

National REPORT: Germany

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Picture front page: Oilseed rape field and traditional carp pond in Franconia (bildarchiv.oekolandbau.de)

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List of abbreviations

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

1 Summary

In the first instance the two German case studies 'Aquaculture in Germany' and 'Oilseed Rape Production in the Wetterau' seem to be very different which is true for production techniques as well as input and output markets. However, there are connections and relevant common challenges: the maintenance and provision of valuable landscape elements (yellow rape fields in early summer, traditional ponds) and the strong global competition with imported oilseeds/palm oil or fish threatening margins of German fish and arable farmers. Both groups of farmers deliver very relevant environmental services for ecosystems and farmland biodiversity and the conservation of the cultural landscapes. At the same time, both are economic activities that affect the natural environment. For that reason, the major EU Directives and Regulations relevant for the protection of water, soil, food safety, and nature conservation and the related national/regional legal rules (including authorization of e.g. RAS or glyphosate) drive the organisation of production systems on the farm level.

1.1 Aquaculture in Germany

Aquaculture is the global food industry's fastest growing sector. The 2015 dataset of the FAO contains records of 591 aquatic species and species groups ever farmed in inland freshwater, inland saline water, coastal brackish water and marine water. These four types are the different forms of aquaculture production systems. Approximately 90 % of global aquaculture production is in Asia. International experts see further growth potential in many countries worldwide. World aquaculture production is continuing its growth reaching a total volume of 106 million tonnes in live weight in the year 2015. In Europe, aquaculture is expanding only in Norway (salmon and salmonids production).

In Germany total fish consumptions accounts for 608,000 t. Thereof 140,000 t was fish from aquaculture which was mainly imported (76.9%). Only, 23,000t (23.1%) were produced in Germany accounting for 3% of the total national consumption. 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. In Germany, fresh water aquaculture is the most common system, either in natural ponds or artificial through-flow systems. 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 farms or fish enterprises producing exclusively fish. Aquaculture in Germany is a small industry, practiced only in a few specifically suited areas. Traditional aquaculture species cultivated in Germany are rainbow trout and common carp, which are farmed in earthen ponds, and modern indoor and outdoor facilities (Bräwick, 2015).

In general, trout farming in freshwater flow-through-systems is the most profitable branch of production, both in terms of quantity and the revenue generated. Two thirds of the flow-through-systems for trout are located in the south of Germany, in particular in the region of Baden. The farming of carp in freshwater ponds is the second major type of aquaculture practiced in Germany and has a long tradition.

Typical carp pond landscapes are located in the north of Bavaria (Franconia), and in the eastern Federal States of 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, and carp consumption has been steadily shrinking over a long time.

Recirculation aquaculture systems (RAS) are alternative 'high-tech' production systems that reuse the water from the fish tanks after purification. The national strategy for aquaculture, published in 2014, highlights the objective to increase the German aquaculture production from RAS significantly. RAS can be warm- or cold-water plants. Most fish farms use freshwater but along the coastline, inland salt water systems have been tested. RAS enterprises produce trout, catfish, carp, pikeperch (zander), and various other fish species, crustacean, or algae. Technical problems were key issues during the 1990s and early 2000s. Today, RAS use reliable technologies but the number of farms is still very limited. Technical expertise, high costs of production and the compliance with manifold legal requirements challenge existing and new fish farms.

The report starts with the literature analysis to present an overview of the sector as a whole. It is followed by the results of two stakeholder involvement processes (focus groups, workshop, interviews, farm visits) in different regions. These focus on the traditional carp systems and the RAS.

1.1.1 Data collection

Role of farmers and stakeholders

Key to the approach taken has been to put the farmers themselves at the centre of the research, in order to get their perspectives on the key issues that need to be considered. In the first instance, a desk-based analysis of market conditions and regulations took place for both aquaculture case studies (sources reviewed included: academic publications; information for practitioners; international reports (FAO and OECD); national government and policy documents – namely the National Strategy and the DAFA Strategy etc.). In addition, we analysed documents from NGOs, supplemented with expert interviews. Secondly, ground proofing of the outcome of the desk-based analysis was done through focus groups, additional interviews and the stakeholder workshop. We organised these activities in close cooperation and with support of regional stakeholders.

Two foci of the aquaculture case study

In 2016, the SUFISA-team joined the case study work on traditional carp of the SUCCESS project, another H2020 Research and Innovation Project on fisheries and aquaculture. Due to this established relationship and the already existing work from the SUCCESS case study on carp, traditional carp pond farming in Middle Franconia represents the first focus of our aquaculture case study. Originally, the idea for the second case study focus was to run a focus group on trout production in the Black Forest area because the industry and the area are of particular economic relevance within the German aquaculture sector. However, the head of the local fisheries centre at Lake Konstanz, responsible for research and advice in the field of trout production, suggested to avoid the focus group in the area, for several good reasons, among them a lack of interest and support of potential participants. Due to this friendly refusal, we decided to cooperate with the Chamber of Agriculture Niedersachsen, and to redirect our emphasis on RAS in Northern Germany.

The organisation of the focus group in the centre of Niedersachsen (FG Wietzenorf 2/2017) took place on a farm with agricultural and aquaculture production including fish processing. It was again a joint event of the HNEE and the Thünen-Institute for Fish Ecology, this time organised by the SUFISA team supported by the Chamber of Agriculture Niedersachsen, Hannover. The main results were farmers' challenges related to public administration and authorisation, policy support measures and vertical cooperation issues. For the stakeholder workshop concept, it was therefore necessary to communicate and discuss these key results with key persons from the industry and from politics and administration on a higher level. However, it was not feasible to organise such a national (or northern German) workshop because the Thünen-Institute had organised a similar event in the summer of 2016, and stakeholders were tired of discussing hampering framework conditions. Instead, we decided to cooperate with the Ministry of Agriculture in the Federal

State of Mecklenburg-Vorpommern for the stakeholder workshop. This workshop focused on horizontal cooperation for the production of young carp in RAS. It took place in the context of the national conference 'German Fisheries Day 2017' in Bonn (WS Bonn 6/2017).

Characteristics of production systems and regions

Focus 1 - Carp ponds in the valley of the river Aisch (Aischgrund): One of the key areas for traditional carp production is located in Middle Franconia (Mittelfranken), in the west of the city of Nuremberg in the Aischgrund area. 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 geographical area of the Aischgrund is situated along the river Aisch, and recognition outside of its region. However, the Aischgrund has national and international recognition among aquaculture experts due to the characteristic carp breeding line of the 'Aischgründer Spiegelkarpfen' (Cyprinus Carpio (3) Aisch valley). The carp represents the pond landscape and transmits regional identity and integration. Rural tourism has improved recently. Stakeholders from the Aischgrund area reflect on the opportunity to apply for registration as an UNESCO World Heritage site because the area has 7,000 ponds with a total pond area of 2 800 ha (including dams). Since the dams have a significant ecological value, the total length of which is about 1,400 km. They are 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 protected areas. 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 bio-gas plants and animal feeds); oats and triticale-legume crop mixtures for carp farming. Due to the reduced soil fertility and unfavourable farm structures, framework conditions for agriculture are difficult. Many farmers cultivate vegetable crops such as horseradish, onions or beet.

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. Many 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. Unemployment rate 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. Access to the fish market is difficult for the large number of small producers. Most farmers depend on a few fish wholesalers who collect, grade, process and distribute the fish to restaurants in the closer and wider area as main sale channel. (OE 6/2016)

Carp 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 warm water particular for breeding. In the third year, fish of around 1.5 kg/animal are harvested and sold for consumption. Most small farmers buy bigger young fish from professional farmers because their own opportunities to nurture fry and fingerlings are limited. The main production challenge is loss of small fish by predators, mainly the cormorant. 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 – sometimes only with legume crops (triticale, barley, lupines and peas). The fat content of the slaughtered fish is of high importance for the quality of the end-product. Harvest takes place in September/October when all ponds are emptied. After harvesting, carp are watered – put in clean water ponds or tanks – for 10-14 days. Young fish go back into the refilled ponds again while sufficiently large fish are held in clean water tanks. Fish for consumption remain in clean water storage tanks during the winter months. After Easter, farmers usually return unsold carp to the natural ponds. 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 conditions. Due to 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 over-regional marketing. Moreover, the product is strongly seasonal because sales are limited to September-April. (FG Aischgrund 6/2016)

Focus 2 - RAS in Northern Germany: Recirculation aquaculture systems (RAS) are alternative production systems that reuse the water from the fish tanks after purification. In the ideal situation, the water circulates continually and hardly any fresh water enters the system but even semi-circulating systems with a higher proportion of continuously in- and outgoing water are defined as RAS (as long as the maximum does not exceed 10% of the total water volume). RAS exist as either warm or cold water systems. RAS with cold freshwater produce eel, trout, zander (pikeperch), carp and some other species. In 2016, Germany had around 48 warm water plants stocked with around 2,200 tonnes of tropical fish species. Farm enterprises usually establish RAS in connection with the construction of a bio-gas plant because warm water fish system (23-28°C water temperature) can use the exhaust heat of the bio-gas plant efficiently. Costs for heating represent about 15% of the total costs of production. Policy and funding schemes are very important for the development of bio-gas plants in Germany (see section 4.2.2.1 for the regulatory framework for renewable energy 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). The technical implementation of RAS differs between farms, which hinders standardised authorisation processes. Most of the enterprises are still pioneers in the field of intensive fish production. Production statistics show that the number of plants fell while the total production increased from 2013 to 2014 (Brämick, 2015).

1.1.2 Policy, regulatory and market conditions

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 fill 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).

Aquaculture and the reform of the Common Fisheries Policy

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 needs to 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). 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 aquaculture through the Common Fisheries Policy (CFP) reform, which has the same premise as the Common Agriculture Policy (CAP); but it has no first and a second pillar.

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 schemes 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 EU Commission claims 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.” (EU Commission, 2016b):

Support for carp farmers in Bavaria

EU area payment for agricultural land (CAP): 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 support for fish farmers under the related articles of e.g. farm investment, agri-environmental schemes, farmers’ cooperation, farm advice, conversion to organic farming.

Rural Development Plan in Bavaria (KULAP): The compensation payment for less-favourable areas in Bavaria does not include pond areas. The participation in an agri-environmental measure requires a maximum stocking rate of 600 fish/ha in the Aischgrund area. LEADER and Local Action Groups related to carp farming contribute to regional development. Support provided by the European Fishery Fund (EFF) has been used in the context of several projects. 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. The main objective of the office was to promote the Aischgrund region for tourism based on its positive image and the offers of ‘carp kitchens’.

Carp farmers’ associations and cooperatives: Pond cooperatives (‘Teichgenossenschaften’) are legally registered public unions. 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. Local pond cooperatives help to define standards (e.g. for the marketing of the Aichgründer association) and supported 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 has been a success factor for the regional development activities. Trust has been built up in recent years. Group ownership of ponds (‘Teichgemeinschaften’), are another type of producers’ union. When large ponds were sold in the past, single farmers were not able to buy them on their own. 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 has existed for the past since 200 years; thus no formal cooperation as an association or cooperative is needed.

National level institutional framework

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.

Germany is a federal state with a three-tiered system of government with the national level, the Federal States (i.e. regional level) and the local level (district/county): Federal States are responsible for nature conservation and aquaculture legislation; and they are responsible for the controls. Consequently, legal and administrative rules and regulation for fisheries and aquaculture may differ between regions. National authorities can only have a very limited impact on the industry's development. On the regional level, several authorities are concerned with aquaculture matters, which is water management, nature protection or construction. The most important authorities are local water authorities.

In the past, legal conditions in respect to nature conservation issues have been subject of legal disputes between individual carp farmers and nature conservation agencies. 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.

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 exhaust heat can, for example, be used for the production of warm water fish.” (Brämick, 2015) In addition, operators of RAS need to take into account a variety of laws, which are irrelevant for aquaculture in earthen ponds:

The EU 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). Obtaining official permission for the construction of a RAS is often very protracted and complex. RAS usually need permission for wastewater disposal, and operators have to pay waste water fees, which are irrelevant for other fish farmers (Lemcke, 2016).

Market conditions

German aquaculture products divers, and their markets are complex. Statistics on market structures, contractual agreements, and prices do not exist. Farmers' information on demand, prices and emerging trends depend on individual engagement and contacts to key persons in a particular economic cluster or network (FG Witzendorf 2/2017).

Most fish farmers in the Aischgrund produce small volumes. For that reason, they sell either to fish wholesale companies or directly to restaurants. Prices are relatively low per kilogramme fish. They are higher in direct marketing but this is a challenging business (FG Aischgrund 6/2016). 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.

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. Bigger fish, which is too large, will enter processing, go into direct marketing, or leave the area through the wholesaler. 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. (FG Aischgrund 6/2016)

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 sustainably farmed or caught fish. Since 2013, the Aischgründer Carp is certified via Geographical Protected Indication (GPI). Linked to this branding, the marketing agency 'Karpfenland Aischgrund' has started to promote the carp within the Aischgrund area and beyond its borders. A small but growing network of restaurants aims to foster carp sales outside Franconia. These partner restaurants are labelled as a special gastronomy for the typical Aischgrund carp menus.

1.1.3 Sustainability issues and development perspectives

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 – comparable to or even better than systems in other countries although with some potential negative impacts (DAFA, 2014).

Economic dimension of sustainability

Economic sustainability of traditional carp farming is a problem for many small and elderly fish farmers. 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 (SR 7/2016).

Access to markets and the ability to add value to the product from RAS emerged from expert interviews as being of critical importance for the viability of the business. Advisors stress that – in contrast to agriculture – investors in fish productions have to develop their market first and then grow with a slowly expanding production into the initiated or detected market niche. Consultants and stakeholders have seen investors in fish farms coming and going during the last decades. Data on bankrupt enterprises is not available. Information on profits or other economic data is not available. Some businesses are economically very successful, others not. The list of registered RAS in Germany shows that several of these are pilot or research plants that have not yet fully proven their economic viability.

Environmental dimension of sustainability

In general, carp production in tradition earth ponds is seen as ecologically sustainable system. 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. Carp is important for the maintenance of ponds because they feed on grasses and keep the ponds clean. The carp population keeps the nutrient level in the ponds in balance because it consumes nearly all nutrients from cereals added to the ponds.

The 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 small carp (K1) are sometimes replaced but not always due to relatively high costs of fingerlings. Without replacement fish, years of high losses of fish of the farm result in reduced harvests in subsequent years. Mainly, predators such as cormorants and otters cause these significant losses. Increasing number of beavers damage pond facilities. These species are protected under conservation law. The conflict of interest between farmers and representatives of policy and the society is growing. 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. (FG Aischgrund 6/2016)

Recirculating aquaculture systems (RAS) have positive environmental effects because recirculating systems conserve more water than other intensive 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; 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 not a problem like in pond production where a profitable production is hardly possible due to predation (mainly cormorants and otters). Circulation systems, which are closed, ensure protection from predators in an optimum way (Deutscher Fischerei Verband, 2015). In particular, innovations in the context of water purification are very important to avoid pollution of water bodies. Apart from the efficient use and treatment of in- and outgoing water, innovations in respect to the feeding regime are important for both the environmental and economic sustainability of the operation. Impact on the natural environment are linked with technological innovation, which have been playing a key role in the development of and the future potential (and acceptance) of RAS.

Organic certifying agencies which are known for their strong perspective on the environmental sustainability of production systems, do not accept indoor fish production as a system to be certified organic. Breeding does not comply with organic principles yet. A strategic and fundamental debate is currently on-going on the national and European level highlighting pros and cons of organic certification for RAS because some characteristics of RAS reach high environmental and animal welfare standards.

[Contribution to the social and cultural context of the Aischgrund](#)

The structure of representing associations is complex. Depending on the issue, responsible stakeholders cooperate or focus on specific interests. The different associations with their thematic and regional divisions are very important for the community of the fish farmers.

If it comes to details of the marketing channels, fish farmers tend to keep this information to themselves, or within their own families. There is competition amongst fish producers in particular when selling on regional niche markets or to specialised sales companies. On the other side, communication and knowledge-exchange was very open when they were e.g. talking about technologies used, constructions, water treatment or authorisation processes with local administration.

Compliance with environmental legislation such as the water law is a key element of the reduction and control of negative environmental effects from aquaculture.

The local acceptance of carp meals is high, which is a significant difference to other German areas. For the public, aquaculture in general tends to have a bad image, mainly because of feeding practices based on fishmeal, fish oil 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. Due to the long tradition of carp farming, the local identity is (even today) closely connected with carp farming. 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 carp museum plays a particular role for tourists and for local dwellers because it offers information and events related to the Aischgründer Carp.

Fish farmer, who use RAS, cannot cooperate on the local level because the location of fish farms is widely spread with long distances between production sites. Moreover, the farms produce different type of fish or seafood. Therefore, they are not be able to cooperate for e.g. joint procurement of inputs or marketing of output. However, they cooperate by sharing knowledge and experiences in respect to the use of technology

or the procurement of fingerlings for the restocking of ponds. In a few cases, farms even cooperate for joint marketing.

A novel concept such as community supported fish farming did not emerge in any interview or discussion.

Animal welfare and ethics

Animal welfare in recirculating systems is a much discussed issue. In general, appropriate technology enables better control of the fresh water within these systems, thus enabling optimum water conditions for the animals. The disadvantage is that diseases not detected early enough can have fatal consequences in closed systems because the entire population can become infected (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. The structure of the habitat in the tanks are usually very poor (Tschudi and Stamer, 2012). Experts discuss 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. This issue is of particular relevance for river fisheries where minimum standards differ from the requirements for the slaughter processes of fish from aquaculture. The only techniques considered acceptable are mechanic and electric techniques, which are widely spread in modern aquaculture systems. 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 (Stamer, 2009).

German consumers are very critical about fish quality and fish production systems. Television documentaries and newspaper articles show negative effects of intensive fish farming such as high stocking rates, suffering fish in small ponds, poor water quality conditions, poor quality feed etc.. Consumer studies show that the aquaculture systems lost the trust of several consumer groups. The connotation of the term 'aquaculture' even hampers the marketing of the products. For this 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 knowledge and detailed information. As a result, these systems are often seen as animal mass production (Korn et al., 2014).

The central theme for RAS that drove discussions and interviews was the given stagnation of the sector's development that counteracts the foreseen expansion of capacities. The case study analysis presents various reasons for this stagnation. Most producers and stakeholders agree on the key issues and their causalities. It is remarkable that knowledge about them is wide spread. Taking into account the different arguments and the situation of the (German) market, it is not clear if the stagnation of the industry is a curse or a blessing.

1.2 Oilseed rape in the Wetterau district

The purpose of this report is to investigate the nature of policy requirements and market imperfections, and their implications for the sustainability and resilience of oilseed rape cultivation and marketing in Germany, as part of the EU-funded Horizon 2020 project, SUFISA (Sustainable finance for sustainable agriculture and fisheries).

Data collection

Key to the approach taken has been to put the farmers themselves at the centre of the research, in order to get their perspectives on the key issues that need to be considered. In the first instance, we conducted a

desk-based analysis of market conditions and regulations (sources reviewed include: academic publications; government and policy documents; market research and consultancy reports; industry reports and NGO documents), which we supplemented with expert interviews. Following the analysis of the resultant data, focus groups with farmers and a workshop with stakeholders were organised in cooperation with the regional branch of the Farmers' Union.

Characteristics of oilseed rape production

Rapeseed (*Brassica napus*) also known as 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 globally 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 that causes a bitter taste of the oil and is not suitable for human consumption. In addition, the *Brassicaceae* plants contain glucosinolates, which cause digestive disorders. Only when traditional breeding was successful reducing the content of both these substances was the cultivation widely spread. This cultivar is called 'double zero rape' or 'canola'. Its production is widely spread in Germany and – at the same time – controversially discussed for a variety of reasons covered by this case study analysis.

The oil is used for food, fuel and feed production, in chemistry, pharmacy and medicine, as well as in the technical industry. 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). The transformation of rapeseed oil into biofuel, which the petrol industry adds to fuel for vehicles, is of particular importance with respect to volumes, values and sustainability issues. Only a small proportion 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. Coupled products from processing of bio-diesel are protein rich rape kernel or rapeseed extraction meal used by the feed industry. Sometimes this vegetable material enters bio gas plants for energy and heat production. The pharmaceutical industry adds rapeseed oil to creams and medication. The oil affects metabolism positively and is rich in vitamin E. The cosmetic industry uses the oil as basic ingredient for hydrating creams, body lotions etc..

Production system

Farmers grow oilseed rape in many regions throughout Germany. In the Federal States of Mecklenburg-Vorpommern and Schleswig-Holstein, rape plays an important role in crop rotation (up to 33%). In the Wetterau area, arable farms cultivate rape on around 10-15% of their fields. In the 1990s and early 2000s, farmers grew more rape and less sugar beet due to economic reasons. In 2007, the areas planted with rape peaked in 2007 due to policy measures that aimed to foster renewable energy sources. (Deter, 2015) Compared to sugar beet, rape was superior in crop rotation for many years in the Wetterau. With the abolition of the sugar beet quota in 2017, it is unclear how rotation systems and the related production volumes will develop in the areas with high-yielding arable farming such as the Wetterau.

Oilseed rape breeding has improved yields and resistance to many diseases in the last decades. Today, farmers can select hybrid varieties, which combine high yields with good resistance. Rape is an intensive crop that requires costly inputs. The highest amounts of nitrogen applied vary from 150 to 230 kg N per ha. Sulphur fertilization sometimes takes place, especially for the winter crop due to lower sulphur leaching.

The annual amounts range between 30 to 60 kg S/ha. Oilseed rape receives organic manures mainly as slurry, depending on availability. Despite the considerable uptake of nitrogen in autumn compared with cereals, recovery of this nitrogen in the seed is very low (Christen, 2000). The use of Glyphosate herbicides is common. Application occurs before sowing in autumn to control broadleaf and grass weeds. Several diseases can infect oilseed rape and frequently result in yield losses. The main problems arise from fungal infections. The efficiency of fungicide use is an issue due to expenditures of each application. Treatments against pests are routinely applied depending on the incidence of the pest. Slugs sometimes are a major problem in winter rape, especially after wet summers. Other significant pests are thrips (*Thrips angusticeps*) and flea beetles (*Phyllotreta spp.*). During spring, the most consequential pest is the blossom beetle (*Meligethes aeneus*) (Christen, 2000). Winter oilseed rape is predominately harvested by direct threshing. The harvest accounts for around 4 tonnes per ha. Oil mills process this volume into around 1,600 litre rape oil or bio-diesel plus 2,100 kg rape meal, which is a regionally sourced high-quality protein feed. Most rapeseed harvested is sold after threshing (Adämmer, 2014). Honeybees can produce around 40 kg of honey from one hectare of flowering rape (HBV, 2016).

Case study area of the Wetterau

The Wetteraukreis (Nuts III area) is located in the middle of the German Federal State of Hessen. Both rural and urban structures characterise the area due its rural towns and villages and the proximity to the Rhine-Main conurbation. The Wetteraukreis includes 25 municipalities; the area has 295,408 inhabitants (2013) and covers an area of about 1,100 km². 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 or sugar beet are characteristic. Sometimes pork production or dairy is linked to arable farming. Over decades, a steady decrease of livestock farming took place. Only the number of horses increased over time.

