers either produce seedlings at the farm or buy them from specialist suppliers, often from abroad. Fish reach marketable sizes in the age of 12–15 months. Some farmers produce larger trout ('salmon-trout') that grow 24 months. Fish farmers sell their harvest usually via wholesale traders. (FAO, 2007)

In-depth case study analysis for SUFISA will focus on the south-west of Germany, the Black Forest area, where trout production is relatively common aquaculture system.

3.1.3 *Carp production in Germany*

3.1.3.1 *Overview of the national situation*

The farming of carp in freshwater ponds is the second major type of aquaculture practiced in Germany and has a long tradition (FAO, 2007). Variation in the intensity of carp production depends largely on both the location of production and the year class. Carp ponds are concentrated in the Federal States (Bundesländer) of Bavaria, Saxony and Brandenburg. The profitability of many carp farms is under pressure because producers in the neighbouring countries such as the Czech Republic and Poland are strong competitors.

In Germany, carp pond culture is concentrated in Bavaria, Saxony and Brandenburg. the most important areas being the Bavarian areas in the west of the city of Nürnberg (Aischgrund), between Hof and Regensburg (Oberpfalz), and the south-eastern area of Brandenburg near the cities of Cottbus, Bautzen, Dresden and Leipzig (Lausitz). Most pond farms in Bavaria are family owned, small size and operate at low levels of production. In contrast, specialized companies mainly operate pond farms in the Saxony and Brandenburg. The average ponds are larger and run at higher production levels. (FAO, 2007) The total pond surface area utilised for carp production amounts to roughly 40,000 hectares, half of which is located in the State of Bavaria. In Saxony, total pond surface area reaches 8,300 ha and in Brandenburg 4,200 ha.

3.1.3.2 *Case study area of the Aischgrund*

The case study analysis on carp focusses on the Aischgrund area in the northern part of the Federal State of Bavaria. Stakeholder interviews and farm visits took place in cooperation with international research

partners of the SUCCESS project. The following paragraphs represent the results of personal interviews with local experts (see names in brackets). A list in the annex shows the affiliation and the date of the interviews.

The geographical area of the Aischgrund along the river Aisch is situated in the upper part of Middle Franconia (Mittelfranken) and has very little over-regional recognition. In the fish farming sector, the Aischgrund has a national and international recognition because of the characteristic carp breeding line of the “Aischgründer Spiegelkarpfen”.

The rural tourism development has improved recently with several bicycle trails and cultural heritage activities. The carp representing the pond landscape is the key characteristic or icon providing regional identity and integration. However, carp products are seasonal because they are only available from September to April. (Schuster)

Stakeholders from the Aischgrund region reflect on the opportunity to apply for the registration as UNESCO World Heritage. (Oberle)

In the area, 7,000 ponds with a total pond area of 2 800 ha (including dams) characterize the typical landscape of the river Aisch valley and the neighbouring valleys. (Note: When comparing different regions, it is important to check if total pond areas cover only water surfaces as in Saxony or include dams as in Franconia!) (Oberle)

Since the dams have a significant ecological value, the total lengths of the dams with about 1,400 km in total is very important in respect to nature conservation and cultural landscape protection. Some of the ponds or chains of ponds are classified as nature conservation or bird protection areas. (Oberle)

The fertility of the agricultural soil is reduced due to clay layers in the soil and subsoil (depending on the site). Common arable crops are barley (for the well-known breweries in the area); maize (for biogas plants and animal feeds); oats and triticale-legume crop mixtures for carp farming. Due to the reduced fertility and unfavourable farm structures, framework conditions for agriculture are difficult. (Schmidt, Frischmann)

Moreover, farmers cultivate vegetable crops such as horseradish, onions or beet. Fish farmers in upper Middle Franconia have small farms with very little machinery and assets. The level of professional education in respect to aquaculture and/or the marketing of fish is relatively low. The good practical knowledge results from own experiences and the traditional knowledge of local families. Farmers work part-time in agriculture and aquaculture. Usually, they earn their living in the industrial sector because several corporations are located in the area (e.g. Adidas, Puma, Siemens). Unemployment rate in the area is very low. The majority of the typical small scaled farmers (<1 ha) gain nearly the total annual income (95%) from employment in other sectors. The access to the market of fish is difficult for the large number of small producers. Most farmers depend from few fish wholesalers who collect, grade, process and distribute the fish to restaurants in the closer and wider area as main sale channel. (Oberle)

Back in history, the area used to be a low-income rural area but traditionally strong in handicrafts and trade. The economic development is based on the settlement of large-scale industrial enterprises. Today, the region is relatively wealthy. (Oberle)

Natural conditions

Most ponds depend from rainfall (“sky ponds” – they are called “Himmelsteiche”). Only very few ponds are located close to rivers or brooks. Since annual rainfall is low with in average around 550-600 mm/m², water is seen as a scarce resource. (Focusgroup)

Water is a relatively scarce resource for pond farming because all surface water results from rainfall. The ponds in the Aischgrund do not have rivers providing continuous surface water flow. This is a significant difference to other areas. . The ponds in the carp farming region Lutetia (Lausitz) – for instance - are supplied via the large rivers Oder and Neisse flowing through the lowland region. (Oberle)

Since many ponds are connected in a row, the so-called “pond-chain” (“Teichkette”), there is a significant interdependency of ponds, water and the potential spread of diseases. (Focusgroup)

Soil and rock structure, as well as the PH-value affect the fertility of the ponds. Due to the high content of lime in the sub-soil, water is not leaching from the earth ponds.

Farm and income structure

Most fish farmers combine agriculture and fish farming as part-time activity. Farms are usually very small with in average less than 5 ha of pond area. Only a few full-time fish farmers exist in the Aischgrund and less than five farms have more than 50 ha of ponds. (Focusgroup)

In average, ponds have a size of 0.4 ha resulting in around 6-10 ponds per farm. Fish farmers usually do not rent land but own land and ponds for aquaculture. Anglers most often use ponds rented out by farm families.

Usually, these ponds are not in a confined area but distributed in the local area. All ponds depend on rainfall because the ponds are not connected to surface waterways.

In general, fish farmers in Aischgrund profit from financial stability of the family income due to non-agricultural/aquaculture employment. Depending on the year, the income from carp production represents around 5 % of the annual income of the farmer couple. Even with a very low income from fish farming, the elder generation ‘likes it’ and continues the production as leisure and/or traditional activity. However, they highlights that the younger generation will only continue when the income will be ‘sufficient’. (Focusgroup)

6 % of the number of ponds (around 10 % of Pond surface) are owned or rented by anglers. Anglers and anglers associations sometimes follow other strategies than the fish farmers. Conflicts come up when anglers do not want to follow the annual cycle of draining interconnected ponds or introduce species that spread into fish farmers’ ponds who do not wish to have them. (Oberle)

3.1.3.3 Organisation of the production system

The production cycle consists of three seasons. Breeding takes partly place in breeding tanks under protected conditions and partly under natural condition in small spawning ponds. Carp need worm water, in particular for breeding conditions. In the third year, fish of around 1.5 kg/animal are harvested and sold for consumption.

Most small farmers buy bigger fish (K1 or even K2) from more professional farmers because they have reduced opportunities to nurture fry and fingerlings under sufficiently protected situations. In particular, when only one pond is available, the separation of age groups is impossible.

Category of carp put into the ponds in year 1-3:

- Ko to Kv (‘Karpfen vorgestreckt’), first 4-6 weeks (20-25 Euro/1000g)
- K1 are fingerlings with a weight of 10-50 g/per fish (average of 25g; around 7 Euro/kg; the smaller the more expensive – up to 8-9 Euro/kg)
- K2 carp ranges between 250-350 at stocking. The costs are relatively expensive and the offer is sometimes short due to high loss caused by cormorant (3.50 Euro/kg in Franconia versus 2.80 Euro in Saxonia) (Focusgroup)

- K3 carp with around 1.5 kg/fish is the sales product as fish for human consumption of the Aischgrund area.

Main challenge of the production are the losses of small fish by predators, which is mainly the cormorant (see section 3.5.1.2)

Cereal volume for feeding represent around 2 tonnes per ha pond area and year.

Fish feed high value protein from natural sources (zoo- and phytoplankton). Instead of fishmeal or soy based nutrition, farmers only feed fish with a mix of cereals – only sometimes with legume crops (triticale, barley, lupines and peas). The fat content is of high importance for the quality of the fish. (Focusgroup)

Maize is not suitable for carp because the meat will get higher in fat content compared with the feeding of other cereals. The fat content of carp can reach 35%. More than 10% is too high (reduced fish meat quality). A fat content of up to 10% is good. Without any additional feed and under normal natural feeding conditions, carp meat fat content will be in a range of 2 – 4 %. In this case, the meat quality is excellent. Under poor natural feeding conditions, the fat content can even fall to a minimum of 1% (which will reduce the fish meat quality). (Schmidt)

Feed costs: Most farmers feed their own cereals from agricultural production. Cereal sales prices: 14.80 Euro/100kg; purchase prices: 15-18 Euro/100kg

- Labour needed for carp ponds: 50-110 hours per ha and year; small well-organised farms require around 80 hours/ha and year; farms of around 20 ha need less than 50 hours/ha and year; the production period 'K1 to K2' needs more time than 'K2 to K3'.
- Harvesting: half day per pond with 3 persons; the 2 helping hands are usually family members or friends (unpaid labour).
- After harvesting, carp will be watered – put in clean water ponds or tanks – for 10-14 days. Some ponds do not produce 'blue algae'. Without blue algae, no muddy taste occurs and consumption is possible without watering. The scientific background is not fully clear yet. (Focusgroup)
- Fingerlings harvested will not be sold but goes back into the ponds for stocking. (Bartmann)
- After Easter, farmers usually bring back remaining carp from the clean water storage tanks into the natural ponds. They will grow for another summer and sold or consumed in the coming season. (Bartmann, Schmidt)
- Compared to intensive aquaculture systems, traditional carp farming shows a variety of farm specific technical or organisational solutions. Due to this variety, input and output differ between farms and pond as well as years. Carp farming depends highly on natural framework conditions. In particular, as a result of the losses caused by predators, the output from these low-intensity aquaculture systems vary considerably. The variety in size of carp, fat content of the meat, and taste is a challenge for a potential growth of an over-regional marketing. Moreover, the product is strongly seasonal because sales are limited to September-April, mostly due to history and traditions. Furthermore, the general demand for carp outside the few German carp regions is weak and very limited to short seasons (Christmas and New Year). These restrictions are seen as hampering factors for the development of an over-regional broader marketing concept. (Focusgroup)

3.1.4 *Recirculation aquaculture systems in Germany*

Recirculation aquaculture systems (RAS) are alternative production systems that reuse the water from the fish tanks after purification (IGB, 2016). Recirculation plants have water purification units that filter nutrients, organic and inorganic particles and fractions. In the ideal situation, the water volume circulates continually and hardly any fresh water enters the system. Semi-circulating systems are still defined as RAS as long as the daily fresh water influx does not exceed a maximum of 10% of the total water volume used. (Schmiedel, 2014)

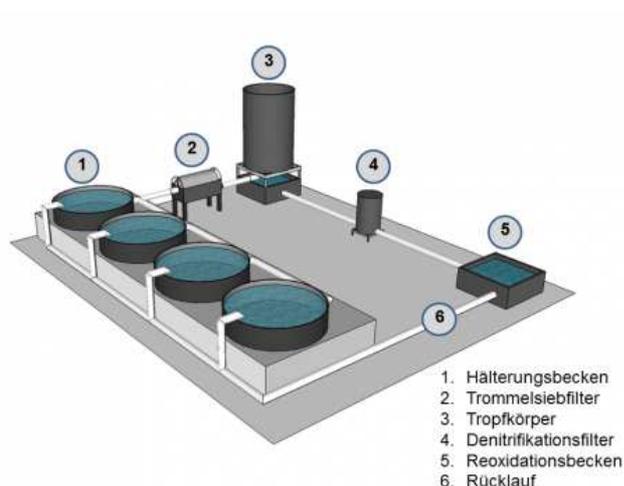
The national strategy for aquaculture highlights the objective to increase the German aquaculture production from RAS significantly. The aim is to reach an annual production of 20,000 tonnes of fish and fishery products from RAS in 2020. (BMEL, 2014) Currently, Germany has around 48 warm water plants stocked with around 2,200 tonnes of fish². Farm enterprises usually establish RAS in connection with the construction of a biogas plant because warm water fish system (23-28°C water temperature) can use the exhaust heat of the biogas plant efficiently. For example, African Catfish need very warm water of more than 27°C. Costs for heating represent about 15% of total costs of production (Wedekind, 2012). The Annex - Aquaculture shows a recent list of the RAS in Germany.

Policy and funding schemes are very important for the development of biogas plants in Germany (see section 4.2.2.1 for the regulatory framework for renewable energy production).

Technical problems concerning the biological purification of recirculation production water were key issues during the 1990s and the early 2000s. Today, fish production in RAS is a well-tested technology in Germany. However, only a limited number of farms run these intensive fish production plants. Key issues today are economic results that mainly depend on production technology and sustainability of the production systems. New technical solutions resulted in significant improvements. However, the financial investment and the related costs require an effective marketing based on higher prices and continuous sales of fish. (LFL Fischerei, 2012) Mainly high-value fish are crustacean are farmed in RAS due to high end-consumer prices needed for the covering of operational costs (Meyer et al., 2016).

Owners of aquaculture facilities have to comply with a number of environmental limitations. In particular, the reduction of effluents from fish farms is an important issue.

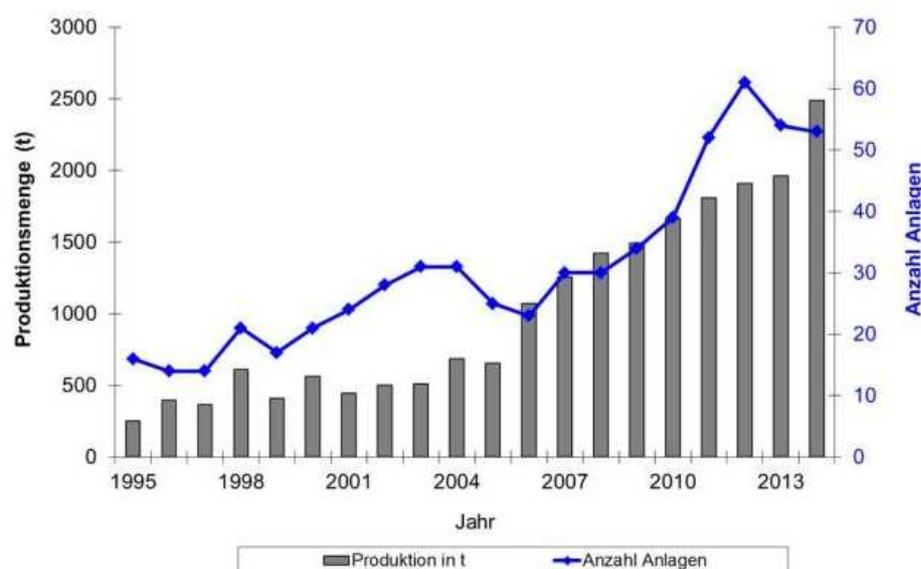
² Note that the volume of fish kept or produced in tanks or ponds differs significantly from the volumes sold. In the end of a production cycle, a proportion of at least 15-20% of the output remains on the farm for breeding or restocking.



Legend: Fish tanks (1), filtration system (2, 3, 4), re-oxidation (5), and reflux (6)

Figure 4: Basic diagram and photo of a Recirculation Aquaculture System

Although costs of RAS based fish production are particularly high, experts consider the system efficient, sustainable and future oriented. (IGB, 2016)



aus dem "Jahresbericht zur Deutschen Binnenfischerei und Binnenaquakultur 2014". Zu den Warmwasserkreislaufanlagen in dieser Darstellung noch weitere Anlagen (5) wie Durchlaufanlagen an Kraftwerken hinzu.

Figure 5: Output volumes in tonnes and number of RAS in Germany (1995 – 2014)

Source: <https://www.lfl.bayern.de/ifi/aquakultur/030683/index.php>

Since many years, eel production shows the highest production volumes of RAS in Germany. Producers sell adult eel for slaughtering or seedlings for rivers and lakes (Brämick, 2015). The most significant growth rate has the production of African catfish (*Clarias gariepinus*). Production is usually coupled with the use of heat of a farm-based biogas plant (Wedekind, 2012). Moreover, the production of Wels catfish, Tilapia (*Nile tilapia*), carp or zander is common in RAS. Different breeds of sturgeon are mainly used for caviar production.

While traditional fish farming systems are closely linked to site-specific conditions, RAS are independent from landscape, soils and surface water supply (BMEL, 2014). Consequently, the selection of construction site depends on local rules for constructions and economic aspects such as the connection to relevant markets (Lemcke, 2014).

Production systems differ between farms. Most of the enterprises are still pioneers in the field of intensive fish production. Production statistics show that the number of plants falls while the total production increased from 2013 to 2014. “This indicates that the trend of growing output per plant continues.” (Brämick, 2015) The Chamber of Agriculture recommends that full-time fish production needs to be based on a minimum production capacity of around 100 tonnes per year. Smaller plants are expected to fail with the realization of long-term viable economic results (Hinz, 2011).

Special type of aquaponic plants

Aquaponics is a compound word and is defined as a food production system that combines conventional aquaculture (raising aquatic animals such as snails, fish, crayfish or prawns in tanks) with hydroponics (cultivating plants in water) in a symbiotic environment (ANSI, 2016). Aquaponics is the coupled production system. Very few systems work on a commercial basis because the majority of internationally existing plants are pilots. The particular strengths of Aquaponics are the perfect recirculation of water and nutrients. Water from an aquaculture system feeds the hydroponic system where the faces of fish, the by-products of fish production, are broken down by nitrification bacteria into nitrates and nitrites (ANSI, 2016).

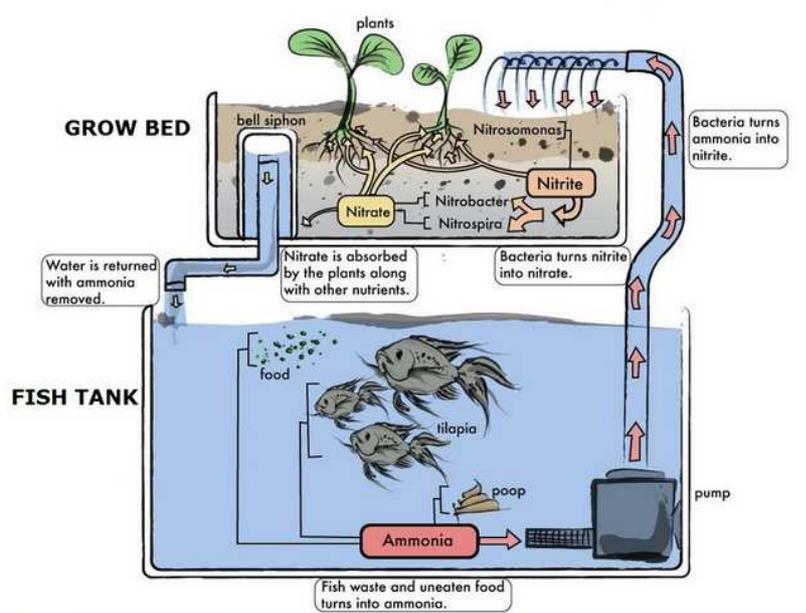


Figure 6: Basic diagram of the aquaponic system

Source: <http://aquaponicsphilippines.com>

The plants utilize these as nutrients. Then, the purified water flows back into to the aquaculture system. In the ideal case, the closed cycles ensure an emission-free production system of e.g. tomato and Tilapia fish. Aquaponic plants started back in the 1980s and 2990s in the Netherlands with the production of African catfish. (BMEL, 2014)

In 2014, only one EFF-funded pilot project tested the system under contemporary technical conditions. Commercial experiences with aquaponics are still lacking in Germany. (BMEL, 2014)

3.2 Policy conditions and institutional framework for aquaculture in Germany

3.2.1 EU policies: the Common Fisheries Policy and the Common Organisation of the Market

3.2.1.1 Aquaculture and the reform of the Common Fisheries Policy

Boosting the EU's aquaculture industry is one of the key elements of the reformed Common Fisheries Policy (CFP). This is no surprise, as farmed seafood is becoming widely recognised as a vital part of our future food supply. On a global level, the Food and Agriculture Organization (FAO) estimates that about half of the fish consumed today comes from aquaculture. In the EU, imported seafood accounts for 65% of consumption, and the gap between seafood production and demand continues to grow. There are limits on how much capture fisheries can sustainably produce, so it is up to Europe's aquaculture sector to step into the gap. While European aquaculture is at the forefront of technical expertise and environmental regulation compliance, its growth is stagnating. The reformed CFP aims to reverse this trend and unlock the industry's considerable potential. (EU Commission, 2016)

Bureaucracy has been identified as one of the main inhibitors of aquaculture investment and development in the EU. The administrative barriers to securing a licence will be reduced in order to encourage entrepreneurship and private funding, without jeopardising the high level of consumer and environmental protection enshrined in EU law. Parallel to this, spatial planning in coastal areas and river basins will help guarantee aquaculture producers adequate access to the space and water they require, whilst minimising impact on the environment and related sectors, such as tourism. (EU Commission, 2016)

Consumer perception of farmed seafood will also be addressed. When provided with readily available, pertinent information, consumers are often willing to pay a premium for high quality, sustainable products. Labelling and communication campaigns will make consumers aware of the specifications of EU farmed fish. This will contribute to making the industry more competitive, and encourage niche-market opportunities such as organic aquaculture. (EU Commission, 2016)

The European Maritime and Fisheries Fund (EMFF) provides financial support for the development of the aquaculture sector during the European funding period of 2014-2020 (EU Commission, 2016)

The Commission intends to boost the aquaculture sector through the Common Fisheries Policy (CFP) reform. The CFP has the same premise as the Common Agriculture Policy (CAP) but it does not distinguish between a first and a second pillar. However, the second pillar of CAP, which is implemented by the Rural Development Plans (RDP) based on the Regulation (EU) No 1303/2013, provides the financial support of aquaculture producers.

In 2013, the EU Commission published Strategic Guidelines for the CFP that present common priorities and general objectives at EU level. Four priority areas were identified in consultation with all relevant stakeholders:

- Reduction of administrative burdens
- Improving access to space and water
- Increasing competitiveness
- Exploitation of competitive advantages due to high quality, health and environmental standards.

Based on the guidelines, the EU Commission and EU Member States are collaborating to increase the sector's production and competitiveness.

Regulation (EU) No 1380/2013 on the Common Fisheries Policies asked EU Member States to develop national strategy plans for the development of aquaculture in the period 2014-2020. In 2014, the Federal Ministry for Food and Agriculture published the National Aquaculture Strategy for Germany (BMEL, 2014).

3.2.1.2 *Common Organisation of the Markets for fish*

The EU policy for managing the market in fishery and aquaculture products is one of the pillars of the Common Fisheries Policy (CFP). The Common Organisation of the Markets (COM) strengthens the role of the actors on the ground: producers are responsible for ensuring the sustainable exploitation of natural resources and equipped with instrument to better market their products. The COM supports measures that inform consumers about the fish products sold on the EU market, which, regardless of their origin, must comply with the same rules.

The Common Organisation of the Markets has developed into a flexible instrument that ensures the environmental sustainability and economic viability of the market for fishery and aquaculture products. The five main areas covered by the scheme are (EU Commission, 2016b):

- Organisation of the Sector: Producer organisations are the key players in the sector. Through their production and marketing plans, they deliver the CFP.
- Marketing standards: Common marketing standards lay down uniform characteristics for fishery products sold in the EU, whatever their origin. They are applied in accordance with conservation measures and help to ensure a transparent internal market that supplies high-quality products.
- Consumer information: Rules on the consumer information establish what information must be provided to the consumer or mass caterer who buys fishery and aquaculture products. They allow consumers to make informed purchasing choices.
- Competition rules: The COM is subject to competition rules. Given the specificities of this scheme, exceptions to the application of these rules exist to ensure the functioning of the policy and the achievement of EU objectives.
- Market intelligence: The Commission has set up the European Market Observatory for Fishery and Aquaculture Products to contribute to market transparency and efficiency. (EU Commission 2016b)

3.2.1.3 *Specific context for the carp farmers in Bavaria*

EU area payment for agricultural land (Common Agricultural Policy): payments are only available for arable and grassland, not for pond area.

The European Rural Development Programme encompasses the opportunity for national/Federal Rural Development Programmes to include the support for fish farmers under the related articles of e.g. farm investment, agri-environmental schemes, farmers' cooperations, farm advice, conversion to organic farming. The compensation payment for less-favourable areas in Bavaria does not include pond areas.

KULAP is the agri-environmental schemes in Bavaria (based on the Rural Development Plan of the Federal State of Bavaria). The participation requires a maximum stocking rate of 600 fish/ha in the Aischgrund area. The payment ranges – depending from additional requirements - from 200 to 550 Euro/ha. Siltation areas of the ponds have a high nature conservation value and receive additional payment. Farmers often apply for KULAP for their low-intensity fish farming in the weaker ponds laced e.g. in forest. In contrast, they prefer higher stocking rates of around 900 fish/ha in the more productive ponds in meadow locations. (Bartmann)

LEADER and Local Action Groups related to carp farming contribute to the regional development.