Around 1,300 farms are located in the area; around 55% are full time farmers. Farmers cultivate 3 % of the land under an organic farming scheme (but usually no organic rape cultivation.) Low-intensity systems represent the majority of permanent grassland cultivation in wet or conservation zones or in the mountainous areas towards the northern and eastern borders of the Wetterau. 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% of farm households receive their main income from primary agricultural production. In the mid-mountain and low-intensity grassland areas, part-time farming is widespread. (Sulz et al., 2006) The proportion of leased farmland is high. In 2013, the average price for arable land Hessen accounted for 197 Euro/ha and year. Soil fertility in the Wetterau district is far above the Hessen average, which impact on the price (see as well Section 'factors of production').

The primary sector represents around 1% of the local GDP, 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. Thus, high-tech industry and global players are located here as well as traditional handicraft, small-scale enterprises and family businesses.¹ Most employees work in the service area (>70%). (LK Wetterau, 2013)

Farmers' close cooperation has a long tradition in the area. Back in the 1980s, farmers established a machinery ring 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), a daughter enterprise of the machinery ring (Maschinen

¹ <http://www.wirtschaftsfoerderung-wetterau.de/standort-zentralperspektive.html>

Ring e.V.), was founded. It is responsible for the sales of cereals, sugar beet, bio-fuel, and high quality feed pellets. Another daughter organisation of MR Wetterau is the HERA economic association (Hessische Erzeugerorganisation für Raps w. V.). In 1994, this producer association was founded named 'Nawaro'.

1.2.1 Policy and regulatory conditions for rape cultivation in Germany at a glance

Overall, the German renewable energy sector has a long tradition in being highly influenced by legislation and the related policy conditions. First, 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 (Mc Sharry reform) but the regulation prohibited the cultivation of food crops on these areas. Second, the 'Electricity Feed-in Law' (Stromeinspeisungsgesetz or StromEinspG, 1991) introduced a minimum compensation for electricity from renewable sources that producers fed into the grid. The 'Electricity Feed-in Law' represented the starting point for energy production based on bio-gas technology; while previously, such energy was mainly used for turning manure into fertiliser. It was of significant importance for the farming sector when the German government established the Renewable Energy Law in 2000 (Erneuerbare-Energien-Gesetz or 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 (UBA, 2011).

Pushed by this development, people from Wetterau machinery association (Maschinenring), the water- and soil associations (Wasser- und Bodenverband) and the Hessian 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 the new Nawaro Economic Association. 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 Association and the enterprise WAS Ldt offered biodiesel, biodiesel-Service stations and biodegradable lubricants. Moreover, they provided information for farmers about the use of biodiesel in farm machinery. 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 Hessen 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 the period 2004-2007, the production of oil from agricultural plants for bio-fuel rose significantly. On-farm price for rape from regional stock lay 1-3 Euro per 100kg rapeseeds higher compared to the conventional sales channel in 2006. At that time, the local government initiated a round table on biomass supported by the Nawaro initiative and with attendance of artisanal food processors, energy supply companies and other enterprises or stakeholders in the Wetterau. Back in time, the round table projected an increase of renewable energy use of up to 15% for 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). Until 2009, the association managed the registration and subsidy payment of bio-energy plant cultivation on set-aside-land for its members with the Federal Agency for Agriculture and Food (BLE) (EZG, 2016). After 2007, nationally produced bio-fuel volumes and the proportion of bio-fuel 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 (DBV, 2016a;

Deutschlandfunk, 2016), and farmers' associations such as HERA tried to cooperate more closely with the food and feed industry.

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.

Specific legislation

Apart from the EEG and its amendments, the specific legislation for agriculture with EU-regulations and national law related to land, water, soil, pesticide use, transportation, taxation etc., including the related costs and controls, play a major role for arable farmers in Germany. As everywhere in the EU, the compliance requirements link the Common Agriculture Policy (CAP) with the specific legislation and the national/regional implementation ('Cross Compliance').

CAP pillar I and II

Rape producers, as all farmers with arable land or grassland, usually apply for direct payments, which provide a safety net ensuring a 'basic income'. This support is decoupled from production, and contributes, through greening, and in combination with cross-compliance, to providing basic public goods. (EU Commission, 2016c) The other core element of the first pillar from CAP is Regulation (EU) No 1308/2013. This regulation establishes a common organisation of the European markets for agricultural products such as cereals, fruit and vegetables, wine, olive oil, dairy products, seeds and many more. These market support measures do not support the European market for oilseed rape but only covers the rape market in the context of seeds for sowing and raw material for animal feeding (rape cake).

Market issues and arrangements within the supply chain

The supplying farmers, farmers' organisations, trade companies, oil mills, and (to a certain degree) food and bio-fuel providers are involved in the oilseed rape supply chain. Supply chains have **bottleneck structures** because the rape requires cleaning, drying and pressing for any further processing in food, bio-energy, pharmaceutical or technical industries. This structure is characterised by a large number of producers who sell to a very limited number of oil mills. Due to high costs of harvesting, storage and transportation, horizontal cooperation between farmers plays an important role for both the procurement of inputs and the marketing of the produce. In many areas typical for rape cultivation, cooperatives or producer associations ensure horizontal cooperation. Farmers appreciate a long-term trust-based cooperation along the supply chain. However, a growing group of farmers negotiates with traders and/or processors individually. Since farmers' become more flexible in selecting marketing channels (in particular when prices are low), producer organisations experience more competition with private trade enterprises than in the past. The need to consider the pros and cons of different sales channels is widely spread among farmers and their families.

Producer organisation 'HERA'

Producer organisations and farmers' cooperatives play a major role for the sales of the rape harvest. Due to the high oil content of the seed, storage of rape is difficult (and cost-intensive). Involved enterprises – including farmers and farmers' organisations - aim to avoid storage, and usually sell the harvest immediately. However, lacking storage capacities limit sales options (and price negotiations), and sometimes cause logistic problems during the season.

² 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

In the Wetterau, some producers market their rape harvest directly to traders or oil mills. The large number of farmers sell jointly through their producer association HERA. Earlier HERA was called Nawaro association (see above). The association negotiates prices and fixes contracts with traders and processors over 25 years. Some years ago, HERA had an agreement with a food corporation for the delivery of rape for the food oil production. This contract included additional environmental standards and payments for the participating farmers (EZG, 2016). During these years, HERA was the role model for the processor corporation and an environmentally friendly vegetable oil production with a slightly higher price (1-2 €/tonne) including agri-environmental payments for each partner farm. When the mill in Mainz closed down, this production was shifted to northern Germany. Moreover, the processor corporation lost the interest in oil production contracts based on higher sustainability standards because the enterprise branch became subject to an outsourcing process. (DE 5/2017)

Many years ago, the producer organisation together with the regional marketing organisation 'Gutes-aus-Hessen' run a pilot project that tested the direct marketing of vegetable oils from farmers for the replacement of pork fat in traditional sausage making. This project was not a break-through. However, the small-scale processing and the direct marketing of around 1,000 litres per year through local farm shops has been a success, although still of very limited importance for the area (DE 5/2017).

Market access, market differentiation and certification

Farmers have market access. However, large scale, over-regional and international oil mill structures and long transport distances limit options for the sales strategies of individual farmers and farmers' cooperatives. In general, most German farmers producing oilseed rape have the option to use two-three marketing channels through agriculture trading companies or processors (Adämmer, 2014).

The supply chains of oilseed rape lack differentiation opportunities. Since organic production is difficult, there is no organic supply chain in the Wetterau area. Other supply chains based on specific product or process standards do not exist either. The way it is handled and moved along the supply chain, oil from Wetterau rape cultivation is a no-name commodity good.

International markets and producer prices

Rapeseed is an oilseed cash crop that competes on international markets for vegetable oil and meals. The development of the rapeseed price in Germany strongly depend on prices for crude oil, soy and soybeans, which are the leading products for the whole oilseed-sector. Since summer 2014, global prices have remained on a low level similar to the period of crisis in 2008 - 2010. With increasing prices in input and factor markets, cost coverage and reduced profitability is an issue for the industry.

Soybean oil price in US \$ per pound



Source: www.macrotrends.net, 04/10/2017

Figure 1: Historical daily soybean oil prices (1997-2017)

Variations in German areas cultivated with rape and in yields per hectare have no impact on national rapeseed prices, which is different to trends in e.g. the potato market where reduced harvest volumes cause rising prices. Instead, prices for oilseed rape depend strongly on the general demand for bio-raw material: "If the bio-fuel channel would collapse, it would be very difficult for us!" (DE 5/2017).

Producer prices in € per tonne
(based on data of AMI, LK, MIO)



Source: www.agrarheute.com, 04/10/2017

Figure 2: On-farm prices in Euro per tonne, southern Germany (2010-2017)

1.2.2 Factors of production: finances, land and labour

Financial issues and access to finances is a minor issue. Some farmers have individual oil presses or other processing facilities, farm shops or bio-gas plants that help to add value to the farm's produces, including the oilseed rape. "The financing of such investments is not an issue." (DE 5/2017) Arable farmers in the Wetterau usually have access to financial support measures, and local banks offer reasonable loans. However, ensuring liquidity during the financial year can be a problem for rape production because the crop requires cost-intensive inputs (seed, fertilizer, pesticide application, harvest), which create expenses that are higher compared to e.g. wheat production.

National statistics show that prices for farmland continued to climb. In 2015, the German average price for arable and grassland rose by 8% to more than 19,000 Euro/ha per year. This increase was below rates in 2014 (+10.5%) and in 2013 (+14%). In Hessen, average prices for land are slightly below the national average (2014: 14,000 Euro/ha). (DBV, 2017)

The proportion of rented land is high and prices per ha are rising! In 2013, 74% of all farms in Hessen cultivated both owned and rented land. Only 15% of the farms managed only their own land. Overall, around 60 % of the farmland in Hessen was rented land (58% in 2013; 64% in 2017). In farms with main income from agriculture ('Haupterwerbsbetriebe'), 68% of the managed farm area was rented land. Thereof, nearly 10% was rented from family members. The majority of landowners who rent out their farmland are retired farmers, their heirs or other private persons. (Statistik Hessen, 2014) Land owned by the state of Hessen, by other public bodies or by the church represents less than 5% in Hessen (HLG, 2017; EKHN, 2017).

The demand for land on lease is high with steadily increasing prices (Langenberg, Theuvsen, 2016). In 2013, the average price for arable land Hessen accounted for 197 Euro/ha and year. Soil fertility in the Wetterau district is far above the Hessen average, which impacts the price. Rising sales prices and rents for farmland are a major challenge, in particular for arable farmers in favourable areas. "The pressure on the land market is significant. Even the demand from the public sector is significant. Farmland is needed for infrastructure (roads, railways, power lines) and for nature conservation purposes serving as compensation for the sealed land. Rising land prices and rents are a huge problem for farming in the Wetterau area." (DL 5/2017)

Labour is cost-intensive and skilled workers are difficult to find but it is not the major concern for Wetterau farmers. The 2016 census shows that farms specialised in arable farming in Hessen are characterised by an average of 2.2 Labour Units (LU) per 100 ha. Farms run on a full-time basis have 2.3 LU/100 ha. In Hessen's farms (run on a full-time basis) have 2.3 persons from the family working on the farm (1.8 LU/farm and year), 0.5 permanent employees (0.4 LU/ farm and year), and 6.6 seasonal workers (0.9 LU/farm and year). In this group, 73% of the farm managers completed a professional training programme (thereof, 25% with an apprenticeship certificate, 25% with a master's certificate, 17% technician's academy, 10% with a bachelor or master university degree). Nearly half of these farmers participated in training schemes during the last 12 months.

The age structure of farm owners (full-time run farms) shows that 9% of the farmers are older than 65 years, 33% of the farmers are in the age group 55-64, 36% in the age group 45-54, 16% in the age group 35-44, and 5% of the farm owners are younger than 34 years. (DESTATIS, 2017)

The availability of skilled workers is an issue in the Wetterau because non-agricultural employment is available in the area and in the cities of the Rhein-Main metropolitan area. Unemployment rates in Hessen are below 5% (SZ, 2017). Quality of life in the rural and peri-urban area of the Wetterau is high with access to all kind of infrastructure. Seasonal workers mainly come from eastern European countries.

1.2.3 Challenges, chances, farmers' strategic thinking and development perspectives

The Focus group and the stakeholder workshop provided information on major challenges and chances as perceived by the farmers. Moreover, the groups discussed strategies aiming to address the challenges identified. The following aspects highlight the challenges identified.

- Reduced international competitiveness: Farmers are concerned because they realised that their problems is not taken seriously in public discussions and political decision-making.
- High proportion of rented land: Most farmers only own a smaller part of the agricultural land they cultivate. Rising prices for rented land and the risk to lose production area at the end of the contractual period increases vulnerability of the farms.
- Costs for inputs are rising as well as the work load for administration/bureaucracy.
- Relatively low producer prices: Constant or decreasing world market prices for oilseed rape and competition from other oilseeds, such as palm oil, puts pressure on the price. Oilseeds in third countries do not have to meet the same standards as EU countries.
- Cost reduction has reached the bottom: In the past, a widespread strategy in the farming sector was the increase of efficiency in production systems. Over time, arable systems changed aiming to ensure improved productivity and efficiency. Now, there is no more room for manoeuvre. Cost reduction has reached the limit.
- Biodiversity issue: Farmers experienced profit margins sink. With the reduction of crop rotation and intensification of the few species or even cultivars, the biodiversity of wild flora and fauna shrank as well. However, farmers are aware that they will have to increase crop variety in their rotation plan. With more crops cultivated that show small profit margins, the economic risk can increase. Rape cultivation enriches the cropping system but is risky due to the high-costs of inputs. (FG Wetterau 4/2017)
- Lacking compensation for environmental services: The participation in the private sustainability programme offered by a private food processor fitted well with farmers' strategic thinking.

However, the contract ended because the responsible oil mill closed down and the processor shifted the procurement area to northern Germany.

- The local mill and storage capacities for rapeseeds at the other mills are lacking. This limits the development of regional supply chains and causes logistic problem during the harvest.
- It is difficult to add value to rape oil because oil is a commodity good and a local processor is missing.
- The image of farming in public media is not very good. The prejudices in public media related to fertilisation and spraying is a problem for farmers. Consumers need more information and change their shopping behaviour if they want to see a reduction of pesticides and nitrogen in the environment.

Farmers identified chances for the production and sales of rapeseeds:

- The risk management systems used earlier helped to develop an adequate pricing and marketing strategy. Farmers have tested a model that is no more in place but could re-established if decided by the food or retail industry.
- Compliance with the high sustainability standards is possible and offers opportunities for premium prices.
- The consumer's willingness to pay for higher standards is a chance that can further develop.
- Cooperation among farmers is strong (machinery ring, producer organisation). The common procurement of inputs works well. The local marketing of rape for bio-diesel via the local producer organisation was excellent in the past, and can improve in the future again.

During the Focus group farmers developed strategies for their farms and oilseed rape production and sales. Farmers imagine basically two different strategies which either focus on the realisation of added value for their products or any kind of financial compensation for the provision of public goods.

- Strategies for the financial compensation of sustainability performances: Farmers have tried out different approaches in the last years. An example was cooperation with a local water supplier but that caused problems when the spring was dry.
- Strategy of the use of public or private sustainability programme: Farmers experienced such a programme and it worked well in order to apply sustainable and credible production systems. Currently such programmes are not at hand.

In addition, strategies can enhance the communication with the public aiming to support the willingness to pay higher prices for local food that is produced under high standards. Another strategy focuses on the marketing of a high-value rape oil from the Wetterau; the development of a regional marketing strategy is an idea to be further developed among stakeholders (Status September 2016).

For a long a time, it was mainly the animal husbandry industry that was in the centre of public criticism (see media content analysis). However, that has changed because new topics in the context of arable farming emerged: water pollution due to fertilisation, disappearing insects, biodiversity issues in agricultural landscape. Farmers are prepared to change but such adjustments in production systems will increase costs. Farmers are deeply concerned about the practicalities and likelihood of the different options for covering additional costs of production.

In addition to a greater variety of crops and agricultural measures, more diversity in the agricultural landscape will be crucial. Small-scale, complex landscapes ensure biodiversity, and enable adaptation to climate change. Moreover, a rich landscape that supports natural pest control measures provides the basis for reduced pesticide uses. Plant breeding is closely linked to the site specific requirements for cropping under changing conditions. (ASG, 2017) For the future, a re-orientation merging traditional approaches with modern technology and science: Enriched crop rotations, reduced and targeted fertilizer use, reduced and re-targeted use of pesticides, as well as the reintegration and improvement of animal production. Excellent management systems and the use of innovative technologies.

In the Wetterau, the development of the producer organisation and the implementation of its business strategies in the past has been a success story which can serve as starting point for the transition for arable production in the area. However, changing natural conditions and difficult market conditions of outputs and inputs hamper currently the implementation of future-oriented strategies and the realisation of relevant adjustment.

2 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.

In the first instance both case studies seem to be very different which is true for the production techniques, input and output markets. However, there are highly relevant connections or common challenges: the maintenance and provision of valuable landscape elements (yellow rape fields in early summer, traditional ponds) and the strong global competition with imported oilseeds/palm oil or fish threatening margins of German fish and arable farmers. Both groups of farmers deliver very relevant environmental services for ecosystems and farmland biodiversity and the conservation of the cultural landscapes. At the same time, both are economic activities that affect the natural environment. For that reason, the major EU Directives and Regulations relevant for the protection of water, soil, food safety, and nature conservation and the

related national/regional legal rules (including authorization of e.g. RAS or Glyphosate) drive the organisation of production systems on the farm level.

The media analysis highlights major issues that general media in Germany published in the years 2012-2016. The key issues identified influenced the in-depth case study analyses in respect to direct concerns such as the Common Agriculture Policy (CAP), EU Directives and Regulations, food safety and environmental impact of farming activities.

The case study analyses are based on a multi-method mix including desk studies of public media, reports, studies, information from homepages, in-depth stakeholder interviews, working groups with farmers and/or stakeholders (focus groups, workshops) and a producer survey in the case study area.

3 Media content analysis

3.1 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.

3.2 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.

3.2.1 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 3 illustrates the most important keywords of the media analysis of general media.



Figure 3: 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

3.2.2 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	Ecological focus areas
		Environmental services
		‘Greening’-measures
		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 4: Key topics in agriculture in German media

3.3 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.

3.3.1 Theme 1: Environmental and consumer protection

Table 4: Key topics related to environmental and consumer protection

Topics	Key terms
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Green gene technology	Economic importance for livestock production	Feed market
		Soya or maize
		Genetic modified plants
		Genetic modified organisms (GMO)
		CRISPR-cas system
	Labelling obligation	CIBUS oilseed rape
		Marketing initiatives for non-GMO
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
	Loss of biodiversity	Herbicide
		Bee mortality
		Use of pesticides
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	
Food waste	Use-by date	Food waste
	Food law	Curvy cucumber
	Marketing standards	

3.3.1.1 *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)³,
- 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).

3.3.1.2 *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

³ The abbreviations are explained in the Annex – Media Analysis in the list of sources

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).

3.3.1.3 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).

3.3.1.4 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).

3.3.1.5 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).

3.3.2 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	
	Use of antibiotics	Fattening installations
	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
	Lack of transparency for the consumer	
Legal regulations and political measures	Animal protection law	Chick culling
		Small poultry flock management
		Tail docking
	practicability and implementation	Alternative solutions
		Outsourcing of livestock production

3.3.2.1 *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).

3.3.2.2 *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).

3.3.2.3 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).

3.3.3 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	

3.3.3.1 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 Federal 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).

3.3.3.2 *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).

3.3.3.3 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
- reasons 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).

3.3.4 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 ¹ -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

3.3.4.1 *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).

3.3.4.2 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.

3.3.4.3 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).

3.4 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.

4 DE Case study A: Aquaculture in Germany

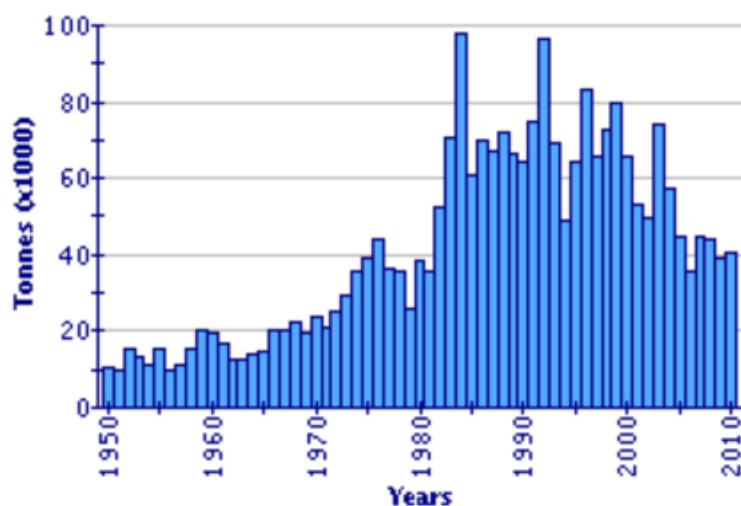
4.1 Case study introduction and context

4.1.1 Inland fish production in Germany

Aquaculture is the global food industry's fastest growing sector. The 2015 dataset of the FAO contains records of 591 aquatic species and species groups ever farmed in inland freshwater, inland saline water, coastal brackish water and marine water. These four types are the different forms of aquaculture production systems. Approximately 90 % of global aquaculture production is in Asia. International experts see further growth potential in many countries worldwide. World aquaculture production is continuing its growth reaching a total volume of 106 million tonnes in live weight in the year 2015 (FAO 2017). 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)

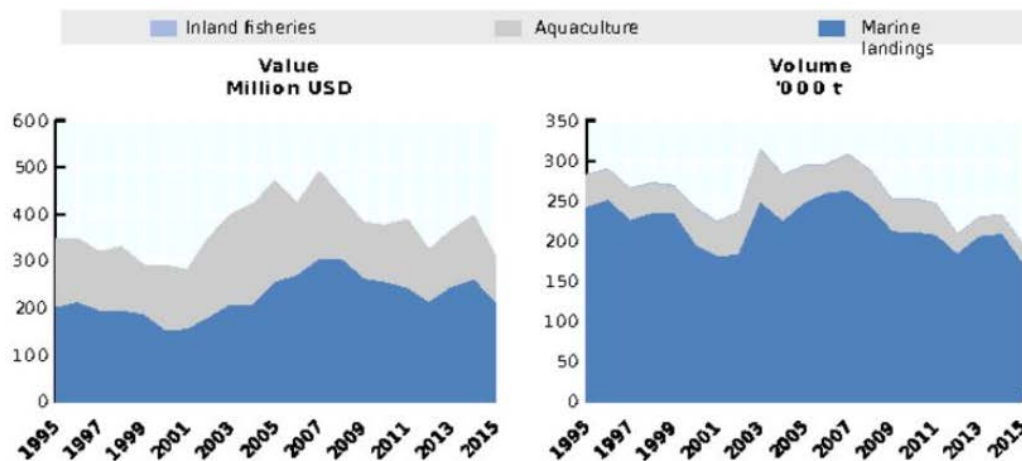
In Germany total fish consumptions accounts for 608,000 t. Thereof 140,000 t was fish from aquaculture which was mainly imported (76.9%). Only, 23,000t (23.1%) were produced in Germany accounting for 3% of the total national consumption. The development of aquaculture in Germany has stagnated even though the country's water resources and technological capacity provide the foundation for a competitive sector. In Germany, fresh water aquaculture is the most common system, either in natural ponds or artificial through-flow systems. 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 farms or fish enterprises produce exclusively fish (FAO 2007; for more details on statistics, see section 4.2.3.4). Aquaculture in Germany is a small industry, practiced only in a few specifically suited areas. Traditional aquaculture species cultivated in Germany are rainbow trout and common carp, which are farmed in earthen ponds, and modern indoor and outdoor facilities (Bräwick, 2015).