Support provided by the European Fishery Fond (EFF) has been used in the context of several projects in the area. Thanks to European funds (EFF and RDP) and other sponsors (local institutions, firms), local stakeholders founded the regional tourist (and regional management) office “Karpfenland Aischgrund “in 2013. Main objective of the office was to promote the Aischgrund region and its links with carp farming. The communication strategy focused on the advertising of the region, firstly on the local level at e.g. local trade shows. For example, the Carp Queen, who is elected annually, welcomes participants at these events and promotes the traditional carp farming. The idea is to develop a ‘soft tourism’ based on the key characteristic of the area: nature conservation and carp farming heritage. Moreover, the office has implemented a training scheme for farmers who which to obtain the skills and know-how to conduct guided visits and hiking tours. Such a rural ranger activity contributes not just to complementary farmers’ income but also to enhance their self-esteem as (small) fish farmers. The tourist office aims to foster this close cooperation with farmers. The plan is to create a FLAG (Fishery Local Action Group) funded by the new European Marine and Fisheries Fund (EMFF). One of the projects is to develop seminars to “coach farmers” to become able to transmit their passion of carp farming, to share the regional heritage with tourists and to convince potential carp consumers of the particular qualities of the fish. The idea is that farmers will be conscious of their knowledge and valuable fish farming experiences, and regional dwellers will be aware of the carp farming history in their neighbourhood. This is expected to help the communication of the value of the Aischgründer carp and carp farming on the regional level and throughout Germany. Meanwhile, touristic infrastructures with hotels and restaurants have to grow to meet the envisaged demand. (Schuster)

3.2.2 National level institutional framework for the aquaculture industry

The national policy for aquaculture has two main objectives: the increase of fish production in Germany and the maintenance or establishment of the sustainable production of healthy products that are traded internationally. (DAFA, 2014) The development of the National Strategy for Aquaculture was a very important national level process in 2013. The BMEL published the strategy in 2014 (BMEL, 2014). In addition, some of the federal states elaborated region specific strategies for aquaculture such as Schleswig-Holstein and Niedersachsen³. Both strategies have the objective to foster aquaculture in the area.

3.2.2.1 Institutional framework

Germany is a federal state with a three-tiered system of government: the federal or national level, the level of the Bundesländer and the cities and municipalities. The Federal States (Bundesländer) are (among other areas) responsible for nature conservation and aquaculture legislation; and they have the administrative control. Legal and administrative rules and regulation for fisheries and aquaculture differ between regions. For that reason, national level authorities have a very limited impact on the industry’s development. Analyses need to consider limited comparability of some relevant framework conditions. Moreover, the regional differences sometimes cause competitive disadvantages for entrepreneurs. For region or production system based case studies, the regional context is of particular importance.

However, some framework regulations in the context of aquaculture are set in the responsibility of the Federal Ministry for Agriculture (BMEL), for example, issues relating to fish sales and marketing, animal welfare, and the prevention of epidemics. The Federal Ministry for the Environment (BMU) is responsible for the protection of groundwater and inland waters as well as maritime zones, for wastewater treatment, pollutant in food, landscape planning and the conservation of species.

Professional organisations such as the freshwater fisheries associations are important institutions for German fish farmers. These associations have local, regional and national level bodies. Each federal state

³ <http://www.lwk-niedersachsen.de/index.cfm/portal/foerderung/nav/515/article/14834.html>

has an own aquaculture association representing the interests of stakeholders within the state. Anglers and inland fishers catching on rivers and lakes are members of specific associations. On behalf of these region-based associations dealing with fishery, pond cultivation or angling issues, federal stakeholders act nationwide but cooperate closely. For example, they organize an annual conference together and liaise for joint political initiatives.

3.2.2.2 *Legislative framework*

Fishery acts exist both at the federal level, including provisions on sea and coastal fisheries (Seefischereigesetz- SeeFischG) and at the level of the federal state with provisions on inland water fisheries and territorial waters (within 12 sm zone). None of the fisheries laws (Fischereigesetz- FischereiG) of the sixteen Bundesländer include explicitly the term aquaculture. For instance, the Fisheries Law of Brandenburg refers to the rearing or culture of fish and other aquatic organisms in all artificial ponds and other facilities⁴.

The National Strategy Plan for Aquaculture highlights the most significant areas of the legal framework for aquaculture (BMEL, 2014): construction and security, water, nature conservation, veterinary controls, hygiene and food safety. National legislation includes protective measures in connection with the marketing of food, feedstuffs (Art. 74 No 20 GG), inland waterways (Art. 74 No 21 GG), the promotion of agricultural production (including fisheries), deep sea and coastal fishing (Art. 74 No 17 GG). In contrast, the regional planning and management of water resources (Art. 75 GG) is part of the federal framework legislation.

The Act on the Regulation of Matters Relating to Water of 1957 is the Federal Water Act (Wasserhaushaltsgesetz, WHG), last amended in 2001). The WHG is the framework law of the Federal Government and lays down the basic provisions related to measures of the water resource management (management of water quantity and quality). Therefore, it has a key role for aquaculture. This frame law is complemented by the water legislation of the federal states such as the Water Act of Mecklenburg-Vorpommern. The Federal Water Act includes provisions on the use of ground and surface water, the handling of substances hazardous to waters, the wastewater disposal as well as the development of waters.

Since the most important federal acts in the field of water resources management (Federal Water Act and Federal Wastewater Charges Act) are only framework statutes, the water resources regulations in the Federal States (state water acts, state wastewater acts and various statutory orders) also contain important provisions which supplement the federal regulations or define them in greater detail. For example, the Federal States regulate ownership of waters, monitoring of waters, maintenance of waters, licensing procedures for uses of waters, and indirect discharges (i.e. discharges via wastewater treatment plants) into waters.

The Federation participates in the discharge of responsibilities of the Bundesländer, in the improvement of the agrarian structure and of coastal preservation including fisheries (Law on the Improvement of the Agrarian Structure and the Coastal Protection (Gesetz über die Verbesserung der Agrarstruktur und des Küstenschutzes). It is a joint task, because such responsibilities are important to society as a whole and federal participation is necessary for the improvement of living conditions.

There is no single authority responsible for aquaculture. Several authorities are concerned with aquaculture matters, such as the authorities in charge of water management, nature protection or construction. The most important authorities with respect to aquaculture are the water authorities. The supreme water

⁴ "Aufzucht und Haltung von Fischen und anderen Wasserorganismen in allen künstlich angelegten Fischteichen und sonstigen Anlagen", Fisheries Law of the Federal State of Brandenburg

authority (oberste Wasserbehörde) in Brandenburg decides about the policy guidelines and supervises the lower water authorities (untere Wasserbehörde) and the superior water authorities (obere Wasserbehörde/Landesumweltamt) in the state of Brandenburg. The lower administrative water authorities are the county administrations. These authorities issue, restrict, withdraw or revoke licences for water use. In general, aquaculture authorisations are granted at discretion of the competent water boards (management discretion). The superior water authority is competent in cases of specialized formal legal water procedures.

3.2.2.3 Fish statistics and changes in data collection methods in Germany

Rules on the statistics of fish production changed a few years ago. The National Agency for Statistics (Statistisches Bundesamt, DESTATIS) took over the responsibility for the collection of production data. Since the methods of data collection changed, stakeholders argue that in reality national production will be actually higher. This potential underestimation of aquaculture production affects public debates and decision-making in policy and administration in respect to fish farming support.

Following the Federal Agency of Statistics, small fish farms dominate the aquaculture system. More than 25% of farms cultivate less than 100m² water surface (DESTATIS, 2015a).

Statistic data of the Federal Agency of Statistics show that 79 recirculation plants with a total water surface of 62,776 m² produced fish in 2014. In principle, RAS are located throughout Germany. However, the concentration of farm enterprises with RAS is slightly higher in Northern Germany, in particular in Lower Saxony with 27 plants. Nordrhein-Westfalen and Mecklenburg-Vorpommern have nine enterprises, and Saxonia as well as Hessen have seven plants. (DESTATIS, 2015a)

The differences in data of the Federal Agency for Statistics and the Regional offices responsible for fisheries and fish production highlight a general problem of the aquaculture sector in Germany (Table 8). Public agencies disagree on the basic data for the representation of the sector.

Table 8: Number of RAS per state of the Federal Agency for Statistics versus regional agency data

Bundesland	Data published by the Federal Agency for Statistics (Destatis)	Data published by the Agencies for Fishery and Aquaculture of the Federal States
Baden-Württemberg	4	-
Bayern	4	-
Brandenburg	2	4
Hessen	7	5
Mecklenburg-Vorpommern	9	7
Niedersachsen	27	18
Nordrhein-Westfalen	9	1
Rheinland-Pfalz	-	-
Saarland	1	-
Sachsen	7	11
Sachsen-Anhalt	1	1
Schleswig-Holstein	5	5
Thüringen	3	1
Total	79	53

Table 9 shows the size of RAS in square meter water surface. Most farms have tanks with less than 100 square meters of water surface.

Table 9: Recirculating aquaculture facilities in 2014, ordered by size

Total water surface per farm (from... to ... m ²)	Number of farms	Size of plants in m ²
Less than 100	21	1153
100-200	19	2463
200-500	12	3589
500-1000	9	5862
1000 and more	18	49709
Total	79	62776

Source: DESTATIS, 2015a

More detailed structural data on fish farms and aquaculture production system is not available.

Since 2011, the Federal Agency for Statistics collects national and regional data for the aquaculture sector. Before, each regional office for fisheries and aquaculture was responsible for the publication of industry data. The methodology of data colligation and aggregation changed. Long-term data on the structural

development of the sector and a description of trends is impossible because data differs significantly (Brämick, 2015).

In 2015, the Federal Agency for Statistics introduced a minimum size of RAS systems for data collection and started to neglect small and very small fish farms (DESTATIS, 2016). This method is not expected to impact on the number of RAS but only on the number of traditional fish farms.

Micro economic data is only published for fisheries and marine production (Publications Office of the European Union, 2014)

3.2.2.4 *Role of national level research*

Research policy concerning fish production is seen as one of the hampering factors for the aquaculture sector: “The German aquaculture research effort has not given the sector the decisive boost required to overcome this stagnation and keep pace with global developments” (DAFA, 2014). However, aquaculture research resources of the different Federal States instead of being pooled. For that reason, a joint effort was lacking to focus on major challenges (see section 3.4).

3.2.3 *Conditions related to the case studies*

3.2.3.1 *Specific administrative context for carp farming*

In Bavaria, more public bodies than in other areas are responsible for the administration of the aquaculture sector: the county (Landkreis), the administrative districts “Regierungsbezirke”, the administrative area of the “Bezirk” and the commune (Gemeinde). The different levels of responsibilities hamper decision-making and (non-monetary) support measures. Most important administrative offices are the local nature conservation agency (untere Naturschutzbehörde), the veterinary inspection office (Veterinärbehörde) for food hygiene and animal welfare issues, the department for agriculture of the county (Amt für Landwirtschaft). A key player for local fish production and administration is the Department for Carp Farming, which belongs to the Institute for Fisheries of the Bavarian State Research Centre for Agriculture (Bayerische Landesanstalt für Landwirtschaft, Institut für Fischerei – LFL). It is located in the town of Höchststadt in the Aischgrund valley.

The Bavarian State Research Centre for Agriculture, Institute for Fisheries is the applied research and advice agency for the fisheries and fish farming sector in Bavaria. The Department for Carp Farming in Middle Franconia started its work 60 years ago when carp suffered from the viral infection of *Spring Viremia* of carp (‘Bauchwassersucht’). Due to this disease, productivity in this time was very low and the economic situation of fish farmers in Mittelfranken was at threat. (Oberle)

International and national level policy and research have often no direct impact on or responsibility for the specific regional/local fish farming issues. (Oberle)

Today, the National Agency for Statistics is responsible for the collection and publication of aquaculture production data. Since the methodology of data collection has changed since 2011, long-term data analysis has to take into account in cut in the methodological approach. Fish farmers’ association often argue that the official statistical data is lower because of the change in data collection methodology. Since the introduction of the new methodology, fish production volumes and values are expected to underestimate the actual situation. For instance, a study undertaken by the Bavarian the Department for Carp Farming and the University of Erlangen compared national statistics with the results of an own local data collection. The study highlights for the year 2014 that federal statistics present a carp pond area of 1,599 ha for the Aischgrund while the local survey results in 2,266 ha. (Lasner, Oberle)

3.2.3.2 *Legal issues highlighted by Aischgrund carp farmers*

Relevant for aquaculture: Building legislation, nature conservation legislation, fisheries legislation, animal protection law, Water Resource Act (according to EU framework regulation for waters)

- Use of ponds: Farmers need permission when they want to stop fish production and use the area for agricultural or other different purposes. Moreover, the annual draining of ponds requires coordination by the regional water administration. Farmers ask for permission when they plan to empty the pond(s) in autumn. Fish farmers do not have to give evidence of a professional training or certificate for carp farming.
- Anglers need a qualification certificate ('Angelschein').
- Around 15% of ponds in the region are classified as Nature Reserves, as Special Protection Area (SPA) or as Natura 2000 area.
- Legislation dealing with dead fish in ponds is more restrictive than in rivers.

In the past, legal conditions in respect to nature conservation issues have been subject of legal disputes between individual farmers and the nature conservation agency (see chapter 3.4). The Department for Carp Farming and farmers' organisations cooperate with the Bavarian agency for water aiming to develop new guidelines for the use of carp ponds in the area. Such guidelines will help to avoid legal conflicts and individual negotiations between fish farmers and the administrative agencies.

It took 20 years to convince the nature conservation agency to allow the defence of cormorants. Since 3-4 years, the single shooting of cormorants is also in Nature Reserves or SPA – under certain rules - possible.

In controversial discussions, effluents from ponds during harvesting are by some groups seen as pollution from fish farming from the point of view of some local water authorities. However, ponds are a sink of nutrients and soil particles from surrounding arable land. Since phytoplankton and plants transform nutrients (N and P) from surrounding fields into feed for fish, carp farming avoids the accumulation of nutrients in the waterways. Only a small proportion of agricultural nutrient losses enter the waterways through the ponds. (Oberle)

Some farmers in the area experienced legal disputes in respect to environmental issues. In particular, perspectives from fish farmers and conservationists seemed to be incompatibly for a long time. Nowadays, open-minded communication and an increasing understanding for nature conservation of all parties lead to improved arrangements between fish farmers and conservation organisations.

3.2.3.3 *Carp farmers' associations and cooperatives*

Pond cooperatives, the Teichgenossenschaften: Pond cooperatives are legally registered public cooperations. The cooperative has been responsible for the administration of the official grants to rebuild and maintain the ponds since the Second World War. The maintenance of field roads ensuring access to the ponds and sometimes the organisation of sales are important activities. Cooperatives nowadays aim to enhance farmers' framework conditions for a sustainable use of ponds. Cooperatives are responsible for the representation of its members' interests in all areas of concern. (<http://www.teichgenossenschaft-oberpfalz.de>)

Local pond cooperatives help to define standards (e.g. for the marketing of the Aichgründer association) and support registration of e.g. Protected Geographical Indication (PGI). A close cooperation between organizations is crucial for the success of the regional development strategies focusing on the maintenance of ponds and fish production. The integration and participation of fish farmers is a success factor for the regional development activities. Trust has been build up in recent years. (Schuster)

Group ownership of pond, the Teichgemeinschaften: When large ponds were sold in the past, single farmers were not able to buy it by themselves. Instead, a group of e.g. 20 small farmers purchased the pond under the concept of multiple-ownership. Each member of the group is a registered owner in the land title register and holds a share of the pond. Farmers share revenue and costs. This concept exists since 200 years; no formal cooperation as association or cooperative is needed. (Schmidt)

The number of fish farmers' representatives or policy stakeholders is very small in all regions in Germany.

3.2.3.4 *Legal framework for operators of recirculation systems*

„The Renewable Energy Act (EEG) offers the opportunity for operators of bioenergy plants to receive a higher price for energy fed into the grid if the exhaust heat is used efficiently. This use of exhaust heat is e.g. the production of fish. In addition, the use of manure from piggeries results in an additional payment for the operation of the biogas plant which is an additional income for the fish producing farm enterprise“ (Brämick, 2015) For more information on the EEG, see section 'case study oilseed rape - legal conditions oilseed (section 4.2.2.1).

Operators of RAS need to take into account a variety of laws, which are irrelevant for aquaculture in earthen ponds:

- The European regulation for organic farming does not allow organic fish production in RAS. Only breeding, the production of seedlings of organic fish systems and the cultivation of organisms for the feeding of organic fish are allowed to take place in tanks of RAS (Gaye-Siessegger, 2009).
- Fish production in tanks is in legal terms not classified as farming but as a commercial operation (Gewerbebetrieb) following § 35 Art. 2 of German construction law (BauGB). The official permission for the construction of a RAS is often very protracted and complex. (Lemcke, 2016)
- RAS usually need permission for waste water disposal, and operators have to pay waste water fees, which are irrelevant for other fish farmers (Lemcke, 2016).

3.3 Market conditions for fish from aquaculture

The regulation (EU) No 1379/2013 on the common organisation of the markets in fishery and aquaculture products⁵ is integral part of the Common Fisheries Policy (CFP, see above). It contains measures related to the markets for fishery and aquaculture products in the Union. The CMO shall be comprised of the following elements: (a) professional organisations, (b) marketing standards consumer information, (d) competition rules and (e) market intelligence (see section 3.2.1.2). Several measures of this regulation supported activities of carp farmers and stakeholders in the Aischgrund.

3.3.1 *Market for 'Aischgründer carp'*

3.3.1.1 *Value chain for carp in the Aischgrund*

Most fish farmers produce small volumes (average of two ha pond surface per farm). For that reason, they either sell to fish wholesale companies or directly to restaurants. Prices are relatively low per kilogramme fish but direct marketing is difficult. (Focusgroup)

⁵ REGULATION (EU) No 1379/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on the common organisation of the markets in fishery and aquaculture products, amending Council Regulations (EC) No 1184/2006 and (EC) No 1224/2009 and repealing Council Regulation (EC) No 104/2000

Since carp is always served freshly slaughtered, the fish is kept in tanks until consumption. The wholesalers in the area buy fish from the farmers and store it in fresh water tanks and ponds. They supply restaurants and processors up to their needs. (Oberle)

Even restaurants store carp in their cellars during the season. Traditionally, carp in Aischgrund is smaller when sold and slaughtered than in other regions. In most German regions, it is custom to steam the carp ('carp blue') while restaurants and households in Middle Franconia half the fish lengthwise and serve it freshly fried. (Oberle)

One dish consists of half a fried fish with supplements and has a price of around 10 Euro. The producer's revenue of 2 Euro per fish represents 10% of the value paid by the end-consumer for two half fish dishes (20 Euro) in the restaurant. (Oberle)

Bigger fish, which is out of size for this dish, will either be processed, enter local direct marketing channels or leave the area through the wholesaler. Other areas such as Upper Lusatia or Bohemia grow fish longer aiming for higher slaughter weights of 2-3 kg. (Focusgroup)

Recently, wholesalers and/or processors started with the preparation of fish nuggets and fish chips that were offered at Norma retail markets during the season. The coming seasons will show how successful these innovative products will be. Currently, production volumes are insufficient for the sales of frozen carp products (fish nuggets, fish fingers) even in summer. (Focusgroup)

In the Aischgrund, local stakeholders have been aiming for years to help farmers to increase sales revenue and to realise a producer price of 3.50 Euro/kg; without success. (Focusgroup)

3.3.1.2 Joint marketing of Aischgründer Karpfenland

Carp farming is a low-intensity system with mainly positive impacts on the natural environment. For that reason, the World Wide Fund for Nature (WWF) presents the carp as the most sustainable farmed or caught fish. A successful communication of the ecological benefits of carp farming to the consumer might lead to increasing demand. (Oberle)

The carp in the Aischgrund is a specific carp breed that has an unique high back. Since 2013, the Aischgründer carp is certified via Geographical Protected Indication (GPI): Within the area, the local breed is branded as so-called 'Aischgründer Karpfen' (carp from Aischgrund), while outside Franconia, it is labelled as 'Fränkischer Karpfen' (Franconian carp). Linked to this branding, the marketing agency 'Karpfenland Aischgrund' has started to promote the carp within the Aischgrund area and beyond its borders (for instance in Munich). A small but growing network of restaurants aims to foster carp sales outside Franconia. These partner restaurants are labelled as specialty gastronomy for the typical Aischgrund carp menus. (Schuster)

The 'Aischgründer Karpfenland' (carp land Aischgrund) association started around the year 2000. It supports the marketing of member restaurants, which are key customers of local produce. So far, it enhances together with the 'Teichgenossenschaft Aischgrund' (pond cooperative) mainly the marketing of the fish in the area. However, over-regional marketing has started recently. In Munich and hopefully soon in Nürnberg, contracted fish restaurants offer the typical dish from the area. These points of sale promote the regional product and dish outside the area. Moreover, it has been driving the negotiations with the retailer Norma aiming to foster the marketing of processed convenience products. (Schuster)

The association developed and now, maintains the website "Karpfenland Aischgrund". (<http://www.karpfenland-aischgrund.eu/>)

The Aischgründer carp has been registered under the protection of geographical identity (PGI based on Council Regulation (EEC) No 2081/92 of 14 July 1992). Two names are protected, the Franken Carp for the over-regional marketing and the Aischgründer Carp for the local marketing. (Schuster)

The association 'Karpfenland Aischgrund e.V.' started in 1999. The mayor of Hoechstadt is the director of the association. Important stakeholders, including some farmers, are members of the association and contribute significantly to the activities. Since 2013, the association has a professional team that supports the marketing of carp in a professional way due to the funding for a 2.5 years project (EU funded, 2013-2015). (Schuster)

The continued funding of the association and the work of the marketing activities is a challenge. Currently, inhabitants pay a very small fee for the support of the organisation. Voluntary support of the local industry supports the activities too. Restaurants pay a fee for the use of the logo. They receive support for their marketing in turn. (Schuster)

This cross-regional market is expected to steadily grow. However, main effort focuses on the acceptance and the local knowledge in respect to carp marketing. (Schuster)

The regional manager participates in trade fairs such as 'Consumenta' in Nürnberg, 'International Green Week' in Berlin. A carp queen supports the representation and marketing of the traditional carp region in local and over-regional events. (Schuster)

Day-travel bus tours come from other Bavarian areas on a regular basis in the carp season (around 6000 visitors/year). Until now, there is no statistic showing details such as the origin or the age of visitors. Tourism is very important for local carp consumption in the traditional restaurants. (Kabelitz, Schuster)

3.3.2 Specific features on markets for fish from recirculating aquaculture systems

The channels of distribution for aquacultures from recirculating systems are highly diverse.

In general, consultants recommend that a business should consider its specific marketing structures already before starting production. This is necessary because fish species suitable for production, such as African catfish, have not yet established themselves in the German market sufficiently (Hintz et al., 2010).

There is no data available with regard to the degree of fish processing from RAS. In general, live fish is sold at wholesale, whereas freshly slaughtered fish, filets and smoked fish are dominant in direct marketing and at retail (Brämick, 2015).

There is no data available on sales prices broken down by the production processes of fish keeping. However, experts assume that the majority of eels and African catfish produced in Germany come from closed warm water systems. For African catfish, a price of 1.06 €/kg was realized at wholesale (2014). In direct marketing aimed at consumers, the price was 1.73 €/kg. For eels, the price was 9.56 €/kg at wholesale and 24.10 €/kg in direct marketing (DESTATIS, 2015b).

Table 10: Prices for fish species by marketing channels

Fish species	Prices in direct marketing (Euro/kg)	Wholesale prices (Euro/kg)
African catfish	1.73	1.06
Brown trout	7.82	4.73
Speckled trout	13.53	4.91
Alsatian char	9.51	4.46
European eel	29.1	4.56
European catfish	10.4	5.56
Common carp	4.97	2.32
Hake	11.31	6.21
Salmon trout	8.55	3.43
Rainbow trout (excluding salmon trout)	6.89	3.44
Tench	6.63	3.79
Siberian sturgeon	12.57	5.87
Zander	16.27	9.09

Source: DESTATIS, 2015b

3.3.3 Competition and strategic business partnership

3.3.3.1 Competition and cooperation on a local level

Competition is significant for traditional fish production. Traditional systems suffer from low-price fish produced in intensive systems in Germany and abroad. The relatively low prices for fish minimize profits in traditional systems. The elderly generation of fish farmers sees the system at threat because the younger generation will be not willing to take over (see section 3.5 xx).

Cooperation on the local level is high with fish farmers' or pond associations and regional administrative offices that connect farmers and represent them in local or regional policy processes. On the national level, umbrella organisations organize an annual conference and delegate stakeholders. However, the group is small and the economic and political weight of fish farmers is limited (see section 3.2.3.3).

3.3.3.2 Competition with other countries

Most of the finfish, shellfish or algae from aquaculture consumed in Germany are import products from other countries. In respect to competitiveness and sustainability of production, experts raise the following questions:

- Are the countries with significant production volumes intrinsically better at aquaculture than Germany?

- Is the labour-intensity of aquaculture processes and the higher wages in Germany hampering the expansion of the national sector?
- Is the sustainability performance of other countries' sector higher than in Germany? Can the environmental impact be more favorable? (DAFA, 2014)

Imported carp fish comes mainly from the Czech Republic and Poland.

3.3.4 *Certificates of sustainable fish production*

- Sustainability certification for aquaculture such as Asc-certification (differ between species)
- Other initiatives: GlobalG.A.P. and Friends of the Sea (homepages do not mention RAS in particular (www.asc-aqua.org, www.globalgap.org, www.friendofthesea.org))
- Organic farming: Naturland brand for organic aquaculture (www.naturland.de/de/naturland/richtlinien.html)
- EU organic standards;
- for more details on organic fish production in Germany: www.bmel.de/DE/Landwirtschaft/Nachhaltige-Landnutzung/Oekolandbau/_Texte/EG-Oeko-VerordnungFolgerecht.html
- Organic label – international, see
- <http://www.oecd.org/tad/fisheries/proceedingsofthehagueroundtableoneco-labellingandcertificationinthefisheriessector.htm>
- <http://www.oecd.org/tad/fisheries/46769240.pdf>

3.4 Key issues identified from literature, media analysis and stakeholder interviews

The SCAR Fish emphasizes that European aquaculture has a high level of environmental sustainability and high animal health and consumer protection standards. However, the cost of ensuring a safe product should be observed. European science and technology for aquaculture lie in the forefront worldwide. In spite of this EU aquaculture is stagnating while FAO estimates that aquaculture is and will remain one of the fastest growing segments of the global food industry. (Scar fish)

Key challenges for the development of the German aquaculture industry list the expert board of the industry in 2014: administrative barriers, sustainability assessment, and economic competitiveness (DAFA, 2014). Representatives of the German fish farming industry highlight the following key issues:

- The potential to produce aquaculture products for national consumption is still to be realised because products and production processes are of high quality. Nationally grown fish has the potential to promote human health, meet the highest food safety standards and come from sustainable production based on high animal welfare standards.
- However, economic competitiveness is insufficient and discourages producers and financiers to invest in national aquaculture production.

It remains a challenge to address these key issues. Manifold questions remain open, specifically regarding

- Ethical issues: How should the production of fish look like? Which negative environmental impacts are acceptable? Is it legitimate to export alleged or actual problems of aquaculture to other countries?
- Economic issues: Does the German aquaculture sector would have the potential to compete on the international market? If yes, to what extent? How do differences in legal frameworks affect economic competitiveness between countries? Will German consumers contribute to the establishment of a premium market for nationally produced fish from high process standards?
- Environmental issues: What are the consequences of more intensive use of local water resources? Where and to what extent has wastewater an impact on the environment?
- Issues relating to product quality: Which measures have to be taken for the maximization of safety and health benefits of the products?
- Production-related issues: Is the optimization of recirculation systems possible. When does the society accept these systems? Can they be profitable?
- Political and legal issues: Which policy processes will be able to support the sustainable development of the sector? Which are the most important barriers set by current policy and regulatory conditions? (DAFA 2014) An OECD report on fisheries and aquaculture concludes that the legal framework would need to change, so the fish producing industry was able to grow. (OECD, 2015)

Some of these particular issues require research. The fragmentation of the research community, however, is another significant problem of the German aquaculture industry. The sector has 30 public sector research organisations but some of these operate with very limited capacity. However, for local policy reason, it is difficult to link activities or even merge budgets.

3.4.1 3.4.1 Training, education and life-long learning for German fish producers

Very few fish farmers are professionally trained, which is a challenge. Some of them have a professional training in agriculture. Continuous training and practical advice are important contributions for the local industry provided by the local branch of the Bavarian state's 'Institut für Fischerei'. (Oberle)

- Interest in professional education is very low (very few apprentices – even on the national level)
- Most traditional fish farming is based on family knowledge and regional traditions – learning from family members or neighbours
- Very close cooperation with regional fish stations (Landesanstalten), which provide advice, locally adapted research and knowledge exchange between farmers.
- Regional fish stations (Landesanstalten) organize regular meetings and team members represent the fish farmers in local administration and policy.
- FAO 2007: Initial and ongoing training of staff are important elements in the aquaculture sector and are the responsibility of the various German States, in addition, to operate as a fish farmer requires an apprenticeship and every year between 70 and 80 apprentices pass their examinations.
- For the apprenticeship of the fish farmer (Fischwirt), new rules and curricula are in place since 1.8.2016; RAS will be part of the new curriculum (Fischwirtausbildungsverordnung – FischwAusbV)
- Very few opportunities for training and education are available; some local authorities organise trainings sessions or workshops on particular topics (Fischereibehörden, Landwirtschaftskammer)⁶.

Lacking qualified staff for the operation of recirculation systems

- Qualified staff for the operation of RAS is lacking.
- On the 1. August 2016, the legislation was put in place for the regulation of the professional education of fish farmers (Fischwirtausbildungsverordnung – FischwAusbV). For the first time, knowledge for RAS operation is part of the education for the first time.
- Further training or certification (Weiterbildung) for RAS is not available. Irregularly, regional offices and Chamber for Agriculture offer courses.

3.4.2 Challenges for carp farming

3.4.2.1 Revenues and costs of carp farming

Carp farmers receive around 2 Euro per kg fish from wholesalers. This price is comparatively low and represents a no-name marketing of small, often heterogeneous output volumes. Small part-time farmers do not have an opportunity to sell alternatively. (Focusgroup)

Calculated with average costs of production, the contribution to margins ('Deckungsbeitrag') ranges from 200 to 300 Euro per ha concerning the production of table carp (K3). (Focusgroup)

Fish farmers in Franconia earn an additional income with carp. In the area, families usually do not depend on agricultural and fish production. Sometimes, carp farming is seen as leisure activity. However, farmers

⁶ for example: <http://ifb-potsdam.de/Portals/0/Repository/Zanderworkshop%202016%20%2011.-12.5.16%20Ank%C3%BCndigung.pdf>

usually expect at least the coverage of costs. In contrast, the younger generation is asking more for positive returns than the currently still engaged (elderly) generation. (Frischmann)

Challenge: Economic data in fish farming is lacking. Regarding the data situation in Germany, official statistics provide only limited information about of the economic performance of carp farming sector in Germany. National statistics include information about the number of enterprises, total sales of fish for human consumption per species/federal state/production system (pond, raceway, net cages, recirculating systems); but no data about costs and returns, FTEs, distribution channels, prices, legal structure etc. In addition, there are national reports, which work in part with estimations of local fisheries authorities and local surveys. Further, there are national trade reports, which focus on carp im- and exports mainly from Czech Republic. However, in contrast to agriculture, there exists no Farm Accountancy Data Network (FADN) or equivalent. In consequence and on a national level, the economic situation of freshwater aquaculture in Germany is widely unclear. There is no comparable data on fish farm economics yet. The Thünen Institute aims to address this issue by the application of the agri benchmark approach to aquaculture systems in Germany and build up a network of typical farm datasets. (Lasner)

3.4.2.2 Marketing of carp in Franconia

Fish farmers lack awareness of the importance of marketing. The associations aims to train farmers raising awareness and self-confidence for their contribution to landscape protection and the conservation of nature and cultural traditions. (Schuster)

During the summer, carp is not available. For the marketing of the region, a local fish for consumption from May to August might be important. The “Karpfenland Aischgrund” association discusses this issue with farmers and stakeholders.

Large-scale (industrial) aquaculture systems produce catfish or Pangasius fish for very low production prices. The low-price fish meat is a significant problem for the realisation of higher prices for carp on the over-regional market (Schmidt, Frischmann).

Note: The term ‘aquaculture’ has a very bad connotation in the area due to negative impacts of intensive circular system fish production. For that reason, stakeholders avoid the term for the low-intensity fish farming in traditional earth ponds.

3.4.2.3 Lacking engagement of young people in traditional fish farming

Farmers describe the lacking engagement of the younger generation in carp farming as a major issue for the maintenance and development of carp farming in the area. (Kabelitz)

In 10-15 years, the most significant problem will be the lack of young people in the area willing to continue traditional carp farming. It is hard work with the ponds and the current income is insufficiently attractive. The focus group discussion highlighted that an improvement of economic results of carp farming will be crucial for the decision of younger people to take over the ponds. Hence, the economic dimension of sustainability is a major issue for the maintenance of ecological and socio-cultural sustainability of this traditional production system. (Focusgroup)

3.4.3 Challenges for the envisaged expansion of RAS in Germany

Experts agree that aquaculture production in RAS will expand. The national strategy projects a significant growth until 2020. In contrast, the Federal Ministry of Agriculture in Mecklenburg-Vorpommern identifies problems: “Due to the high costs for investment, high operational costs and – depending on the fish species cultivated – a very high standard of professional qualification of the manager needed, it is very difficult to

realise profits with RAS in Germany (Lemcke, 2014). DAFA experts agree and emphasis that research is needed for the further development of RAS based production in Germany (BMEL, 2014).

Statistics on aquaculture production is insufficient for a thorough analysis of the status quo of the industry and its recent development of RAS in Germany (DESTATIS, 2016)

The application for an authorisation for the construction and operation of a RAS is a complex process. Entrepreneurs need support for compliance with the related administrative and legal framework. The ministry in Schleswig-Holstein developed a guideline for potential investors, which is seen as highly relevant for the start of new RAS (Lemcke, 2016).

Another significant challenge is the demand. Consumers lack the knowledge about aquaculture production, which results in a very small market for fish produced in RAS lacks. An increase in sales of fish from intensive production systems requires a professional marketing (Korn et al., 2014)

3.5 Sustainability performances

Although encompassing scientific research results are not (yet) at hand, the German board of aquaculture research concludes that the sustainability performance of the German aquaculture system is – depending on the particular system – good compared to other countries' systems with some significant negative impacts (DAFA, 2014). DAFA argues that

- Germany has relatively abundant water resources compared to many countries with growing fish production.
- fish from traditional systems is more sustainably produced than imported fish (from the perspective of the protection of natural resources (mainly water), animal welfare and/or food safety).
- studies indicate consumers preference for regional food to be quite strong. This is likely to apply not only for vegetable, meat and dairy products but for fish as well. (DAFA, 2014)

3.5.1 Sustainability performance of traditional carp farming

3.5.1.1 Economic dimension of sustainability

Economic sustainability of traditional carp farming is a problem for many small and elderly fish farmers; see section 3.4.1 for revenues and costs of traditional carp farming. However, examples show that some farm business have good economic results so that the younger generation is willing to take over and invest in carp farming. The positive contribution of carp farming to the regional economy (traditional fish restaurants, rural tourism, regional image etc.) is significant (Schuster).

The Aischgrund cities and villages are close to the University City of Erlangen and the international trade place of Nürnberg and the historic city of Bamberg. Many medium- and large-scale enterprises are situated in this metropolitan area of Franconia. A large group of consumers is quite wealthy. The majority of the Franconian residents likes to consume carp menus in typical restaurants, the so-called 'fish kitchen' ("Fischküche"), on a regular basis. (Oberle)

3.5.1.2 Environmental dimension of sustainability

In general, carp production in tradition earth ponds is seen as ecologically sustainable system. (Oberle) The dams surrounding ponds or chains of ponds have a high ecological value because they represent the habitat or feeding area for flora and fauna. The pond landscape is of very high ecological value providing habitats for a large variety of water related flora and fauna, in particular for birds. Most ecological requirements of the ecosystems in and around carp ponds are in line with current farming practices. (Oberle)

Importance of carp for the maintenance of ponds: pond plants grow quickly. Older carp fish (K2) are looking for benthos in the pond soil. They make the water turbid and remove small macrophytes from the ground. Carp (K2) help to avoid a too high increase of the pH-value in the ponds. This is also important for insects, the pray of water birds. Without carp, the mud in ponds grows quickly. The carp population keeps the nutrient level in the ponds in a balance. The fish population consumes nearly all nutrients from cereals added to the ponds and then, these nutrients are exported from the ecosystem via the harvesting of carp. Some of the fish faeces will increase the production of phyto- and zooplankton and will so become part of the natural food-chain. (Oberle)

Main challenge for carp farmers is the significant risk of losses, which can be up to 60 or 80% of stocked fish per pond. Losses of K1 carp are sometimes replaced but not always due to relatively high costs of fingerlings. Without replacement, years of high losses of the farm result in reduced harvests in precedent years. Mainly, predators such as the cormorants and increasing number of beavers and otters cause these significant losses. These species are protected under the conservation law. There is a significant conflict of interest between farmers and representatives of policy and the society. Recently, rules have slightly changed and farmers are allowed to shoot – under restrictions – cormorants, which are seen as a significant improvement. The reduction of cormorant numbers is seen as key factor for the future of the fish farming. (Focusgroup)

The district's veterinary agency is responsible for the protection of animals and the nature conservation authority of the district (Untere Naturschutzbehörde) supervises the maintenance of nature conservation areas and the protection of listed species. Fish farmers' and their representatives are engaged in dialogues with these public bodies on a regular basis. Stakeholders have the impression that administrative rules and their implementation are often not based on a good understanding of the situation in the field. (Focusgroup)

3.5.1.3 Contribution to the social and cultural context of the Aischgrund

The local acceptance of carp meals is high, which is a significant difference to other German areas. (Kabelitz)

For the public, aquaculture in general tends to have a bad image, mainly because of feeding practices based on fishmeal, fishoil and antibiotics. For that reason, it is important to inform the consumer that carp farmers only feed locally grown cereals and legume crop mixtures. They do not use any fishmeal or other concentrate. (Schuster)

Carp farming is of significant importance for the local tourism and local cultural heritage.

Carp farming has a long history in the Aischgrund. Roman sources document carp fish to live in rivers and ponds. Cultivation started in early medieval times. In particular, bishops and cloisters fostered the digging of pond. Most ponds date back from the 16th century when even more ponds than today were cultivated. Carp was an expensive meat. In the 17th century, ownership spread with more farmers owning ponds for fish production. In the middle of the 20th century, machinery for pond maintenance and use started to develop.

Most ponds are part of very small family farms owned by the family for generations. In mediaeval times, not only noble families and the church as owner of cloisters and bishop residences constructed and owned carp ponds, but in Aischgrund even peasant farmers had own carp ponds for sales and own consumption. This particular ownership structure is a significant difference to the other traditional carp producing areas in German Lausitz, Polish Silesia or Czech Bohemia. Over centuries, carp was an expensive food product that only rich people could afford to eat when the church calendar prescribed the abstinence from meat on Fridays, holidays and in Lent (catholic fasting period). (Oberle, Kabelitz)

Due to the long tradition of carp farming, the local identity is (even today) closely connected with carp farming. Because the consumption of carp was common for everybody, the carp became part of the traditional kitchen. Today, local population loves carp and all generations visit the typical carp restaurants during the season (September – April). Carp has always been a seasonal product, which was not available in any form from May to August. (Kabelitz)

A variety of large-scale carp sculptures decorates parks, public places or circular points at the entrance of towns. Traditional signs or names of roads or places remind inhabitants as well as travellers of the traditional role and economic importance of the carp for the public and private life in the area.

The particular role of the carp museum: Many items representing the regional carp heritage are displayed at the carp museum in Neustadt a. d. Aisch. The museum is a core element of the touristic infrastructure in the Aischgrund area. Once a homeland museum, it changed - 15 years ago - into a carp museum with the financial support from the European LEADER programme. The EFF contributed to the development of the museum as well. In the past, mainly voluntary staff run tours and organised exhibitions but today employees are responsible for the museum. Currently, around 6,000 tourists visit the museum each year, which sets it as the second regional museum. Visitors are mainly elderly people visiting the city on a day trip. They discover the museum during 1 to 1.5 hours. The exhibition shows carp farming techniques, carp biology and local flora and fauna. It is also possible to learn more about carp recipes, numerous arts and crafts objects (plates, paintings etc.), as well as innovative products consisting of carp skin and bones. A future project of the museum, which is expected to be funded by the EMFF, aims to develop a one-day carp experience combining the visit of the museum with a carp meal and a fieldtrip to a pond guided by a biologist. (Kabelitz)

3.5.2 Sustainability issues of intensive fish farming

German consumers are very critical about fish quality and fish production systems. Documentaries in TV and articles in newspapers showed negative effects of intensive fish farming such as high stocking rates, suffering fish in small ponds, poor water quality conditions, poor quality feeding etc.. Consumer studies show that several customer groups the aquaculture systems lost consumers' trust. The connotation of the term 'aquaculture' is even hampering the marketing of the products. For that reason, experts emphasise that fish has to be a high quality product that should promote human health, meet the highest food safety standards and come from sustainable production based on high animal welfare standards.

In the case of RAS, many consumers lack detailed knowledge and detailed information on these particular systems for fish production. As a result, these systems are often seen as animal mass production (Korn et al., 2014). Korn et al. (2014) show that many customers wish to buy naturally grown and 'authentically' farmed fish. Nevertheless, fish products from RAS tend to have a bad recommendation and the marketing sometimes is a problem (Korn et al., 2014) although, RAS use water efficiently and therefore, tend to utilize natural resources in an efficient way.

Environmental effects

Recirculating aquaculture systems (RAS) have positive environmental effects, especially when compared to more intensive aquaculture systems than low-input systems such as traditional carp farming.

Water is an increasingly valuable resource. Recirculating systems conserve more water than other aquaculture systems. Furthermore, nitrogen effluents can be minimized by filtration, so the pollution of natural water bodies should (theoretically) not be an issue (Wedekind, 2008)

Unlike open water systems, fish cannot escape and mix with wild species, so the separation of bred and wild species is not an issue in indoors aquaculture systems (Gaye-Siessegger, 2009)

Furthermore, the debate about the protection of predators is defused. In some regions, a profitable production in ponds is hardly possible due to predation (mainly cormorants and otters). Circulation systems that are closed ensure protection from predators in an optimum way (Deutscher Fischerei Verband, 2015).

Animal welfare and ethics

Animal welfare in recirculating systems is an issue much discussed. In general, appropriate technology enables a better controlling of the fresh water within these systems, thus enabling optimum living conditions for the animals. The water is disinfected; medication is not being used at all. The disadvantage is that diseases have fatal consequences in these systems because the entire population can become re-infected again (Tschudi and Stamer, 2012).

Furthermore, RAS allow for high stocking rates due to the continual treatment of the water. Strong economic pressure means that companies opt for high stocking rates, which leads to stress, aggression and injuries among the animals, and thus affects health negatively. (Tschudi and Stamer, 2012)

The structure of the habitat in the tanks are usually very poor (Tschudi and Stamer 2012). Experts discuss controversially whether the lack of plants, stones etc. has an influence on the animals' wellbeing (Möller, 2015).

According to Stamer, most killing techniques in fish breeding are not compliant with animal welfare. The only techniques considered acceptable are mechanic and electric techniques. However, since the morphology of eels and African catfish, both prevalent in RAS, results in their robustness, an immediate death is not guaranteed even when using mechanic and electric killing techniques (Stamer, 2009).

3.6 SWOT analysis of traditional fish farming and of intensive fish production

Strengths of German aquaculture	Weaknesses of German aquaculture
<p>Highly efficient production system in respect to the use of input protein and food protein harvested for human consumption. Fish metabolism is more efficient because the body temperature and activity depends on the water temperatures. Fish do not need energy for the filtration and excretion of Ammonium. (Maribus, 2013)</p>	<p>Media and public debates criticised aquaculture systems significantly!</p> <p>The connotation of the term aquaculture is very bad for many German consumers; fish marketing already avoids the term.</p>
<p>Traditional systems with low stocking rates produce healthy fish with a low risk of medication needed.</p> <p>Fish from aquaculture is a high quality food product, which is rich in protein; sustainability indicators and standards are at hand for certification of premium products.</p>	<p>Nutrient from feed material and fish faeces contribute to nitrification of water bodies.</p> <p>High stocking rates in intensive production plants have a higher risk of fish diseases (risk of the need to use antibiotics that harm water ecosystems, predator species (birds, wild mammals) and end-consumers</p>
<p>Traditional carp production ensures the conservation of the pond areas' ecosystems. Carp feeds on small pond flora and fauna, clean ponds and protect ponds from degradation. Carp ponds provide particularly clean water.</p>	<p>Ethical concerns for fish kept in densely stocked tanks.</p> <p>However, legislation for the slaughter process of fish from aquaculture is stricter than for fish caught in rivers or oceans.</p>
<p>Intensive mussel production contributes to the purification of coastal water. They reduce nutrient concentrates in water and hamper algae blossom.</p>	<p>Wastewater from high-intensity production plants can pollute rivers or coastal areas. However, emissions of fish farming plants cause less problems than poultry plants that produce a comparable amount of high protein food for human consumption. (Maribus, 2013)</p>
<p>Traditional systems contribute to the conservation of local culture and traditions; rural tourism, agriculture, gastronomy fosters rural economies</p>	<p>Depending on local traditions, fish menus are less attractive than e.g. poultry, in particular for the younger generation (fish bones, taste, smell etc.)</p>
<p>Traditional fish farming are locally adjusted systems with strong local stakeholders. In contrast, over-regional (national) structures and strategies are lacking or cannot enhance new processes.</p>	<p>Knowledge gaps in the society about aquaculture fish production (bad image). Moreover, fish consumption is limited, because several consumers groups are not used to eat fish.</p>

Opportunities of German aquaculture	Threats of German aquaculture
Traditional, often informal knowledge is still available in fish farming areas and families. Regional fish centres receive (limited) public funding for advice and locally adapted research (only in some federal states)	Knowledge intensive systems but the number of apprentices and trainees in fish production in Germany have been decreasing and are very low.
Gain more market share due to positive impact on human healthy and the natural environment. The use of sustainable feed based on e.g. locally grown crops or closed cycles with re-use of raw material from other processes, waste, offal etc.	For the society, animal welfare has a very high priority (see media analysis). Animal welfare is an issue in fisheries and aquaculture. If fish is treated in an inadequate way, lacking animal welfare can turn into a significant threat.
Fish farming produces substitutes for wild catches; it can contribute to the prevention of overfishing in marine areas at threat.	Continuation or even acceleration of the decreasing trend of fish consumption is a relevant threat, in particular in young consumer groups.
Processing of raw material that remains from the use of the main products from fish farming (e.g. by-catch in fisheries, offal etc.)	Intensive systems based on low quality feed and/or poor water quality contributes to a bad image and reduced consumer trust in aquaculture.
Development of production processes for high-quality proteins with a sustainable system	Bad taste of fish (too high fat content of carp, too fishy taste, too high water content in fish meat)
Fish is very suitable for seniors and persons with special diet requirements	Contamination of fish due to water pollution, medication, chemicals etc.
High potential of information and education for specific consumer groups that have very little knowledge about fish.	Fish diseases can threaten the production significantly.
Innovative products such as new convenience food can open new markets (e.g. carp fish nuggets, fish fingers from carp). Apart from food, fish can be a raw material for other industries	Manifold legal and administrative restrictions hamper the development of the sector. Differences between regional governance and support systems are significant.
Aquaculture can represent systems that are in line with the society's expectations for a more sustainable food production.	Intensification and inefficient use of resources can reduce sustainability of the system and enforce the negative trends in aquaculture (including the negative image of intensive fish production)

Strengths of RAS	Weaknesses of RAS
Systems save water compared to traditional systems; the efficiency of water use is high.	The public image of intensive fish production tends to be a problem due to negative impacts of salmon production in the North Sea and animal welfare and hygiene issues known from e.g. Pangasius systems.
Use of (agricultural) land is very limited	The system is very capital and knowledge intensive: Initial financial investment and operational costs are high. Expertise and qualified personal is essential.
Independency from natural seasons	Constructions/buildings and facilities are needed.
Easy controls of potential diseases and pests	Consumers are not used to buy certain species; excellent marketing schemes are crucial for the economic success of the plants.

LFL Fischery (2012)

Opportunities of RAS	Threats of RAS
Industrial plants do not need much land	Technical performance of plants is risky.
Optimization of fish keeping systems is possible; High-tech systems are available for water purification and feeding appliances	Standardisation of output is difficult, products can vary.
Combining other systems with intensive fish production (bio-energy, cropping, new technologies)	Policy and legislation can change.
	Financial Investment is significant: risk of long-term debts.

4 DE Case study B: Oilseed rape production in the Wetterau

4.1 Case study introduction and context

Rapeseed (*Brassica napus*) also known as rape, oilseed rape is a bright-yellow flowering member of the family *Brassicaceae*. Main countries cultivating rapeseed are China, Canada, India, Germany, France, Ukraine and Poland. Worldwide, rape grows on around 36.5 million ha. In 2014, farmers sowed genetically modified seed material on around 25% of the land (not in Germany.) Traditional plant breeding, however, played a significant role for the use of rape. The wild type of *Brassica napus* contains erucic acid, so the oil is bitter and not suitable for human consumption. Moreover, the glucosinolates of these brassicaceae plants caused digestive disorders. Only when traditional breeding was successful with the reduction of the content of both substances significantly in rapeseeds and plant material, the cultivation spread widely. This cultivar is called double zero rape or canola.

The oil of rape plants is used for food production, in chemistry, pharmacy and medicine, as well as in the technical industry. The transformation of rapeseed oil into biofuel, which the petrol industry adds to the fuel for vehicles, is of particular importance in respect to volumes, values and sustainability issues. The cultivation of rape is widely spread in Germany and – at the same time - controversially discussed for a variety of reasons.

With our case study on oilseed rape, we are particularly interested in the following questions: How did policy and regulatory conditions influence the cultivation of oilseed plants, in particular rape? Which sustainability issues are particularly important for the production, processing and the final use? Which adjustments will help to improve the sustainability effects of oilseed rape cultivation?

4.1.1 Use of oilseed rape

The pharmaceutical and medical industries add rapeseed oil to creams or other types of medication. Moreover, the oil is a raw material for chemical processes. The oil of the rape affects the metabolism positively and it is rich in vitamin E. The cosmetic industry uses the oil for basic ingredients for hydrating cream and body lotions.

The technical industry buys a large proportion of rapeseed oil production. For example, the oil serves as filling material for rubber goods or it is used as lubricant. Biodegradability is a significant advantage of the vegetable oil because it will not pollute waterbodies when applied to machinery or equipment or for the protection of iron material from corrosion. (Florapower, 2015)

The chemical industry uses the oil for the protect plants from diseases as e.g. insecticide and as a raw material for the production of various products.

In Europe, the use of oil for bio-fuel production is of particular importance. A small proportion of this production is turned into vegetable fuel, while the large proportion is processed into bio-diesel (rape oil methyl ester, RME).

Representatives of the industry argue that the use of rape for bio-fuel is very positive because biodiesel is biodegradable, free from sulphur, renewable and accounts neutral for climate relevant emissions. (Florapower, 2015) Emissions of cars that burn bio-diesel are less toxic than conventional diesel. A by-product of the bio-diesel production is glycerine, which is used as a feed material and as a hydrated vegetable oil.