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



Source: FAO Fishery Statistics, Aquaculture production

Figure 5: Reported aquaculture production in Germany (1950-2010)



Value data for inland fisheries was not reported. More information is available in the OECD Fisheries Database. Source: OECD Fisheries Database.

Figure 6: fisheries and aquaculture production in Germany (1995-2015)

In 2010, annual aquaculture production in Germany was, according to official statistics, approximately 40,000 tonnes. Stakeholders expect national production to be actually higher (see section 4.2.3.4). By comparison, the German fishing fleet landed about 70,000 tonnes in 2010. 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). Following the statistical data, the production volumes of aquaculture had fallen to 24,300t in 2015. (Marine landings decreased as well delivering 170,100t in 2015). (OECD, 2017)

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 4.1.3) 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.

4.1.2 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 companies 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)

4.1.3 Carp production in Germany

4.1.3.1 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 Nuremberg (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.

4.1.3.2 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. (SR 7/2016)

Stakeholders from the Aischgrund region reflect on the opportunity to apply for the registration as UNESCO World Heritage. (OE 6/2016)

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!) (OE 6/2016)

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. (OE 6/2016)

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 bio-gas 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. (ST, FN 6/2016)

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 international corporations of the garment industry are located in the area. 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. (OE 6/2016)

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. (OE 6/2016)

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. (FG Aischgrund 6/2016)

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. (OE 6/2016)

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. (FG Aischgrund 6/2016)

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. (FG Aischgrund 6/2016)

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'. (FG Aischgrund 6/2016)

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. (OE 6/2016)

4.1.3.3 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 warm 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:

- K0 ('carp zero'/brood) to Kv ('Karpfen vorgestreckt'), first 4-6 weeks (20-25 Euro/1000g)
- K1-carp 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 Saxony) (FG Aischgrund 6/2016)
- 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.

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. (FG Aischgrund 6/2016)

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). (ST 6/2016)

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. (FG Aischgrund 6/2016)
- Fingerlings harvested will not be sold but goes back into the ponds for stocking (BN 6/2016).
- 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. (BN, ST 6/2016)
- 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 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. (FG Aischgrund 6/2016)

4.1.4 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, published in 2014, highlights the objective to increase the German aquaculture production from RAS significantly. The aim was 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 fish⁴. Farm enterprises usually establish RAS in connection with the construction of a bio-gas plant because warm water fish system (23-28°C water temperature) can use the exhaust heat of the bio-gas 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 bio-gas plants in Germany for the regulatory framework for renewable energy production.

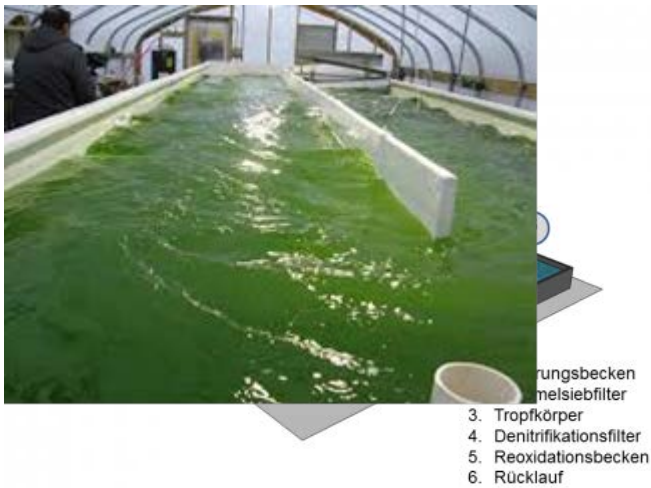
4.1.4.1 RAS technology

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.

⁴ 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.

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.

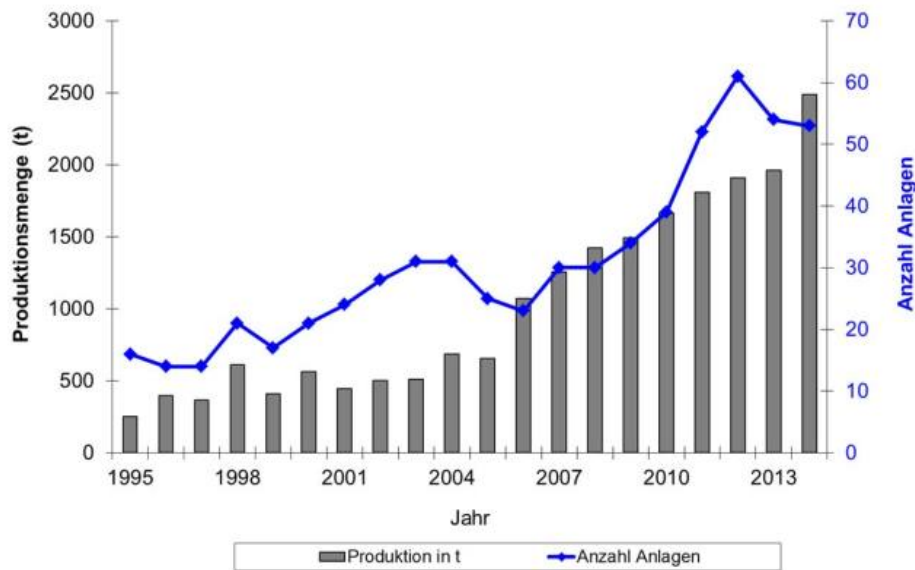


Legend: Fish tanks (1), filtration system (2, 3, 4), re-oxidation (5), and reflux (6)

Source: Leibnitz Institute for Water Ecology and Inland Fishery (IGB, 2016)

Figure 7: 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)



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

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

Figure 8: Output volumes in tonnes and number of RAS in Germany (1995-2014)

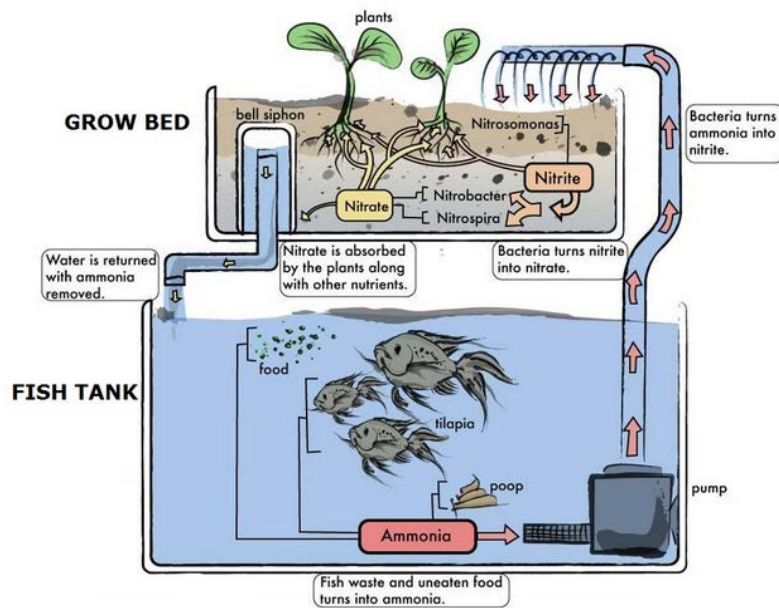
Since many years, eel production shows the highest production volumes of RAS in Germany. Producers sell adult eel for slaughtering or seedlings for rivers and lakes (Brämick, 2015). The most significant growth rate has the production of African catfish (*Clarias gariepinus*). Production is usually coupled with the use of heat of a farm-based bio-gas 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).

4.1.4.2 Aquaponics, a special type of RAS

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).



Source: <http://aquaponicsphilippines.com>

Figure 9: Basic diagram of the aquaponic system

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. Aquaponics 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).

Currently, operations with aquaponics have the problem that the nutrients that feed the plants come from the fish and only partly match the needs of plants such as vegetable. The cultivation of vegetable in glasshouses usually apply water with optimised nutrition contents. However, the nutrient mix from the fish pond usually differs from the need of the plants. Currently, the fine-tuning of plant production that drives the economic viability of the farms is still an issue in combined aquaponics.

4.2 Policy conditions and institutional framework for aquaculture in Germany

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

4.2.1.1 *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).

4.2.1.2 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)

4.2.1.3 Bavarian Rural Development Programme and European Fishery Fund

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' cooperation, 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. (BN 6/2016) In the Aischgrund, around 15% of the ponds are classified as Nature Reserves, as Special Protection Area

(SPA) or as Natura 2000 area. Farmers in these zones are eligible for nature conservation payments of the KULAP.

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

Support provided by the European Fishery Fund (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 wish 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. (SR 7/2016)

4.2.1.4 *(Lacking) policy support for RAS*

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).

Since policy support schemes and legal rules relevant for water use and nature conservation are as well topics that are within the responsibility of the Federal States, any national-level engagement from stakeholders, policy or administration is of minor relevance for the development on the ground. The latter hampers any goals set by any national initiatives. The Federal Ministry aims to implement the National Strategy but the responsible authorities that decide on the approval or rejection of new developments are located on the level of the district or the community. These authorities issue, restrict, withdraw or revoke licences for water use and compliance with environmental and veterinary rules. Consequently, the realisation of the National Strategy which argues for RAS depends on local policies which often argue (for good reasons) against RAS. On the local level, authorities often face strong resistance against intensive fish production plants in the neighbourhood (FG Wietzendorf 2/2017). This dichotomy of different policy interests is a well-known in the industry. Stakeholders highlight local level policies and administrative decision making as main reason for stagnation of fish production and the non-achievement of the National Strategy of Aquaculture in Germany.

KNAQ network in the Federal State of Schleswig-Holstein

The Federal State of Schleswig-Holstein engages more than any other region in fostering the development of inland aquaculture. Schleswig-Holstein has established and the network project KNAQ (Competence Network Aquaculture of the Federal State of Schleswig-Holstein; <http://www.knaq-sh.de>). The aim of the continuation of the KNAQ is to stabilise the aquaculture industry in Schleswig-Holstein and in particular to support the establishment of new and the expansion of existing aquaculture companies and thus substantially increase the value added from aquaculture in Schleswig-Holstein. The network is already in its second period. The current KNAQ project phase is funded by the State Program for Fisheries and Aquaculture through participation of the European Union from the EMFF, the federal government and the state of Schleswig-Holstein. KNAQ cooperates closely with the regional business development agency. Schleswig-Holstein has, for example, developed a guideline for potential investors, which is seen as highly relevant for the start of new RAS (Lemcke, 2016).

4.2.2 Implementation of the case study

The German aquaculture sector is divers in systems, products and geographical distribution. The following paragraph will explain why we choose the focus on RAS in northern Germany for the case study work in 2017, after concentrating on traditional carp farming in our 2016 case study work.

Inland aquaculture with its three main branches (trout, carp, and RAS) is a relatively small sector in Germany with only a few key players active in production and lobbying. Despite regional distances and heterogeneity of production, the important persons from the industry know each other and communicate regularly. However, interests and liaisons of actors can differ between regions and orientation.

In the beginning of the SUFISA case study work, we learned from colleagues that case study work in the fish sector requires the support from relevant key actors from the local research, training and advisory centres funded by the German Federal States. Without this support, fish farmers would not support the work of an 'outsider' coming from e.g. an agricultural institute. In addition, uncoordinated investigations undertaken by different institutions that do not know about the engagement of other projects present the significant risk to tire the few key actors. This would be a long-lasting negative effect for both, practitioners and researchers.

To avoid such a risk and to improve cooperation with the project, the HNEE-Team liaised with the researchers from the National Research Centre, the Thünen-Institute in Hamburg, because they keep an overview of ongoing research on the international, national and regional level in the field of fisheries and aquaculture. This liaison presented the starting point for the cooperation between the SUCCESS project (www.success-h2020.eu/) and the SUFISA project. Both project have similar orientations but SUCCESS focuses on fish exclusively while SUFISA is a project that focuses on sustainable finance in the agri-food sector, and was covers fisheries and aquaculture additionally.

In 2016, our German SUFISA team from the HNE had the opportunity to cooperate in the case study on traditional carp with the SUCCESS project, which was a significant advantage for the SUFISA project. In consultation with the Thünen-Institute later in 2016, we decided to approach the Federal Research Centre at Lake Konstanz aiming to liaise with them in the following working steps. The projected focus would have been on trout production in the Black Forest area because it is of economic relevance for the German aquaculture sector (see 4.1.2). However, the Head of the regional research centre and key stakeholder fish production in the area suggested avoiding a workshop in the area due to lacking interest of potential participants (BR 12/2016). He pointed out that trout farmers are well established and run their businesses successfully. Potential new entrants lack options to have access to water, and in case, they had so-called 'water rights' they would have major problems to receive an authorisation for the construction of a new

plant outside of industrial zones (Gewerbegebiet). “Each plant that has not been constructed is a good plant.” states Brinker indicating that local politicians and their authorising district or community offices implement local dwellers wish not to have any fish production facilities in the neighbouring landscape. “The society prefers to import fish from Canada that serves as typical dish from the area instead of having more production sites here. Nobody questions sustainability of these imports. People argue that our landscape and the natural environmental needs protection. Is production and transports of fish from abroad more sustainable than the fish from new plants here?!” (BR 12/2016).

Due to that friendly refusal, we decided to cooperate with the Chamber of Agriculture Niedersachsen and to focus on RAS in Niedersachsen (Northern Germany). The organisation of the Focus Group in Wietzendorf took place on a farm with agricultural and aquaculture production including fish processing. It was again a joint event of the HNEE and the Thünen-Institute for Fish Ecology, this time organised by the SUFISA team with the support of the Chamber of Agriculture Niedersachsen in Hannover. Main results of this discussion focused on issues related to public administration and authorisation, policy support measures and the farms’ potential vertical cooperation. It was evident to communicate and discuss the key results of the FG with stakeholders from the industry and key persons from politics and administration. However, we renounced to organise such a national (or northern German) stakeholder workshop because the Thünen-Institute had organised a similar event as a large-scale conference with all stakeholders from aquaculture only recently in summer 2016 (LR 6/2017). Instead, we decided to cooperate with the Ministry of Agriculture in the Federal State of Mecklenburg-Vorpommern for the organisation of the case study workshop. This workshop took place in the context of the national conference ‘German Fisheries Day 2017’ in Bonn (WS Bonn 6/2017).

4.2.3 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 Niedersachsen⁵. Both strategies have the objective to foster aquaculture in the area.

4.2.3.1 Federal structures and administrative responsibilities

Germany is a federal state with a three-tiered system of government: the federal or national level, the regional level of the Federal States (Nuts1), the intermediate level of the sub-regions (Regierungsbezirke, Nuts2), the districts (Landkreise, Nuts3) 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

⁵ <http://www.lwk-niedersachsen.de/index.cfm/portal/foerderung/nav/515/article/14834.html>

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.

Particular structures in Bavaria

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 Middle Franconia was at threat. (OE 6/2016)

International and national level policy and research have often no direct impact on or responsibility for the specific regional/local fish farming issues. (OE 6/2016)

4.2.3.2 Professional organisations on the national and local level

Representation of fish farmers

The structure of representing associations is complex. The sector distinguishes between the different ‘professions’ (inland fisheries, fish farmers, coastal fisheries, anglers), and regions (federal states). The role for its members and the orientation of the lobby work of the different associations have developed over time. These associations have local, regional and national level bodies. Each federal state has an own aquaculture association representing the interests of stakeholders within the state.

The German Fishery Union for professional fishermen and anglers (DEUTSCHER FISCHEREI-VERBAND e.V., Union der Berufs- und Angelfischer), the DFV, is the umbrella organisation for professionals and leisure anglers. The DFV has four sub-associations called ‘Divisions Unions’ (Spartenverbände); each has regional or even local groups that are responsible for local activities. All organisations are non-profit associations and are politically independent. The ‘Union for German Inland Fisheries and Aquaculture’ (VDBA – Verband der Deutschen Binnenfischerei und Aquakultur) is the most relevant body for the representation of aquaculture. The organisation has three branches (trout farming, farming of carp ponds, river and lake fisheries). On behalf of the region-based associations dealing with fishery, pond cultivation or angling issues, federal stakeholders act nationwide but cooperate closely. Depending on the issue, responsible stakeholders cooperate or focus on specific interests. Regional differences are obvious, which key persons and their arguments mirror. The organisations organize an annual conference together and liaise for joint political initiatives. Overall, the professional organisations are important institutions for German fish farmers.

Since policy support schemes and legal rules relevant for water use and nature conservation depend on the federal states, there is little impact of national-level engagement on both stakeholders and policy/administration (see 4.2.1.4). The latter is a problem for the Federal Ministry that aims to drive the National Strategy, and for the work of the national research organisation, the Thünen-Institute (see 4.2.2.5).

Carp farmers' associations and cooperatives in Franconia

Pond cooperatives, the Teichgenossenschaften, are legally registered public cooperatives (eingetragene Genossenschaften, e.G.). 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. (SR 7/2016)

Group ownership of pond ('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. (ST 6/2016)

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

4.2.3.3 Legislative framework

Fisheries law

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 Federal States 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 facilities⁶.

Relevant laws for aquaculture

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 plays 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-

⁶ "Aufzucht und Haltung von Fischen und anderen Wasserorganismen in allen künstlich angelegten Fischteichen und sonstigen Anlagen", Fisheries Law of the Federal State of Brandenburg

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.

The Federal States regulate ownership of waters, monitoring of waters, maintenance of waters, licensing procedures for uses of waters, and indirect discharges into waters (i.e. discharges via wastewater treatment plants).

Programme of GAK

The Federal Ministry of Agriculture support the activities of the Bundesländer for “the improvement of the agrarian structure and of coastal preservation” (Law on the Improvement of the Agrarian Structure and the Coastal Protection or ‘Gesetz über die Verbesserung der Agrarstruktur und des Küstenschutzes’). The law and related financial support programme of the ‘Gemeinschaftsaufgabe für Agrarstruktur und Küstenschutz (GAK) includes fisheries. It is a joint task of the national and regional governments.

Administrative offices are in charge on locally

On the administrative level of the district or municipality, several authorities are responsible for the aquaculture industry such as the office responsible for the local water management, nature protection or construction. The most important authorities with respect to aquaculture are the water authorities. The supreme water 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.

Rules and regulations for carp farming in Franconia

When farmers had cultivated natural ponds in Franconia, they need permission in case they want to stop fish production and to use the area for agricultural or other 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.

When a new fish farmer starts the cultivation of a pond, certification or professional training for carp farming is not required. However, anglers need a qualification certificate (‘Angelschein’) when they go angling at a pond or river. Animal welfare for the slaughtering of fish from aquaculture and the hygiene rules for the handling of dead fish from aquaculture are more restrictive than for angling or catching of wild fish in rivers and lakes.

Relevant legal framework for operators of RAS

„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 bio-gas 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.

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).

4.2.3.4 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 Saxony as well as Hessen have seven plants. (DESTATIS, 2015a)

Inconsistent datasets

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

Federal State	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.

Before 2011, the regional offices for fisheries and aquaculture were responsible for the publication of data for the aquaculture industry. Since 2011, the Federal Agency for Statistics collects national and regional data for the aquaculture sector. Since the methodology of data collection has changed with this transfer, long-term data analyses on the sector's development and a description of trends is impossible because data differs significantly (Brämick, 2015). Fish farmers' association argue that fish production volumes and values are underestimated with the new methodology. 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. (LR, OE 2016)

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 to affect the number of traditional fish farms.

Farm economic data and information

Micro economic data is mainly published for fisheries and marine production (Publications Office of the European Union, 2014). Data for the comparison of fish farm economics was not available The Thünen Institute addresses this issue by the application of the *agri benchmark* approach to aquaculture systems in

Germany. The network offers model calculations based on data sets for so-called typical farms (<http://www.agribenchmark.org/fish.html>). First results were available for trout production in Germany, Denmark and Turkey (Lasner et al., 2016).

Data availability for sustainability assessments

The sustainability of the aquaculture industry is an integral part of the EU's Common Fisheries Policy (CFP) and a key objective of the National Aquaculture Strategy Plan. Moreover, consumers are questioning the (environmental) sustainability of fish from aquaculture. For that reason, data on the environmental impact of aquaculture are important in order to measure and analyse the environmental sustainability, and assess the achievement of the development goals for fish production in Germany. A study of the Thünen Institute for Fishery Ecology shows that (apart from federal statistics and from fisheries authorities of the federal states) authorities collect data on notifiable fish diseases, measures regarding the protection from predating birds as well as on the introduction of species which are not (yet) used for German aquaculture. Moreover, local or regional administrative services collect information on aquaculture operations and their technical processes during application and approval processes or from public monitoring processes. Veterinary data on animal health and data on products used (pharmaceutical and food law) is only transferred to the authorities when requested. This data transfer takes place in cases of e.g. increased mortality, outbreaks of notifiable fish diseases or specific water-related concerns. (Sähn et al., 2017) The report shows that relevant data for the analysis of sustainability effects of aquaculture exists but the data is not accessible. Due to the lack of empirical data, it is impossible to inform the public and relevant stakeholder groups (local politicians, administrative staff, NGOs and producers) about environmental effects caused by fish farming. Sähn et al. (2017) argue the access to and use of empirical data in scientific analyses will be a precondition for the development of the sector and the achievement of the National Strategy Plan.

4.2.3.5 Role of the federal research institute

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).

DAFA experts agree and emphasize that well-coordinated research is needed for the further development of small industry of fish production in RAS in Germany (BMEL, 2014). However, regional research institutions emphasize that federal research projects should not interfere with regional level studies. Traditionally, regional research institutes for fisheries and aquaculture were the key players in the industry.

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. For local or regional policy reason, it is difficult to link activities or even merge budgets. In case of research and governance fostering the aquaculture industry, some experts confess that federal structures were disadvantageous for the expansion of fish production in Germany.

The national engagement in research and development in the fish sector has never played a role in the past. However, the DAFA strategy notes that a joint effort of aquaculture research could help to address challenges relevant to several regions.

The Federal Research Institute focuses on four key areas for the aquaculture sector: sustainable fish nutrition, environmental impacts, animal welfare in aquaculture and profitability of fish farming (see 4.2.2.3; <https://www.thuenen.de/de/fi/projekte/>). The institute is involved in the H2020 SUCCESS project and in the network project *agri benchmark* fish (www.agri-benchmark.org). The German SUFISA team

cooperated closely with colleagues from both projects in the context of this case study (see 5.1.2 for interviews and working groups, 2016-2017).

4.2.3.6 *Training and professional education*

Little interest from young people in the professional education and training for fish farmers is another problem. In the case of fish farming, the federal system hampers not only efficient research but education and professional training as well. The education of fish farmers is based on specific training programmes but very few apprentices participate in the professional master courses. Consequently, very few fish farmers are professionally trained, which challenges the industry as a whole. Some fish farmers have a professional training in agriculture.

Bavaria and Baden-Württemberg continue to offer fish farming training courses and seminars because in these areas, the training programme is seen as an important contribution to the local aquaculture industry and is provided by local branch of the Bavarian state's 'Institut für Fischerei' (OE 6/2016).

Overall, the 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 comes from family members or neighbours. However, the fish farmers cooperate closely 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. For the apprenticeship of the fish farmer ('Fischwirt'), new rules and curricula are in place since 1.8.2016. Information and training on RAS will be part of the new curriculum (Fischwirtausbildungsverordnung – FischwAusbV).

The FAO (2007) highlights that "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." Since then, the situation has changed and the number of apprentices has fallen significantly (OE 6/2016).

In most regions in Germany, very few opportunities for training and education are available; some local authorities such as local fishery administration offices (Fischereibehörden) or the Chamber of Agriculture in northern Germany (Landwirtschaftskammer) organise training events or seminars on topics required⁷.