Due to changes in the policy and legal framework, the production of oil from agricultural plants for bio-fuel rose significantly in the period 2004 – 2007. Since then, nationally produced bio-fuel volumes and the proportion of bio-fuel for in fuel mixtures for vehicles remained relatively stable in Germany. Oilseed rape is the most important culture for the German production of bio-fuel. However, the area of rape cultivation for bio-fuel shrank in recent years because farmers and farmers’ associations increased sales to the food and feed industry. (DBV, 2016a; Deutschlandfunk, 2016)

Since plant breeding managed to cultivate rape species with a low content of erucic acid, oil from rapeseed became suitable for human consumption. Since then, the vegetable oil is used as oil and margarine in baking, cooking and frying. Due to the low content of saturated fat and the high proportion of linoleic acid and Omega-3 fat, salads are often prepared with it. In the food industry, the oil is a common ingredient of e.g. mayonnaise or cakes because it does not develop a bitter taste when mixed with egg or dairy products. (Florapower, 2015)

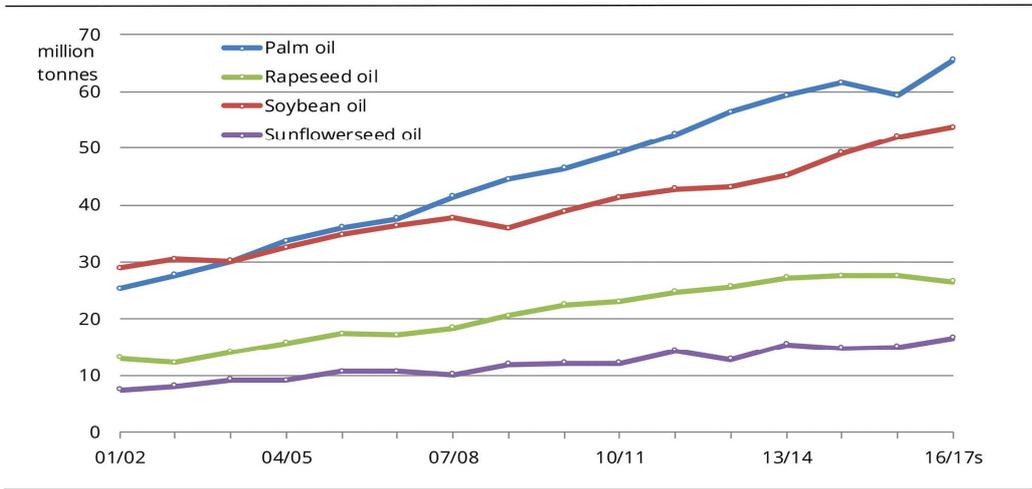
Coupled products from processing are protein rich rape kernel or rapeseed extraction meal. The feed industry uses these by-products of the vegetable oil production. Sometimes this vegetable material enters bio gas plants for energy and heat production.

Overall, the use of oilseed rape is very divers. Since many industry sectors are purchasing rape or vegetable oil from national production, a variety of marketing channels exist. This case study mainly focuses on the cultivation and marketing of oilseed rape for human consumption and for bio-diesel, including the by-product of animal feeds stuff.

4.1.2 Oilseed rape production

Palm oil, soybean oil, oilseed rape and sunflower oil account for around 87 per cent of the production of vegetable oil. The remainder consists of coconut oil, olive oil and peanut oil, among others.

Global vegetable oil production



Source: USDA, AMI

note: e = estimated

Figure 7: Global vegetable oil production

Palm oil and soybean oil production is expected to increase in 2016/2017, while oilseed rape is anticipated to see a decline to around 26.6 million tonnes from the previous year (AMI, 2016).

In Germany, farmers harvested 5.0 million tonnes rapeseed in 2015. That was 20% less than in 2014 caused by limited acreage and lower crop yields (DBVc, 2016). In winter 2015/2016, the acreage increased slightly due to crop rotation (1.339 million ha).

Mecklenburg-Vorpommern is the most significant German region of rape cultivation with 231,000 ha in total, followed by Sachsen-Anhalt (170,000 ha) and Brandenburg (145,000 ha). (UFOP, 2015)

The use of oilseed rape for food remained constant over the last years but the demand for rapeseed for bio-diesel production, which is the most important sales segment in Germany, varies significantly between years. Overall, the use of rape for bio-diesel, however, follows a shrinking trend since 2007 (BMEL, 2016c)

- Statistics on annual production and processing of oilseed rape are available (e.g. <http://www.raps-aktuell.de/Rapsstatistik> and DESTATIS)

4.1.3 Production system of rapeseed oil

Oilseed rape cropping is mainly confined to arable farms without a significant proportion of high-value crops such as potatoes or vegetables. Sugar beet used to be a relevant competitor in crop rotation but as a result of changing policy and market conditions sugar beet cultivation shrank in the early 2000s.

Crop rotation: For the highest yields, oilseed rape needs to be preceded by an early harvested crop, such as winter barley. Winter wheat may offer an opportunity for winter oilseed rape when weather conditions in autumn are favourable in the centre or south of Germany such as the Wetterau. (Christen, 2000)

Farmers avoid the cultivation of oilseed rape in a rotation with sugar beet because of the problems of rapeseed volunteers and the risk of nematode infection. Instead, rotations mostly consist of various cereals and rapeseed. The shortest crop rotations are currently practiced in the northern part of Germany (Schleswig-Holstein, Mecklenburg-Vorpommern and Niedersachsen) based on three-course rotations with oilseed rape - winter wheat - winter barley or even two-course rotations. Some farmers replace barley by winter wheat. (Christen, 2000)

Oilseed rape itself is considered as an excellent preceding crop for cereals. In most areas of Germany, the value of an oilseed rape crop is similar to a preceding legume like peas. This positive effect is due to a break in the disease cycle for a number of cereal pathogens (e.g. *Gaeumannomyces graminis*). Moreover, rape has a favourable effect on the soil structure. (Christen, 2000)

Tillage: The standard tillage method for winter oilseed rape consists of ploughing followed by a harrowing. However, the soil treatment and sowing methods differs with respect to the farm size and the need to conserve water.

Breeding: Oilseed rape breeding has improved yields and resistance to many diseases significantly. Farmers select varieties, which combine high yields with good resistance to as many diseases as possible. Hybrid varieties are widely used. Sowing takes place from the middle of August to the middle of September depending on the area. Spring rape is normally sown during March and April, as soon as soil conditions are favourable.

Fertilisation: With the introduction of direct payments in the 1990s, the recommended rates of nitrogen for winter oilseed rape have been reduced throughout Europe (see cross-compliance, section 4.2.1.1). The highest amounts of nitrogen applied vary from 150 to 230 kg N ha. Areas of high nitrogen inputs include Schleswig-Holstein and Mecklenburg-Vorpommern in northern Germany. Only limited amounts of nitrogen are applied in autumn to the winter crop (between 30 and 50 kg N per hectare). Spring nitrogen application is split, between the beginning of the crop development and stem elongation. Sulphur fertilization

sometimes takes place, especially for the winter crop due to lower sulphur leaching but more on lighter and shallow soils. The annual amounts range between 30 to 60 kg S/ha. Oilseed rape receives organic manures mainly as slurry, depending on availability. Slurry is applied to winter oilseed rape before ploughing in the autumn or in the spring when growth has recommenced. Despite the considerable uptake of nitrogen in autumn compared with cereals, recovery of this nitrogen in the seed is very low. (Christen, 2000)

Weed control: Glyphosat products are used in rape cultivations. Application is before sowing in autumn to control broadleaf and grass weeds. It is also sprayed for pre-harvest crop desiccation (application of a herbicide to a crop for the enhancement of the ripening process 7-14 days before harvest). The use for desiccation is limited in Germany but more common in other countries such as the UK. (Wikipedia crop desiccation, 2016)

Disease and pests: Several diseases can infect winter oilseed rape and frequently result in yield losses; on the other hand, disease is rarely a problem in the spring crop. The main problems arise from infection with *Pyrenopeziza brassicae*, *Sclerotinia sclerotiorum*, *Phoma lingam* and *Alternaria*. The input level of fungicides varies but widespread fungicide has to be checked for cost effective. In northern Germany, spraying in autumn plays a role to control foliar and stem diseases and to increase winter hardiness. Plant growth regulators are not widely applied. An important application date for fungicides is post flowering to fight *Sclerotinia* and *Alternaria* during periods of wet weather. In drier years or regions, *Sclerotinia* will not have a major effect on yield. Treatments against pests are routinely applied depending on the incidence of the pest. Slugs sometimes are a major problem of winter rape, especially after wet summers. Other important pests are thrips (*Thrips angusticeps*) and flea beetles (*Phyllotreta spp.*). During spring, the most important pest is the blossom beetle (*Meligethes aeneus*). (Christen, 2000)

Harvest: Winter oilseed rape is predominately harvested by direct threshing. The harvest accounts for around 4 tonnes/hectare. In 2016, Hessen rape farmers harvested between 25 and 45 quintals per hectare (overall, less than in average years) (DBV, 2016b).

Processing: Oil mills process this volume into around 1,600 litre rape oil or bio-diesel plus 2,100 kg rape meal. Rape meal is a high-quality protein feed for dairy cows, pigs or poultry. The national production of protein feed material from rape supplies more than 3 million tonnes of GMO free protein feed. (This would represent around 1.3 million ha of soybean production in Latin America.) (DBV, 2016c)

On one ha flowering rape, honeybees can produce around 40 kg of honey. (HBV, 2016)

4.1.4 Case study area of the Wetterau

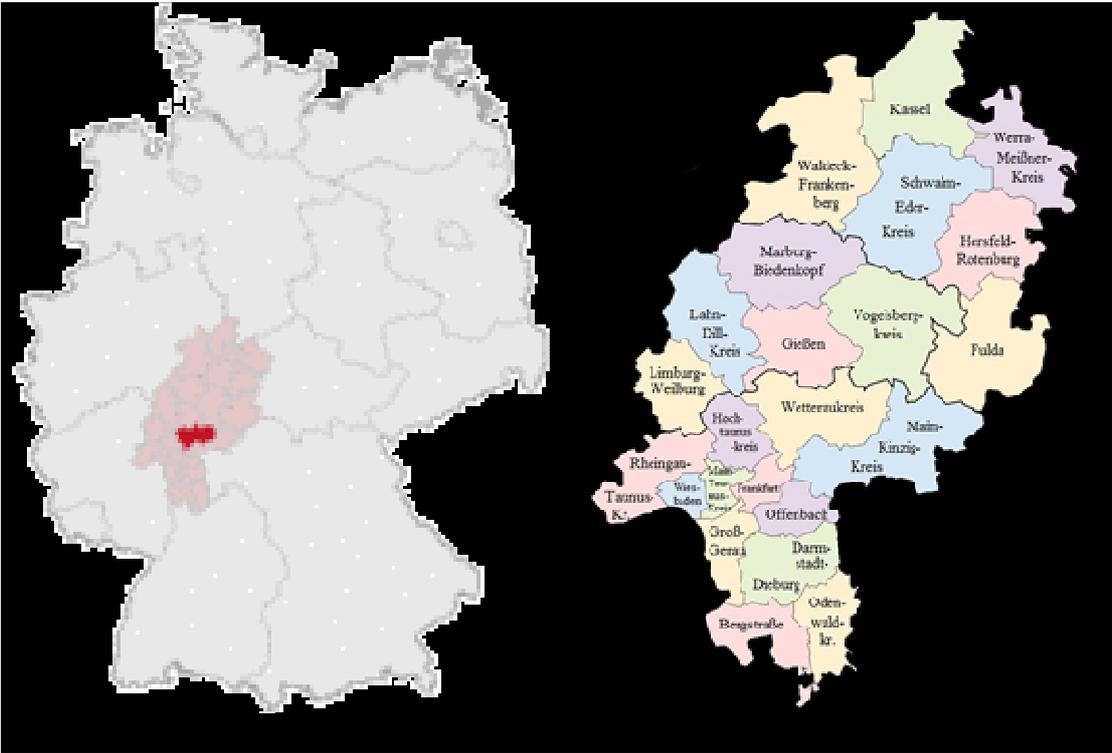


Figure 8: Location of the Wetterau district in Germany and in Hessen⁷

The Wetteraukreis (Nuts III level) is located in the middle of the German federal state Hessen, in the north of Frankfurt/Main. The Wetteraukreis includes 25 municipalities; the population number amounted for 295.408 inhabitants (2013) and covers an area of about 1,100 km². The administrative district Wetteraukreis was named after the landscape Wetterau, which is on her part named after the river „Wetter“. The administrative district called Wetteraukreis, was founded in 1972. The name of the district has its origins in the geographical landscape Wetterau, located in the north of the city of Frankfurt/Main. It is one of the most fertile agricultural landscapes in Germany. In the eastern part of the district, many mineral and thermal springs are situated. Both rural and urban structures characterise the area. Thus, the closeness to the Rhine-Main conurbation as well as towns and villages shape the region. (Sulz et al., 2006)

The Wetteraukreis has a varied landscape ranging from a flat and fertile valley bottom in the west to semi-mountainous areas in the east. The flat centre of the region is characterised by an intensive agriculture. It has surrounding mountainous areas, the Taunus and the Vogelsberg. The southern border represents the Rhine-Main metropolitan area. (Sulz et al., 2006)

⁷ <http://de.wikipedia.org/wiki/Wetteraukreis>

Table 11: Some key data for the Wetteraukreis

Criteria	Wetterau data
Population (30 June 2004)	295.408
OECD Predominately or Significantly Rural	SR / PU
Density of population (inhabitants/km ²)	268
Arable land (% UAA; 2003)	76.3
Area	1,101 km ²
Acreage	54.2%
Forest area	29%
Structure and open space	7%
Surface of the water	1.1%
Cities*	13
Communities**	12
Average proximity to conurbation (estimated)	close (< 50 km)

*Cities: Bad Nauheim (30,304 inh.), Bad Vilbel (30,396 inh.), Büdingen (21,583 inh.), Butzbach (25,234 inh.), Friedberg (27,491 inh.), Gedern (7,847 inh.), Karben (21,476 inh.), Münzenberg (5,618 inh.), Nidda (18,321 inh.), Niddatal (8,967 inh.), Ortenberg (9,293 inh.), Reichelsheim (6,854 inh.), Rosbach (11,547 inh.)

The regional gross value added of 30,323 €/inhabitant is nearly 30 % higher than the German average of 23,400 Euro. More than 2,500 high-tech companies and around 100 research institutions are located in the area. The private income of 17,114 €/person is something higher than the Hesse average of 16,772 €. Municipal tax revenue per inhabitant is on the average 779 Euro.⁸

The unemployment rate in Wetteraukreis is significantly lower than in Hessen and in Germany (10.4 % in 2003 and 12% in 2005). (Wetteraukreis, 2004b) The number of persons with employment grew significantly during the last 30 years (27% since 1987). (LK Wetterau, 2013) In 2012, 74,788 persons were employed, thereof less than 600 employees in agriculture and forestry.

The primary sector represents around 1%, the secondary sector accounts for nearly one third and the tertiary sector for around two thirds of the economic activities. Traditionally, the industry and regional economy of the Wetteraukreis is highly diversified, the range of enterprises and companies is very diverse. Thus, high-tech industry and global players are located here as well as traditional handicraft, small-scale enterprises and family businesses.⁹ Most employees work in the service area (>70%). (LK Wetterau, 2013)

The region is one of the most productive agrarian regions in Germany: the climate is moderate and the soil is very fertile. Intensive agriculture is widely spread. Arable crop rotation with wheat, oilseed rape and (with a decreasing trend) sugar beet is the predominant farming system. This is sometimes combined with pork production. Around 1,300 farms are located in the region; around 55 % of them are full time farmers.

⁸ <http://www.wirtschaftsfoerderung-wetterau.de/standort-zentralperspektive.html>

⁹ <http://www.wirtschaftsfoerderung-wetterau.de/standort-zentralperspektive.html>

Farmers cultivate 3 % of the land under organic farming scheme. Low-intensity systems represent the majority of permanent grassland cultivation. A steady decrease of livestock farming took place. Only the number of horses increased over time.

The proportion of leased farmland is very high because farmers own only around 25 % of the cultivated land. The demand for land on lease is very high with steadily increasing prices for land.



Figure 9: Images of the Wetterau landscape Land use and income structure

Approximately two thirds of farm households have several income sources. In most farm households, at least one member has a permanent off-farm employment. Only around 20 percent of farm households receive their main income from primary agricultural production. In the mid-mountain and low-intensity grassland areas, part-time farming is particularly widespread. (Sulz et al., 2006)

4.1.4.1 History of oilseed rape production

Back in the 1980s, farmers established a machinery ring (MR) aiming to reduce workload and high costs for the investment in large-scale machinery for arable crop production, in particular harvesters and transport capacities for cereals and sugar beet. In the 1990s, the Wetterauer Agrar Service GmbH (WAS) was founded. WAS Ldt is a daughter organisation of the machinery ring responsible for the sales of cereals, sugar beet and

bio-fuel, and it markets high quality feed pellets. Another daughter organisation of MR Wetterau is the HERA economic association (Hessische Erzeugerorganisation für Raps w. V.). Originally, this producer group was founded under the name 'NAWARO' in 1994 (see below).

In the early 1990s, overproduction of cereals and other agricultural products was a significant issue. In 1992, there was a political decision to have an obligatory percentage of 15% of set-aside-areas on Hessian farms. The regulation prohibited the cultivation of food crops on these areas. Pushed by this development, people from Wetterau machinery association (Maschinenring), the water- and soil associations (Wasser- und Bodenverband) and the Hesse Farmers' Union (HBV) developed a strategic plan for the use of the set-aside-areas in 1993. They searched for information, tested and discussed a variety of options in respect to fibre or bio-fuel processing and marketing. When they settled a sales contract with a biofuel processor in Nordrhein-Westfalen, stakeholders from the three local organisations founded a new organization, the so-called NAWARO economic association, in 1994. This initiative started with 150 members and 500 ha of rape from set-aside-areas aiming to realise the highest possible price for the member farmers. The liaison of NAWARO assoc. and WAS Ldt offered biodiesel, biodiesel-Service stations and biodegradable lubricants. Moreover, they provided information for farmers about the use of biodiesel in farm machinery. In 2000/2001, the "Hessische Nawaro Kapital GmbH", a 100% sub-company of the NAWARO initiative, was founded. It was a holding in the oil mill company "Rheinische Bioesther GmbH & Co" in Neuss, which annually produced around 150.000 tonnes of biodiesel. (Zerger, 2006)

The NAWARO initiative managed to set-up a regional market for biofuels in cooperation with other distributors and machinery rings in the Federal State of Hessen. The circular flow model „Biofuels from Hesse farmers“ grew. Farmers were able to realise a higher added value due to the establishment of a supply chain from production to fuel consumption. In 2006 for example, on-farm price for rape from regional stock lay 1-3 Euro/quintal (100kg) rapeseeds higher compared to the conventional sales channel. (Zerger, 2006)

Until 2009, the EZG organised registration and subsidy payment of bio-energy plant cultivation on set-aside-land for the members with the Federal Agency for Agriculture and Food (BLE). (EZG, 2016)

Moreover, the local government initiated a round table on biomass with attendance of the NAWARO initiative, craftsmen, energy supply companies and others in Wetterau district in 2006. When the initial circle grew too big, they established a steering committee and working groups. Back in time, the round table initiative projected an increase of renewable energy use of up to 15% in the year 2015. The idea was to improve regional business cycles and increase added value aiming to secure and sustain employment in the area, diversify incomes in agriculture and forestry and to install pilot projects. (Zerger, 2006)

4.1.4.2 Current situation of rape production in the Wetterau

In the state of Hessen, rape fields covered around 6,100 ha or nearly eleven percent of farmland. This is even more than the national average, which represents slightly more than ten percent of farmland in Germany. Rape became one of the most important field crops in Hessen. (FAZ, 2016)

The case study area Wetterau is the most fertile area in the mountainous state of Hessen. Apart from wheat, sugar beet, and maize, rape is an important cash crop (see section 4.1.4).

As mentioned above, arable farmers in the area have a long tradition of close cooperation. This is highly relevant for the production, harvesting, and transport of rape. The following paragraphs will present the structure and the engagement of the associations related to arable farming in the Wetterau.

The MR Wetterau with its daughter organisations WAS and HERA is engaged in the Wetterau administrative district as well as the adjacent districts of Gießen, Vogelsberg, Main-Kinzig, Frankfurt and Hoch-Taunus. (MR Wetterau, 2016)

HERA is an economic association aims to realise the best possible sales of oilseeds for the member farmers. HERA offers the following services¹⁰:

- independent price information
- pool price contracts
- fixed price contracts (EZG, 2016)

In 1994, the Erzeugergemeinschaft (producer group, EZG) had 150 farmers with around 500ha. Today, ten times more farmers are members and the land cultivated with rape grew up to 9000 ha. In 2015/16, HERA realized a turnover of 15 million Euro (36,000 t rapeseed). For the next year, the volume is expected to rise to around 40,000 tonnes. (EZG, 2016)

Since 2015, HERA has a framework contract with Cargill-Unilever corporation for the sustainable rape cultivation for food. This sustainability standard includes biodiversity and environmental protection measures such as the development of flower strips, lark protection areas, or a set ceiling for nitrogen fertilizer. Moreover, fertilization is managed applying the CULTAN concept (*Controlled Uptake Long Term Ammonium Nutrition*), and farmers are required to install drop-leg-nozzles for spraying. (EZG, 2016) The application fits on all spraying systems. The innovative technology shows promising results for the protection of bees and other pollinating insects. Test results show that the honey from sprayed rape fields in flower was free from measurable contamination (Wallner, 2014).

The sugar beet transport alliance (Zuckerrübenauflade- und Abfuhrgemeinschaft Nord, ZAAG) was founded in 1998 as a producer group, which was independent but closely connected with the MR (Landwirtschaft heute, 2016). Collaboration with the ZAAG has been the road to success for the rape producers in the context of transportation.

4.2 Policy and regulatory conditions

4.2.1 CAP and its implications for the cultivation of oilseed rape

4.2.1.1 Direct payments, cross-compliance and 'Greening' (first pillar of CAP)

Rape producers as all farmers with arable land or grassland can apply for direct payments. These payments are granted directly to farmers to ensure them a safety net (EU Commission, 2016c). These are a "basic income support, decoupled from production, stabilising farmers' income stemming from sales on the markets, which are subject to volatility. In order to maximise their profits, the producers must respond to market signals, so that they produce goods that are demanded by consumers. Direct payments also contribute, through greening, and in combination with cross-compliance, to providing basic public goods." (EU Commission, 2016c)

Farmers who do not comply with certain requirements in the areas of public, animal and plant health, environment and animal welfare are subject to reductions of or exclusion from direct support. This system - called 'cross-compliance' - forms an integral part of EU support under direct payments (EU Commission, 2016c).

¹⁰ <http://www.hessenraps.de>; <https://www.wasgmbh.de>

Some of the cross compliance rules cover all EU Member States in the same way; others differ between countries. The following cross-compliance rules are of particular importance for this case study:

Cross-compliance rules related to food and feed safety

- Traceability of feed material – farmers need to document the origin of feed material components. Since vegetable material from rapeseed oil production enters feed mixtures, this rule is relevant for the farmers.
- Storage of seed and plant material used for feeding have to be stored in a safe way (not contamination with oil, lubricants, cleaning substances etc.)
- Pest control in storage areas of rapeseed and other plant material – it is possible to apply pest control measures in storage but documentation and compliance with product instructions are relevant.
- Storage, transport, treatments or rapeseeds and other plant material: Clear documentation of all types of handling and treatment of material that will be used for animal feeding or human consumption.

Cross-compliance rules related to storage of other material

- Storage and use of chemical products for e.g. spraying, pickling, pest control are strictly regulated and require specific equipment, facilities and the related documentation.
- The emptying and disposal of chemical product containers has to comply with the related rules.
- The farm diesel station has to comply with the related legislation and rules.

Cross-compliance rules related to the cultivation of rape

- Measures to avoid the risk of soil erosion – soils have to be covered during the winter months; special rules apply in case of a particular risk of flooding; special rules apply in case of a particular risk of wind erosion
- Conservation of humus content in the soil – The farmer has different options to give evidence of the compliance of the farms' production system. This requirement of the conservation of humus content can be relevant for rape production because a crop rotation of only the two main cultures winter rape and winter wheat might not be sufficient. (ActGmbH, 2016)
- Ensure measures for the protection of the soil
- Plant protection: Various requirements to the use of chemical products for spraying the culture
- Use of fertilizers: Nitrogen fertilizer use is controlled and documented; organic fertilizer application is controlled and documented; annual comparison of nutrient input/flows; application of fertilizers have to be in-line with the rules.

Cross-compliance rules related to the protection of nature and landscape features

- Landscape elements are to be protected (hedges, trees etc.). This requirement can interfere with the use of large-scale machinery, and has to be taken into account in ICT technology solutions (precision farming).
- General compliance with the Natura 2000 Directive and Water Framework Directive

This list of cross compliance controlling areas is limited to those areas that are of relevance for rape production. The original list is longer and covers a variety of areas related to animal production. The

chambers for agriculture or the administrative offices for agriculture in the regions provide information and advice related to cross compliance controls (LWK-NRW, 2016). Landwirtschaftskammer LWK - NRW (2016) Checkliste Cross Compliance 2016 für landwirtschaftliche Unternehmen in Nordrhein-Westfalen. <http://www.landwirtschaftskammer.de/landwirtschaft/beratung/pdf/cross-compliance-checkliste-nrw.pdf>

'Greening', a major innovation brought in under the 2013 CAP reform, aims to make the direct payments system more environment-friendly. Farms with 10-30 ha are required to cultivate at least two main crops with a maximum of 75% of one of it. Farmers over 30 ha have to establish a crop rotation of at least three main cultures. Grassland is not seen as a main culture. Since many rape producers fall into that group, Greening is a relevant policy requirement of the case study on rape production.