As a result, qualified staff is lacking for the operation of RAS that require technical knowledge and training for the work in such a high-tech plants. Since 2016, the legislation for the professional education of fish farmers (Fischwirtausbildungsverordnung – FischwAusbV) changed, and knowledge for RAS operation has been introduced into the curriculum. Further training or official certificates for the management of RAS are not (yet) available. A few private academies offer their services and organise seminars or workshops.

4.3 **Market conditions for fish from aquaculture**

The regulation (EU) No 1379/2013 on the common organisation of the markets in fishery and aquaculture products⁸ 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

⁷ for example: <http://ifb-potsdam.de/Portals/0/Repository/Zanderworkshop%202016%20%2011.-12.5.16%20Ank%C3%BCndigung.pdf>

⁸ 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

following elements: (a) professional organisations, (b) marketing standards consumer information, (d) competition rules and (e) market intelligence (see section 4.2.1.2). Several measures of this regulation supported activities of carp farmers and stakeholders in the Aischgrund.

4.3.1 Market for Aischgründer Carp

4.3.1.1 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. (FG Aischgrund 6/2016)

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. (OE 6/2016)

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. (OE 6/2016)

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. (OE 6/2016)

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. (FG Aischgrund 6/2016)

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. (FG Aischgrund 6/2016)

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. (FG Aischgrund 6/2016)

4.3.1.2 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. (OE 6/2016)

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. (SR 7/2016)

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. (SR 7/2016)

The association developed and 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. (SR 7/2016)

The association 'Karpfenland Aischgrund e.V.' started in 1999. The major 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). (SR 7/2016)

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. (SR 7/2016)

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. (SR 7/2016)

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. (SR 7/2016)

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. (KT, SR 6/2016)

4.3.2 Specific features on markets for fish from RAS

A significant challenge is the demand. Consumers lack the knowledge about locally versus imported aquaculture products and the sustainability impacts. The image of fish from aquaculture has suffered from negative media reports on intensive fish farming in marine or coastal environments, the use of antibiotics and other negative impacts on the natural environment and on the product. Currently, the market for quality fish produced in RAS lacks in Germany, and producers compete with imported fish. An increase in sales of fish from intensive production requires an individual and professional marketing (Korn et al., 2014)

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
Trench	6.63	3.79
Siberian sturgeon	12.57	5.87
Zander	16.27	9.09

Source: DESTATIS, 2015b

In fact the sales channels for fish from recirculating systems are highly diverse and do not show characteristics that relate to the area of origin. 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).

Availability of market data is a problem. Information is not available on volumes of processed fish which was produced in 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).

4.3.3 Competition and strategic business partnership

4.3.3.1 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.

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.

4.3.3.2 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 favourable? (DAFA, 2014)

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

4.3.4 Certificates of sustainable fish production

Several sustainability certification for aquaculture are available such as ASC-certifications for different fish species. ASC's certification programme rewards responsible farming practices and creates change through different initiatives (www.asc-aqua.org). Another large initiatives is Friends of the Sea (FOS), established in 2006. FOS has standards for wild capture fisheries and aquaculture fish and seafood products, including fishmeal. It claims to cover 10% of the world's wild capture fisheries. FOS incorporates Greenpeace's criteria on social accountability, has requirements related to carbon footprint, and will also certify products as organic. Its certification methodology is based on official data in terms of stock assessment. The certification process involves a preliminary assessment of the candidate by the FOS advisory board (usually taking 1 week). An independent certification body will evaluate this official data. A local on-site audit and a traceability assessment will follow (www.asc-aqua.org).

The organic farming association Naturland was established in Germany in 1982 to certify organic farming. Naturland engages explicitly in aquaculture production which is different from the other organic associations in Germany. Naturland certifies organic fish production in traditional ponds (www.naturland.de), and engage in the process of potential organic RAS which do not exist yet. The Federal Ministry for Agriculture provides information on organic fish production in Germany⁹, and the OECD published a report on a round table process on eco-labelling and certification in fisheries and aquaculture¹⁰.

4.4 Key conditions, strategies and performances

4.4.1 Challenges for aquaculture identified from literature, media analysis and stakeholder interviews

The scientific board of experts concludes in 2014 that key challenges for the development of the German aquaculture industry are 1.) administrative barriers, 2.) sustainability assessments, and 3.) the economic competitiveness of many production systems (DAFA, 2014).

- The potential to produce aquaculture products for national consumption is still to be realised because products and production processes in Germany usually follow high quality

⁹www.bmel.de/DE/Landwirtschaft/Nachhaltige-Landnutzung/Oekolandbau/_Texte/EG-Oeko-VerordnungFolgerecht.html

¹⁰www.bmel.de/DE/Landwirtschaft/Nachhaltige-Landnutzung/Oekolandbau/_Texte/EG-Oeko-VerordnungFolgerecht.html; and <http://www.oecd.org/tad/fisheries/proceedingsofthehagueroundtableoneco-labellingandcertificationinthefisheriessector.htm>; <http://www.oecd.org/tad/fisheries/46769240.pdf>

standards. Nationally grown fish has the potential to promote human health, meet the highest food safety standards and come from sustainable production based on animal welfare standards.

- However, economic competitiveness is often insufficient and discourages producers and financiers to invest on a large-scale in national aquaculture production.

Key questions in the field of aquaculture have to be answered.

- 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)

4.4.2 SWOT analysis

Table 11: Overview of the SWAT analyses covering all types of German aquaculture

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</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 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>

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.	Ethical concerns for fish kept in densely stocked tanks. However, legislation for the slaughter process of fish from aquaculture is stricter than for fish caught in rivers or oceans.
Intensive mussel production contributes to the purification of coastal water. They reduce nutrient concentrates in water and hamper algae blossom.	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)
Traditional systems contribute to the conservation of local culture and traditions; rural tourism, agriculture, gastronomy fosters rural economies	Depending on local traditions, fish menus are less attractive than e.g. poultry, in particular for the younger generation (fish bones, taste, smell etc.)
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.	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.

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, to 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.

<p>High potential of information and education for specific consumer groups that have very little knowledge about fish.</p>	<p>Fish diseases can threaten the production significantly.</p>
<p>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</p>	<p>Manifold legal and administrative restrictions hamper the development of the sector. Differences between regional governance and support systems are significant.</p>
<p>Aquaculture can represent systems that are in line with the society's expectations for a more sustainable food production.</p>	<p>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)</p>

Table 12: Overview of the SWAT analyses for Recircular Aquaculture Systems (RAS)

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.
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.

*Based on LFL Fischery (2012)

4.4.3 Conditions and key challenges for carp farmers in Franconia identified from interviews and working groups

4.4.3.1 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. (FG Aischgrund 6/2016)

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). (FG Aischgrund 6/2016)

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 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. (FN 6/2016)

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 in- 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 (Lasner et al., 2016). The Thünen Institute and the agri benchmark project started to work on farm economic data and studies international competitiveness of German aquaculture (see 4.2.3.5 and www.agribenchmark.org)

4.4.3.2 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. (SR 7/2016)

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 e.V.' (Carp Land 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 (ST, FN 6/2016).

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.

4.4.3.3 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. (KT 7/2016)

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. (FG Aischgrund 6/2016)

4.4.3.4 Legal issues highlighted by Aischgrund carp farmers

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. (OE 6/2016)

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.

4.4.4 Conditions and key challenges for fish farmers with RAS in Germany identified from interviews and working groups

The central theme for RAS that drove discussions and interviews was the given stagnation of the sector's development that counteracts the foreseen expansion of capacities. The sections below present various reasons for this stagnation. Most producers and stakeholders agree on key issues and their causalities; knowledge about them is wide spread. Taking into account the different arguments and the situation of the (German) market, it is not clear if the stagnation of the industry is a curse or a blessing.

4.4.4.1 Management of the fish farm

It is a challenge to manage a demanding technology such as RAS and to be an excellent sales person at the same time. Often, a team of two to three key persons who have different competences runs the RAS. For that reason, many farms are managed as a family enterprises or a small business team with shared responsibilities. Based on different training, education and professional experiences, work and decision making is split between spouses and/or the younger generation. Such a complex enterprise with RAS technology, sales and sometimes with processing requires professional management. This includes the administration of the commercially registered enterprise ('Gewerliches Unternehmen') that encompasses compliance on various levels with the related bureaucratic requirements.

"Fish farmers have to be business people who seek to add value to their products." (FG Wietendorf 4/2017). It was clear in the focus groups that fish farmers are wary of openly discussing the extent to which they are able to add value and where their best markets are. If it comes to details of the marketing channels, there is an intention to keep this information to themselves, or within their own families. There is competition amongst fish producers in particular when selling on regional niche markets or to specialised

sales companies. “Many fish farmers lack the entrepreneurial courage to widen their horizon when it comes to marketing opportunities”, said advisor HZ (2/2017). On the other side, communication and knowledge-exchange was very open when they were e.g. talking about technologies used, constructions, water treatment or authorisation processes with local administration.

4.4.4.2 Role of technological innovations

Technological innovations have been playing a key role in the development of and the future potential of RAS. RAS is a technology-based system that has changed with various milestones of technical improvements in the past. In particular, innovations in the context of water purification are very important for authorisation processes for new plants. Sometimes technological solutions are at hand that are not yet known by local water authorities. In this case, investors have to argue carefully with water agency representative. Support from advisors or the Chamber of Agriculture is needed and highly appreciated (FG Wietzendorf 2/2017) (see Section ‘training of administrative staff’). Apart from the efficient use and treatment of in- and outgoing water, innovations in respect to the feeding regime are important and drive farm economics through daily growth rates of fish and health of fish and ponds.

No organic certification so far

For several species used in RAS, breeding technologies depend strongly on innovation in due time. In particular, the organic sector aims for new hormone-free methods because limitations in breeding methods hamper any certification of RAS fish production (FG Wietzendorf 2/2017). Currently, the organic certification is not feasible because certifying organisations claim that technological constraints misfit with organic principles. In particular, breeding technologies cannot meet organic principles due to the application of hormones. A strategic and fundamental debate is currently on-going on the national and European level highlighting pros and cons of organic certification for RAS. Some characteristics of RAS reach high environmental and animal welfare standards. Research and innovation are required for future changes in the systems.

4.4.4.3 Interpretation of EU legislation and training of administrative staff

Challenge of strict legal interpretation in Germany: EU law covers all Member States. In practice however, the rules are applied differently, according to the opinion of the participants. “Compared to other member states, the German interpretation of EU law is more stringent than the implementation in the neighbouring countries. There is a potential for a more flexible interpretation of EU rules but this is hardly used. Moreover, the interpretation at the state or district level seems to be inconsistent. This leads to site-specific conditions that differ between regions. For us, authorisation processes follow their own logic depending on the German or European area. Decision-making processes in local policy and administration is not convincing. We sometimes do not understand the logic behind the arguments and the guidelines we have to comply. Apart from environmental regulation, this issues also applies to veterinary and hygiene regulations, e.g. for slaughtering and fish processing.” (FG Wietzendorf 2/2017)

In addition, fish farmers pointed out that “staff members in administration often do not fully understand the issues being faced by fish farmers. It’s about our everyday management like water use and compliance with water regulations, but also in approval procedures for new constructions or technical changes due to innovative technologies”. (FG Wietzendorf 2/2017)

During controls or approval processes, farmers experience friendly encounters with the staff from public offices. “However, the atmosphere of controls is difficult and stressful because we feel like having done something wrong. Although, you wish to comply with the rules and have followed them to the best of your knowledge, it feels like an interrogation.” Farmers confess that they are always worried because the agents might detect something and that penalties might follow. (FG Wietzendorf 2/2017)

Instead of good cooperation on eyes-level and an attitude of joint solution finding in case of an issue, the farmers have to feeling to depend on whatever administrative agent who is in charge. This phenomenon has changed in recent years, the farmers report, because the professional knowledge around e.g. technical production systems is often not any more present in the administrative agencies at district level. Former staff with training in the industry wave retired, and younger employees have received thorough training and qualification in administration but not in farming, animal husbandry or water related sectors.

“If you want to invest in aquaculture, you need to know the rules and legislation better than the guy from the local office. Otherwise, you will never get the approval for a new construction or an innovative technology. It is up to you to find options for a more flexible interpretation of the law. They want to apply the general rules but with our plants, each is different and you have to find your niche and argue with them. Sometimes, you don’t understand their logic and just have to accept it. There are quite a few ventures out there that have not yet been realised because there was no understanding and support from the local agencies. And then, people on the higher level wonder why there is nothing happening in this sector.” (FG Wietzendorf 2/2017)

Participants agreed that a lack of support from local administration is one of the key factors slowing down the envisaged development of the sector. The Federal States of Mecklenburg-Vorpommern and Schleswig-Holstein aim to foster investment in aquaculture and delegate skilled staff for the provision of particular support for e. a. the management of approval procedures.

4.4.4.4 Discrepancies in local and national policy strategies

Stakeholders and researchers observe that political arguments and strategies vary on the different levels of responsibility (FG Wietzendorf 2/2017). “High level policy in Berlin aims to encourage aquaculture production for economic and global sustainability reasons but the regional and local level policy and administration often have no interest, or even fear, the dispute with civil society initiatives when a producer submits a building permit application.” (FG Wietzendorf 2/2017)

When taking a glance at Germany, it is important to note the diverging policies in the different Federal States. The southern states Bayern and Baden-Württemberg, established support structure for all farmers (agricultural and aquaculture), which serve well generally but lack measures specifically focussed on fish farmers’ needs. Rural development plans address landscape protection and the conservation of the natural environment provided by agriculture. “But for us, agri-environmental measures for our traditional fishpond farming are lacking. We see that policy support is much weaker than for e.g. alpine dairy farmers” (WS Bonn 6/2017).

The northern states Schleswig-Holstein and Mecklenburg-Vorpommern (where rural economies are much weaker than in the south) proclaim strong support for aquaculture enterprises to locate in rural areas Schleswig-Holstein finances the network programme KNAQ (KNAQ 3/2017. In Mecklenburg-Vorpommern, the Ministry offers a plan of potential aquaculture production sites, as well as administrative and economic support for entrepreneurs who aim to invest in intensive fish production.

The other Federal States, namely Niedersachsen and Brandenburg, do not pay particular attention to the enhancement of aquaculture, according to the practitioners (FG Wietzendorf, 2/2017). “In Hessen, there is no support. They just do not care at all.” (FG Wietzendorf, 2/2017) “As advisory of the Chamber of Agriculture, we see the problems with the new staff on the local level in Niedersachsen too. We try to help when fish farmers and investors seek help but it is not always easy.” (HZ 2/2017)

During the phase of the development of the National Aquaculture Strategy (2014) and of the DAFA Strategy for Aquaculture (2014), the establishment of a national coordinator has been proposed and discussed. The

idea was to nominate an 'Aquaculture Representative' ('Aquakulturbeauftragter') on the national level. Such a key person in this position could help to coordinate interests, bundle power and implement strategies by driving relevant processes in research, policy, and networking or just help with the coordination of pest controls. However, it was not possible to agree on the creation of such a central position. Fish farmers agreed that it "would have been good to have a national aquaculture representative" (FG Wietendorf 2/2017).

4.5 Strategies of fish farmers identified from the group events

4.5.1 Strategies of carp farmers

The following tables give an overview of most relevant strategies of the carp farmers identified during the field trip in the Aischgrund in 2016. The strategies listed feed into the SUFISA Inventory.

Strategy I – Marketing through Franconian 'fish kitchen'	
Category	Markets, contracts and institutional arrangements
Key words	Collective arrangements (e.g. cooperatives, producer organisations, partnerships, horizontal cooperation, vertical integration)
Description of the strategy	Several farmers with larger or more professional carp farms manage to add value to their harvest by either slaughtering, cooking and offering the carp in their own 'fish kitchen' or by making pre-arrangements with local gastronomes. There are numerous very close partnerships between carp producers and typical local restaurants. The regional management office aims to foster rural tourism based on the culture of carp production and carp dishes. Hotels and fish farmers may profit from new carp-related tourist initiatives that have been supported by local administration and politics and by EU funding. Current initiatives aim to develop tourism, year-round carp dishes and alternative carp products (fish fingers, filets etc.).
Indicators	2. Added value, 3. Greater profitability, 4. Improved access to markets, 5. Greater financial stability, 6. Enhanced farm / business resilience, 7. Improved information and communication, 9. Social benefits, 10. Environmental benefits
Notes	<p>The integration of the different parts of the value chain (fish production, processing, sales and consumption) works well in Franconia. It ensures added value to low-intensity carp production and ensures access to the local niche market. The close, trust-based cooperation between farmers, gastronomy and tourism brings financial stability and establishes the viability for participating fish farms. In Franconia, the integration of the value chain results in social benefits for producers, restaurant owners/chefs, guests/consumers and rural dwellers.</p> <p>Currently, local production and consumption is well balanced. Expansion of premium marketing is constricted because carp dishes have a limited acceptance outside of Franconia. In Germany (as well as in neighbouring countries), carp consumption has declined over recent decades, which is a major concern for stakeholders of the national aquaculture sector.</p>

Strategy II – Diversification - more from something else

Category	Competitiveness, viability and risk management
Key words	Diversifying income sources, both on- and off-farm
Description of the strategy	When the economic situation of fish production is difficult, farmers focus on alternative agricultural systems. For example, they may produce field vegetables such as horse radish (typically grown in Franconia) or onions. Instead of feeding the harvest to the fish, they sell a higher proportion of cereal or legume crops to processors. Farmers may also produce pork or concentrate on dairy farming while carp production is scaled back. Diversification includes direct marketing or rural tourism. In particular when young farmers are willing to engage in the family business, they develop diversification strategies and invest in other production systems, on-farm processing or alternative marketing.
Indicators	3. Greater profitability, 5. Greater financial stability
Notes	The most important issue for the viability of traditional aquaculture is the profitability of ponds. The older generation fears that young farmers will not be willing to spend a lot of time on pond maintenance while the income from fish production is low. Impacts on natural heritage landscape and water resources and pond related ecosystems will be significant when farmers spend less time on pond maintenance. Resilience: In advance, it is unknown if diversification will contribute to more or less resilience. This will depend on demand, price and market development of production and sales.

Strategy III – Lacking successors in traditional carp farming

Category	Competitiveness, viability and risk management
Key words	Extensification, downsizing or abandonment
Description of the strategy	Currently, many fish producers are already retired or they work full- or part-time in non-agricultural industries. Carp farming used to be a hobby for them and contributed more or less to the household income. However, these fish farmers realise that the younger generation has a different attitude towards pond farming. They may only spend time and resources on carp farming when it ensures profitability. Elderly carp farmers see a significant risk that the next generation will abandon ponds followed by ecosystem, biodiversity and cultural heritage losses. Therefore, succession is a critical issue.
Indicators	3. Greater profitability
Notes	Reduction of 'unpaid' ecosystem services provided by current pond farmers has negative effects on the natural environment. When farmers abandon their ponds, the negative outcome is irreversible. The numbers of fish farming trainees is low and continually declining, whereas, the average age of active carp producers is continuously rising.

Strategy IV – Conservation of pond landscape: payment for public goods

Category	Political support
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Key words	Subsidies and grants
Description of the strategy	Fish farmers and their representatives are engaged in dialogues with the responsible nature conservation and rural development agencies. Fish farmers and stakeholders aim for more support from policy makers and administrators. They argue that the conservation of the traditional carp system deserves the same support that is given to alpine farmers for delivering ecosystem services through their traditional farming methods. However, stakeholders of the fish sector have the impression that administrative rules and their implementation are often not based on a good understanding of the practitioners' situation. They see area-based payments (direct payments, less-favoured area payments, agri-environmental schemes) as an appropriate tool for the conservation of this particular landscape. Neither the Common Fisheries Policy nor the CAP includes area-based payment for pond landscapes and its unique ecosystems.
Indicators	5. Greater financial stability, 10. Environmental benefits
Notes	<p>Payments for the public good of the conservation of carp ponds and the related ecosystem leads to the maintenance of the pond ecosystems; Indicators can be e.g. payment could be calculated per hectare of water surface area or by riparian strips surrounding the pond.</p> <p>Indicators could be similar to agri-environmental schemes (indicator species, higher costs of production caused by mowing or feeding requirements, water management</p>

Strategy V – Part-time with improved marketing	
Category	Markets, contracts and institutional arrangements
Key words	Collective arrangements (e.g. cooperatives, producer organisations, partnerships, horizontal cooperation, vertical integration)
Description of the strategy	When the older generation is not able work the carp ponds, the next generation of pond owners may continue the carp system. They may apply strategies to reduce costs of production or add value to the fish. The cooperation with other carp producers may help to reduce costs of production (e. g. sharing maintenance jobs like mowing or harvesting, joint procurement). Cooperation may help to avoid losses by keeping bigger fish of the final period of production only while partner farms supply small fish on a contractual basis. Cooperation for common processing or marketing with other fish farmers, local processors, traders or fish kitchens is an option to add value to the fish sold for slaughter.
Indicators	2. Added value, 3. Greater profitability, 4. Improved access to markets, 6. Enhanced farm / business resilience, 10. Environmental benefits
Notes	Several successors implemented such strategies and were able to profit from vertical and/or horizontal cooperation. This applies in particular for the small and part-time fish farmers. The institutional arrangements are manifold depending on personal relationships, production capacities, knowledge and individual engagement. Examples show that such arrangements helped to generate income and offered opportunities

	<p>for new ventures.</p> <p>Indicators: differences between trade and import prices and the prices of alternative sales options; cost reduction by out-sourcing etc. Data on individual institutional arrangements or the underlying formal or informal contracts are not available.</p> <p>The maintenance of ponds contributes to environmental benefits (natural resource and landscape protection, contribution to biodiversity).</p>
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Strategy VI – Rural tourism - carp pond landscape ranger	
Category	Competitiveness, viability and risk management
Key words	Diversifying income sources, both on- and off-farm
Description of the strategy	When the older generation is no longer able to manage the fish ponds, the next generation of pond owners may decide to continue the carp system (if not, see record No 3). In this case, they will develop a strategy that aims to add value to the fish. Alternatively, they participate in a regional management initiative offered by the local tourist office. This initiative includes training courses for fish farmers to become a local 'ranger'. The 'ranger' guides tourists and shares stories about the cultural and natural heritage of the area. The tourist office promotes the services of the rangers and their particular tours.
Indicators	2. Added value, 5. Greater financial stability, 6. Enhanced farm / business resilience, 9. Social benefits, 10. Environmental benefits
Notes	<p>The cooperation between engaged fish farmers and the regional management initiative is very good.</p> <p>As ranger farmers are able to generate additional income based on the traditional pond culture.</p> <p>The tourist initiative encourages fish farmers to develop unique tours and experiences designed based on their carp farming heritage. Farmers and farming families have been able to stabilise their income and simultaneously increase their work satisfaction through creative personalised engagement. The maintenance of ponds contributes to environmental benefits (natural resource and landscape protection, contribution to biodiversity etc.).</p>

4.5.2 Strategies of fish farmers with RAS

Strategy I – Investment in new RAS	
Category	Competitiveness, viability and risk management
Key words	Diversifying income sources, both on- and off-farm
Description of the strategy	Agricultural farmers develop long-term strategies for their businesses. The investment in aquaculture is one option when on-farm conditions are favourable. Fish production may be combined with the use of the exhaust heat from bioenergy plants or with other farm activities such as production of crops to be used for fish feed. Marketing strategies are very important for successful fish farmers because a general market for fish produced in Germany does not exist. For that reason, the establishment of sales and business partnerships with processors and fish traders is critical. Sales have to be organised before the production of large volumes can take place.
Indicators	1. Increased productivity, 5. Greater financial stability, 6. Enhanced farm / business resilience
Notes	The development of RAS can contribute to income generation of rural families and their employees. The risk of the investment in an aquaculture plant is high. Numerous ventures have failed in the past. Since the production technology requires experience and skills, receiving professional advice and the willingness to learn is very important. The number of new plants has remained far behind expectations and projections highlighted in the National Aquaculture Strategy in 2014.