HERA association as well as the seeds industry encourages farmers to evaluate the Greening as a valuable contribution to their farming system that among other positive effects contributes to the improvement of the farmers' image (EZG, 2016; Innovation 2016xx). The farmers union publishes the statement that HERA rape farmers provided around 60 ha of flower strips, which not only offer food to honeybees but to wild insect species and small game such as hares or partridge as well. (DBV, 2016) Farmers usually sow phacelia, lupines or crimson clover on the strips.

4.2.1.2 Common Market Regulation

Regulation (EU) No 1308/2013¹¹ establishes a common organisation of the European markets in agricultural products. It focuses on cereals, rice, sugar, dried fodder, seeds, wine, olive oil and table olives, flax and hemp, fruit and vegetables, processed fruit and vegetables, bananas, milk and milk products, and silk-worms. In contrast, the European or national market support measures do not support the European market for oilseed rape. The regulation only covers rape markets in the context of seeds for sowing and raw material for animal feeding (rape cake).

4.2.1.3 Rural development programme (pillar of CAP)

The Rural Development Regulation (EU) No 1305/2013 drives rural development schemes in all EU Member States. The Federal State of Hessen has an individual rural development programme, which is approved by the EU Commission. The European fund, national funding based on the national task for agriculture GAP (Gemeinschaftsaufgabe Agrarstruktur und Küstenschutz) and state's funding from Hessian budget provides finances for the different measures. The shift towards a low carbon and climate resilient economy is, among others, part of the Rural Development Regulation (EU) No 1305/2013 (Publications Office of the European Union, 2013).

A variety of rural development measures applies to arable farmers with rape and vegetable oil production. The following list mentions the most significant support schemes:

- Promotion of agricultural investment aiming to enhance the sustainability of farming and processing
- Agri-environmental schemes related to arable farming
- Support of primary producer associations (Erzeugerzusammenschlüsse, EZG) (see collective marketing section 4.3xx)
- Establishment of Operational Groups under EIP-Agri

¹¹ Regulation (EU) No 1308/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 December 2013 establishing a common organisation of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007

- Advisory services, support for professional networks etc.

4.2.1.4 *Farm-based bio-energy production*

The European Commission has developed the 'Europe 2020 Strategy' that calls for a bio-economy serving as a key element for smart and green growth in Europe' (European Commission, 2012:2; European Commission, 2010). The definition of the bio-economy approach includes 'the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy'. (European Commission, 2012:3).

The bio-energy production is one of the bio-economy's 'key sectors' (Global Bioeconomy Summit, 2015:4). The bio-economy concept connects with a range of different policy areas such as agriculture and fisheries, climate and environment, research and development. A variety of regulations and the stakeholders' engagement drive (and govern) production and the processing of energy crops.

The farmers' unions emphasise that the EU decided to start a reform process for the bio-energy policy until 2020. The aim is to realise a proportion of 10% of renewable energy use in the transport sector, thereof a maximum of 7% from agricultural sources. Indirect effects of land use changes will not impact on the calculation of greenhouse gas emissions." (DBV, 2016a)

This overarching policy aim affects a variety of policy areas, not only the CAP. Numerous documents are available in the context of EU bio-energy regulation, support and production. However, this case study will mainly focus on the shifts and local drivers for decisions made by Wetterau farmers.

- <http://www.biokraftstoffverband.de/index.php/die-these.html>

4.2.2 *National level policy and regulatory conditions for rape production*

4.2.2.1 *Support for renewable energy production in Germany*

The national level support for renewable energy production was of significant importance for rape cultivation and the processing of vegetable oil for fuel (bio-diesel and bio-ethanol) in the past. In addition, the policy and legal framework for renewable energy production plays a role for intensive aquaculture systems (see section 3.1.4). For that reason, this sections aims to give a brief overview of the related policy and regulatory framework.

In Germany, the Federal Ministry of Food and Agriculture (BMEL) and the Federal Ministry of Education and Research (BMBF) pursued strategies on the bio-economy policy and bio-economy research referring on the National Sustainability Strategy (NSS) (BMEL, 2014; BMBF, 2010).

For the farming sector, two bio-energy sections of the NSS are of key relevance: the cultivation of oilseed plants for the production of bio-fuel in local (cooperative) plants and farm-owned biogas plants that e.g. use manure or green waste for power production that feeds into the general grid. Apart from electricity, biogas plants produce heat that farmers can use in e.g. for the heating of greenhouses or water for intensive aquaculture systems (see case study aquaculture). The competitiveness of warm water fish production in Germany is closely linked to the policy (and financial) support of renewable energy production. For that reason, regulatory conditions related to bio-energy production in farming is highly relevant for both cases, the oilseed rape cultivation in the Wetterau and the intensive aquaculture production in different areas.

Overall, the German renewable energy sector has a long tradition in depending significantly from legislation and the related policy conditions. In 1991, the Electricity Feed-in Law (Stromeinspeisungsgesetz – StromEinspG) introduced a minimum compensation for electricity from renewable sources that producers fed into the grid. This law represented the starting point for energy production based on biogas technology;

while previously, such energy was mainly used for turning manure into fertiliser. It was of significant importance for the farming sector when in the year 2000, the German government established the Renewable Energy Law (Erneuerbare-Energien-Gesetz – EEG). This law offered the opportunity to feed energy from renewable sources into the grid on the basis of a guaranteed tariff for a period of 20 years. In the wake of EEG introduction, an expansion of the feed-in compensation by a so-called ‘Nawaro’ (**Nachwachsende Rohstoffe**) bonus for renewable materials led to rapid growth in energy crop cultivation (Bruns et al., 2009). Two amendments in 2004 and 2009 helped to increase bio-energy production from farming even further (Umweltbundesamt, 2010). With the stalling of the 20-year feed-in guarantee approaching, operators need to consider their perspective. However, there are also more short-term market changes and policy volatility – e.g. the re-organisation of the residual materials directive, marking a recess for farm-based biomass use – that the farmers and other actors need to respond to. Access to information and exchange of ideas on how to best react to such changes is key.

In 2010, the German state government put in place the ‘Energy Concept 2050’ (Energiekonzept 2050) that aims to achieve an energy supply mostly from renewable sources by 2050. In 2011, resolutions followed focusing strongly on the acceleration of the so-called ‘Energiewende’ (‘Energy Turnaround’), the German policy idea proclaimed after the Fukushima nuclear catastrophe. The EEG’s third amendment in 2012 aimed, amongst others, to encourage in particular farmers to operate ‘mini’ biogas plants with up to 75 kW.

However, in the meantime, the critical discussion of pros and cons of energy versus food production on arable fields developed and over time, prices for oils and fat on the markets increased. Both factors enhanced the re-conversion from bio-fuel production to oilseed production for human consumption.

Amendment law for EEG in 2016

The EEG is currently under revision. In the past, the EEG fostered the production of bio-energy in farms. The new framework for the support of on-farm energy production will be based on an award system for both, existing and new plants. It is not yet clear if small plants that are characterized by particular efficiency will have access to the support system in a similar way as in the past. Some stakeholders expect potential disadvantages for smaller plants. In a case of reduced competitiveness of small plants with an efficient use of the exhaust heat by e.g. a RAS, the coupled production would be affected by the changes in the energy support scheme as well.

- [http://www.biogas.org/edcom/webfvb.nsf/id/DE_Gemeinsame-PM-08-06/\\$file/16-06-08_PM_BBE_DBV_FvB_FVH_Kabinettsentwurf.pdf](http://www.biogas.org/edcom/webfvb.nsf/id/DE_Gemeinsame-PM-08-06/$file/16-06-08_PM_BBE_DBV_FvB_FVH_Kabinettsentwurf.pdf)
- https://www.bundestag.de/presse/hib/2014_05/-/279760
- <http://www.agrarheute.com/wissen/eeg-novelle-aenderungen-ueberblick> → Neuerungen EEG 2017

Sustainability regulation for bio-fuel (Biokraft-NachV)

Since 2009, the German bio-fuel sustainability regulation is in place (Biokraft-NachV). It is part of the EEG, which is implemented by two regulations, the Biokraftstoff-NachV and the Biomassestrom-Nachhaltigkeitsverordnung. For the enhancement of bio-fuel production, the aim set in 20107 was to realise a proportion of of biofuel in all fuels (“Biokraftstoffquote”) of at least 6.25% measured by energy content. In 2015, the obligation changed to an obligation to reduce greenhouse-gas emission (Treibhausgaserminderungspflicht) which is a reference value for biofuel that is the saved volume of greenhouse-gas (BMEL, 2015). This obligation reduced greenhouse-gas emission and resulted in a reduced percentage of bio-fuel utilisation of 5.8%. The underlying assumption is that bio-diesel from rapeseed

reduces emissions by 60%. For that reason, a lower percentage of bio-fuel fulfils legal requirements (UFOP, 2016b)

The aim is to create the greenhouse-gas balance for biodiesel. All members of the production chain have to pass their CO₂-value, there are default values for rapeseed production for different regions in the EU (OVID, 2014)

- Biokraft-NachV: only raw materials from sustainable cultivation are allowed → farmers give declaration to observers that they are farming sustainable (BLE, 2010)
- <https://www.landwirtschaftskammer.de/duesse/znr/pdfs/2010/2010-11-25-biokraftstoffe-05.pdf> → Structure of certification (linkages between producers)

4.2.2.2 *Relevant regulation for vegetable oil production in Germany*

Overview of regulatory conditions for arable farmers growing rape and oilseed rape processors

- Sectoral legislation: Not all legal requirements are linked with the direct payments via cross compliance. Additional regulations and rules are relevant for arable farmers, which are not yet listed in section 4.2.1.1)
- It is not allowed to treat rape seed with agrochemicals (Verbot Saatgutbeizung)
- Legislation related to water protection is of particular importance for rape farmers due to fertilization and chemical plant protection.
- The MR Wetterau provides an advisory service for farmers in drinking water protection zones (ground water protection). Since 2012, the team is responsible for the implementation of the Water Framework Directive in the Wetterau district as well. (<http://wrrl-wetterau.de/beratung-mr-wetterau/>)

4.2.2.3 *Organisations for the support of the vegetable oil sector in Germany*

FNR: The Fachagentur Nachwachsende Rohstoffe (FNR) is a national agency supporting the production and processing of renewable raw materials. It is the central coordinating institution for research, development and demonstration projects in the field of renewable resources. FNR coordinates activities throughout Germany according to the guidelines of the R&D Funding programme for Renewable Resources.

FNR funds and supervises about 400 projects per year. These projects focus on e.g. energetic or material use of renewable resources. Additionally, FNR funds bioenergy projects in the framework of the Energy and Climate Fund. FNR is also involved in activities on European and international level. Many other countries are involved in similar activities due to the global need to use resources in a more sustainable way. (FNR, 2016)

In order to accelerate this development, coordination of respective efforts plays an important role for using synergies and avoiding overlaps across national boundaries. FNR aims to contribute to coordination and knowledge transfer. Representatives of FNR have been participating in various trans-national projects and international cooperations with a focus on industrial biotechnology and bioenergy – in particular biofuels- and material use of renewable resources. (FNR, 2016)

Besides, FNR provides information and advice to a wide range of different target groups. The agency supports the market introduction of products with publications or the organisation of events. FNR provides information for experts and for the public. Moreover, FNR provides advice to the Federal Government, the German Federal States, the processing industry, the agricultural and forestry sectors as well as other interested parties.

UFOP: The German Farmers Union (DBV) and the Federal Association for Plant Breeders e.V. founded the Union for the support of oil and protein plants association (UFOP e.V.) in 1990. UFOP links enterprises, associations, and institutions that cooperate under the umbrella of the association. Trust and the cooperative spirit is seen as a starting point for the improvement of agricultural production and sales. The organisation managed to group breeding, cultivation, market and policy and to develop a common strategic concept. (UFOP, 2016)

Activities of UFOP focus on

- policy representation on the national and international level,
 - the optimization of farm production through a support of research and of a framework for the testing of cultivars,
 - the development of new forms of use and processing of rape, and
 - Public relation activities aiming to support the marketing of end end-products of the local oil and protein plants.
- (UFOP, 2016)

4.3 Market conditions

4.3.1 Production and input costs

Environmental conditions and farm size structures are main drivers for differences in production and related costs. The maritime climate in the north of Germany contrasts markedly with the more continental climate of southern and southeastern parts, which results in frequent dry-spells during the growing season. The highest input and the shortest rotations with respect to oilseed rape are currently found in the northern part of Germany (and the UK) with a strong maritime influence and heavy, loam soils. With few exceptions, crop inputs are lower in the south of Germany. Fundamental differences exist in farm size between former East- and former West Germany. This has an important influence on the workload per hectare, which in turn influences timeliness of fertilizer input and the ability to apply crop protection chemicals at the most appropriate time. (Christian, 2000) Land: Land prices increased significantly over the last decade. Depending on the contract period, soil quality and location of the field, farmers pay 200-400 Euro rent per hectare. Since the Wetterau is close to urban agglomeration. This is an advantage for farming in the case of direct marketing or cooperation with other urban industries. In the case of vegetable oil production, proximity to conurbations does not play a role. Instead, high prices for land are a disadvantage for arable farming. Calculated costs for the land use of rape cultures are below 100% of the annual costs because rape stocks the field for less than one calendar year.

Workforce: Workload for rape production accounts for around 9 hours per hectare depending on the size of parcels and machinery (Schätzel et al., 2016). Skilled work force is available in the area. However, the competition for technically skilled people is high with a large variety of well paid work opportunities in other industries. Unemployment rate in the Wetterau is low and the requirements for the machinery related work on an arable farm is high.

Financial capital: For the production of one hectare of rape, working capital is fixed in the system and therefore causes (imputed) cost of production (not necessarily related with expenses). Schätzel et al. (2016) calculates an average working capital of around 525 Euro per hectare and year. Access to finances is not a particular issue for rape production because arable farms have assets (land) and have a stable income basis provided by the direct support (single farm payment schemes, see section 4.2.1.1). Combine harvesters are very expensive machines. (It is the same harvester for cereals but with special equipment for the mowing

and thrashing of rape cultures.) Due to the high costs of harvesting and transportation of arable crops, Wetterau farmers have a long tradition in sharing machinery (see section 4.1.4.1).

4.3.1.1 *Calculation of profit contribution*

The profit contribution is a farm economic key figure that is easy to calculate and useful for the comparison of production systems within the farm and between farms. The profit contribution equals turnover per hectare minus variable cost of production per hectare. The state's office for agriculture in Bavaria¹² offers an online tool for the calculation of the profit contribution for rape (LFL-Agri, 2016).

Experts¹³ of the Bavarian State Office for Agriculture (LFL) published average figures for the model calculation in the online form (see Table 12). In the online system of LFL, farmers can introduce individual volumes, prices and costs and prepare their own calculation of farm economic key figures.

¹² Farming conditions in north-western Bavaria slightly differ from the conditions in the Wetterau.

¹³ Dr. Robert Schätzl, Jörg Reisenweber, Martin Schägger, Jürgen Frank, Bayerische Landesanstalt für Landwirtschaft, Institut für Betriebswirtschaft und Agrarstruktur (LFL, 2016)

Table 12: Calculation of farm economic figures for winter rape – an example for 2016

Yields and prices	Unit	
Yield of rape fields	quintal/ha	40
On-farm price (incl. additions, distractions, 10.7% AVT)	€/ha	37.83
Revenue rapeseed sales	€/ha	1512.80

Overview of profit contribution calculation		
Revenue rapeseed sales	€/ha	1512.80
Variable costs:		
Seeds for sowing (incl. 19 % vat)		85.90
Fertilizer (incl. 19 % vat)		273.00
Plant protection (incl. 19 % vat)		231.70
Variable costs for machinery and contractor		301.00
Payment of seasonal workers		0.00
Cleaning of harvested volumes (incl. 19 % vat)		34.40
Drying (incl. 19 % vat)		36.90
Hail insurance		84.70
Other variable costs		0.00
Variable costs – total		1047.60
Profit contribution (incl. vat)		465.20

Other key figures related to the profit contribution	Unit	
Workload per hectare (excluding seasonal workers)	hours/ha	9.27
Profit contribution per quintal rapeseed	€/ha	11.63
Profit contribution per employee workhour	€/ha	50.20
Opportunity costs for own land, work and working capital		

Disproportional* and fixed costs per hectare rape culture	Unit	
Disproportional costs and fixed costs for machinery, equipment and constructions	€/ha	258.00
Costs or rent for storage area and facilities	€/ha	33.00
Costs for land (proportion of annual rent)	€/ha	220.00
Other fixed costs (share of costs for accountancy service, office equipment, telecommunication, vehicle, farm insurances etc.)	€/ha	115.00
Other operational costs and fixed costs	€/ha	335.00

*Disproportional cost are operational costs that do not change proportionally with each unit more or less cultivated e.g. machinery repair (they are also called non-variable costs).

Calculation of return per hectare rape culture	Unit	
Revenue rapeseed sales	€/ha	1512.80
Single farm payment, Hessen¹⁴	€/ha	261.56
Total revenue per ha	€/ha	1773.56
Variable costs	€/ha	1047.60
Other operational costs and fixed costs	€/ha	335.00
Return per ha rape culture	€/ha	390.96

This model calculation shows that the return per hectare rape accounts for 400 Euro/ha based on a yield of 40 quintals per hectare harvested.

4.3.1.2 *Competitiveness of the field crops rape, sugar beet and wheat*

The result for rapeseed in 2016 presented above is below the profits presented in the next section, which are based on figures of the harvest 2013. The state's Institute for Agriculture in Hessen published an model analysis to discuss the competitiveness of rape, sugar beet and wheat with Hessian arable farmers. (Bickert, 2014)

¹⁴ DBV, 2016: <http://www.bauernverband.de/praemienschaetzer>

Table 13: Sales revenue and variable costs of rapeseed versus sugar beet and wheat (model data, 2013)

	Rapeseed €/ha	Sugar beet €/ha	Wheat €/ha
Sales revenue	2050	3800	1800
Seeds for sowing	290	220	290
Fertilizer	90	300	85
Plant protection	200	330	180
Thrashing/harvest	140	250	140
Diesel	100	100	100
Profit contribution	1260	1600	1005
Direct payment	290	290	290
Average non-variable and fixed costs	900	900	900
Return	620	990	345

Source: Bickert (2014)

Bickert presents a list of other operational and fixed costs for the farm size of 100 and 200 ha. (Bickert, 2014) He assumes that these costs are the same for all arable crops on the individual farm. The highest result has the cultivation of sugar beet. However, the Common Market Policies limits the sugar production by the quota system.

Key figures that drive this calculation are the sales prices for the products, yields per hectare, the single farm payments and the operational and fixed costs for machinery and equipment. The latter are usually assumed to shrink with increasing farm size as Table 14 shows (Bickert, 2014). Moreover, farmers' annual income depends strongly on the number of hectares he cultivates.

Table 14: Costs for land, hired labour, machinery and a proportional share of fixed costs (model data, 2013)

	Costs for a 100 ha farm	Costs for a 200 ha farm
Rent for land	450	450
Machinery, equipment	300	200
Constructions	80	60
Salaries	10	80
Other costs	100	160
Profit contribution	940	870

Source: Bickert (2014)

4.3.2 Supply chain for oilseeds in Germany

Rapeseeds processing chains have bottleneck structures because the rape has to be cleaned, dried and pressed for vegetable oil production. A large number of producers sell to a small number of oil mills. Vertical cooperation along the supply chain is relevant for both business partners supplying farmers and purchasing mill. Due to high costs of harvesting, storage and transportation, many farmers liaise with each to share costs. Hence, horizontal cooperation plays an important role for the analysis of the supply chain as well.

HERA association has a contract with Unilever for the delivery of vegetable oil for food processing. (EZG, 2016)

4.3.2.1 Structure of oil mills

The next oil mill for rape growers in the Wetterau is the oil mill in Mainz. However, Cargill corporation announced to close the mill in Mainz. This would require further transport of the Wetterau harvest to the cities of Mannheim Neuss, Hamm or even Salzgitter, which will raise the cost. The farmers' union expects the competitiveness of Wetterau farmers to be affected. Regional production and processing cycles will be impossible without an oil mill in the Rhein-Main area. (DBV, 2016)



Figure 10: Locations of oil mills (members of the OVID association, 2016)

The OVID association is the representative body for 19 oil mills in Germany. (OVID, 2016)

The small number of oil mills with significant processing capacities is the result of a concentration process.

Small and medium-size oil mills present an alternative market channel to the large-scale oil mills, which are the result of a concentration process of the industry.

These so-called decentral oil mills founded an association, the BDOel e.V, in 2005 that represents their interests in their economic and political environment. The decentral oil mills are mainly small plants with a daily capacity between 15 – 1,000 kg of oilseeds. Decentral oil mills highlight particular advantages:

- value added in the rural area (additional income and employment)
- potential on-farm differentiation with an additional income for farmers,

- higher prices for the harvest,
- closing of regional cycles of materials, facilitation of re-flux of by-products in the agricultural use (rape cake, vegetable oil in tank),
- avoiding long distant transports,
- offering opportunities for the direct marketing of native vegetable oils as a local speciality. (BDOel, 2016)

In 2007, more than 580 small to medium-size oil mills were registered producing vegetable oil and protein feed. Three years later, the processed volumes shrank by 40% because of a closure of many of the small oil mills. The remaining decentral oil mills have unused capacities waiting for chaining, more favorable conditions for their business. Many of these local mills depend on the marketing of oilseed cake as a high-value protein feed to local farmers. If the oil cannot be sold, the mills store it. Due to low oil prices, the demand of rape oil added to the tanks of vehicles fell significantly. The vegetable oil used in the tanks is not competitive. (BDOel, 2016)

A particular issue was the cancellation of the refunding of bio-diesel used in the agricultural sector ('Agrardiesel-Rückvergütungsgrenze' for farmers and farm contract services). This policy support scheme fostering the demand for bio-diesel affected the oil mill sector significantly. Moreover, the sustainability requirements of biomass power and bio-fuel regulations (Biomassestrom- und Biokraftstoff-Nachhaltigkeitsverordnung) are perceived as a difficult hurdle for the operations. (BDOel, 2016)

Consequently, many operators of decentral oil mills suffered from the policy change and have little confidence in the future economic results of their business. A small number of oil mill operators might profit from the increasing demand from operators of cogeneration unit. (BDOel, 2016)

4.3.2.2 *Support of farmers' collective marketing*

The first efforts to improve agricultural marketing in Germany were aiming at removing the structural disadvantages of the agricultural sector and introducing marketing 'top-down' by law. The result of these efforts was the Marketing Fund's Law in 1969 supporting the establishment of so-called 'Erzeugergemeinschaften' (producer communities), and the establishment of the CMA, the Central Marketing Agency for the German agriculture. The aim of this organisation was to improve the competitiveness of the German agriculture and its products in the growing European market by using modern marketing measures. To finance the work of the CMA, levies were collected at the industries' bottlenecks such as slaughterhouses, dairies, mills, breweries or sugar refineries. The annual budget of this national marketing agency was significant composing of farmers' contributions, EU financial support and the agencies' economic revenues. The role and the potential of a general marketing agency for all farmers and all types of products have been subject to ongoing controversial debates. In 1991, a restructuring of CMA activities took place in order to achieve a stronger orientation towards producers' interests. Nowadays, the CMA does not exist anymore. Instead, the organisation AMI (Allgemeine Marktinformation) was founded to take over the national task of agricultural market analysis. AMI sells its analyses on a commercial basis.

Instead of the former general and not clearly targeted marketing of the CMA, market-oriented locally based producer associations are responsible for the marketing of the member farms' produce. These producer groups usually focus on specific farm products and develop their well-targeted marketing channels.

In the 1970s, many of these producer groups, the 'Erzeugergemeinschaften' (EZG), emerged but later, in the 1980s and 1990s, the number stagnated and partly even decreased. Many failed to systematically to implement measures to develop independent cooperative production and marketing concepts. Moreover,

the groups failed to establish an efficient information and communication policy. Instead, the member farmers lost the motivation to engage in joint cooperative production and joint marketing activities. In early days, the potential of EZG tended to be used insufficiently. However, many of the producer associations that are working today were able to overcome the challenges and play an important role in alternative marketing channels for agricultural products. (Zerger et al., 2008)

4.3.3 Market for rapeseed

Rapeseed is an oilseed cash crop that competes on international markets for vegetable oil and meals. Figure below shows trade flows for rape oil (yellow) internationally.