Strategy II – RAS with on-farm processing/marketing	
Category	Competitiveness, viability and risk management
Key words	Intensification, specialisation, upscaling, changing crop focus
Description of the strategy	Fish producers using RAS may not only aim to increase productivity through the implementation of innovative technology but may also attempt to find ways to add value directly to the fish product. The investment in processing and/or specific marketing strategies is a common approach. Financial support for such investments may be obtained through funding programmes such as the Rural Development Plan or by joint ventures with non-agricultural business partners.
Indicators	1. Increased productivity, 2. Added value, 3. Greater profitability, 4. Improved access to markets, 6. Enhanced farm / business resilience, 8. Strengthened negotiation power
Notes	It is very important to ensure profitability of these intensive production systems since they are linked to a high cost of production. On-farm processing helps to ensure profitability by improving the access to consumer markets. Negotiation power is strengthened by creating unique processed products for the premium fish market.

Strategy III – RAS with vertical integration

Category	Markets, contracts and institutional arrangements
Key words	Collective arrangements (e.g. cooperatives, producer organisations, partnerships, horizontal cooperation, vertical integration)
Description of the strategy	Producers may develop business partnerships with processors or vendors. It is crucial to develop personal relationships with individual buyers, such as head chefs or fish merchants who have a clear understanding of high quality fish. Due to the large number of primary producers and manifold import options, downstream chain partners have the option to purchase from a variety of suppliers. Well-established business partnerships are recognised as enabling good producer prices. Fish farms and their individual business models use variable vertical integration methods. Individual businesses may enter contracts independently. Business partners could establish an umbrella organisation that would determine fish production, processing and sales for its members. Any combination of these integration methods could be applied in order to ensure success.
Indicators	1. Increased productivity, 2. Added value, 3. Greater profitability, 4. Improved access to markets, 5. Greater financial stability, 6. Enhanced farm / business resilience, 8. Strengthened negotiation power
Notes	The productivity of fish farming and processing can increase as a result of vertical cooperation if the delivery of inputs such as fingerlings, feed or fish for slaughter is planned in advance. The cooperation along the supply chain may also ensure added value through the use of alternative marketing. Greater profitability and improved access to markets are important goals of the cooperation along the supply chain. Depending on the type of cooperation, greater financial stability may be achieved. However, fixed contracts or the integration in an umbrella cooperative may also have negative consequences. Contracts limit flexibility. At times, sales prices on the open market may exceed those determined by contractual agreements.

4.5.2.1 *Markets and farmers' sales strategies*

Access to markets and the ability to add value to the primary produce emerged from expert interviews as being of critical importance. Advisors stress that – other than in agriculture – investors in fish productions have to develop their market first and then grow with a slowly expanding production into the initiated or detected market niche (ME 2/2017). Entrepreneurial thinking and decision making is a precondition for a successful fish production (FG Wietendorf 2/2017). The main issues - the group reflected on – related to markets, sales and marketing. “For those farmers who are less experienced in marketing and sales activities cooperation is a good option. In particular, smaller businesses could probably profit more from cooperation.” (HZ 2/2017) “Regional embeddedness and a professional marketing based on the quality attribute of ‘regionality’ plays a key role for some producers; but organic or other certification is less relevant than in animal farming like poultry.” (ME 2/2017)

4.5.2.2 *Strategic reflection of producers with RAS*

The following quotes present farmers conclusions referring to key challenges, strategies, achievements and desired changes (FG Wietendorf 2/2017):

- “It has proved to be a good strategy to openly communicate and cooperate closely with the officers from administrative bodies,” and “It would be great the ‘other side’ could improve the knowledge of new staff. We need more or better training in the administration.”
- “It definitely makes sense to cooperate with other producers for an application process for new constructions because more expertise is available in a team of producers.”
- “Linking agricultural systems with aquaculture helps to establish a closed circular flow of nutrients. Both branches can profit from potential synergies,” and “The use or re use of phosphates and nitrates need improvements. Aquaponic plants are still behind expectations unfortunately.”
- “Creation of the position of an aquaculture representative on the level of the district would be great. This advisor could support the administrative bodies when technical expertise is required.”
- “The sustainability debate around RAS is an issue - there are good arguments saying that RAS is a sustainable high value method for protein production when compared to other systems. On the other hand, people emphasise that the marketing of fish from RAS in Germany should not use sustainability reasons.” So far, it is not clear if those that argue against the sustainability of RAS do so because they want to limit the competition from the high tech (and more efficient) fish production of RAS. Such arguments seem to be driven (at least partly) by policy and lobby group interests.

4.6 In-depth analysis concerning vertical integration: from RAS to fork

4.6.1 Divers institutional arrangements

Based on the results of the field trip on traditional carp farming to the Aischgrund and the focus group results on RAS, we organised the workshop on pros and cons for the vertical cooperation of producers with RAS and fish farmers with earthen ponds for the finishing of the fish. The aim of the workshop was to find out if there was an interest of traditional carp producers to cooperate with a large-scale producer of young carp. The Mecklenburg-Vorpommern Ministry of Agriculture and Fisheries supported this venture planning to deliver small carp in a closed system until the fish is beyond the size to be caught by predators. The (challenging) preparation and realisation of the workshop offered insights into stakeholders’ communication and agendas in the small industry where producers usually know each other.

The composition of the working group represented the mix of farm types in northern Germany. The management of fish farms differs mainly between family businesses that have been specialised in fish farming for a long time or fish producers who are farmers by origin and training but invested in RAS. In addition, a limited number of cooperatives, joint ventures or enterprises from other industries produce fish in aquaculture plants. Some of the non-family businesses are located in the eastern part of northern Germany because they took over former socialist cooperatives or state-owned plants. Large-scale enterprises are still run by local experts who were already active in GDR times. The owners are investors from other industries or joint ventures of different kind (no statistics available). Employed managers mix well with owner-managers and respect each other’s knowledge and competences.

Vertical integration differs between farms and business models. Fish farmers gave some examples (FG Wietzendorf 2/2017):

- 1) Two enterprises under the umbrella of one family farm: The family business has two business units, primary production and processing. The processing Ltd sells to an intermediate, to customer enterprises or to end-consumers. The two business units are connected by contracts and services.

Payment is based on market prices. Sales channels are divers aiming to reduce dependency from one or very few buyers.

- 2) Marketing cooperative with several member farms: A few number of producers/production sites sell their fish through the Marketing Union for Zander (Vermarktungsverband für deutschen Edeltzander). In addition, direct marketing to end-consumers is successful. The Union is responsible for the marketing, sales negotiations, organisation and delivery. It has four sales channels. The sales of fingerlings works well, sales to small processors that deliver to small retail businesses is another successful marketing. Difficult, however, are the delivery of large-scale processors and wholesale enterprises with own processing.
- 3) The intermediately operating company is a 'spider in the web': A successful intermediate business purchases fish from producers, partly based on fixed contracts (Lohnmäster), sells fingerlings back to farmers and slaughtered fish to processors – both on the regional level. Another segment is Zander fingerlings sold internationally.
- 4) One enterprise integrates the three tiers of the supply chain: A producer-processor-sales enterprise has three sales channels; wholesaler, farm shop and a fish trader. The latter sells to restaurants and end-consumers which are a similar clientele as the customers of the wholesaler. However, this own sales business is time consuming because many individual customers in gastronomy have to be reached. The marketing through the wholesaler is difficult too due to relatively small volumes and a limited time of supply.
- 5) Producer-processor cooperative: A cooperative collects the production of various fish farmers who deliver to two member slaughter plants. Processing takes place at a contracted business. The fish products coming either from slaughtering or from contract processing is sold to retail or wholesale businesses. Alternatively, a large-scale processor buys the fresh fish after slaughtering. Problems occur due to the costs of processing within the cooperative and the fixed prices paid to member farmers.

A novel concept such as community supported fish farming did not emerge in any interview or discussion.

4.6.2 Cooperation among farmers

Fish farmer, who use RAS, cannot cooperate on the local level because the location of fish farms is widely spread with long distances between production sites. Moreover, the farms produce different type of fish or seafood. Therefore, they are not able to cooperate for e.g. joint procurement of inputs or marketing of output. However, they cooperate by sharing knowledge and experiences in respect to the use of technology or the procurement of fingerlings for the restocking of ponds. In a few cases, farms even cooperate for joint marketing (see above Section 'vertical integration'). "Maybe, more fish producers should put more effort in the cooperation with other fish farmers. They should aim for more market power!" (Wietzendorf FG). However, it is unclear if competitiveness and cooperativeness will affect the emergence of new partnerships. Since the group of intensive fish producers is small, fish farmers know each other and have a strong network. It is obvious that many persons have known each other for a long-time. As an outsider/researcher it is not possible to fully understand the underlying strategies driving more cooperation and partnership, or, in contrast, competitiveness and individualism of the entrepreneurs. The issue of eastern and western provenience and the related experiences in different technologies, scales of operations and marketing patterns seems to play a certain role (which the given case study methodology cannot capture). However, advisors and key persons in the network encourage fish farmers to ask for support and cooperate more closely aiming to strengthen the position of German aquaculture on regional markets and on different levels of policy and administration (KNAQ conference 3/2017).

4.6.3 Cooperation with fish traders, restaurants or regional marketing initiatives

Linked with an excellent handling of the technological system of aquaculture is the establishment of a reputation for providing quality fish, including quantities and time of delivery up to the buyer's expectation. The development of personal relationships with individual buyers, such as head chefs or fish merchants who have a clear understanding of high quality fish is crucial. Due to the large number of primary producers and manifold import options, downstream chain partners can stick to or change the supplying farmer. Well-established business partnerships are recognised as enabling good prices. "It is very hard to find strong and reliable business partners for a longer period of time. The network of engaged people and enterprises is small. Everybody knows each other" (WS Bonn 6/2017).

Selling locally to restaurants or to end-consumers from the area is a market avenue that adds value for those enterprises that were able to develop a good relationship with the restaurant owner or the head chef. In some areas with a regional development programme, local fish producers contribute to events such as fish weeks or festival events. However, the production in natural ponds is more suitable for these cultural events (see 4.4.3.2) than e.g. intensive catfish production in RAS. Fish farmers with traditional fish such as trout or pikeperch (zander) production, contribute to and profit from rural tourism or regional marketing initiatives (FG Witzendorf 2/2017).

4.6.4 Changing eating habits of consumers

In many households, fish are not a very important part of the culinary culture. Mainly elderly people or religious families still stick to the custom of having fish on Friday. However, this is usually fish fingers when children are around the table or fish fillets from the supermarket. In most regions of Germany, there is not an identification for fish from a particular area. (Middle Franconia as mentioned in the carp case study above and fresh fish from the catch in Hamburg or Schleswig-Holstein harbour cities are exceptions.) "German consumers are weakly connected to the origin of their fish." (FG Wietendorf 2/2017). Discussions in the workshops echo what the literature review revealed. Domestic demand for locally or nationally produced fish has 'hopefully' – as producers say - stabilised after years of a slow but steady decline. "It is risky to neglect local sales and only develop markets outside the region, because those farmers may have a problem in ensuring the awareness of people around them; an awareness for fish production as a viable industry in their community or county." As such, there is an opportunity and a need to develop more local markets and ensure public interest and understanding for this business. (FG Wietendorf 2/2017).

4.7 Sustainability performance

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)

4.7.1 Traditional carp farming

4.7.1.1 *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 (SR 7/2016).

The Aischgrund cities and villages are close to the University City of Erlangen and the international trade place of Nuremberg 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. (OE 6/2016)

4.7.1.2 *Environmental dimension of sustainability*

In general, carp production in traditional earth ponds is seen as ecologically sustainable system. (OE 6/2016) 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. (OE 6/2016)

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. (OE 6/2016)

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. (FG Aischgrund 6/2016)

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. (FG Aischgrund 6/2016)

4.7.1.3 Contribution to the social and cultural context of the Aischgrund

Unlike other areas in Germany, there is an enjoyment of carp dishes. (KT 7/2016) 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. (SR 7/2016)

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). (OE 6/2016; KT 7/2016)

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. (KT 7/2016)

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. (KT 7/2016)

4.7.2 Intensive fish farming (RAS)

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.

4.7.2.1 Economic dimension of sustainability

Access to markets and the ability to add value to the product emerged from expert interviews as being of critical importance for the viability of the business. Advisors stress that – in contrast to agriculture – investors in fish productions have to develop their market first and then grow with a slowly expanding production into the initiated or detected market niche. Consultants and stakeholders have seen investors in fish farms coming and going during the last decades. Data on bankrupt enterprises is not available.

Information on profits or other economic data is not available. Some businesses are economically very successful, others not. The list of registered RAS in Germany shows that several of these are pilot or research plants that have not yet fully proven their economic viability.

4.7.2.2 Environmental dimension of sustainability

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).

In particular, innovations in the context of water purification are very important to avoid pollution of water bodies. Apart from the efficient use and treatment of in- and outgoing water, innovations in respect to the feeding regime are important for both the environmental and economic sustainability of the operation. Impact on the natural environment are linked with technological innovation, which have been playing a key role in the development of and the future potential (and acceptance) of RAS.

Organic certifying agencies which are known for their strong perspective on the environmental sustainability of production systems, do not accept indoor fish production as a system to be certified organic. Breeding does not comply with organic principles yet. A strategic and fundamental debate is currently on-going on the national and European level highlighting pros and cons of organic certification for RAS because some characteristics of RAS reach high environmental and animal welfare standards.

4.7.2.3 Social dimension of sustainability

The structure of representing associations is complex. Depending on the issue, responsible stakeholders cooperate or focus on specific interests. The different associations with their thematic and regional divisions are very important for the community of the fish farmers.

If it comes to details of the marketing channels, fish farmers tend to keep this information to themselves, or within their own families. There is competition amongst fish producers in particular when selling on regional niche markets or to specialised sales companies. On the other side, communication and knowledge-exchange was very open when they were e.g. talking about technologies used, constructions, water treatment or authorisation processes with local administration.

Compliance with environmental legislation such as the water law is a key element of the reduction and control of negative environmental effects from RAS. However, during controls or approval processes, farmers experience a friendly encounters with the staff from public offices but the atmosphere of controls remains stressful. Farmers confess that they are always worried because the agents might detect something and that penalties might follow.

Fish farmer, who use RAS, cannot cooperate on the local level because the location of fish farms is widely spread with long distances between production sites. Moreover, the farms produce different type of fish or seafood. Therefore, they are not be able to cooperate for e.g. joint procurement of inputs or marketing of output. However, they cooperate by sharing knowledge and experiences in respect to the use of technology or the procurement of fingerlings for the restocking of ponds. In a few cases, farms even cooperate for joint marketing.

4.7.2.4 Performance related to animal welfare issues 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).

4.8 Outlook

The outlook on the development of aquaculture in Germany highlights perspectives from different actors and stakeholders in the industry. Due to the variety of systems, related challenges and sustainability performances of fish farming in traditional earth ponds or high-tech RAS, it is not possible to present only one picture and consistent conclusions. Instead the lessons learned are based on cases that provide insights in a particular area or production niche. The following paragraphs show key issues or statements of experts that represent the findings from the case studies on carp farming in Franconia and on RAS in northern Germany.

- 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)
- Aquaculture is booming and is the fastest growing sector in the food industry. The global increase in demand for fish and seafood products and the decline in wild stocks due to overfishing caused this expansion. However, the development of intensive aquaculture in recent decades has often had a negative impact on the environment. Current research results and new technologies show that ecologically sensitive and sustainable fish production is possible. Negative environmental effects of intensive fish farming in fresh water ponds or RAS are well known. Pollution, impairments of wild populations or energy and water consumption are reasons for the bad reputation that aquaculture has in the wider public. However, new technologies and efficient management systems can minimize these effects taking into account animal health and welfare conditions as well. (Haas, 2018)
- Receiving the official approval for the construction of a RAS requires time and efforts of all involved persons, in particular of the entrepreneur. Various administrative offices (for water, environmental and veterinary issues) have the responsibility to authorise the development and operation of fish production facilities. Compliance with the complex legal framework is a major issue. This is a challenge for both applicants and responsible persons in local administration, in particular when the development is located outside from a designated industrial zone. Excellent knowledge and training for compliance and an open communication seem to be key success factors.
- When taking a glance at Germany, it is important to note the diverging policies in the different Federal States. The southern states Bayern and Baden-Württemberg established support structure for all farmers (agricultural and aquaculture), which serve well generally but lack measures specifically focussed on fish farmers' needs. Rural development plans address landscape protection

and the conservation of the natural environment provided by agriculture. However, agri-environmental measures for traditional fishpond and their positive effects on local ecosystems do not exist. The northern states Schleswig-Holstein and Mecklenburg-Vorpommern proclaim strong support for aquaculture enterprises to locate in rural areas for economic development reasons. Other Federal States such as Hessen, Niedersachsen and Brandenburg, do not invest in the enhancement of aquaculture.

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

5.1 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?

Our case study work in the Wetterau area was based on a multi-method concept. The basis was a literature review collecting statistical data, research studies, publication on oilseed rape production and marketing as well as region- or sector-based information such as brochures or homepages. We conducted semi-structured interviews with key stakeholders in the area and on the national level, organised a Focus Group with farmers and a stakeholder workshop. Additional information came from a national-level conference on future-oriented arable farming, held in November 2017. Presentations and discussion focused on similar issues as identified in our SUFISA analyses. Many experts in conventional and organic farming, representative from policy and administration, and scientist from different areas in Germany contributed to the conference (<http://www.asg-goe.de/ASG-Herbsttagung-2017.shtml>). The conference's agenda and the analyses of economic, environmental and social impacts in and for Germany and Europe reflect the relevance of questions asked by the SUFISA project. A final remark pointed out that a continuation of current practices in arable farming will (similar to intensive animal husbandry) no longer work! Changes are needed have to have to be enhanced together with the farming community. In fact, farmers, experts and stakeholders seem to have numerous approaches at hand that could help to improve the development perspectives for the economic and social situation as well as the protection of natural resources within of the food and farming sector. However, various efforts will be needed! (ASG 2017)

5.1.1 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.

5.1.2 Oilseed rape production volumes

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.

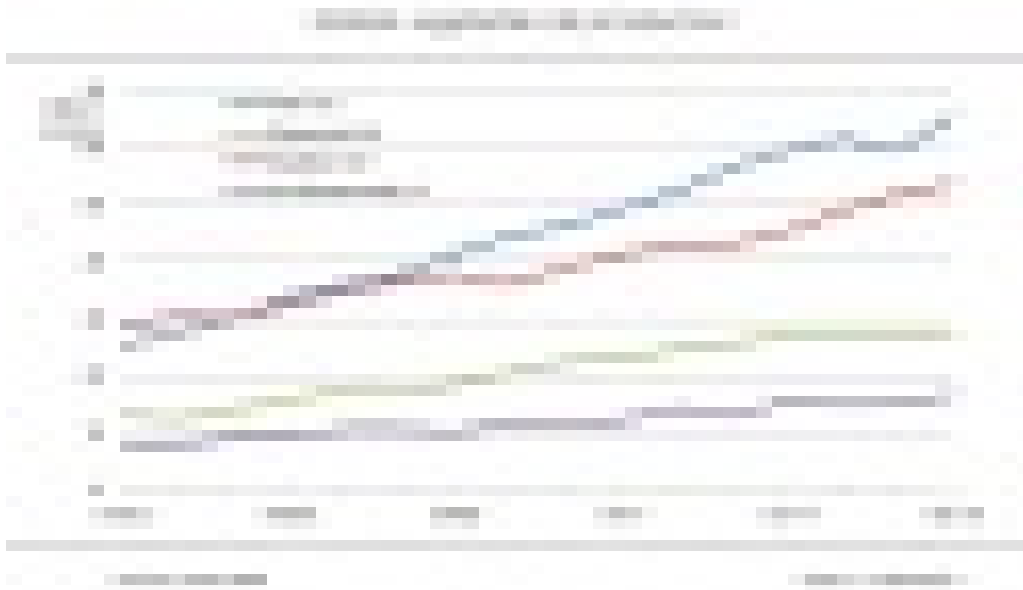


Figure 10: Global vegetable oil production

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)¹¹

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 (DBV, 2016c)

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)

5.1.3 Production system of oilseed rape – crop rotation, tillage and sowing

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)

¹¹ Statistics on annual production and processing of oilseed rape are available under <http://www.raps-aktuell.de/Rapsstatistik> and at DESTATIS (Federal Office of Statistics)

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 and sowing: The standard tillage method for winter oilseed rape consists of ploughing followed by a harrowing. However, the soil treatment and sowing methods differ with respect to the farm size and the need to conserve water. 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. All rape cultivated in Germany is GMO free. This is a particular chance.

Harvesting: 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).

5.1.3.1 Plant nutrition – nitrogen supply in spring is critical

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). 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)

5.1.3.2 Plant protection - a major challenge

The protection of plants is a key issue in oilseed rape cultivation. For that reason, very few organic farms grow rape. As in all arable crops, plant protection in canola rape is more than the application of pesticides. Both aspects are relevant, on-site protection which focuses on the field and off-site protection that takes place in the landscape. Only a very limited number of organisms harm the plant, while useful organisms and indifferent organisms populate the soil and the plant as well. When farmers fight on pest, sometimes indifferent organisms grow in population and become pest status. Plant protection measures have to aim to fight pests as selected as possible. However, non-pest organisms usually suffer from plant protection measures as well.

Weed control

As a general rule, a large variety of different field weeds is effective because none of the weed species can develop into a pest status. Since arable systems have changed and become narrower, the variety of weeds shrank as well. As a consequence, a limited number of weeds dominate modern cropping systems. The

increase of pesticide use followed this trend causing major environmental effects. In addition, herbicide resistance is seen in more and more species. (ASG Conference 11/2017)

The media analysis shows the importance of debates related to glyphosate impact on human healthy and biodiversity. Glyphosate products are used in rape cultivations. The application is before sowing in autumn to control broadleaf and grass weeds. It is also sprayed for pre-harvest crop desiccation (application of an 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) Key issue of the Glyphosate use are the high volumes used worldwide since the protection of the patent ended and the chemical products became very cheap. Apart from the prophylactic and standard use in farming and infrastructure or urban areas, environmental issues and the resistance of plants is a significant problem. The impact on human health is discussed but experts rank the negative impacts differently. (ASG conference 11/2017)

As a consequence of the public dispute about glyphosate authorisation in 2017 (the Federal Minister approved the European extension of chemical product approval), counties or communities started to question the use of Glyphosate. The abolition of the herbicide requires alternative methods of weeding. Higher costs due to more work hours needed for clearing public areas require an additional budget. (Local Farmers' Union 2/2018)

Disease and pests control

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)

“Currently, the pickling of the rapeseeds for sowing is our main problem since the ban of neonicotinoids is in place.” (Local Farmers' Union 2/2018)

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.