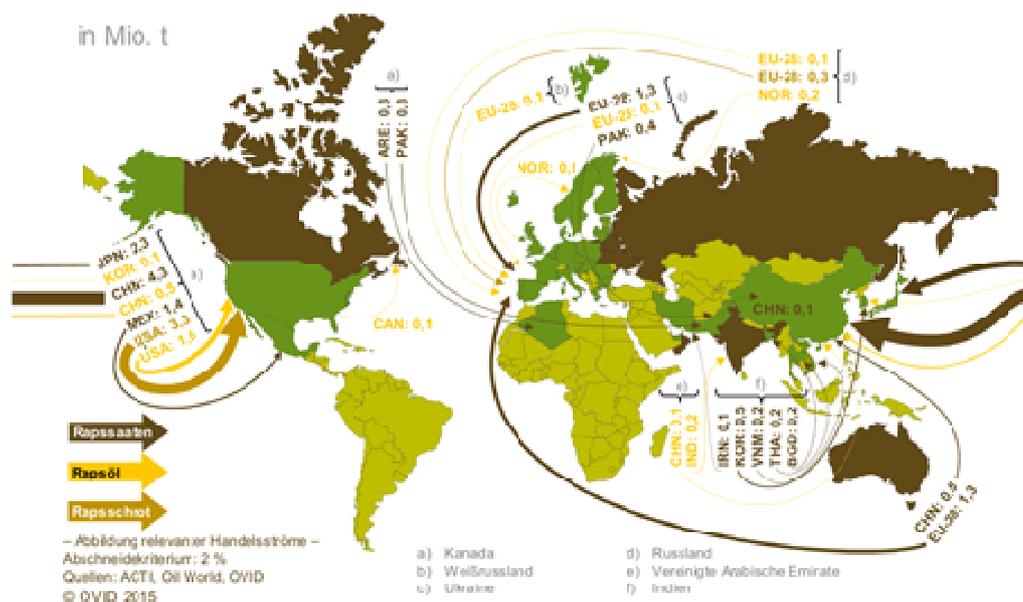


Figure 11: Global trade of rapeseed, rape oil and rapeseed meal in 2014 (in million tonnes per year)

In 2014, the rapeseed harvest accounted for 6.2 million tonnes but around 9.6 million tonnes were processed in Germany. A volume of 3.8 million tonnes were imported, mainly from France and Poland (OVID, 2016) Farmers have alternative options to sell rapeseed: to mills or to distributors, at commodity exchanges, futures exchanges and by different types of contracts (see section 4.3.3) In General, most German farmers producing oilseed rape have 2-3 marketing channels such as agriculture trading companies or processors. (Adämmer, 2014) Most rapeseed harvested is sold after threshing (Adämmer, 2014)

Rapeseed meal (or cake) is a co-product from the oil production and an important feed. In 2015, farmers fed around 4.0 million tonnes of rapeseed meal and 3.9 million tonnes soybean meal to animals in Germany. These figures represent a turning point, because - for the first time - the use of meal from rapeseed was higher than the use of soybean in feed mixtures (OVID, 2016b)

4.3.3.1 Special phenomenon of the bio-energy boom in the early 2000s

- Global increase in demand for raw material for bio-fuel production
- Policy support for bio-fuel production
- EU policy aimed to realise a proportion of the bio-fuel consumption of 5.75% until 2010 and 10% until 2020; and 20% renewable energy of the total energy used until 2020

Reasons for the bioenergy boom:

- Until the end of the 1990s, oil prices were relatively stable.

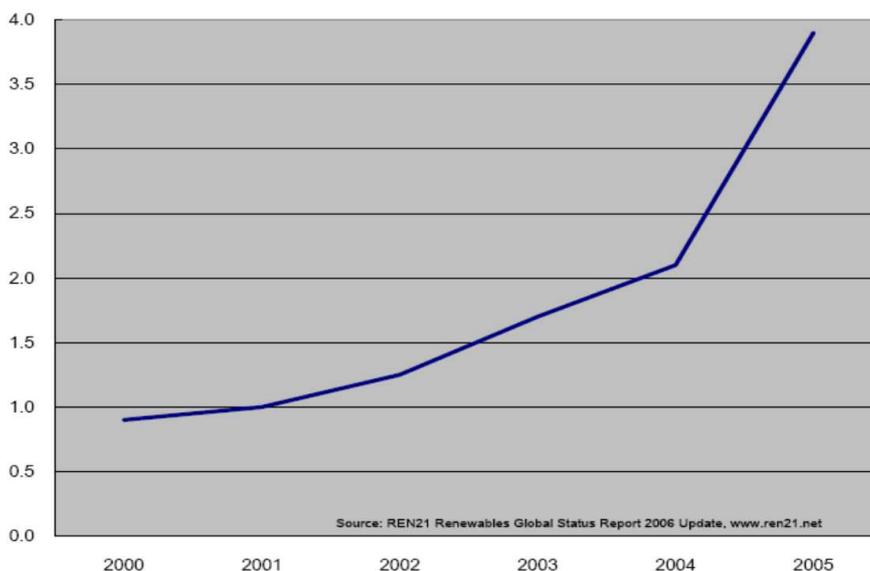
- Since 1999, oil prices started to steadily increase of up to 100 \$/barrel in 2005
- In 2005, experts prospected the oil price to remain high in the long-term.

This price development had a significant impact of rising energy prices on renewable energy production:

- In the first instance, farmers used waste material and other low-cost material for bio-energy production
- As soon as profitability was given, the operators of the plants decided to shift from food to energy production. That was a significant change.
- As a consequence, the land planted with energy crops increased significantly.
- Prices in the EU: 60\$ for bio-diesel and 90\$ for bioethanol (2007)
- With increasing prices of the raw material like maize, wheat, sugar, and rapeseed, the economic results of the bio-energy production shrank.

In 2007, researchers of Bonn University forecasted the increase of prices for arable crops in the year 2014. They expected a price increase of 6% for wheat, 8% for maize, nearly 20% for vegetable oil and around 60% for sugar (Holm-Müller, 2007). As a result, the expected effects driven by these price increases on the agriculture industry were expected to be as follows:

Figure 12: German bio-diesel production, 2000-2005 in billion litre per year



- Significant profits for supplier and operator of biogas plants, for suppliers of raw material and for landowners.
- Disadvantages for pig and poultry producers, dairy and cattle farmers due to increasing costs for feed.
- Increasing prices for energy, food and feed causes rising prices for land (and reduced availability of land). (Holm-Müller, 2007)

A Swiss study focused on the expected environmental impact of the rising demand for bio-energy crops. (based on a life-cycle-assessment):

- Increasing impact on the environment at all steps of the production (more fertilizer/pesticides, more expensive machinery use, higher costs for seeds etc.)
- Reduced CO₂ emissions compared to a 100% use of fossil fuels. (Holm-Müller, 2007)

4.3.4 Prices, price building and contract arrangements

The development of the rapeseed price in Germany is strongly related to global markets. Rapeseed prices depend on crude oil and soy, soybeans, which are the leading products for the whole oilseed-sector. Fluctuations in yields in Germany have no impact on the rapeseed prices, which is different to e.g. potato prices. Bad weather conditions and reduced harvests of rape will not necessarily relate with increasing prices.

4.3.4.1 International markets and stock exchange for futures

MATIF SA (Marché à Terme International de France) is a private corporation, which is both a futures exchange and a clearing house in Paris. It is the leading European exchange for agricultural products including rapeseed.

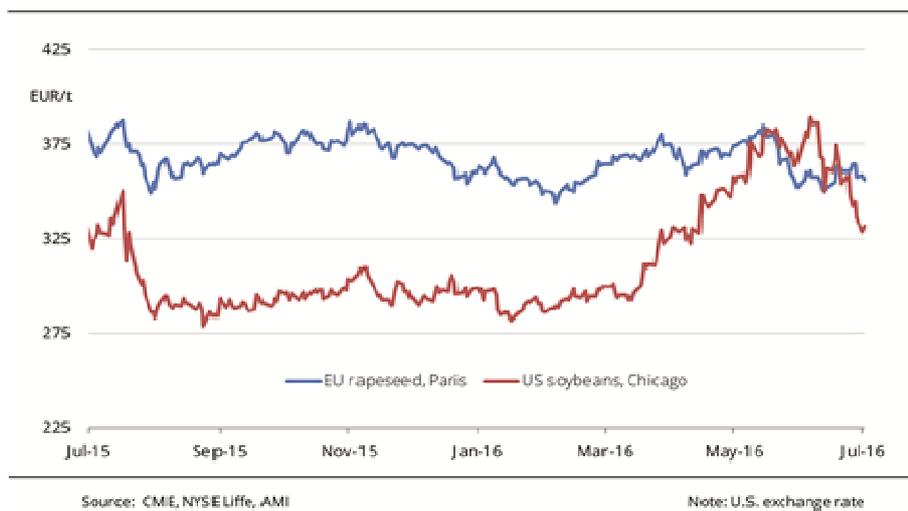


Figure 13: Oilseed futures settlement, July 2015 – July 2016

Figure 13 shows exemplarily the relation between soybean prices of the Chicago stock exchange and rape prices in Paris. In July 2016, positive crop prospects in the US put massive downward pressure on soybean prices but this has hardly had any impact on rapeseed in Paris. An anticipated drop in supply in the EU in 2016/17 and slow harvest progress improved prices slightly. The price for soybeans in Chicago slumped below the level of USD 10 per bushel (the equivalent of EUR 334 per tonne) in summer 2016. According to AMI, the pressure from overseas affected rapeseed prices in Paris too.

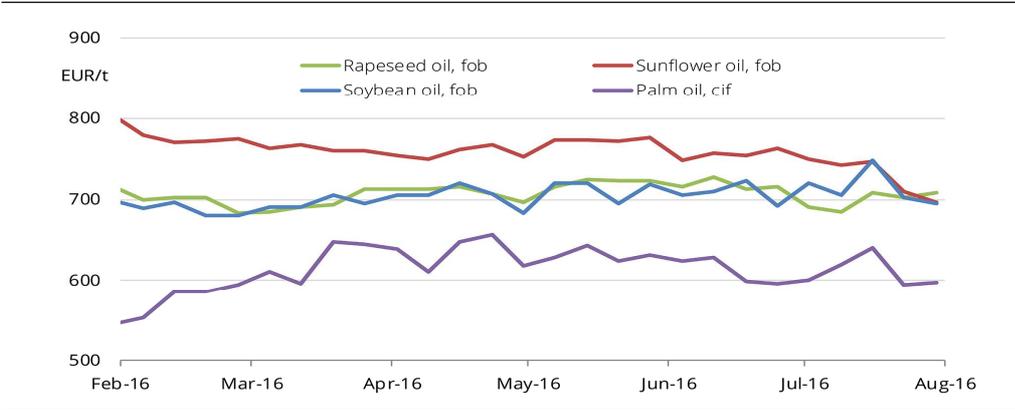
The trading and processing industries use the futures exchanges as an orientation. Consequently, the spot market is connected with the market for rape futures (Adämmer, 2014). Although just 5% of the German rapeseed is sold at futures exchange, it still determines the market prices (Adämmer, 2014).

Internationally, growth in vegetable oil demand has slowed recently due to contracting biodiesel production from vegetable oils in 2015 in several developed (such as Germany) and developing countries. The FAO/OECD outlook projects that in nominal terms all oilseeds and oilseed product prices will increase over the outlook period (up to 2023). The continuously growing demand for protein meals has been the main driver behind the expansion of oilseed production in recent years (see section 4.3.2.1). Consequently, the price relationships will shift slightly in favour of the meal component. Due to saturation in per capita food demand in many emerging economies and reduced growth in biodiesel production from vegetable oils, vegetable oil prices will decline. (FAO, 2016)

4.3.4.2 European prices

On the European cash market, prices for rapeseed oil, soybean oil and sunflower oil are closely linked. However, the supply of feedstock of the different products causes differences. In summer 2016, for example, prices for soybean oil and sunflower oil were slightly weaker due to abundant supply of feedstock. At the same time, the price curves for rapeseed oil showed a slight upward trend (Figure 14).

Wholesale prices of vegetable oils



Source: AMI

Figure 14: Wholesale prices of vegetable oil of rapeseed, sunflower, soybean and palms in 2016

According to AMI, oil mills werer stocked up well with feedstock. However, supply could become increasingly difficult and more expensive in the end of 2016 because of smaller than expected EU rapeseed supply. In addition, demand for rapeseed oil is expected to rise because the cap on greenhouse gas emission will rise from 3.5 to 4 per cent in 2017. Demand for biodiesel will surge as a result. This development is likely to stabilise the upward trend in prices of rapeseed oil. (AMI, 2016)

Figure 15 shows the development of rapeseed prices in 2014, 2015 and 2016. AMI (Agrarmarkt Informations-Gesellschaft mbH) publishes the prices for agricultural products and analyses the market development. Currently, bids are ranging from EUR 385 - 390 per tonne free of all charges. Processors are expected to still see shortfalls even in September 2016. Due to lower yields than expected, supply is short now. One of the reasons is that farmers are still holding on to their produce, which is not surprising in view of current price trends.



Source: AMI

Figure 15: Development of rapeseed prices (ex-farm), 2014-2016

4.3.4.3 Prices and rapeseed qualities

In Germany, the oil mills usually set prices following the given conditions and quality standards. This system is well established and widely accepted. Key quality criteria are the oil content, the humidity and the contamination of seeds. The long-term average accounts for an oil content of 42%, which is above the basic value of 40%. Consequently, the on-farm price is above basic prices published for rapeseed. Rape farmers find detailed information for the rape price calculation in the internet (UFOP, 2016): <http://www.ufop.de/agrar-info/erzeuger-info/raps/ufop-praxisinformation-die-rapsabrechnung/>

Onlinerechner – Kalkulation der Rapsabrechnung	
<small>Die Zahlen des Kalkulationsbeispiels können mit individuellen Werten überschrieben werden. Die Gesamtauswertung der Onlineberechnung kann im Anschluss als pdf-Dokument geladen werden.</small>	
Basispreis der Standardqualität	280,00 €/t
Anlieferungsgewicht (lose, ungeriebt)	150 t
Aspirationsabfälle	0,0 %
Feuchte	10,0 %
Schwundfaktor	1,2
Ölgehalt	44,0 %
Besatz	1,50 %
Reinigungskosten	0,00 €/t
Laboruntersuchung	25,00 €
Transportkosten	0,00 €
Trocknungskosten (ggf. vom unten angezeigten Wert der Beispielrechnung abweichender Betrag)	€/t
Bezeichnung der Lieferung (z. B. Name/Datum)	Name/Datum
Ergebnis der Kalkulation für den Abrechnungsbetrag (netto)	€
pro Tonne (bezogen auf Trockengewicht)	€/t
Trocknungskosten (gemäß Beispielrechnung)	€/t
<small>Alle Angaben ohne Gewähr</small>	
Gesamtauswertung	

Figure 16: Online system of UFOP for the pre-calculation of the payment of rape

With the online rape price calculation, farms have the opportunity to calculate their expected price for rape. With this instrument, each farmer has the opportunity to decide if e.g. the drying of a humid rape harvest in the own facilities will be cost efficient.

- Prices depend on quality of the seeds. The standard-quality contains a proportion of 40% vegetable oil, 9% moisture and 2% additional substances (causing impurity) (Proplanta, 2012).

If the delivered rape differs from this standard, the buyer will impose extra fees or reduce prices (Funk, 2010; Artavia, 2010)

- To a certain degree, producers can store their rapeseed harvest in case of a low price period. However, facilities for drying, airing and circulating are needed.
- Prices differ between years and areas/farms. An analysis of farm-gate prices shows that prices reflect additional costs such as costs for transport, storage as well as the local market situation (Funk, 2010).
- An average on-farm price was around 345 Euro per tonne for the Wetterau farmers in 2015. (DBV, 2016)
- AMI market report for calendar week 27 in 2016 shows a producer price of 335.50 Euro/tonne.

4.3.4.4 Sales contracts

Around 75% of the German farmers have contracts for around 50% of their harvest with sales businesses and mills, but just 5% of sales are based on pre-contracts with futures exchanges (Adämmer, 2014)

The AMI market report shows that German rape farmers made already contracts covering about 30-40% of the expected harvest in 2016/17 (AMI's report of calendar week 25, 2016). This is common because the marketing starts even before sowing in august and ends 20 month after the harvest with the end of 'shelf life' (Funk, 2010).

Rape farmers in the Wetterau can sell their rape to the HERA initiative, to agricultural traders or to rural cooperatives. Unlike the HERA initiative, agricultural traders retain profits. If farmers are members of HERA, they have the opportunity to choose between contracts based on a fixed-price or a pool-price system.

Fixed-price contracts

Contracts for fixed-prices work only for deliveries per lorry, which represents a volume of around 25-27 tonnes/lorry. The contract defines a certain price level depending on delivery or collection time. The return is set for the farmer. Each delivery is tested in the oil mill and quality and additions or deductions will be calculated (see UFOP rape calculator mentioned above).

The risk with this fixed contract is that the farmer is obliged to deliver a defined volume. If the delivery is not possible, fees are imposed. The mills usually process the payment within three weeks. If HERA member farms wish to opt for secure prices, they can choose fixed contracts as an alternative to the pool price contract.

Pool price contracts

HERA's main activity is the marketing of rape with the pool price model. The farmers agree on the delivery of the harvest from the land under contract but the price is unknown when the contract is signed. The volume will depend on the yield, which reduces the risk in comparison to the fixed price. The pool price depends on the sales negotiation of HERA with Unilever or potential other business partners. This price model reduces the risk for farmers because prices of smaller quantities tend to be lower than more significant volumes but farmers can profit from a price increase. The risk is shared among the large group of farmers. (EZG, 2016)

With the signature of the contract between November and Mai, the farmer is obliged to deliver the total yield of his rape fields to HERA. It will be impossible to sell part of the harvest somewhere else but the contract does not fix the volume. The farmer has no risk related to the volumes.

Most of the harvest is delivered directly without storage on the farm. Intermediate storage sometimes takes place with agricultural traders who have a business partnership with HERA.

HERA pays a discount of 70% until the end of August and the final transfer is after the fixation of the final pool price by the annual assembly of the members in the end of November. The pool price is the same for all farmers but costs for transport to the mill, potential cleaning and drying are subtracted. The quality criteria of the seeds influence the price as well. Due to the variety of factors driving the price, payments for one quintal of rape differ between farmers.

Overall, members assume that the initiative has lower clearing costs and a better marketing. (e.g. by additionally marketing by-products). The prices of HERA aim to be above competitors' prices. Moreover, farmers do not have to mind moisture of the oilseed, as they do when marketing to agricultural traders. HERA has good connections and collaborates with agricultural traders or rural cooperatives in respect to e.g. storage, processing, and transport of rape. An advantage of HERA is that the association is one partner 'for everything'. However, there are also dependencies of farmers because of the pre-financing of production equipment. (Zerger, 2006)

4.3.5 Standardisation

The federal agency FNR is engaged in on-going national and international standardisation. FNR explains the most relevant standardisation projects in the field of renewable energies:

- A technical standard represents the state of technology as determined in a consensus-based process organized by a standards body. Standards lay down general and/or detailed specifications for products, procedures and services alike. In Germany the acknowledged national standards body is the DIN, the German Institute for Standardization, which also represents German interests in European and international standards organizations, e.g. in European Committee for Standardization (CEN) and in International Organization for Standardization (ISO). (FNR, 2016)
- The term "standard" is defined in the standard DIN EN 45020: "Document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context". (FNR, 2016)
- In the field of renewable resources, relevant standards are for example the standards for solid biofuels. In the last years 40, a variety of standards developed in respect to terminology, fuel specification and classes, quality assurance, sampling, analysis physical, mechanical and chemical properties. The two most important standard deals with classification and specification (EN 14961) and quality assurance for solid biofuels (EN 15234). Another standardization process focuses on the sustainability of biomass. The DIN-Committee 172 "Sustainability Criteria for Biomass" is the responsible committee for this standardisation in the field of sustainable bioenergy at national, European and international level in Germany. (FNR, 2016)
- The Technical Committee CEN/TC 383 "Sustainability Criteria for biomass" works on standards to support the implementation of the Renewable Energy Directive 2009/28/EC. The aim is to define criteria, which support the certification of sustainable produced biomass for energetic use. Only certified sustainable biomass can enter the calculation for the achievement of the targets in respect to the renewable energy share, which is laid down in the directive. (FNR, 2016)

- The International Organisation for Standardization (ISO) has been working on the development of a global standard for sustainability criteria for bioenergy since 2010. The German Institute for Standardization (DIN) and the Brazilian Association of Technical Standards (ABNT) provided the secretariat and leadership of the committee ISO/PC 248 “Sustainability Criteria for bioenergy” under a twinned arrangement (FNR, 2016)

The farmers’ association HERA in the Wetterau is certified in respect to hygiene standards (GMP B3). Moreover, the group of farmers and the first points of collection have a sustainability certification (Redcert EU). (EZG, 2016)

4.4 Key issues identified in the literature, media and interviews

- Closure of the oil mill in Mainz will affect significantly on the cost structure of rape production and sales (including transport). Regional cycles of production – processing - consumption will no more exist. The disappearance of regional/local oil mills is an issue for the sector.
- Amendment law of EEG (2016) can affect biogas plant operators significantly. Only, the introduction of the related new award system for energy producers will show the degree of effects on rape producers and the future results of biogas plants.
- Water protection is an issue for intensive arable farming and rape production
- Various areas of cooperation play a role for rape producers under the umbrella of the MR Wetterau. This is specific to arable farming in the Wetterau.
- The significant changes of oilseed plant production used for bio-energy production in the early 2000s, is an interesting example for an agricultural market that is strongly affected by major changes in the policy and regulatory conditions. Major transitions took place over the last decades with a replacement of sugar beet field by rape fields. Hence, the use of rape shifted from bio-energy to food.
- Dichotomy for policy support for rape producers: food versus bio-fuel
- French and German farmers are deeply concerned about the future of rape farmers: “As a result of a year with big difficulties for farmers hit by the bad weather conditions resulting in bad yields and sometime poor quality stakeholders of the industry addressed the question of availability of plant protection products as an important production facility for farming. They are concerned that an increasing limitation of active substances will lead to more pest resistances. They particularly reaffirm the need of coherence in the political decisions. Legislators could not at the same time ask for greening with more diversity in crop on the farms, promote the interest of legumes as homegrown protein source and prevent farmers to protect and nourish their plants. On the simplification of greening, the new proposals promoted by the European Commission may have the opposite effects of those looking for.” (UFOP, 2016)
- Climate change: Due to climate change, global and local fluctuation in yield and an increase in price volatility is expected (Marktberichte, 2016). Price volatility is an issue for farmers when prices are below average or below a cost-covering base line. <http://www.proteinmarkt.de/markt/marktberichte/>
- GMO: Genetic modification with modern genetic technology is an issue in rape breeding. An alternative to the work with GMO. <http://www.pflanzen-forschung-ethik.de/>

- Genome Editing is another modern technology that changes targeted genes in plants. The process is not classified as a genetic modification. The technology is widely accepted by national governments. However, critical voices articulate their concerns about this form of artificial mutations (Transgen, 2016)
- Glyphosate: Farmers use the herbicide Glyphosate before sowing and during vegetation. The media analysis shows the importance of debates related to glyphosate impact on human health and biodiversity.
- Pest control: Mice populations affecting field crops became an increasing problem in recent years due to mild winters and dry summers. In February 2016, winter rape cultivations in Wetterau and in other Hesse areas suffered from mice that feed on young plants and roots. This caused skeletonised areas in the fields. (DPA, 2016) Chemical pest control of mice is prohibited in open space.
- Based on his profit and farmers' income calculation of different arable crops, Bickert suggests three strategies for the further development of the farms in 2014:
 - Termination of farming (and investment of assets somewhere else)
 - Changing to part time farming
 - Changing to organic (improving the income share of support payments; alternative marketing channels for the field products)
 - Expansion with investment in more land (if available) or in intensive animal husbandry
(Bickert, 2014)

4.4.1 SWOT analysis

Strengths of rape production in the Wetterau	Weaknesses of rape production in the Wetterau
Policy support for alternative energy production	Strong policy dependency in respect to EEG and required proportion of bio-fuel in total fuel of German transport
Variety of potential marketing channels	Commodity good; very limited potential for own processing
Large number of producers offers good opportunities for cooperative initiatives	Price depends on global oil and commodity prices
Positive effects in crop rotation systems;	Crop rotation needed; no monoculture!
Winter oilseed rape is the most important early-flowering culture for honeybees in spring. Rape honey is very common in Germany.	Potentially high disease and pest pressure (farmers apply chemical plant protection measures with negative impact on biodiversity, water and soil)
Knowledge and technology for rape production is widely spread and easily accessible (professional media, vocational education, input industry etc.)	Farmers' exposition to chemicals (risk of contact contamination – skin, eyes, inhalation etc.)
Rape has a positive effect on the following crop, in particular on winter wheat	Restrictions in respect to crop rotation need to be considered (clubroot infection in areas of long-term rape cultivation every second year)
Farmers groups and stakeholder engagement around rape production and marketing fosters the self-organisational capacity and the ability to liaise and cooperate (horizontal and vertical cooperation)	
Rape production and sales via the different potential marketing channels tends to contribute to learning and knowledge exchange	
Innovative technology such as the drop-leg nozzle for spraying flowing rape cultures are available and their use is compulsory under the sustainability standards of HERA supply contracts.	High pressure of plant diseases and pests requires chemical pesticide application, which affects biodiversity, water and soil (and partly even organic fields nearby).
Yellow flowering rape fields enrich the landscape in spring.	

Opportunities for rape production in the Wetterau	Threats for rape production in the Wetterau
Increasing demand for vegetable oil for food and	Closure of oil mill in the area; disappearance of

renewable energy resources worldwide	small processing plants as a general phenomenon
Increasing demand for locally produced food and feed material ('Regionality' as a quality attribute)	Potential change of CAP policy
Greening and cross-compliance contributes to the image of intensive arable farmers	Volatility of international market rape sales
Replacement of protein feed imports	Increasing competition for land use
Seed is (still) free from GMO plant material	Disease and pests <ul style="list-style-type: none"> - new phenomenon: Field mice predation, partly even skeletonisation
Positive image due to landscape feature and honey from rape fields	Negative effects on soil (humus content, erosion, fertilizing, chemical substances from plant protection)
Widening of the crop rotation system with legume crops to improve N-balances	Soil compression due to the use of large-scale heavy machinery from MR
Storage of rape harvests is an option to avoid sales during low price periods.	Storage of oilseeds is more difficult than the storage of cereal crops due to the high oil content of the seeds. Airing and/or drying, moving and cleaning of the seeds stock requires knowledge and facilities.
OECD Outlook: In nominal terms all oilseeds and oilseed product prices are projected to increase over the outlook period	More and more restrictions for the use of chemical treatments due to <ul style="list-style-type: none"> - Increasing resistance of diseases and pests - Prohibition of agro-chemical products - Potential prohibition: GLYPHOSAT!
Genetically modified rapeseed oil contains high contents of Omega-3-fat (which has positive effects in human nutrition). This GMO rapeseed oil is used in the US for both human consumption and for feeding aquaculture salmon (Omega-3-content in salmon meat is increasing)	Genetically modified plants in the natural environment cannot be re-collected in case of spreading into the non-GMO rape cultivars.

4.4.2 Sustainability performance and resilience related to rape production

4.4.2.1 Economic dimension of sustainability and contribution to farms' resilience

The contribution of rapeseed production to the farm income is positive. Due to the competitiveness of the crop, the area of rape production increased significantly in the long term.

- Because of the increase in prices, chances for the safeguarding of farms and the continuation by the successors may have risen in the past. (Zerger, 2006) Today, the demand for rapeseed of the different type of food and bio-economic industries is expected to remain high or even further increases.
- Today, an on-farm price of 345 Euro per tonne covers the cost of production and provides a return. However, several of the costs show increasing trends (land prices, machinery costs, transport costs). This is a potential threat for farmers. (DBV, 2016)
- Farmers' associations (MR, WAS, HERA), as well as the farmers' union offer information, newsletters and information activities to improve farm management, production systems and fosters on-farm diversification. The vocational school of Wetterau district in Friedberg offers the related qualification opportunities. (Zerger, 2006)

4.4.2.2 Environmental dimension of sustainability

Overall, the effects of rape production on the natural environment are relatively neutral with some potentially positive as well as negative effects.

- Rape cultivation has impacts on the environment: the use of biodiesel has positive effects on greenhouse gas emissions. However, the effects on biodiversity and landscape are rather discussed. (Zerger, 2006)
- The introduction of a type of *brassicaceae* can expand crop rotation. Farmers emphasize that rape has positive effects on the following crop. However, this depends on the consideration of alternative crops potentially planted such as maize versus legume crops.
- Due to a significant pressure of plant deceases and pests, the cultivation of rape regularly requires the application of pesticides in conventional farming. Pesticides affect biodiversity in agricultural landscapes and affect the water bodies. (Schrot & Korn, 2016) Spraying is needed even when the plants are flowering, which is significant threat for pollinating insects and honey production. (Wellner, 2015)
- The Wetterau has numerous springs. The mineral water industry is important for the area (value added and employment). Approx. 15 % of the bottled mineral water comes from here. The partly very intensive agriculture causes nitrate loads and problems with drinking water. Since nitrogen leaching results from a large variety of agricultural cultures, it is impossible to distinguish between cereals and oilseed rape or other arable crops. (Only legume crops reduce nitrogen leaching on fields.)
- Intensive arable crops such as cereals, maize, sugar beet or rape are more compatible than field forage production with clover or alfalfa, which were common elements of typical crop rotation in the area. The intensification of arable cropping is affecting the field hamster negatively. Nowadays, the native hamster is an endangered species in the Wetterau (Reiners, 2016) <http://www.feldhamster.de/gefaehrdung.html>
- Rape cultivations enrich the landscape due to the yellow flowers that colour the landscape in spring.

- Natural pest control requires the improvement of predators' conditions. The only option to fight devastating mice populations is the installation of numerous racks for birds of prey in or along the fields.

4.4.2.3 *Contribution to climate change mitigation and adaptation*

- Oil production from rape replaces – to a certain degree – the import of vegetable oil from processes with significant climate change impacts (deforestation for palm oil plantations or soy bean cultivations, transportation to Europe)
- Biofuel from oilseed rape is a renewable resource and replaces a certain (politically defined) proportion of fuel from mineral oil. Bio-fuel reduces the use of fossil fuel, which is positive. However, bio-fuel production on agricultural land competes with food production.

4.4.2.4 *Social dimension of sustainability*

- HERA economic association helped improving the image of farming in society back in time when energy production in agriculture was “en vogue”. Today, social acceptance of bio-fuel production has changed significantly due to global food safety reasons.
- With the changes from sugar beet production to rape for bio-fuel and rape for vegetable oil/fat, alternative processing and marketing channels for farms developed.
- Local traditions and traditional production techniques are untouched by vegetable oil production in the Wetterau.
- The different cooperative initiatives and related activities were successful over the last 3 decades. For that reason, the confidence of farmers in collective action was probably strengthened.
- Hessen has an annually nominated Raps-Königin (rapeseed queen) who represents the rape producing and processing sector in policy events, traditional fairs, thanks giving etc.

4.4.2.5 *GMO-free feeding material in animal production*

- In Germany, there is a strong trend to local protein production for feed. Policy fosters national protein crop and feed production. Moreover, consumers prefer meat from animals that received GMO-free feed {UFOP}
- Rape seeds are still free from GMO. This is the positive result of the testing of more than 300 seed samples analysed by the responsible authorities of the federal states. Seed propagators always face the risk that genetic material from GMO spreads into non-modified plants or seeds but testing indicated that rape seed in Germany is still GMO free (Schrot & Korn, 2016).
- Genetic engineering in agriculture is a high-risk technology because nobody will be able to recollect GMO after spreading in the natural environment. They will enter the food chain. Potential side effects of changes in the genetic material are unknown. The argument that genetic modified plants will require fewer pesticides, could not be supported by trials. So far, the use of pesticides increased even in cultivations of GMO plants. (Schrot & Korn, 2016)

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Statistics, legislation and other literature on aquaculture

International data and information on aquaculture

FAO statistics

FAO special issue fish production in Eastern Europe;

FAO studies on different topics, e.g. on certification (<http://www.fao.org/3/a-i1948e.pdf>)

The OECD published a special report on fish production in Eastern Europe with one particular focus on carp (OECD series 850)

Modelling: AGMEMOD PE, Magnet CGE

Data: STECF, EUROSTAT

SCAR - Fish prepared a first report on 15th April 2013 (PDF icon 899 KB) . The report was used for the Commission's work with Horizon 2020. http://ec.europa.eu/research/agriculture/scar/scarfish_en.htm
https://ec.europa.eu/research/scar/pdf//scar_fish_report_3042013_fin.pdf#view=fit&pagemode=none

Rules and regulations, legal documents for fish production and sales

2030 Sustainable Development Agenda

EU Regulations; EU Directives

German legislation for fish production, fish trade and food marketing

Rules and administrative regulations (Bundesländer, nature conservation agencies, regional funding rules (e.g. Rural Development Programmes etc.)

Additional literature and list of international projects

Some of the literature or research projects found during the desk study were not used for citation in this report. However, the following section lists these documents because they might be of interest for the on-going case study work.

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<http://wwf.panda.org/?uNewsID=258632>

Sustainability assessment: http://www.tierzucht.uni-kiel.de/dissertationen/diss_fitwi_12.pdf

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List of relevant international research projects

SUCCESS - Strategic Use of Competitiveness towards Consolidating the Economic Sustainability of the European Seafood sector; Homepage: <http://www.success-h2020.eu/>

Idaqua project (French project, "inter-professionel", committee for fish farming (marine and inland);

IDEA indicators – economic, socio-territorial, environmental;

'Primefish' – Horizon2020 project; SUCCESS cooperation in respect to indicators and criteria (<http://www.primefish.eu/>)

This brochure of the European Commission presents all marine projects funded under Horizon 2020: https://www.marine.ie/Home/sites/default/files/MIFiles/Docs_Comms/H2020%20Projects%20Final%20Brochure.pdf

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http://www.bmel.de/SharedDocs/Downloads/Ministerium/Beiraete/Agrarpolitik/Klimaschutzgutachten_2016.pdf?__blob=publicationFile

http://www.biokraftstoffverband.de/tl_files/download/Daten_und_Fakten/14-05-16%20Informationsblatt%20zur%20deutschen%20Biodieselbranche%20.pdf

http://www.proplanta.de/Agrar-Nachrichten/Agrarwirtschaft/Immer-mehr-Oelmuehlen-verschwinden-vom-Markt_article1327907747.html

<http://www.carmen-ev.de/>

www.llh-hessen.de

<http://www.mr-wetterau.de/>

<http://www.rapsbiodiesel.de/>

<https://www.dsv-saaten.de/service/greening/>

<http://www.raps-aktuell.de/Rapsstatistik> and DESTATIS)

Annex – Aquaculture

Aischgrund case study: members of the research team and list of interviewees

The field trip for the SUCCESS and SUFISA case study on carp took place from June 28th to July 1st 2016.

Members of the research team:

- Tobias Lasner, Thünen-Institute for Fisheries Ecology, Unit Economic Analysis, Hamburg
- Susanne von Münchhausen, Eberswalde University for Applied Science (FH)
- Adam Mytlewski, Department of Fisheries Economics, Polish National Marine Fisheries Research Institute (NMFRI), Gdynia
- Myriam Nourry, Université de Bretagne Occidentale (UBO), Brest
- Martin Oberle, Bavarian State Research Center for Agriculture, Institute for Fisheries, Department for Carp Farming, Höchststadt a. Aisch
- Marcin Rakowski, Department of Fisheries Economics, Polish National Marine Fisheries Research Institute (NMFRI), Gdynia

Interviewees and participants of the focus group:

- Konrad Bartmann, Director of „Teichgenossenschaft Oberpfalz“
- Hans Frischmann, Carp farmer
- Walter Jakob, Carp farmer and head of „Teichgenossenschaft Aischgrund“
- Karola Kabelitz, Head of the Homeland and Carp Museum
- Christoph Oberle, Fish farmer and restaurant owner
- Martin Oberle, Head of Department for Carp Farming, Institute for Fisheries
- Gerhard Schmidt, Carp farmer
- Sandra Schuster, Manager of the tourist and marketing agency “Karpfenland Travel”
- Wolfgang Städtler, Fish farm master, Department for Carp Farming, Institute for Fisheries

List of aquaculture operations in Germany

Article 2, 7 of EU-Directive No. 708/2007 asks Member States to publish production plants for nonnative fish species. The following list shows production plants for fish located in Germany:

Table 15: List of aquaculture operations in Germany

Aalhof Götting	Fischzuchtanlage Oppmann
ALBE-Fischfarm GmbH Co KG	FLUXX ² GmbH & Co. KG Förde Garnelen OHG
Aalversandstelle	Garnelen Farm Grevesmühlen GmbH & Co. KG
AGRAR GmbH Gersdorf-Oberlichtenau	GMA - Gesellschaft für Marine Aquakultur mbH
Agrargenossenschaft Jesewitz e.G.	Hansefisch-Anlagenbau
Agrargenossenschaft Schkölen eG.	Institut für Binnenfischerei e.V.
Ahrenhorster Edelfisch GmbH Co. KG	Institut für Fischerei der Landesforschungsanstalt für
Attilus GmbH Jessen	Landwirtschaft und Fischerei des Landes Mecklenburg-
Bioenergie Lüchow GmbH & Co. KG	Vorpommern
ECF Farmsystems GmbH	Institut für Fischerei Starnberg
Emsland Fischzucht GmbH & Co. KG	imare (Institut für Marine Ressourcen GmbH)
Erbrütungsanlage Triglitz OT Silmersdorf	Kirschauer Aquakulturen GmbH
F & M Anlagebau	Kreba-Fisch GmbH
Firma Hahn - Lachs	Krebszucht am Schloß
Fischaufzucht Drellborg	Krebszucht Oeversee
Fischmast Fuhrmann	Landgenossenschaft Pröttlin e.G.
Fischzucht Abtshagen GmbH & Co. KG	Leibniz-Institut für Gewässerökologie und
Fischzucht Beelitz-Elsholz	Binnenfischerei
Fischzucht Fischgut Primus	Neomar GmbH
Fischzucht Kemnitz	Russian Sturgeon GmbH
Fischzucht Kortmann	Saxenstör GmbH
Fischzucht M. Stüer	Sukower Bioenergie und Welsfarm GmbH & Co. KG
Fischzucht Jänschwalde GmbH	Tessiner Edelfisch GmbH
Fischzucht Rietschen GmbH (Kreislaufanlage	TopFarmers c/o Blue Economy
Hammerstadt)	Universität Göttingen, Abteilung Aquakultur und
Fischzucht Trebbin	Gewässerökologie
Fischzucht Ummern	Venhaus Fisch GmbH
Fischzucht U. Schulte	VIVACE GmbH
Fischzucht Weisendorf	Wildlachszenrum Rhein-Sieg“

[http://www.portal-fischerei.de/bund/aquakultur/einfuehrung-gebietsfremder-arten-in-der-aquakultur/verzeichnis-aquakulturanlagen/?no_cache=1&sword_list\[\]=aquakultur](http://www.portal-fischerei.de/bund/aquakultur/einfuehrung-gebietsfremder-arten-in-der-aquakultur/verzeichnis-aquakulturanlagen/?no_cache=1&sword_list[]=aquakultur), downloaded on the 18.06.2016

Glossary for aquaculture and fisheries

Table 16: Glossary for aquaculture and fisheries

Aquaculture	Aquaculture, also known as fish farming or aquafarming, is the farming of aquatic organisms such as fish, crustaceans, molluscs and aquatic plants. (aquaculture = fish farming)
Mariculture	Mariculture is a specialized branch of aquaculture involving the cultivation of marine organisms for food and other products in the open ocean, an enclosed section of the ocean, or in tanks, ponds or raceways. All containers or ponds are filled with seawater. (Mariculture = Marine aquaculture)
Inland aquaculture	Natural sweet water ponds or rivers used for the production of carp, trout and other species; and indoor recirculation systems, often combined with alternative energy plants.
Fishery	Fishery is an entity engaged in raising or harvesting fish in the open sea, along the coastline, in rivers and lakes. The definition often includes a combination of fish and fishers in a region, the latter fishing for similar species with similar gear types. A fishery may involve the capture of wild fish or raising fish through fish farming/aquaculture.
Fishing	Fishing is the activity of trying to catch fish. Fishing sometimes takes place in the wild. Techniques for catching fish include hand gathering, spearing, netting, angling and trapping. The term is not normally applied to catching farmed fish.
Fish	One or more/many animals
Fishes	Different species of fish
Restocking	Proportion of total output or production used for the start of the new population (around 25% in pond systems)
Salmonids	Biological classification; group of fish species and sub-species of salmon, trout, grayling and char
Trawling	Midwater trawling is trawling, or net fishing, at a depth that is higher in the water column than the bottom of the ocean – see pelagic zone
Trawls, trawl nets	Trawls or dragnets are pulled by fishing vessels. Trawl nets differ between target species of bottom fish or flat fish or fish in upper sea water spheres
Pelagic	Any water in a sea or lake that is neither close to the bottom nor near the shore, also called the pelagic zone; Pelagic fish live in the pelagic zone of ocean or lake waters which is in the middle of the water column. Semi-pelagic trawls
Demersal	Demersal fish live and feed on or near the bottom of seas or lakes (the demersal zone). Demersal fish can be divided into two main types: strictly benthic fish, which can rest on the sea floor, and benthopelagic fish which can float in the water column just above the sea floor. Flat fish live in this zone.
Marine Protection Areas (MPA)	Protected zones in the sea; breeding areas for fish
Stockfish	Stockfish is unsalted fish, especially cod, dried by cold air and wind (Bacalà or bacalao)
Fingerlings	Young fish put in the pond (Setzlinge)
TAC	Total allowable catches (TACs) is the quota set by the European Commission for some species such as North Sea cod, Celtic Sea cod and Southern hake
	International Council for the Exploration of the Sea, the scientific body that advises the European Union

Sources: Wikipedia English, Wikipedia Deutsch, Wikipedia Français (Nov 2015)

Table 17: Dictionary – scientific terminology and names of aquatic species commonly used in EU fisheries and aquaculture

English	German	French	Italian	Greece	Scientific
Alaska pollock	Alaska-Seelachs				Theragra chalcogramma
Arctic Char	Seesaibling, Wandersaibling, Rotforelle				Salvelinus alpinus
Brill	Glattbutt	Barbue	Rombo Liscio	Καλκάνι (Calcani)	Scophthalmus rhombus
Brook trout	Bachsibling				Salvelinus fontinalis
Brown trout	Bachforelle				Salmo trutta
Carp	Karpfen				Cyprinus carpio
Cods, codfishes or true cods	Dorsche				Gadidae
Cusk	Lumb				Brosme brosme
Grayling	Äsche				Thymallus
Haddock	Schellfisch				Melanogrammus aeglefinus
European hake	Hechtdorsch, europäischer Seehecht				Merluccius merluccius
Lemon sole					
Ling	Leng, Lengfisch				Molva molva
Meagre, shade-fish, salmon-basse or stone basse	Adlerfisch, Umberfisch	Maigre			Argyrosomus regius (sciaena)
Megrim or whiff	Flügelbutt				Lepidorhombus whiffiagonis
Northern pike	Hecht				Esox lucius
Pangasius	Pangasius				Pangasius
Plaice	Scholle				
Pollock	Steinköhler, Kalmück				Pollachius pollachius
Salmon	Lachs				Salmo
Salmonids	Salmoniden	Salmonides			Salmonidae
Salvenius, char, charr	Sibling				Salvelinus
Sea basses	Wolfsbarsche				Moronidae
Sea breams	Meerbrassen				Sparidae

Seithe	Köhler, Seelachs				Pollachius virens
Sole	Seezunge				
Tench	Schleie				Tinca tinca
Trout	Regenbogenforelle				Oncorhynchus mykiss
Turbot	Steinbutte				Scophthalmidae
Wels catfish	Europäischer Wels, Waller				Silurus glanis
Zander	Zander				Sander lucioperca

Sources: Wikipedia English, Wikipedia Deutsch (2015)

Annex - Media Analysis

SOURCE	YEAR	TITLE	RETRIEVED FROM
BMEL1	2016	Der Einsatz von Reserveantibiotika muss restriktiver werden	https://www.bmel.de/SharedDocs/Pressemitteilungen/2016/021-FL-MinisterkonferenzAntibiotikaresistenzen.html
BMEL2	2016	Strategie zur Antibiotika-Minimierung in der Tierhaltung greift	http://www.bmel.de/DE/Tier/Tiergesundheit/Tierarzneimittel/_texte/AntibiotikaTherapiehaeufigkeit-2015-02.html
BMEL3	2016	Bei sachgerechter Anwendung haben Wissenschaftler keine Zweifel an der gesundheitlichen Unbedenklichkeit von Glyphosat	http://www.bmel.de/SharedDocs/Interviews/O-Toene/16-05-19-BM-Statement-GlyphosatEU.html
BMEL4	2014	Zur aktuellen Berichterstattung über das Töten männlicher Eintagsküken	http://www.bmel.de/SharedDocs/Pressemitteilungen/2016/036-SC-Eintagskueken.html
BMEL5	2014	Konsequenter Einsatz für mehr Tierwohl zeigt Erfolg	http://www.bmel.de/SharedDocs/Pressemitteilungen/2016/057-SymposiumTierschutz.html
BMEL6	2014	Wie reagiert die deutsche Landwirtschaft auf gesellschaftliche Veränderungen und wirtschaftliche Herausforderungen?	http://www.bmel.de/SharedDocs/Pressemitteilungen/2014/272-BL-Winterschulung-Agrargenossenschaftl.html
BMEL7	2016	Mindestlohn in der Landwirtschaft	http://www.bmel.de/DE/Landwirtschaft/Foerderung-Agrarsozialpolitik/Agrarsozialpolitik/_Texte/Mindestlohn_StudieTI.html
BMEL8	2013	Protokollnotizen zu den BVVG-Privatisierungsgrundsätzen beschlossen	http://www.bmel.de/SharedDocs/Pressemitteilungen/2013/123-Protokollnotizen-BVVG-Privatisierungsgrundsaeetze-beschlossen.html
BMEL9	2013	Die Rolle außerlandwirtschaftlicher Investoren auf dem landwirtschaftlichen Bodenmarkt in Deutschland	http://www.bmel.de/DE/Laendliche-Raeume/04_Flaechennutzung/_texte/StudieInvestorenBodenmarkt.html
BMEL10	2015	Biopatente: Keine Patentierung von Tierrassen und Pflanzensorten	http://www.bmel.de/DE/Tier/Nutztierhaltung/Biopatente/biopatente_node.html
BMEL11	2014	Bundesminister Schmidt: "Die Agrarreform stärkt Bauern und Umwelt"	http://www.bmel.de/SharedDocs/Pressemitteilungen/2014/055-SC-Kabinett-Gesetzentwurf-Direktzahlungen.html
BMEL12	2014	Kleine und mittlere Bauernbetriebe werden 2014 bessergestellt	http://www.bmel.de/SharedDocs/Pressemitteilungen/2014/046-BauernbetriebeDirektzahlungen.html
BMEL13	2014	Höhere Zahlungen für den Ökolandbau und für die Agrarumwelt- und Klimaförderung beschlossen	http://www.bmel.de/DE/Landwirtschaft/Foerderung-Agrarsozialpolitik/_Texte/Foerdergrundsaeetze-MSL-BG.html
BMEL14	2015	Grundzüge der Gemeinsamen Agrarpolitik (GAP) und ihrer Umsetzung in Deutschland	http://www.bmel.de/DE/Landwirtschaft/Agrarpolitik/_Texte/GAP-NationaleUmsetzung.html
BMEL15	2016	Die Reform der EU-Ökoverordnung	http://www.bmel.de/DE/Landwirtschaft/Nachhaltige-Landnutzung/Oekolandbau/_Texte/Reform-EU-Oekoverordnung.html
DBV1	2016	DBV: Antibiotikaeinsatz in der Nutztierhaltung erneut verringert	http://www.bauernverband.de/dbv-antibiotikaeinsatz-in-der-nutztierhaltung-erneut-verringert
DBV2	2016	Debatte um Pflanzenschutz auf fachlicher Basis weiterführen	http://www.bauernverband.de/debatte-um-pflanzenschutz-auf-fachlicher-basis-weiterfuehren
DBV3	2013	Handelsabkommen mit den USA kann auch Chancen bringen	http://www.bauernverband.de/handelsabkommen-usa
DBV4	2016	DBV setzt sich für Veränderungen beim Mindesthaltbarkeitsdatum ein	http://www.bauernverband.de/dbv-mindesthaltbarkeitsdatum
DBV5	2012	In der Landwirtschaft wandern Lebensmittel nicht in die Tonne	http://www.bauernverband.de/landwirtschaft-wandern-lebensmittel-tonne
DBV6	2016	Rukwied: Klimaschutz darf heimische Lebensmittelerzeugung nicht gefährden	http://www.bauernverband.de/rukwied-klimaschutz-darf-heimische-lebensmittelerzeugung-nicht-gefaehrden
DBV7	2016	Kooperativer Naturschutz schafft biologische Vielfalt in Agrarlandschaften	http://www.bauernverband.de/kooperativer-naturschutz-schafft-biologische-vielfalt-in-agrarlandschaften
DBV8	2016	Umweltgutachten: Zielkonflikte nicht einseitig zu Lasten der Landwirtschaft lösen	http://www.bauernverband.de/umweltgutachten-zielkonflikte-nicht-einseitig-zu-lasten-der-landwirtschaft-loesen
DBV9	2016	Debatte über Landwirtschaft mit den Landwirten führen	http://www.bauernverband.de/debatte-ueber-landwirtschaft-mit-den-landwirten-fuehren
DBV10	2016	Faktencheck "Haltung von Milchkühen" (PDF) >>	http://www.bauernverband.de/milchviehhaltung
DBV11	2016	Faktencheck TIERHALTUNG	http://www.bauernverband.de/tierhaltung