5.1.4 Case study area of the Wetterau

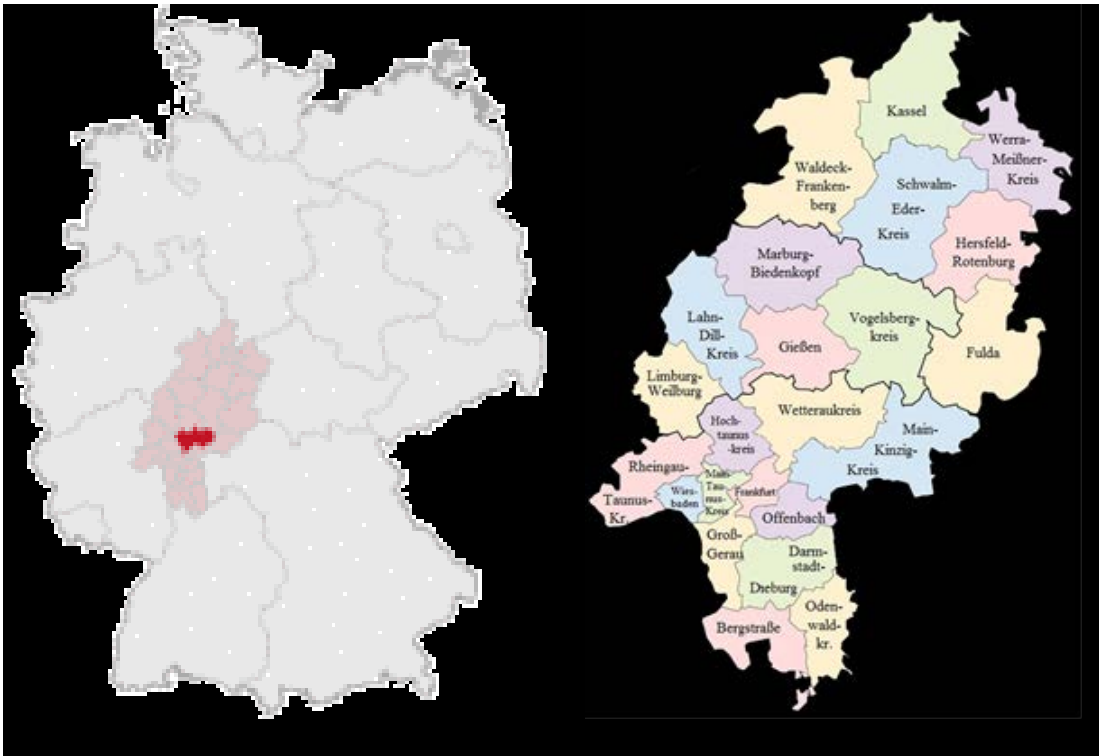


Figure 11: Location of the Wetterau district in Germany and in Hessen¹²

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)

¹² <http://de.wikipedia.org/wiki/Wetteraukreis>

Table 13: 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.)

** Communities: Altenstadt, Echzell, Glauburg, Hirzenhain, Kefenrod, Limeshain, Ober-Mörlen, Ranstadt, Rockenberg, Wölfersheim, Wöllstadt

Source: Sulz et al., 2006

Regional economics

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.¹³

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.¹⁴ Most employees work in the service area (>70%). (LK Wetterau, 2013)

¹³ <http://www.wirtschaftsfoerderung-wetterau.de/standort-zentralperspektive.html>

¹⁴ <http://www.wirtschaftsfoerderung-wetterau.de/standort-zentralperspektive.html>



Source: © www.natur-wetterau.de

Figure 12: Images of the Wetterau landscape

Land use and income structure

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. 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.

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)

5.1.4.1 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 another oil mill company, located 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)

5.1.4.2 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.

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 services¹⁵:

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

In 1994, the 'Erzeugergemeinschaft' (producer organisation, 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 a food 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.

5.2 Policy and regulatory conditions

5.2.1 CAP and its implications for the cultivation of oilseed rape

Future oriented farmers will have to take into account the changes in the society. The wish to support farmers only because they deliver food within the country is no more common sense. However, since farmers are far from earning their income from the sales of their harvest, they will have no choice but take into account higher standards of production and additional services that the society (and the tax payer) is expecting from the agri-food sector (Ehlers, 2017).

5.2.1.1 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

¹⁵ <http://www.hessenraps.de>; <https://www.wasgmbh.de>

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).

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.¹⁶

'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 2016). 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.

5.2.1.2 Common Market Regulation

Regulation (EU) No 1308/2013¹⁷ 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).

5.2.1.3 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 GAK and state's funding from Hessian budget provides finances for the different measures. The shift towards a

¹⁶ <http://www.landwirtschaftskammer.de/landwirtschaft/beratung/pdf/cross-compliance-checkliste-nrw.pdf>

¹⁷ 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

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 (EZG)
- Establishment of Operational Groups under EIP-Agri
- Advisory services, support for professional networks etc.

5.2.1.4 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' Union 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.¹⁸

5.2.2 European legal framework

Three guidelines are relevant for handling of nitrogen and phosphate in farming which are key drivers for nutrient surpluses in the environment: the Nitrates Directive, the Water Framework Directive and the Directive on national emission ceilings for certain Air pollutants (NEC directive). Germany is bound to this legal framework. These goals are binding and Germany risks sanctions. Nearly a third (28%) of the measuring points of the EU nitrate monitoring network under agricultural land had values above threshold (50mg N/l). Accordingly, one quarter of groundwater bodies hold the status 'bad condition' due to high Nitrate contents. In addition, the nitrate content shows rising trends. The EU Commission has taken Germany to the European Court of Justice. Due to this pressure, Germany has changed the national fertilizing law and introduced the Nutrient Flow Balance Law. Reduction in phosphate content of rivers in northern Germany were driven by laundry detergents that no longer contain phosphates but agriculture did

¹⁸ <http://www.biokraftstoffverband.de/index.php/die-these.html>

not contribute to this reduction although being responsible for around 50% of phosphate losses in water bodies. (Ehlers, 2017)

On the basis of the European Food Safety Authority (EFSA) report, the EU Commission, restricted the use of neonicotinoid active substances through the Implementing Regulation (EU) No 485/2013 of 24 May 2013. This regulation limited the uses of three the neonicotinoid active substances Clothianidin, Imidacloprid and Thiamethoxam in plant protection products. Following this Regulation, plant protection products with these substances may only be authorized for industrial use. Seed and soil treatments are no longer allowed for certain crops, and leaf treatments may only applied after flowering. The pesticide Cruiser Osr for seed treatment in rape was also banned. (agarheute, 2016) The prohibition of Neonicotinoid pickling of rapeseed for sowing is a major problem for farmers. Instead, farmers now spray approved pyrethroid insecticides on the soil when damages of the rape beetles appear on young leafs (Rapool-Ring, 2017).

The media analysis highlights the relevance of the public debate focussing on the farmer's right to breed and use seeds from the own farm (in 2011/2012). Crop varieties are protected under the Community Plant-Breeding Law. Based on the European law, the German law (Saatgutverkehrsgesetz - SaatG) and the implementing rules defines the registration of plant varieties, the authorisation of the use of varieties and the sales of seeds and seedlings. (BMEL, 2018)

5.2.3 National level policy and regulatory conditions for rape production

The historical and social background of farming have changes dramatically over time in Germany. This trajectory had good reasons due to the basic needs of the society: The post-war Germany had an enormous pent-up demand for sufficient quantities of safe, high-quality food. In the recent politically driven 'NaWaRo-Boom' arising from the societies' demand for clean, low-risk, renewable energy. But needs are changing: the demand for good and low-cost food continues as well the wish to use renewable energy sources. However, the post-war food shortages changed into overproduction and large volumes food waste. Biogas and biofuel from renewables sill plays a role but competition for land use and negative environmental impacts subdued the euphoria in energy cropping. Instead, environmental protection and climate change mitigation are key issues in Germany. Developments in the energy sector mainly focus on the generation of electricity from renewables. Animal welfare is a key topic that has always been present in the general public but its role has grown significantly, challenging the entire food supply chain. (Ehlers, 2017)

5.2.3.1 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 4.1.4). 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 bio-gas plants that e.g. use manure or green waste for power production that feeds into the general grid. Apart from electricity, bio-gas 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 bio-gas 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 (UBA, 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 ‘Energiekonzept 2050’ (Energy Concept 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’ bio-gas 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. New amendments have been published in EEG 2017.¹⁹

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

¹⁹ Further details are available here: [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-nouvelle-aenderungen-ueberblick>

(Treibhausgasminderungspflicht) 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). The law Biokraft-NachV says that only raw materials from sustainable cultivation are allowed. Farmers have to declare that they are farming sustainable (BLE, 2010).

5.2.3.2 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.
- It is not allowed to treat rape seed with agrochemicals (ban of pickling)
- 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/>)

5.2.3.3 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 cooperation 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 - Union for the support of oil and protein plants](#)

The German Farmers' Union (DBV) and the Federal Association for Rapeseed 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 rapeseed, and
 - Public relation activities aiming to support the marketing of end products of the local oil and protein plants.
- (UFOP, 2016)

5.3 Market conditions

5.3.1 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 south-eastern parts, which results in frequent dry-spells during the growing season. The highest input and the shortest rotations with respect to rapeseed 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 rapeseed cultures are below 100% of the annual costs because rapeseed stocks the field for less than one calendar year.

Workforce: Workload for rapeseed 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 rapeseed, 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 rapeseed production because arable farms have assets (land) and have a stable income basis provided by the direct support (single farm payment schemes). 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 5.1.4.1).

5.3.1.1 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 Bavaria²⁰ offers an online tool for the calculation of the profit contribution for rape (LFL-Agri, 2016).

Experts²¹ of the Bavarian State Office for Agriculture (LFL) published average figures for the model calculation in the online form (see Table 14). In the online system of LFL, farmers can introduce individual volumes, prices and costs and prepare their own calculation of farm economic key figures.

Table 14: 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

²⁰ Farming conditions in north-western Bavaria slightly differ from the conditions in the Wetterau.

²¹ Schätzl, R., Reisenweber, J., Schägger, M., Frank, J. (2016). Bayerische Landesanstalt für Landwirtschaft, Institut für Betriebswirtschaft und Agrarstruktur (LFL, 2016)

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, equipment, telecommunication, vehicle, farm insurances)	€/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, Hessen²²	€/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

Source: LFL (2016)

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.

5.3.1.2 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 Institute for Agriculture in Hessen published a model analysis to discuss the competitiveness of rape, sugar beet and wheat with Hessian arable farmers. Bickert (2014) presents a list of other operational

²² DBV, 2016: <http://www.bauernverband.de/praeмиenschaetzer>

and fixed costs for the farm size of 100 and 200 ha. 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.

Table 15: 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)

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 16 shows (Bickert, 2014). Moreover, farmers' annual income depends strongly on the number of hectares he cultivates.

Table 16: 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)

5.3.2 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 other 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 the food corporation for the delivery of vegetable oil for food processing. (EZG, 2016)

5.3.2.1 Structure of oil mills

The next oil mill for rape growers in the Wetterau is the oil mill in Mainz. However, the food 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)

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 and 1,000 kg of oilseeds.



Source: Ovid, 2016

Figure 13: Locations of oil mills (only members of OVID association)

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 churning, more favourable 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)

5.3.2.2 Collaborative procurement and sales

Producer Organisations

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 organisation), 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) In the Wetterau the producer organisation HERA plays a central role for the rape farms (see 5.3.4.4, 5.6.1.2).

Raiffeisen Warengenossenschaft, the agricultural cooperative

Apart from the EZG, the Raiffeisen Warengenossenschaft (RWZ) plays an important role for collective purchases of the inputs and the sales of grain and oilseeds in the Federal State of Hessen. The national umbrella cooperative RWZ is the main driving force in Germany in agricultural trade cooperatives. Regional branches are present in several areas of North Rhine-Westphalia, Hesse, Thuringia and Saxony, and fully cover Rhineland-Palatinate and the Saarland. The RWZ is also represented in France and BeNeLux countries. (RWZ, 2018) Raiffeisen has 150 member cooperatives with more than 40.000 agricultural, horticultural or wine producing members, and around 2.300 employees at 200 locations. Furthermore, RWZ outlets offer a wide range of products for construction, gardening, feed for animals etc. to private customers.

Since the 1950s, Raiffeisen buys and sells grain and oilseeds. The cooperative collects the harvest, has storing capacities and sells the farmers' harvest like a private trading company. In the Wetterau, two local branches of the regional RWZ cooperative ‚Raiffeisen Waren-Zentrale Rhein-Main e.G.‘ collect the rapeseed harvest from the farms (RWZ, 2018; see 5.3.4.4, 5.6.1.2.)

5.3.3 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.

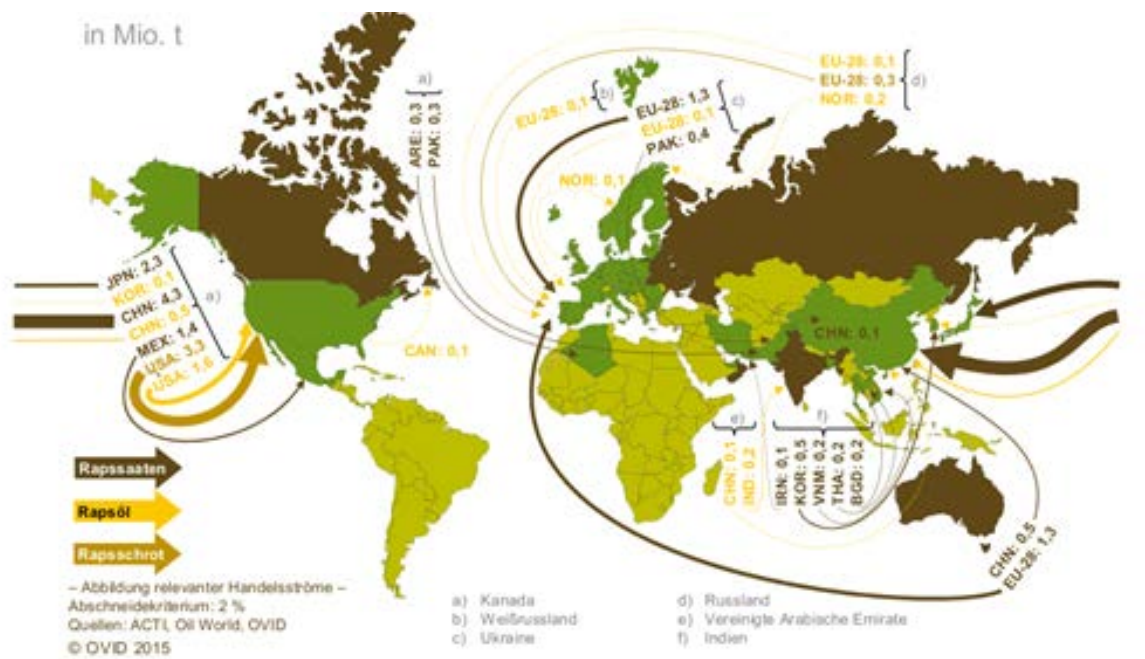


Figure 14: Global trade of rapeseed, rape oil and rape meal (2014, in million tonnes per year)

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 5.3.3) 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)

5.3.3.1 *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:

- Significant profits for supplier and operator of bio-gas 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)

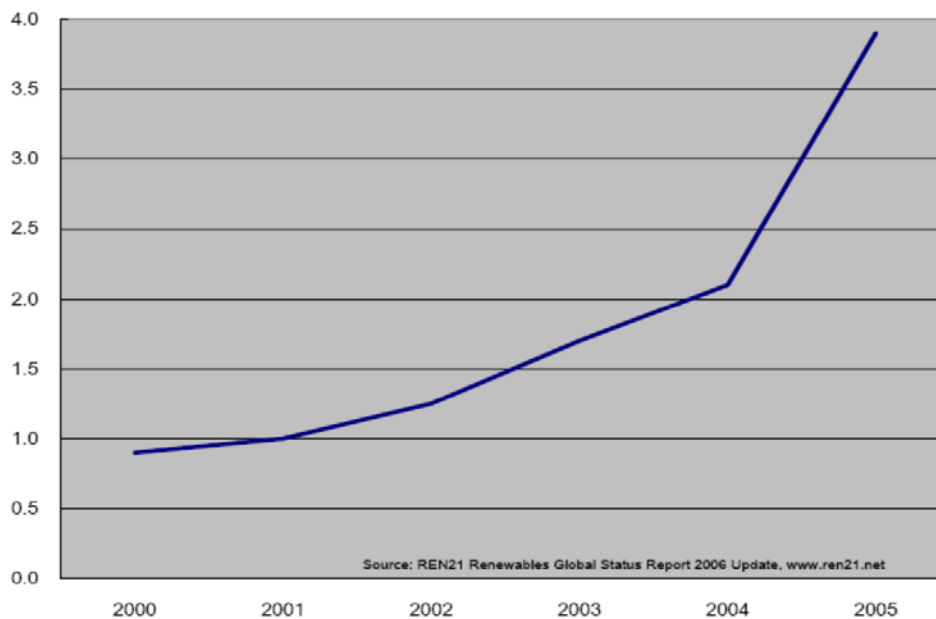
5.3.4 Prices, price building and contract arrangements

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.

5.3.4.1 International markets and stock exchange for futures

MATIF SA (Marché à Terme International de France) is a private corporation, which is both a futures

Figure 15: German bio-diesel production (2000-2005, in billion litres per year)



exchange and a clearing house in Paris. It is the leading European exchange for agricultural products including rapeseed.

Figure 16 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 as well.



Figure 16: Oilseed futures settlement (2015-2016)

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 5.3.2.1). 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)

5.3.4.2 European prices

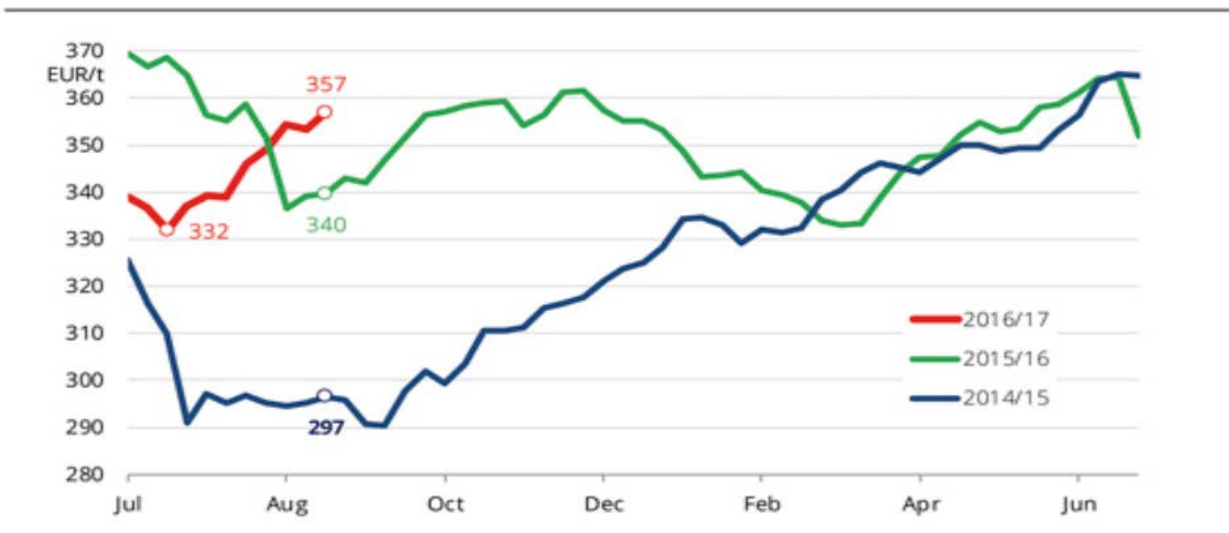
On the European cash market, prices for rapeseed oil, soybean oil and sunflower oil are closely linked. However, the supply of feedstock of the different products causes differences. In summer 2016, for example, prices for soybean oil and sunflower oil were slightly weaker due to abundant supply of feedstock. At the same time, the price curves for rapeseed oil showed a slight upward trend (Figure 17).

According to AMI, oil mills were 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 17: Wholesale prices of vegetable oil of rapeseed, sunflower, soybean and palms in 2016

Figure 18 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 18: Development of rapeseed prices (2014-2016, ex-farm prices)

5.3.4.3 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

Die Zahlen des Kalkulationsbeispiels können mit individuellen Werten überschrieben werden.
Die Gesamtauswertung der Onlineberechnung kann im Anschluss als pdf-Dokument geladen werden.

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

Alle Angaben ohne Gewähr Gesamtauswertung ▶

Source: UFOP, 2016

Figure 19: 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.

5.3.4.4 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.

The large cooperative RWZ offers a minimum price model for farmers that is based on a price insurance against falling prices (RWZ, 2018)

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 the food corporation 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)

5.3.5 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)

5.4 SWOT analysis for rape production in the Wetterau

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

The dichotomy of policies for rape producers offers changes and is a challenge: food versus bio-fuel	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)
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. 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)	Closure of the oil mill in Mainz has affected the cost structure of rape production and sales (including transport). Regional cycles of production – processing - consumption does no more exist. The disappearance of regional/local oil mills is a weakness for local producers.
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.	Nutrient emissions is a problem in intensive arable farming and rape production

Opportunities for rape production in the Wetterau	Threats for rape production in the Wetterau
Increasing demand for vegetable oil for food and renewable energy resources worldwide	Closure of oil mill in the area; disappearance of small processing plants as a general phenomenon
Increasing demand for locally produced food and	Potential change of CAP policy

feed material ('Regionality' as a quality attribute)	
Greening and cross-compliance contributes to the image of intensive arable farmers	Volatility of international market rape sales. 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/
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 (drives Omega-3-content in salmon meat up)	Genetically modified plants in the natural environment cannot be re-collected in case of spreading into the non-GMO rape cultivars.
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.	Amendment law of EEG (2016) can affect bio-gas 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 bio-gas plants. <p>The reputation of farmers' activities is bad; in particular when spraying. Social pressure on the</p>

families is increasing. Some younger farmers aim to drop farming due to the personal rejection.

5.5 Farmers' survey: oilseed rape production and sales in the Wetterau area

The target group of the survey were farmers with oilseed rape production when their farm was registered in January 2018-March 2018

Manager of the survey and draft report: Lena Röbe-Oltmanns

Interviewers: René Kleinert, Sarah Andrea Kohane, Sophia Seitz, Janina Ebert

5.5.1 Introduction to the survey

The survey aims to verify and adjust the findings from the literature review and the working groups. Apart from general conditions and challenges for the production of oilseed rape in the Wetterau area (NUTS3), the survey focuses on the role of the vertical integration of the rapeseed supply chain and related institutional arrangements.

Already in 1994, the HERA (Hessische Erzeugerorganisation für Raps w. V.), a producer organization for rapeseed was founded specialising on the marketing of locally produced oilseed rape. The Raiffeisen Cooperative and its branches have a long history in Hessen dating back in the 19th century. In 1948, Raiffeisen was re-established and played an important role for the sales of farmers' grain and oilseed harvest in all areas in Hessen. Various questions of the survey deal with the impact of collective sales (for more details on both collective sales channels, see chapter 5.3.2.2).

One key issue identified in the focus group and the interviews was the role of rented land, lease and land prices in the area. For that reason, we asked additional questions related to land and ownership of the farmland. Results show that the proportion of leased farmland in the Wetterau is very high. Farmers own only around 25 % of the cultivated land. The demand for land on lease is very high with steadily increasing prices for land (see chapter 5.1.4).

5.5.1.1 Methodological approach of the survey in the Wetterau

The producer survey of the SUFISA project aimed to present horizontal and vertical cooperation of farmers on the foundation of a representative data basis. In the following sections, we will present the approach chosen for the survey. Since the aim of the SUFISA work was to ensure representativity of the sample, we will show statistical data for the area and link it with collected interview results. This discussion is critical for the analysis because the number of completed interviews remained behind expectations.