DBV12	2015	Export der Nutztierhaltung ist keine Lösung für Landwirtschaft und Tierschutz	http://www.bauernverband.de/export-der-nutztierhaltung-ist-keine-loesung-fuer-landwirtschaft-und-tierschutz
DBV13	2015	Nutztierhaltung lässt sich nicht mit Ordnungsrecht weiterentwickeln	http://www.bauernverband.de/nutztierhaltung-laesst-sich-nicht-mit-ordnungsrecht-weiterentwickeln
DBV14	2013	Beim Tierschutz sind wir weltweit ganz vorne	http://www.bauernverband.de/beim-tierschutz-weltweit-ganz-vorne
DBV15	2016	DBV kritisiert ungebremsten Flächenverbrauch durch Bundesverkehrswegeplan 2030	http://www.bauernverband.de/dbv-kritisiert-ungebremsten-flaechenverbrauch-durch-bundesverkehrswegeplan-2030
DBV16	2016	Die ländlichen Regionen brauchen stärkere und gezielte Unterstützung	http://www.bauernverband.de/gezielte-unterstuetzung-laendlicher-raeume
DBV17	2016	Mindestlohn und Export entscheiden über Zukunft des heimischen Obst- und Gemüsebaus	http://www.bauernverband.de/mindestlohn-und-export-entscheiden-ueber-zukunft-des-heimischen-obst-und-gemuesebaus
DBV18	2013	Mehr Züchtungsfortschritt ohne Biopatente	http://www.bauernverband.de/mehr-zuechtungsfortschritt-ohne-biopatente
DBV19	2012	DBV begrüßt Urteil des EuGH zum Saatguthandel	http://www.bauernverband.de/dbv-begruesst-urteil-eugh-saatguthandel
DBV20	2015	Nachbau: Das sogenannte „Vogel-Urteil“ und seine Auswirkungen	http://media.repro-mayr.de/13/648813.pdf
DBV21	2016	„Vereinfachungsvorschläge der EU-Kommission zum Greening unzureichend“	http://www.bauernverband.de/vereinfachungsvorschlaege-der-eu-kommission-zum-greening-unzureichend
DBV22	2015	Vereinfachungen der Agrarreform müssen bei Landwirten ankommen	http://www.bauernverband.de/vereinfachungen-der-agrarreform-muessen-bei-landwirten-ankommen
DBV23	2015	Agrarpolitik muss entbürokratisiert werden	http://www.bauernverband.de/agrapolitik-muss-entbuerokratisiert-werden
DBV24	2015	Deutliche Fortschritte bei EU-Öko-Verordnung	http://www.bauernverband.de/dbv-deutliche-fortschritte-bei-eu-oeko-verordnung
DBV25	2016	Unterstützung für Milchbauern schnell und effizient umsetzen	http://www.bauernverband.de/rukwid-unterstuetzung-fuer-milchbauern-schnell-und-effizient-umsetzen
DBV26	2013	Deutsche Milcherzeugung wird wettbewerbsfähiger	http://www.bauernverband.de/deutsche-milcherzeugung-wird-wettbewerbsfaehiger
DBV27	2014	Rukwied sieht deutsche Milcherzeugung gut aufgestellt	http://www.bauernverband.de/rukwid-sieht-deutsche-milcherzeugung-gut-aufgestellt
DBV28	2014	Die Ära der Milchquote ist beendet	http://www.bauernverband.de/die-aera-der-milchquote-ist-beendet
DBV29	2013	Deutsche Milcherzeugung wird wettbewerbsfähiger	http://www.bauernverband.de/deutsche-milcherzeugung-wird-wettbewerbsfaehiger
DF1	2013	Neuer Aktionsplan vorgestellt	http://www.deutschlandfunk.de/antibiotika-resistenzen-neuer-aktionsplan-vorgestellt.697.de.html?dram:article_id=269447
DF2	2012	Etikettenschwindel bei Lebensmitteln	http://www.deutschlandfunk.de/etikettenschwindel-bei-lebensmitteln.697.de.html?dram:article_id=79122
DF3	2013	Grenzenloser Skandal	http://www.deutschlandfunk.de/grenzenloser-skandal.795.de.html?dram:article_id=243555
DF4	2016	Gentechnik als neue Option für den Biolandbau	http://www.deutschlandfunk.de/landwirtschaft-gentechnik-als-neue-option-fuer-den.697.de.html?dram:article_id=350456
DF5	2014	Bedeutung von Gentechnik steigt	http://www.deutschlandfunk.de/futtermittelindustrie-bedeutung-von-gentechnik-steigt.697.de.html?dram:article_id=280528
DF6	2016	Warum Bioproduzenten TTIP kritisch sehen	http://www.deutschlandfunk.de/freihandelsabkommen-warum-bioproduzenten-ttip-kritisch-sehen.697.de.html?dram:article_id=345396
DF7	2015	Zu viel Gülle fürs Grundwasser	http://www.deutschlandfunk.de/duengeverordnung-zu-viel-guelle-fuers-grundwasser.724.de.html?dram:article_id=318149
DF8	2015	Jede dritte Art in Deutschland gefährdet	http://www.deutschlandfunk.de/artenschutzbericht-jede-dritte-art-in-deutschland-gefaehrdet.1818.de.html?dram:article_id=320346
DF9	2014	Fünf Jahre EU-Pflanzenschutzverordnung	http://www.deutschlandfunk.de/agrarwirtschaft-fuenf-jahre-eu-pflanzenschutzverordnung.697.de.html?dram:article_id=274860
DF10	2015	Hamburgs Bauern wehren sich	http://www.deutschlandfunk.de/tierhaltung-und-umweltauflagen-hamburgs-bauern-wehren-sich.697.de.html?dram:article_id=311173
DF11	2014	Streit im Stall	http://www.deutschlandfunk.de/zukunft-der-landwirtschaft-streit-im-stall.724.de.html?dram:article_id=306037
DF12	2015	"Tierschutzgesetz lässt grausame Qual zu"	http://www.deutschlandfunk.de/kritik-vom-tierschutzbund-tierschutzgesetz-laesst-grausame.697.de.html?dram:article_id=330704

DF13	2015	Vielen Schweinen soll es künftig besser gehen	http://www.deutschlandfunk.de/initiative-tierwohl-vielen-schweinen-soll-es-kuenftig.697.de.html?dram:article_id=321604
DF14	2016	Küken töten ist mit Tierschutz vereinbar	http://www.deutschlandfunk.de/oberverwaltungsgericht-kuekenstoeten-ist-mit-tierschutz.1818.de.html?dram:article_id=354660
DF15	2016	Einsatz für Tierwohl muss sich lohnen	http://www.deutschlandfunk.de/massentierhaltung-einsatz-fuer-tierwohl-muss-sich-lohnen.697.de.html?dram:article_id=359789
DF15	2014	Landgrabbing - Ausverkauf der ostdeutschen Landwirtschaft	http://www.deutschlandfunk.de/landgrabbing-ausverkauf-der-ostdeutschen-landwirtschaft.724.de.html?dram:article_id=274916
DF16	2016	Landflucht - Die Einsamkeit der Bauern	http://www.deutschlandfunk.de/landflucht-die-einsamkeit-der-bauern.1148.de.html?dram:article_id=347253
DF17	2014	"Ich möchte auch in Zukunft eine regionale Spargelproduktion haben"	http://www.deutschlandfunk.de/koalitionsstreit-um-mindestlohn-ich-moechte-auch-in-zukunft.694.de.html?dram:article_id=288884
DF18	2016	Widerstand gegen Nachbaugebühr wächst	http://www.deutschlandfunk.de/streit-ums-saatgut-widerstand-gegen-nachbaugebuehr-waechst.1769.de.html?dram:article_id=353172
DF19	2014	Blaue Erdäpfel finden keine Käufer	http://www.deutschlandfunk.de/alte-kartoffel-sorten-blaue-erdaepfel-finden-keine-kaeufer.697.de.html?dram:article_id=295884
DF20	2013	EU-Vorschriften verhindern Sortenvielfalt	http://www.deutschlandfunk.de/eu-vorschriften-verhindern-sortenvielfalt.697.de.html?dram:article_id=244035
DF21	2015	Was Biobauern das Leben schwer macht	http://www.deutschlandfunk.de/politikrisiko-statt-wetterrisiko-was-biobauern-das-leben.724.de.html?dram:article_id=309126
DF22	2014	Reform der EU-Agrarpolitik in Deutschland	http://www.deutschlandfunk.de/bundestagsentscheidung-reform-der-eu-agrarpolitik-in.697.de.html?dram:article_id=287094
DF23	2015	Kompromiss für die Bauern, zu wenig für die Umwelt	http://www.deutschlandfunk.de/oekologische-vorrangflaechen-kompromiss-fuer-die-bauern-zu.697.de.html?dram:article_id=325301
DF24	2014	Deutschland weicht Ökovorschriften auf	http://www.deutschlandfunk.de/eu-agrarreform-deutschland-weicht-oekovorschriften-auf.697.de.html?dram:article_id=278559
DF25	2014	Deutsche Biobauern lehnen Reformentwurf ab	http://www.deutschlandfunk.de/eu-oekoverordnung-deutsche-biobauern-lehnen-reformentwurf-ab.697.de.html?dram:article_id=291195
DF26	2015	Biobauern produzieren regional	http://www.deutschlandfunk.de/bauernmeierei-biobauern-produzieren-regional.697.de.html?dram:article_id=329909
DF27	2016	Die Not der Milchbauern	http://www.deutschlandfunk.de/vor-dem-gipfel-im-landwirtschaftsministerium-die-not-der.1773.de.html?dram:article_id=355522
GER1	2016	Mehr Reserveantibiotika im Kuhstall – Hohes Risiko von Resistenzen	https://germanwatch.org/de/11573
GER2	2016	Glyphosat in aller Munde	https://germanwatch.org/de/12474
GER3	2014	Eine Landwirtschaft, die Mensch, Tier und Umwelt achtet	https://germanwatch.org/de/9249
GER4	2014	Eine Frage der Haltung	https://germanwatch.org/de/10943
GER5	2012	Bei der EU-Agrarreform geht mehr	https://germanwatch.org/de/5424
KA2015	2015	Der kritische Agrarbericht 2015	http://www.kritischer-agrarbericht.de/2015.346.0.html
KA2015	2015	Deutschland fördert mit EU-Geld weiter Landkonzentration	http://www.kritischer-agrarbericht.de/fileadmin/Daten-KAB/KAB-2015/KAB2015_17_24_Jasper.pdf
KA2016	2016	Dauerkrise überwinden – für Bauern, Umwelt und die Tiere!	http://www.kritischer-agrarbericht.de/fileadmin/Daten-KAB/KAB-2016/KAB2016_Kap1_34_39_Jasper.pdf
KA2016	2016	Das Schlimmste abgewehrt – wichtige Weiterentwicklungen durchgesetzt	http://www.kritischer-agrarbericht.de/fileadmin/Daten-KAB/KAB-2016/KAB2016_Kap1_59_63_Hausling.pdf
KA2016	2016	Immer weiter wurschteln? Über die Milchkrise 2015 und die Ideologie des Mengenwachstums	http://www.kritischer-agrarbericht.de/fileadmin/Daten-KAB/KAB-2016/KAB2016_Kap1_40_46_Ilchmann.pdf
PLA1	2016	Antibiotika-Einsatz bei Masttieren sinkt	http://www.proplanta.de/Agrar-Nachrichten/Agrarpolitik/Antibiotika-Einsatz-bei-Masttieren-sinkt_article1459496988.html

PLA2	2016	Gerangel um Glyphosat schadet allen Beteiligten	http://www.proplanta.de/Agrar-Nachrichten/Agrarpolitik/Gerangel-um-Glyphosat-schadet-alle-Beteiligten_article1467273055.html
PLA3	2016	Tierschützer warnen bei Initiative Tierwohl vor Etikettenschwindel	http://www.proplanta.de/Agrar-Nachrichten/Tier/Tierschuetzer-warnen-bei-Initiative-Tierwohl-vor-Etikettenschwindel_article1435616881.html
PLA4	2016	Gentechnik in Deutschland von größerer wirtschaftlicher Bedeutung als angenommen	http://www.proplanta.de/Agrar-Nachrichten/Unternehmen/Gentechnik-in-Deutschland-von-groesserer-wirtschaftlicher-Bedeutung-als-angenommen_article1467269183.html
PLA5	2016	Gentechnikfreie Lebensmittel stehen hoch im Kurs	http://www.proplanta.de/Agrar-Nachrichten/Verbraucher/Gentechnikfreie-Lebensmittel-stehen-hoch-im-Kurs_article1468215783.html
PLA6	2016	Agrarminister Backhaus: Gülle-Euro ist bürokratisches Monster mit geringer Wirkung	http://www.proplanta.de/Agrar-Nachrichten/Agrarpolitik/Agrarminister-Backhaus-Guelle-Euro-ist-buerokratisches-Monster-mit-geringer-Wirkung_article1468015546.html
PLA7	2016	Bienen durch Pflanzenschutzmittel bedroht	http://www.proplanta.de/Agrar-Nachrichten/Tier/Bienen-durch-Pflanzenschutzmittel-bedroht_article1462950276.html
PLA8	2016	Deutlich mehr Tierschutzverstöße beim Transport	http://www.proplanta.de/Agrar-Nachrichten/Tier/Deutlich-mehr-Tierschutzverstoesse-beim-Transport_article1469703612.html
PLA9	2016	Handelsriesen setzen sich für Tier- und Verbraucherschutz ein	http://www.proplanta.de/Agrar-Nachrichten/Unternehmen/Handelsriesen-setzen-sich-fuer-Tier-und-Verbraucherschutz-ein_article1457856159.html
PLA10	2016	Politische Bedeutung von Tierschutz	http://www.proplanta.de/Agrar-Nachrichten/Agrarpolitik/Politische-Bedeutung-von-Tierschutz_article1455282638.html
PLA11	2016	Wie kann man Tierwohl aus der Nische helfen?	http://www.proplanta.de/Agrar-Nachrichten/Tier/Wie-kann-man-Tierwohl-aus-der-Nische-helfen_article1452766622.html
PLA12	2014	Bauern erhalten Planungssicherheit beim Greening	http://www.proplanta.de/Agrar-Nachrichten/Agrarpolitik/Bauern-erhalten-Planungssicherheit-beim-Greening_article1415885403.html
PLA13	2015	Agrarreform selbst für Fachleute nicht durchschaubar	http://www.proplanta.de/Agrar-Nachrichten/Agrarpolitik/Agrarreform-selbst-fuer-Fachleute-nicht-durchschaubar_article1428553510.html
PLA15	2016	Investitionen in die Umwelt lohnen sich - Agrar-Förderprogramme tragen Früchte	http://www.proplanta.de/Agrar-Nachrichten/Agrarpolitik/Investitionen-in-die-Umwelt-lohnen-sich-Agrar-Foerderprogramme-tragen-Fruechte_article1469513795.html
PLA16	2014	Höhere Prämien für Agrarumwelt und Ökolandbau	http://www.proplanta.de/Agrar-Nachrichten/Agrarpolitik/Hoehere-Praemien-fuer-Agrarumwelt-und-Oekolandbau_article1408711140.html
SPON1	2014	Resistenzen: Landwirte müssen Antibiotika-Einsatz melden	http://www.spiegel.de/wissenschaft/medizin/resistenzen-landwirte-muessen-antibiotika-einsatz-melden-a-961706.html
SPON2	2015	Chemikalien: Wie die Industrie EU-Regulierung beeinflusst	http://www.spiegel.de/wirtschaft/soziales/chemikalien-wie-die-industrie-eu-regulierung-beeinflusst-a-1034563.html
SPON3	2016	Streit um Pflanzenschutzmittel: Was für ein Glyphosat-Verbot-Verbot spricht - und was dagegen	http://www.spiegel.de/wirtschaft/soziales/glyphosat-was-fuer-ein-verbot-spricht-und-was-dagegen-a-1084846.html
SPON4	2012	Lebensmittelverschwendung: Her mit den krummen Gurken!	http://www.spiegel.de/wissenschaft/mensch/lebensmittelverschwendung-her-mit-den-krummen-gurken-a-810450.html
SPON5	2013	Rekord bei Mastanlagen: Zahl der Fleischfabriken in Deutschland wächst	http://www.spiegel.de/wirtschaft/unternehmen/zahl-der-mastplaetze-in-deutschland-steigt-auf-rekordhoch-a-878194.html
SPON6	2012	Deutsches Ackerland: Agrarminister kämpfen gegen Bodenspekulanten	http://www.spiegel.de/wirtschaft/soziales/agrarminister-wollen-spekulation-mit-deutschen-aeckern-verhindern-a-829510.html
SPON7	2016	SRU-Gutachten: Rüge für die deutsche Agrarpolitik	http://www.spiegel.de/wirtschaft/soziales/regierungsberater-ruegen-deutsche-agrarpolitik-a-1091532.html
SPON8	2016	Bioland-Präsident: "Wir können gar nicht so viel liefern, wie verkauft wird"	http://www.spiegel.de/wirtschaft/service/bio-lebensmittel-bioland-praesident-erwartet-absatzboom-a-1072084.html
SPON9	2015	Karges Jahr für Deutsche Bauern	http://www.spiegel.de/wirtschaft/soziales/bauern-machen-im-schnitt-35-prozent-weniger-gewinn-a-1066721.html

SPON10	2014	Landwirtschaft: Milchpreis erreicht Rekordniveau	http://www.spiegel.de/wirtschaft/service/landwirtschaft-molkereien-zahlen-bauern-2013-hohen-milchpreis-a-960067.html
SRU2016	2016	Umweltgutachten 2016	http://www.umweltrat.de/SharedDocs/Downloads/DE/01_Umweltgutachten/2016_Umweltgutachten_HD.html
SZ1	2015	Schweigen im Saustall	http://www.sueddeutsche.de/wirtschaft/medikamente-in-der-tierhaltung-transparenz-unerwuensch-1.2619262
SZ2	2016	Wie eine Landwirtschaft ohne Glyphosat-Verbot aussehen würde	http://www.sueddeutsche.de/wissen/pflanzenschutz-zurueck-in-die-zukunft-1.2998694
SZ3	2013	Alle Angaben ohne Gewähr	http://www.sueddeutsche.de/politik/lebensmittelskandale-unter-ilse-aigner-alle-angaben-ohne-gewaehr-1.1603213
SZ4	2013	Grüne Gentechnik schadet Umwelt und Landwirten	http://www.sueddeutsche.de/wissen/studie-zu-gengemuese-gruene-gentechnik-schadet-umwelt-und-landwirten-1.1588708
SZ5	2015	Gentechnik im Tarnmodus	http://www.sueddeutsche.de/wissen/gentechnik-die-gruene-grenze-1.2563470
SZ6	2016	TTIP-Enthüllungen befeuern Ängste europäischer Bauern	http://www.sueddeutsche.de/wirtschaft/ttip-papiere-ttip-enthuellungen-befeuern-aengste-europaeischer-bauern-1.2976497
SZ7	2016	Krumm und krummer - wie unperfektes Gemüse den Markt erobert	http://www.sueddeutsche.de/wirtschaft/lebensmittel-krumm-und-krummer-wie-unperfektes-gemuese-den-markt-erobert-1.2954495
SZ8	2016	Es stinkt zum Himmel	http://www.sueddeutsche.de/wirtschaft/tierhaltung-es-stinkt-zum-himmel-1.2818032
SZ9	2013	"Betrug an den Verbrauchern"	http://www.sueddeutsche.de/politik/aigner-ueber-falsche-bio-eier-betrug-an-den-verbrauchern-1.1609036
SZ10	2015	Wider strengere Bauernregeln	http://www.sueddeutsche.de/politik/agrarpolitik-und-tierschutz-wider-strengere-bauernregeln-1.2537589
SZ11	2016	Streit um Schwein und Schein	http://www.sueddeutsche.de/wirtschaft/geldmangel-schwein-und-schein-1.2901119
SZ12	2013	Gnadenloses Wettrüsten im Hühnerstall	http://www.sueddeutsche.de/wirtschaft/gefluegelmaester-in-deutschland-gnadenloses-wettruesten-im-huehnerstall-1.1759132
SZ13	2015	Gegen das Gemetzel	http://www.sueddeutsche.de/wirtschaft/schreddern-von-kueken-gegen-das-gemetzel-1.2558403
SZ14	2015	Bio-Bauer trifft Anleger	http://www.sueddeutsche.de/wirtschaft/oekolandbau-schonende-rendite-1.2780632
SZ16	2015	"Die Gurke wird noch teurer"	http://www.sueddeutsche.de/wirtschaft/lebensmittelhersteller-kuehne-die-gurke-wird-noch-teurer-1.2374845
SZ17	2014	Bauern warnen vor höheren Gemüsepreisen	http://www.sueddeutsche.de/wirtschaft/mindestlohn-bauern-warnen-vor-hoeheren-gemuesepreisen-1.1941483
SZ18	2016	Früchte des Zorns	http://www.sueddeutsche.de/wirtschaft/landwirtschaft-fruechte-des-zorns-1.2938350
SZ19	2015	Patentstreit ums Gemüsebeet	http://www.sueddeutsche.de/wirtschaft/lebensmittel-gemischter-salat-1.2638852
SZ20	2013	Tiefschlag für Hobbygärtner	http://www.sueddeutsche.de/wirtschaft/saatgutverordnung-der-eu-tiefschlag-fuer-hobbygaertner-1.1666512
SZ21	2016	Warum dieser Ökobauer die Biobranche verlässt	http://www.sueddeutsche.de/wirtschaft/landwirtschaft-ein-aussteiger-steigt-aus-1.2804133
SZ22	2013	EU kürzt Subventionen für Großbauernhöfe - außer in Deutschland	http://www.sueddeutsche.de/wirtschaft/agrarreform-eu-kuerzt-subventionen-fuer-grossbauernhoeefe-ausser-in-deutschland-1.1779967
SZ23	2013	Untergepflügt von der Bauernlobby	http://www.sueddeutsche.de/politik/reform-der-eu-agrarpolitik-untergepfluegt-von-der-bauernlobby-1.1810412
SZ24	2014	EU plant strengere Regeln für Bioprodukte	http://www.sueddeutsche.de/wirtschaft/reform-der-oeko-verordnung-eu-plant-strengere-regeln-fuer-bioprodukte-1.1921215
SZ25	2016	Bauern fürchten wegen Billigpreisen um Existenz	http://www.sueddeutsche.de/wirtschaft/landwirtschaft-bauern-fuerchten-wegen-billigpreisen-um-existenz-1.2920263
SZ26	2015	Dann eben nicht	http://www.sueddeutsche.de/politik/landwirtschaft-dann-eben-nicht-1.2796967
SZ27	2016	Wer wirklich schuld ist am großen Wettmelken	http://www.sueddeutsche.de/wirtschaft/milchpreise-wer-wirklich-schuld-ist-am-grossen-wettmelken-1.2978613
TOP1	2014	Neuer Betrug bei Bio-Eiern	http://www.topagrar.com/news/Home-top-News-Neuer-Betrug-bei-Bio-Eiern-1377532.html
TOP2	2015	Weiterer Fall von Bio-Betrug aufgedeckt	http://www.topagrar.com/news/Home-top-News-Weiterer-Fall-von-Bio-Betrug-aufgedeckt-1812698.html

TOP3	2016	Niedersachsen fördert Direktvermarktung von tierischen Produkten aus gentechnikfreier Fütterung	http://www.topagrar.com/news/Home-top-News-Niedersachsen-foerdert-Direktvermarktung-von-tierischen-Produkten-aus-gentechnikfreier-Fuetterung-4148144.html
TOP4	2016	Preisabstand zwischen GMO- und Non-GMO-Sojaschrot schrumpft	http://www.topagrar.com/news/Markt-Marktnews-Preisabstand-zwischen-GMO-und-Non-GMO-Sojaschrot-schrumpft-3882531.html
TOP5	2016	Wirtschaft bittet um Zulassung von GVO-Sojasorten	http://www.topagrar.com/news/Home-top-News-Wirtschaft-bittet-um-Zulassung-von-GVO-Sojasorten-3681495.html
TOP6	2016	TTIP: Heidl warnt vor faulem Kompromiss und Kuhhandel	http://www.topagrar.com/news/Home-top-News-TTIP-Heidl-warnt-vor-faulem-Kompromiss-und-Kuhhandel-3227472.html
TOP7	2016	Grüne üben Kritik an möglicher Abschaffung des Haltbarkeitsdatums	http://www.proplanta.de/Agrar-Nachrichten/Agrarpolitik/Gruene-ueben-Kritik-an-moeglicher-Abschaffung-des-Haltbarkeitsdatums_article1459202927.html
TOP8	2014	Deutscher Ökolandbau von Billig-Konkurrenz abgehängt?	http://www.topagrar.com/news/Home-top-News-Deutscher-Oekolandbau-von-Billig-Konkurrenz-abgehaengt-1434965.html
TOP9	2013	Pachtpreishöhe bereitet den Biolandwirten Probleme	http://www.topagrar.com/news/Home-top-News-Pachtpreishoe-bereitet-den-Biolandwirten-Probleme-1062383.html
TOP10	2013	Bioenergie und Ökolandbau auf Konfrontationskurs	http://www.topagrar.com/news/Energie-Energienews-Bioenergie-und-Oekolandbau-auf-Konfrontationskurs-964159.html
TOP11	2013	Happach-Kasan: Saatgutverordnung stärkt moderne und alte Sorten	http://www.topagrar.com/news/Home-top-News-Happach-Kasan-Saatgutverordnung-staerkt-moderne-und-alte-Sorten-1148608.html
TOP12	2016	Deutliche Unterschiede bei der Ökoförderung in der EU	http://www.topagrar.com/news/Home-top-News-Deutliche-Unterschiede-bei-der-Oekofoerderung-in-der-EU-2746222.html
TOP13	2013	ÖkoKomPakt Thüringen 2020: Neues Förderpaket für den Ökolandbau	http://www.topagrar.com/news/Home-top-News-OekoKomPakt-Thueringen-2020-Neues-Foerderpaket-fuer-den-Oekolandbau-1295072.html
TOP14	2014	Sollen die Bauern wirklich für den Ökolandbau auf Geld verzichten?	http://www.topagrar.com/news/Home-top-News-Sollen-die-Bauern-wirklich-fuer-den-Oekolandbau-auf-Geld-verzichten-1364912.html
TOP15	2015	Chancen für Ökolandbau so gut wie lange nicht	http://www.topagrar.com/news/Home-top-News-Chancen-fuer-Oekolandbau-so-gut-wie-lange-nicht-1757953.html
TOP16	2015	Biobauern verdienen überall mehr, nur bei uns nicht	http://www.topagrar.com/news/Home-top-News-Biobauern-verdienen-ueberall-mehr-nur-bei-uns-nicht-1808250.html
TOP17	2013	Schlechte Stimmung: Biobranche besorgt über Billigkonkurrenz	http://www.topagrar.com/news/Home-top-News-Schlechte-Stimmung-Biobranche-besorgt-ueber-Billigkonkurrenz-1062027.html
TOP18	2012	Reportage entzaubert Bio-Mythos	http://www.topagrar.com/news/Home-top-News-Reportage-entzaubert-Bio-Mythos-931640.html
TOP19	2016	Molkereien suchen in Heu- und Weidemilch ihr Heil	http://www.topagrar.com/news/Rind-Rindernews-Molkereien-suchen-in-Heu-und-Weidemilch-ihr-Heil-3944862.html
TOP20	2016	Agrarminister fordern Neugestaltung der Lieferbeziehungen	http://www.topagrar.com/news/Rind-Rindernews-Agrarminister-fordern-Neugestaltung-der-Lieferbeziehungen-3074959.html
TOP21	2015	DBV: Positionspapier zum Quotenende	https://www.topagrar.com/news/Rind-Rindernews-DBV-Positionspapier-zum-Quotenende-1734032.html
TOP22	2016	Noch große Gegensätze bei der EU-Ökoverordnung	http://www.topagrar.com/news/Home-top-News-Noch-grosse-Gegensaetze-bei-der-EU-Oekoverordnung-3152580.html