5.5.1.2 Organisation of the survey

Originally, the aim of the survey was to perform 200 interviews with farmers who manage a farm that is located within the borders of the Wetterau district and cultivate oilseed rape.

The development of the questionnaire and the practical organization of the survey emerged from the close cooperation between the HNEE team and the team members of the local and regional Farmers' Union. Together, we discussed the options for the realization of the survey – personal interviews, telephone interviews by assistants or by a professional company.

The Farmers' Union team argued that the group of oilseed rape producers are very busy because they usually manage larger and full-time arable farms. Farm size and the level of professionalisation is expected to be above the average of farmers in the area. Experiences showed that farmers had little time available for meetings and would probably not be in favour for a personal visit of an interviewer. We contacted professional marketing companies and asked for a bid to maintain this survey. However, one company said they would not have access to contact details of oilseed rape farmers in this area. Another market-research company mentioned, that there is only a small participation rate at telephone interviews. For that reason,

this company offered they could probably manage to make an offer for 10-15 interviews. Due to these statements, the option of subcontracting the survey was discarded as well.

We decided to make telephone interviews. The questionnaire creation as well as the collection of data were run by the web-based survey-tool. Because it was difficult to attract people for the telephone survey, later we also started an online survey.

The CEO of the local Farmers' Union promised to support the survey by making contacts between the farmers and the interview team. In return, we invited the team to add questions to the survey, which were helpful for the political work of the Farmers' Union.

At the beginning of January the CEO of the local Farmers' Union send a newsletter to all members, asking the farmers to participate in the survey (see annex). Since the Board Members of the local Farmers' Union could not agree on the passing on of telephone numbers to the interviewers, we searched for the numbers (published list of 'Ortslandwirte', the 'village farmers', and yellow pages). In the Wetterau farmers of each village provide a contact partner, the overview with contact data is available in the internet. The survey team called all farmers found in the telephone book or in the internet.

At the first telephone contact, the interviewer asked the farmer if he/she grows rape. Most of the farmers called did not grow rape. If they did, it was difficult to gain the farmer's confidence, especially when farmers were not member of the Farmers' Union and had not received any information on the telephone survey.

When farmers agreed to participate, the interviewer arranged a date for the telephone interviews. The interview took place at the agreed day and time. Many calls were not successful because farmers refused a participation in the survey. Since privacy and flexibility during the day were issues, we offered an online questionnaire as well. The survey manager provided the link to the farmers. In addition, the secretary of the Farmers' Union called some growers of oilseed rape, asking them personally if they would be willing to participate in the telephone interview. Even then, most farmers refused it. We also presented the aim of the survey at the annual meeting of local arable farmers. Overall, the willingness to participate in the survey was very limited (see 'Reflections on method' as well).

Altogether, the HNEE team called over 300 farmers but only 44 interviews took place (30 by telephone, 14 online). The following sections will compare statistics of the interviewed farmers with regional statistics. The results from the data analysis focus on differences between farms with individual or collective marketing channels and the details of the contractual arrangements. Sustainability issues and perspectives on the farm's development were important elements of the survey as well. In the concluding paragraphs of this survey section, we discuss the lessons learned from the survey.

5.5.2 Agricultural statistics (2016 data)

In the Wetterau district, 905 farms cultivate a total amount of 52.508 ha land (2016). The average area per farm accounts for 58 ha. Around 20% of the farms (163) managed more than 100 ha. 56% of the farm enterprises have farm animals, and only 0.06% farms are registered for organic production. Around half of the farms are specialised in arable farming (475 arable farms). The majority of these (425 farms) are registered as individual farm entities. 49 farms have the status of private companies and only one farm is a corporation. (Statistik Hessen, 2017a)

The Wetterau district (NUTS3) is located in the administrative unit of the Nuts2 area 'Regierungsbezirk Darmstadt', covering the southern third of the Federal State of Hessen. In this larger area, around 80% of farm businesses are individual farms, and 20% are legally registered private companies. Only 21% of all farms are run part-time. (Statistik Hessen, 2017b)

The Wetterau natural area is well known for its fertile soils. Therefore, 38.926 ha or 74% are arable land, while permanent grassland covers only 13.250 ha (26%). (Statistik Hessen, 2017a)

Around one half (52% or 475) of all Wetterau farms are specialised in cropping. Around 20% (194) of the farms earn their main income from animal husbandry (production system type 'fodder' with cattle, sheep or horse farming). The remaining farm businesses specialise in horticulture (26 farms), permanent crops (40 farms), raising slaughter animals (8), or are mixed farms (161). (Statistik Hessen, 2017a)

From all farms in the Wetterau, 55% (498) grow oilseed crops on a total land area of 5.643 ha (average of 11 ha per farm). Only 30% of the farms with oilseed production are not 'specialised arable farms'. This underlines that the vast majority (70% or 347 farms) of the farmers who were worth considering for this survey are specialised cropping farms. (Statistik Hessen, 2017a)

In 2016, the national report on the grain and rapeseed harvests shows that yields remained below-average. Weather conditions were challenging due to a dry period in early autumn 2015 which hampered the early development of the crop. The mild winter and heavy rain in spring caused an increase in plant diseases resulting a reduced yields and qualities of the harvest 2016. Nationally, the area planted with oilseed rape rose up to nearly 4% compared to the precedent year but the total harvest shrank by 7%. However, losses were less devastating in southern Germany than in the northern regions where production plunged by up to a quarter. (BMEL, 2016)

5.5.3 Informative value of the survey

The survey shows relevant results, in particular from the analysis of the sales channels. The results support the findings from the interviews and focus group although the number of completed questionnaires was much lower than planned. Taking into account the low number of data sets, the informative value of the collected data is an issue. The concluding section of this chapter seeks to reflect on questions emerging and lessons learned from the SUFISA survey (see 5.5.9).

The results indicate (as expected from the working groups) that farmers have limited options to sell their harvest. Mainly three marketing channels are available which the survey clearly presents (producer organisation HERA, Raiffeisen Cooperative, various private grain traders operating in the area).

From all 498 farmers who grow rape, 44 farmers participated in the SUFISA survey. This accounts for nearly 10% (8.84%).

The average proportion of rape fields from all arable land (15%) covered by the survey matches well with data published in agricultural statistics (14.5%). However, the size of 124ha/farm (average of surveyed farms) was much bigger in the survey than in arable farming in local statistics (58 ha/farm) (Statistik Hessen, 2017a). This indicates that it was more difficult to reach the smaller farmers with the survey. We assume that the Farmers' Union was able to convince more of the farmers managing a larger farm that the survey would be an asset for the lobby work through the SUFISA project and the Farmers' Union.

The reduced number of data sets does not allow for general statements about the operational structure within the area. The restriction of the survey to farms growing rape narrowed down the number of potential participants in the area.

Of the 44 farms surveyed, 76% are full-time farmers, and 24% manage their farm part-time. Taking into aspect the criteria of income sources, the survey fits well with local statistics (see 5.5.2).

As rapeseed cultivation in organic agriculture is very challenging due to the need to control pressure from insects, none of the interviewed farms produced organically.

In most cases, the owner and manager of the farm completed the survey (91%), the remaining 9% were farm tenants. Half of the interviewed persons was between 51 and 65 years old.

Around 70% of interviewees indicated to manage a farm registered in the farm type category 'specialized cropping' ('Spezialisierter Ackerbau') and 28% were mixed-farms without specialisation ('Nicht-Spezialisierter Verbundbetrieb'). One farmer had a farm specialized in dairy ('Spezialisierter Futterbaubetrieb mit Milchkühen').

Around half of the interviewed farmers (23) grow sugar beet as well. The interviewers asked questions about sustainability issues and farmers' strategies for sugar beet cultivation. Since only one farmer owns machinery for the harvesting and transportation of sugar beet, the services of the machinery ring MR Wetterau e. V. is of key importance for the growers (www.mr-wetterau.de). The Wetterau machinery ring is 'mother organisation' of HERA producer organisation (although HERA is financially independent!). In addition to the machinery ring, sugar beet farmers cooperate in transport associations in long-distance shipping to the processing facilities (around 150km).

5.5.4 Sales channels: individual versus collective marketing

In average, the total production of rapeseeds amounted for 76t per farm in 2016. Farmers harvested 3.2-3.4t/ha in the 2016 harvest due to unfavourable weather conditions (see 5.5.2). The average farm size of the interviewees was 124ha. Thereof, around 18ha were planted with oilseed rape which represents a crop rotation with a share of around 15% rape. This matches well with data from official statistics for the Wetterau district (14.5% rape from total arable land; see 5.2.2). None of the interviewed farmers sells oil. From the interviews we know that only a couple of farmers process their own oil in farm shops (DE 5/2017).

At the time of the survey, nearly all farmers (43) had sold 100% of production while only one farmer has storage capacities and still stored 75% of the harvest.

More than half of the interviewed farmers sold their rapeseed harvest collective (59%), one third chose individual sales channels (36%), and only two farmers used both ways for their sales (Table 17). The most important collective sales channel was the producer organisations. More than 80% of the farmers used this channel. Nearly a quarter (23%) said they had sold the rapeseed to a cooperative. Since farmer sometime use several sales channels, it is possible to list several options. Farms with individual sales sold the total harvest to a trading company. (Table 17)

Table 17: Overview of sales channels

	Number of farmers	thereof rapeseed sold to a cooperative	Thereof rapeseed sold to a PO	Thereof rapeseed sold to traders
100% collective sale	26 (59%)	6 (23%)	21 (81%)	0
100% individual sale	16 (36%)	0	0	16
Farms using both ways	2 (5%)	0	2	1
Total	44 (100%)	6 (14%)	23 (52%)	17 (39%)

Source: SUFISA, survey conducted January 2018 – March 2018

Nearly half (48%) of the interviewed farmers were members in the cooperative (RWZ) but only six farmers indicated that the cooperative is their sales partner for rapeseed. The most frequently mentioned advantage of the membership in the cooperative is the benefits from purchasing inputs (mentioned by 38% of all interviewed members). (Table 18)

More than half of the interviewees are members of the producer organization (PO) (64%). Most of them sell the produced rapeseed to the PO (89%). For the PO, farmers said that also quality controls were a service provided by the PO (22%). (Table 18)

Most interviewees were members in the farmers' association (82%). Main advantages listed were 'lobbying' and 'legal advice' (50% and 44%) (Table 18).

In terms of sales, farmers did not mention any additional services (Table 18).

Table 18: Sales channels and memberships

	Number of farmers	Thereof, farms with 100% collective sales	Thereof, farms with 100% individual sales
Members of the cooperative	21 of 44 (48%)	13 of 26 (50%)	6 of 16 (38%)
Members of the PO	28 of 44 (64%)	22 of 26 (85%)	4 of 16 (25%)
Members of the Farmers' Union	36 of 44 (82%)	24 of 26 (92%)	11 of 16 (69%)

Source: SUFISA, survey conducted January 2018 – March 2018

Some farmers are members in both the cooperative and the PO because the two organisations offer distinct services. For that reason, memberships follow different purposes. The membership in the Raiffeisen cooperative has been a benefit for a long time and for all supplies for the farm. Instead, the PO HEAR is specialised in oilseed rape and the relate advice, inputs (seeds) and the marketing activities. The membership in the Farmers' Union is independent from the sales channels. However, the proportion of farmers with Farmers' Union membership is much higher (92%) than with farmers who are selling individually. This might indicate that farmers with an attitude toward joint marketing might have a positive attitude towards network activities as well.

5.5.5 Characteristics of the sale agreements

Most of the interviewed farmers signed a legal contract or made an oral agreement before or during the production phase (76%). Only 5% of farmers negotiated their sales during or after harvest. The collective organization defines the conditions for 19% of the sales agreements.

Less than half of the sales agreement (43%) covered a period of 3 to 6 months, and a third (33%) projected a time frame of 7 months to 1 year. For 19% of the interviewees, the sales agreement was only valid for this particular sale, at collective sale only at 8% in contrast to 38% at individual sale. This indicates that farmers who choose the collective marketing channel tend to continue over the years while farmers with individual marketing are more flexible.

Less than half of the sales agreements (43%) require exclusivity, and the farmers have to sell 100% of their rapeseeds to this particular buyer. In case of the collective marketing, 35% of the contracts prescribe exclusivity. Individual business partners are even stricter. Most farmers (63 %) said that the purchasing company requires the status of being the only buyer. More than one third of the farmers (38%) said that safeguards were in place if the buyer fails to fulfil the agreement. Collective sales are even more secure with safeguards mentioned by 46% of the interviewees, but only 25% in the case of individual sales.

The majority of collective marketing agreements ensures price premiums when farmers deliver higher qualities (58% of the sales agreements), which offer individual sales agreements in 69% of the contracts. In total, 61% of the contracts offer premiums (see 5.3.4.3).

More than half of the interviewees (55%) indicated to profit from services like collection, storage, transport or handling of rapeseeds. There is no difference between collective and individual marketing channels.

Other contractual terms such as penalties, interests in case of delayed payments, managerial support, technical or credit assistance, special assets or automatic contract renewal did not appear.

Interviewees indicated average sales prices of 366€ per tonne of rapeseed. Prices were slightly higher (370€) with collective sales than with individual sales (361€). However, the number of data sets can be too small for an in-depth interpretation of different sales prices.

Three quarter of the farmers stated that the price was linked to the published market prices at the time of delivery. Only 14% of farmers said the price depends on the delivered quality, and 11% of the farmers had fixed prices. However, farmers using collective sales channels tend to have more security regarding the duration of the sales agreement.

Several questions focused on hidden costs or services that relate to the time of financial transaction or particular costs that are covered such as transport or storage. Sales contracts are different to compare by price levels because such additional costs or services can make a difference.

In the Wetterau, most interviewed farmers receive their payment at the time or after the delivery of the rapeseed (65%). Only 15% of interviewees are payed at the time of delivery, while the rest of farmers receive their money in the end of year. This late payment is relevant to half of farms with collective sale and only for 6% of farms with individual sales. The final settlement of the pool price of the PO requires more the longer period than the direct payment (see 5.3.4.4)

One third (34%) of the sales agreements include expenses for the collection, storage, transport and handling of the seeds; slightly less (30%) include the costs of quality testing. Promotional and marketing costs as well as commissions are included in 11% of the agreements.

A proportion of 15% of the farmers with collective sale say that the payment includes the membership fee of the organisation.

One fifth of the farms with collective marketing have to deliver up to relatively high standards of the product qualities; one sixth said they have to meet particular standards for the protection of natural resources and nature conservation. Instead, farms selling individually mentioned only standards for the mitigation and adaptation to climate change (19%).

As expected, all interview partners agreed to status of GMO-free oilseed rape production. In Germany, genetically modified rape plants or seeds have not yet identified which is an asset for the sector as a whole. The survey shows that all farmers are aware of the GMO-free status of their crop.

Farmers mirror a consistent positive picture when asked about the satisfaction with their sales agreement, presented in Table 19. However, they give different answers concerning potential price negotiations; 41% of interviewees (strongly) disagree with the statement that their sales agreement offers the opportunity to negotiate sales prices; 27% of farmers are neutral. In contrast, 29% of farmers (strongly) agree which means they have the opportunity to negotiate sales prices with the buyer. The statement 'I have no alternative option to sell my products' nearly half of the farmers strongly reject. Instead, most farmers think they have the opportunity to choose the sales channel with the highest price and most price stability. Moreover, they decline the statements there are 'delays in the payments', too 'high costs' and too 'restrictive quality standards'. These answers indicate that most farmers are more or less happy with the current situation. (Table 19)

Table 19: Satisfaction with aspects of the sale agreement

	Strongly disagree	disagree	neutral	agree	Strongly agree	Do not know
Sales satisfaction	3 (7%)	3 (7%)	7 (16%)	17 (39%)	14 (32%)	0 (0%)
No alternative	21 (48%)	4 (9%)	5 (11%)	6 (14%)	8 (18%)	0 (0%)
Higher prices	2 (5%)	1 (2%)	12 (27%)	16 (36%)	12 (27%)	1 (2%)
Stable prices	3 (7%)	3 (7%)	8 (18%)	17 (39%)	11 (25%)	2 (5%)
More negotiation	10 (23%)	8 (18%)	12 (27%)	5 (11%)	8 (18%)	1 (2%)
Payment delays	36 (82%)	3 (7%)	1 (2%)	0 (0%)	2 (5%)	2 (5%)
High costs	29 (65%)	4 (9%)	4 (9%)	4 (9%)	1 (2%)	2 (5%)
Restrictive standards	22 (50%)	9 (20%)	9 (20%)	1 (2%)	2 (5%)	1 (2%)

Source: SUFISA, survey conducted January 2018 – March 2018

When asked for the general situation of the marketing of their harvest, 39% of farmers are somewhat satisfied, and 32% are even completely satisfied. This is a very interesting result of the survey.

5.5.6 Farmers perspective on sustainability issues

The survey contained questions focussing on the self-assessment of environmental effects of the cropping system. The interviewees were asked to reflect on the requirements related to their sales or even vertical integration. Most interviewees confirmed their current sales channel allows for a sustainable management of the farm.

The farmers mostly approved the other statements as well: “The sales channel allows us to maintain biodiversity and soil organic matter”, “...a good connection with buyers”, “...to connect with other farmers”, “...to maintain profitability (even in periods with low prices)” and “...to cope with changing market conditions”.

Most farmers chose the box ‘neutral’ when asked for “the possibility to maintain water quality, to achieve societal recognition of the farming activities and to invest in the farm business.” (Table 20)

Table 20: Impact of the sale agreement to sustainability

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Do not know
Maintain biodiversity	4 (9%)	5 (11%)	8 (18%)	9 (20%)	14 (32%)	4 (9%)
Maintain water quality	5 (11%)	3 (7%)	14 (32%)	6 (14%)	10 (23%)	6 (14%)
Maintain organic matter	2 (5%)	4 (9%)	6 (14%)	12 (27%)	16 (36%)	4 (9%)
Create good connection with buyers and input providers	4 (9%)	6 (14%)	10 (23%)	9 (20%)	12 (27%)	3 (7%)
Connect with other farmers	4 (9%)	8 (18%)	10 (23%)	6 (14%)	13 (30%)	3 (7%)
Achieve societal recognition of farm activities	4 (9%)	3 (7%)	14 (32%)	8 (18%)	10 (23%)	5 (11%)
Secure successor	8 (18%)	5 (11%)	10 (23%)	7 (16%)	9 (20%)	5 (11%)
Maintain profitability	1 (2%)	3 (7%)	5 (11%)	16 (36%)	15 (34%)	4 (9%)
Invest in the farm business	2 (5%)	4 (9%)	13 (30%)	9 (20%)	9 (20%)	7 (16%)
Periods with low prices	3 (7%)	6 (14%)	9 (20%)	8 (18%)	13 (30%)	5 (11%)
Improve the ability to cope with changing market conditions	2 (5%)	2 (5%)	12 (27%)	8 (18%)	13 (30%)	7 (16%)

Source: SUFISA, survey conducted January 2018 – March 2018

The statement ‘this sales channel secures farm succession’ shows different positions; 18% of the interviewees strongly disagree, 11% disagree, 23% were neutral, 16% agreed and 20% strongly agreed (12% made no comments) (Table 20).

Asked about the impending ban on neonicotinoids, two thirds of the farmers (68%) said that the ban results in the use of higher volumes of another pesticide. More than half of the farmers (57%) indicated that the economic impact would be unpredictable. Asking for the potential ban of glyphosate, farmers also expect that higher volumes of other chemical products will be applied (43%) but they think the income of farmers will remain stable.

Farmers recon the impact of sugar beet cultivation is similar to rape cultivation: For neonicotinoids, 83% interviewees said that a ban would lead to an increasing use of other chemical products. The majority (61%) stated an unpredictable influence on the economic situation. For glyphosate products, nearly half of the farmers (48%) confirmed that the use of other pesticides would (due to the ban) increase, and more than a third of the farmers (35%) assumed the impact on the economic situation to be unpredictable.

The questionnaire contained boxes for comments related to environmental sustainability effects. To summarise, farmers assume negative environmental effects in the wake of the ban of pesticides such as the neonicotinoids or glyphosate. They note that negative effects will be caused by a) more frequent travelling on the soil (sometimes even on different tracks), and b) faster humus degradation due to mechanical weed control and the use of insecticides, which - in contrast to seed dressing – will be spread widely on the total surface of the field (instead of the ‘on the spot’ application with the dressed seed).²³ Overall, the farmers ranked the consequences of the ban of all types of neonicotinoids more negative than the ban of glyphosate (for both rape and sugar beet cultivation).

In the field of agri-environmental measures, 24 farms (55%) stated to take part in such programmes. The most used measure is winter greening, 41% of all participate.

5.5.7 Strategies and drivers in crop farming

Another focus of the survey was the long-term developments of farms aiming to learn more about perspectives and the viability (and resilience) in the Wetterau area.

Nearly 60% of farmers confirmed that a severe drop in market prices had an important impact on decisions related to rape production. A proportion of 41% of the interviewed farmers said that adverse climate conditions or pests already affect farm strategies strongly. Farming regulation are strong drivers as well, nearly half of the interviewees recon. (Table 21)

Fluctuations of input prices and changes in CAP are expected to influence the strategies considerably, several interviewees (20%) said. (Table 21)

Access to loans for capital investments and access to farm credits, consumable inputs or materials were classified as ‘not important’ (43% and 39%). (Table 21)

We asked the farmers if they aim to continue or change the strategy for rape production. Most farmers confessed they will maintain the current situation, strategic adjustments are not planned in the next 5 years (83%). 5% of farmers plan to expand the existing production while 9% want to downscale. Only one farmer plans to abandon farming.

Table 21: Factors affecting the farm strategy

Influencing factors	Not at all	Partly	Somewhat	Considerably	Strongly
Adverse climatic conditions or pests	3 (7%)	5 (11%)	11 (25)	6 (14%)	18 (41%)
Annual fluctuation of input prices	3 (7%)	3 (7%)	14 (32%)	10 (23%)	13 (30%)

²³ The same argument appeared in the focus group (5/2017) and in the expert interview (ASG-Conference 11/2017)

Severe drop in market prices	3 (7%)	2 (5%)	7 (16%)	5 (11%)	26 (59%)
Changes in consumer behaviour and preferences	1 (2%)	2 (5%)	14 (32%)	11 (25%)	14 (32%)
Access to loans for capital investments	19 (43%)	9 (20%)	8 (18%)	1 (2%)	3 (7%)
Access to credit for farm inputs/material	17 (39%)	12 (27%)	9 (20%)	3 (7%)	1 (2%)
Change of farming regulations	2 (5%)	3 (7%)	5 (11%)	11 (25%)	21 (48%)
Changes in the CAP	4 (9%)	2 (5%)	12 (27%)	9 (20%)	14 (32%)

Source: SUFISA, survey conducted January 2018 – March 2018

Nearly nobody plans production related changes. This is very interesting. 20% of the interviewed farmers said they plan to invest in production facilities. 16% want to externalize particular aspects of rapeseed production and only 9% plan focus on the farm's specialisation. 27% of farmers are interested in insurances against crop losses. (Table 22)

Table 22: Planned production related changes

Production related changes	Yes	No	Do not know
I plan to invest more in production facilities	9 (20%)	32 (73%)	3 (7%)
I plan to externalize particular aspects of my operations	7 (16%)	33 (75%)	4 (9%)
I plan to specialize my production	4 (9%)	37 (84%)	3 (7%)
I plan to insure against crop/livestock losses	12 (27%)	29 (66%)	3 (7%)
I do not have specific plans	12 (27%)	25 (57%)	7 (16%)

Source: SUFISA, survey conducted January 2018 – March 2018

The share of interviewed farmers who plan market related changes was higher. 25% of the farmers aim to diversify and grow different crops and develop new partnerships. Insurances against volatile prices and expenses that help to avoid income losses are relevant for 41% of the interviewees. 14% of the farmers plan to develop new sale channels for the rapeseed harvest, and 16% want to add value to the crop. (Table 23)

Nearly half of the interviewed farmers with sugar beet cultivation said that current prices for sugar beet are 'very low' (10 out of 23 farmers), and more than a third ranked prices as 'low' (8 out of 23 farmers). Only four of the farmers aim to plant more sugar beet on their fields (18%). Due to 'negative price trends' (36%) and 'restriction from crop rotation' (27%), most farmers will not expand their sugar beet production.

Table 23: Planned market related changes

Market related changes	Yes	No	Do not know
I plan to insure against volatile prices and costs to avoid loss of income	11 (25%)	29 (66%)	4 (9%)
I plan to insure against volatile prices and costs to avoid loss of income	18 (41%)	22 (50%)	4 (9%)

I plan to develop new partnerships	11 (25%)	29 (66%)	4 (9%)
I plan to develop new sale channels	6 (14%)	34 (77%)	4 (9%)
I plan to add value to the rapeseed	7 (16%)	33 (75%)	4 (9%)
I do not have specific plans	9 (20%)	27 (61%)	8 (18%)

Source: SUFISA, survey conducted January 2018 – March 2018

Overall, the survey draws a picture of farmers who aim to stick to their pattern of production mainly.

5.5.8 Land use and land prices in the Wetterau area

The average agricultural area is 124 ha/farm. When farming is the main activity, the average size of the farm is 140ha/farm. For part-time farmers, it is 80ha. The average farm has 86 ha of rented land or 69%. 57% of the farmers rent land from retired farmers, or from their heirs (30%). 9% of the interviewees cultivate leased land that is owned publicly (federal/communal land) or by the protestant church (both 9%).

The average lease area per farm is 91 ha from other active farmers, 55 ha from former farmers and 43 ha from heirs of former farmers.

The most expensive leased areas are from former farmers (383€/ha and year) and from other private persons (360€/ha). Farmers pay less for land owned by the Catholic Church (200€/ha and year) and from other active farmers (205€/ha).

Even though the topic of rental agreements is confidential and many farmers had concerns, many interviewees answered the questions related to leases (70%).

5.5.9 Reflections on the methodological approach

In the concluding paragraphs of this survey section, we discuss the lessons learned from the survey.

We changed the structure of the questionnaire from the SUFISA template due to the pre-test. The new structure followed a logic and was clear for the interviewees. Easy questions at the beginning made a soft start for the farmers to get into the survey. That was positive.

Working with the web-based survey tool made the designing of the questionnaire easy. Furthermore the transmission of the data from completed surveys worked well.

It was a very challenging task to convince farmers to take part in the survey. With 30 minutes (or sometimes more), the time needed to fill in the questionnaire was perceived as too long.

Many farmers confessed they would not an encouraging perspective in rape cultivation, and they are very busy with their daily work. Many contacted farmers were not interested in spending time for this topic. Difficult was as well that those farmers who were not farmers' union members, were not prepared when we called. Farmers who had never heard of the survey were suspicious because many commercial telephone calls come in suggesting surveys for any sales reasons. Farmers were hesitating, especially regarding the data about land prices, which is a very sensitive topic.

Even if the farmers were interested in the survey, it was often not easy to set a date for the call. In particular farms with both dairy and cropping had no time slots available. Since the application of manure started in the beginning of February, many farmers were busy with this work at this time of the survey.

For future big surveys asking for sensitive data we recommend to maybe replace telephone interviews by personal encounters. However, farmers have little time available for that reason, they might even less available. This is an issue that needs very good reflection with stakeholders and actors from the case study area.

In any case, it is important to inform all called farmers about an upcoming survey aiming to explain the aims in advance. This presentation has to have a format that farmers recognise any personal advantages for themselves. Overall, farmers who read the Farmers' Union's newsletter and information about the survey, were more willing to participate at the survey than those who had no insights. A presentations of the upcoming survey at farmers' meetings before the event, would be very helpful, farmers said during a meeting (farmers' meeting 2/2018).

Even though, the agreement with a partner like the Farmers' Union was set months before, still several details were not defined. This is a problem that is very difficult to address in advance when the cooperation is not yet well-established.

In our cooperation on the case study level, we had decided for the liaison with the farmers' union in the context of the SUFISA case study. This process was a recommendation of one of the local stakeholders we contacted in advance. Maybe also a cooperation with the Regional Department of Agriculture would have been an option. However, the agricultural administration in the Hessen areas are reserved when it comes to the cooperation with external projects due to work load and time restriction.

From the survey process, we learned as well that telephone numbers collected from the phone book were not useful. Many of these farmers were retired or even deceased.

The length of the survey was another important issue that hampered participation. When it took too much time, farmers were annoyed and wanted to finish the questionnaire. To show gratitude for the time invested, a small payment or a prize would be an option to test next time.

Moreover, the design of the questionnaire should be improved for a next telephone interview e.g. working with different colours for parts to read out and information for the interviewer. Such colours were an element in the original questionnaire but the online-tool did not show such elements.

5.6 Key conditions, strategies and sustainability performances

5.6.1 Challenges and chances identified from interviews, working groups and a national conference on future oriented arable farming

5.6.1.1 Challenges

Reduced international competitiveness: Costs for land use (lease payment for rented land, purchase price for land, see above) are high in comparison to other countries, in particular to Eastern European countries or overseas (MM 4/2017). Farmers emphasised the impact of high costs for land use on the competitiveness of arable farming in the 'Wetterau'. "The heritage system with a traditional division of farmland among siblings ('Realteilung') and the short distance to the Rhine-Main metropolitan drive the market for agricultural land." "Prices have been rising significantly during the last decades, which is a problem for us. " (FG Wetterau 4/2017) Farmers are concerned. They experienced the problem was not taken seriously in public discussions and political decision-making.

High proportion of rented land: Most farmers only own a smaller part of the agricultural land cultivated which is seen as a challenge because farmers dependent on and suffer from increasing prices for rented land. To improve transport and other structural issues, voluntary parcel exchange was a common measure employed as far back as the 1970s to enhance the use of bigger machines and reduce costs. Even now, agricultural administration considers the voluntary exchange of parcels or fields as a convenient opportunity to improve efficiency. However, it includes practical problems such as taxation. Furthermore, the land managing body in Hessen (HLG) uses a system based on so-called Eco-points (HLG, 2017). The idea is to hold a pool of public land for e.g. compensation processes. However, farmers claim that this public eco-point system also contributes to the rise of demand for land and of land prices.

Other costs rise too: "We have to spend more and more time on bureaucracy. These working hours are missing somewhere else. And input prices rise constantly." (FG Wetterau 4/2017)

Relatively low producer prices: Another major concern are constant or decreasing world market prices for oilseed rape. Participants saw competition with other oilseeds, such as palm oil, as a major challenge for the economic situation of oilseed rape production. Farmers pointed out German food processors are free to purchase vegetable oil worldwide without any sustainability requirements for the imported produce but national production has to comply with sustainability standards set by European and national legislation. This is seen as a significant disadvantage of commodity crop production in the EU, and in Germany in particular "because legislation is applied and controlled more thoroughly than in other countries" (FG Wetterau 4/2017).

Cost reduction has reached the bottom: In the past, a widespread strategy in the farming sector was the increase of efficiency in production systems. Farmers optimised cultivation techniques. With a reduction of expenses per unit harvested, farmers were able to maintain or even increase margins. Over time, arable systems changed aiming to ensure improved productivity and efficiency. "There is no more room for manoeuvre. Cost reduction has reached the limit." (FG Wetterau 4/2017). In other words, sustainable intensification of plant production requires fundamental changes through innovation because the marginal benefit of an increasing resource use has been declining (Wegener et al. 2017).

The only options for new strategies farmers can imagine is either the realisation of added value to their products or any kind of financial compensation for the provision of public goods. "We have high standards of sustainability and we want to maintain these standards required by good farming practice and the specific legislation. We have so many eyes that observe us when we drive through the village with the

sprayer. We want to comply and we could even contribute more to our natural environment. But who pays for it?" (FG Wetterau 4/2017)

Biodiversity issue: Farmers experienced profit margins sink. This trend continued to challenge the income and farmers decided to only grow the most economical products. Consequently, the number of different species cultivated decreased to only three to four crops. With the reduction of crop rotation and intensification of the few species or even cultivars, the biodiversity of wild flora and fauna shrank as well. However, farmers are aware that they will have to increase crop variety in their rotation plan. With more crops cultivated that show small profit margins, the economic risk can increase. Rape cultivation enriches the cropping system but is risky due to the high-costs of inputs. (FG Wetterau 4/2017)

Organic rape cultivation: Even in organic crop farming, crop rotation systems need further development. The proportion of oilseeds in organic rotations is too low in German systems. Demand for vegetable oil from organic production in Germany is higher than the offer. Organic cropping is mainly based on cereals while oilseeds are underrepresented. This is a challenge for the organic farming sector. Smart organic crop rotation as well as a transition in weed and biodiversity management has to take place. (Schmidtke, 11/2017 ASG-Conference)

Lacking compensation for environmental services: The participation in the private sustainability programme offered by the processor corporation fitted well with farmers' strategic thinking. The agri-environmental programme, initiated and payed by the corporation, ended after a three years contract because the responsible oil mill in the city of Mainz closed down and the processor corporation shifted the procurement area to northern Germany. "We liked this agri-environmental schemes embedded in this contract very much. Even now, we maintain the measures as far as we can – bee protection and nitrate measures and so on. But we cannot continue with that if we do not get a certain financial compensation" (FG Wetterau 4/2017).

There is no oil mill in the wider region. Farmers see the long distance to the oil mills in the cities of Neuss or Mannheim or even further as an important obstacle for any direct marketing opportunities. Only a few farmers were able to sign contracts directly with an oil mill or have small oil processing plants themselves for direct marketing purposes.

Storage capacities for rapeseeds are lacking. "Temporary storage is often needed before processing because mills sometimes get blocked during the season. Oilseeds require specific storage facilities that farmers cannot provide. Sometimes that's a real problem." (FG Wetterau 4/2017)

It is difficult to add value to rape oil: "It is very difficult to place a high-quality oil from a smaller mill or a producer cooperative on the market. There is an oil in Lower-Saxony that sells regional oil ('Kurhessisches Rapsöl') but, as far as I know, they do not earn money with it. This only works for very small volumes and individual farm shops." (DE 5/2017) "We do not see any new or alternatives marketing opportunities in the region." (FG Wetterau 4/2017)

The image of farming in public media is not very good. "The prejudices in public media when it comes to the use of nitrogen fertilizers in farming is an example for misleading information of the public. Media claim farmers apply very high nitrogen levels and pollute the environment. In fact, journalists would not take into account the nitrogen uptake of high yielding crops on the fertile land. They have no insights in farming, and create a negative image of our work. These prejudices are not just, they hurt." "On the other hand, people go to discounters and buy very cheap food that has no additional standards. Consumers have to change if they don't want pesticides and nitrogen on the fields." (FG Wetterau 4/2017) Farmers feel that there is a bias between the exacting demands of the society claimed by public media or civil society groups and the

individual behaviour of customers who decide for low-cost food. This perception is in line with the results of the findings of the federal expert committee for environmental issues: “Agricultural production systems are under progressing social critique. They are held responsible for negative effects on the environment like e. g. increasing loss of biodiversity, nitrate pollution of groundwater as well as pesticide residues in surface waters and in food” (SRU 2016).

Bureaucracy is a major burden for the implementation and maintenance of policy programmes. Currently, the controllability of measures set the frame for many policy programmes. This hampers the definition of various environmental measures. When the policy machine continues to follow the logic of CAP measures to be based on controllability, the system will not be able to enhance farming in line with the increasing expectations of the society and the requirements of the natural environment and a sustainable resource use.

5.6.1.2 Chances

“The use of risk management systems helped to develop an adequate pricing and marketing strategy. That is an opportunity for farmers.” (FG Wetterau 4/2017)

“Our compliance with the quite high sustainability standards is a burden but also an opportunity because society (or consumer groups) want to see additional sustainability standards in farming”. (FG Wetterau 4/2017)

“There should be a market - a willingness to pay - for rapeseeds that are produced under high - or even higher? - process standards in the Wetterau.” “We are so close to the Rhein-Main area, there should be people who pay more for high-quality oil from the area.” (FG Wetterau 4/2017)

“We have very strong cooperation among farmers (such as the machinery ring).” “Our common procurement of inputs works well.” “Even the local marketing of the oilseed rape as bio-diesel via the local producer organisation was excellent in the past (Nawaro Association). And this pillar is still very import to us. But there is insecurity among farmers. We fear a potential political reorientation of the bioenergy policy.” “On the other side, the renewable energy policy can stabilise and that would be a chance for us – let’s see.” (FG Wetterau 4/2017)

Science is encouraged to liaise with practice (and vice versa). Well-targeted interdisciplinary research has to face current problems and bridge the gap between research and practice. European innovation concepts offer chances for the agri-food sector. Based on the Innovation Partnership concept, the future development of the European Agricultural Policy (CAP) will include funding that supports the promotion of the protection of biodiversity, soils, and of the climate. This is a chance.

5.6.2 Farmers’ strategies identified from literature, interviews and Focus Groups

Based on profit and income calculations of different arable crops, Bickert (2014) suggests three strategies for the further development of the farms:

- 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)

5.6.2.1 Strategies identified from the focus group with farmers

Strategies for the financial compensation of sustainability performances: Farmers have tried out different approaches in the last years. An example was cooperation with a local water supplier (a semi-public body) who compensated farmers for reduced nitrogen levels applied. “However, that causes problems when the weather is too dry in spring. Then, measured nitrogen rises even with little fertiliser used.” (FG Wetterau 4/2017)

Another strategy was the mentioned above sustainability programme of an international food corporation. “The problem was the programme was taken from our area after only three years – that was bad luck.” “Such a project would be good for a longer period in order to be sustainable and credible but there is no processor around at the moment who would help us with the development of such a supply chain.” (FG Wetterau 4/2017)

Strategies for the communication with the public: “How can we communicate sustainable performances to customers, and thus create an added value?” The farmers agreed that a self-marketing of the ‘better’ production process would be necessary, but an adequate strategy is still missing. Social media could be a suitable instrument of communication with the public. “GMO free agriculture is an important issue and our oilseed rape produced in Germany has this advantage compared to imports”. (FG Wetterau 4/2017)

Strategy development for the marketing of a high-value rape oil from the Wetterau: The focus group concluded with the mandate to use the planned stakeholder workshop (to be organised by the SUFISA team and the Farmers’ Union) for a critical reflection with chain representatives. The group of farmers set the goal to check marketing options for a locally produced high-quality rapeseed oil. (FG Wetterau 4/2017)

Stakeholders from the value chain confirmed that it would be worth to check further option for the development (and realisation) of a regional marketing strategy (WS Wetterau 5/2017). The aim of the SUFISA workshop, based on the outcome of the focus group, was to decide if the development of a regional marketing strategy for vegetable oil from rape production is a realistic goal that should be pursued. In the end of the workshop, it was decided that the Farmers’ Union representatives would liaise with HERA producer association (and other relevant actors) to discuss options for the development of a regional marketing strategy (Status September 2016).

5.6.2.2 Synopsis of farmers’ strategies (SUFISA Inventory)

The following tables show six strategies from the case study as described for the SUFISA Inventory instruments. The strategies are based on the analyses of framework conditions and are data sets for the comparison among countries and cases in the SUFISA project. Categories, key words and indicators had to be selected from a given list.

Strategy I – Collective arrangements of the producer organisation	
Category	Markets, contracts and institutional arrangements
Key words	Collective arrangements (e.g. cooperatives, producer organisations, partnerships, horizontal cooperation, vertical integration)
Description of the	Production systems have seen an optimisation in recent decades. There is no more room for increasing efficiency in the production in the short term, farmers highlight.

strategy	Rape is an intensive crop that requires costly inputs. Since many years, farmers follow the strategy of cooperative buying of inputs (fertilizer, chemicals) via their producer organisation HERA. Moreover, HERA provides advisory services for the use of inputs.
Indicators	1. Increased productivity, 3. Greater profitability, 4. Improved access to markets, 8. Strengthened negotiation power,
Notes	<p>Since oilseed rape is competing with other crops such as wheat or sugar beet on the farm level, the farm economic indicator 'variable gross margin' is key to farmers' decision making for crop rotation.</p> <p>Rapeseed production causes high input costs during the vegetation season (plant protection, fertiliser, seeds, and machinery). For that reason, the financial liquidity of the farm during the first half of the year is a major issue for farmers.</p> <p>Improved market access to farm inputs which is supplied by large-scale corporations is difficult to measure due to in-transparent prices and market power relations.</p> <p>Farmers say that the institutional arrangement of joint procurement through HERA has been very successful.</p>

Strategy II – Collective arrangements of the machinery ring	
Category	Markets, contracts and institutional arrangements
Key words	Collective arrangements (e.g. cooperatives, producer organisations, partnerships, horizontal cooperation, vertical integration)
Description of the strategy	Many decades ago, Wetterau farmers developed machinery partnerships and a machinery ring, which grew over time. It helps to reduce machinery costs per farm and ensures high-tech harvesting for all farmers. The Wetterau machinery ring is a very strong and well-established institution. It served as starting point for other arrangements such as the oilseed producer organisation HERA.
Indicators	1. Increased productivity, 3. Greater profitability, 5. Greater financial stability
Notes	<p>The list of owned machinery per farm is - linked with the farm size (ha) - an indicator for arable farms and the related information on offering or demanding machinery services.</p> <p>The indicator fixed and semi-fixed costs per ha arable land per farm represent the machinery equipment per farm. In the German farming sector, many farms have overcapacities when powerful machinery rings are lacking in the area.</p> <p>For a long time, the collective arrangement of the machinery ring in the Wetterau has been proved to be successful.</p>

Strategy III – Market orientation	
Category	Markets, contracts and institutional arrangements
Key words	Market orientation (e.g. developing new markets, differentiation, standards and certification, adding value)

Description of the strategy	<p>"Strategy development for the marketing of a high-value rape oil from the Wetterau: Farmers encourage the leaders of the producer cooperative to critical reflect the market situation and reflect on alternative sales opportunities together with representatives of the supply chain. Farmers wish to sell their harvest through a value chain for regional high-quality rapeseed oil. Stakeholders from the value chain confirmed that it would be worth to check further option for such a regional marketing strategy. However, earlier attempts for the direct marketing of oil failed because some important factors hampered such an initiative. For that reason, some stakeholders are not very optimistic. Farmers' Union representative and the producer organisation will study if the development of such a regional marketing strategy for vegetable oil from rape production may be a realistic goal that should be pursued.</p> <p>Farmers still believe in the power and potential of HERA. However, they wish to see more strategic reflection or strategy changes among HERA leaders."</p>
Indicators	2. Added value, 3. Greater profitability, 10. Environmental benefits
Notes	<p>Structure of the processing sector: The development of a values-based supply chain depends on the cooperation with a processor. Oil mills are located far away from the Wetterau area. Moreover, they process large volumes which is a disadvantage for the development of a regional supply chain for a quality food product.</p> <p>Sales of vegetable oil to retailers, caterers and end-consumers: The analysis of the demand for high-quality oil from the area is difficult. Market analyses are not at hand.</p>

Strategy IV – Focus on environmental issues	
Category	Social and environmental sustainability
Key words	Deliberate focus on environmental issues
Description of the strategy	<p>Farmers want to comply with legal requirements of e.g. water protection, and they even wish to contribute more to the natural environment than the legal baseline requires. However, policy programmes, enterprises or consumers had to pay for such extra 'services'. In the past, the participation in the private sustainability programme offered by the processor corporation fitted well with farmers' strategic thinking. This agri-environmental programme, initiated and payed by the corporation, ended after a three years contract because the processor corporation shifted the procurement area to northern Germany. Participating farmers liked this agri-environmental schemes which was embedded in the supply contract. Even now, they try to maintain the measures as far as possible (bee protection, nitrate measures) but this is difficult due to the lacking financial compensation. Farmers would like to use such agri-environmental schemes offered by the Rural Development Plan or by the processing or sales industry.</p>
Indicators	3. Greater profitability, 5. Greater financial stability, 10. Environmental benefits
Notes	Indicator: Payment per hectare for a specific requirements such as N-balancing, bee protection, number and size of 'field windows' for birds, proportion or size of flowering strips.

	The compensation for environmental measures in high value crop field such as oilseed rape or sugar beet is costly and therefore difficult to integrate in public budgets.
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Strategy V – drop rape cultivation or stop farming	
Category	Competitiveness, viability and risk management
Key words	Extensification, downsizing or abandonment
Description of the strategy	If the income from rape cultivation or from arable farming as a whole shrinks, farmers may stop the production of oilseed rape or even stop farming. Since rents and sales prices for land are high in the area, this may serve as a source for an alternative income for the families. Farmers have opportunities to find work easily within or outside the agricultural sector. Growing farms in the neighbourhood are seeking for additional land. Or non-agricultural demand for land may turn arable fields into horse paddocks, construction zones or infrastructure.
Indicators	3. Greater profitability, 5. Greater financial stability, 10. Environmental benefits
Notes	Number of farms will continue to decline. Maybe, some remaining farms will expand. Number of farmers in the area will fall with potential social and cultural effects on the communities. It is likely to use more and more arable land which will contribute to several negative environmental effects (loss of productive land, water shed, landscape, flowering fields, biodiversity, fresh air provision for neighbouring cities etc.)

Strategy VI – drop rape cultivation or stop farming	
Category	Markets, contracts and institutional arrangements
Key words	Collective arrangements (e.g. cooperatives, producer organisations, partnerships, horizontal cooperation, vertical integration)
Description of the strategy	Since more than two decades, farmers follow the strategy of cooperative sales via their producer organisation for oilseed rape. Firstly, the producer association focused on the production of oilseed for the bioenergy sector. When the comparative advantage of biodiesel and ethanol production shrank, the association changed the strategy and searched for contracts with the food industry. The business model of the HERA association worked very well for the farmers. However, it was more difficult to realise prices that satisfied farmers' expectations. Farmers encourage the leading team of the producer association to develop visions and new sales strategies for the medium and long-term.
Indicators	2. Added value, 3. Greater profitability, 4. Improved access to markets, 8. Strengthened negotiation power
Notes	Prices: 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 prices and volumes. The pool price depends on the sales negotiation of HERA with its buyers. 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.

5.6.3 Sustainability performance and resilience related to rape production

For a long time, it was mainly the animal husbandry industry that was in the centre of public criticism (see media content analysis). However, that has changed because new topics in the context of arable farming emerged: water pollution due to fertilisation, disappearing insects, biodiversity issues in agricultural landscape (Rumpf, 2017). Farmers are prepared to change but such adjustments in production systems will increase costs. Farmers are deeply concerned about the practicalities and likelihood of the different options for covering additional costs of production (FG 4/2017).

5.6.3.1 Contribution to economic dimension of sustainability and to the farms' resilience

The following aspects play a major role for the reflection on the contribution of rape production to the economic sustainability of arable farms in the Wetterau.

- The contribution of rapeseed production to the farm income has been positive in the past. 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). The demand for rapeseed of the processing industries is expected to remain high or to even further increase.
- An on-farm price of 345 Euro per tonne covers the cost of production and ensure a return (DBV, 2016c). However, several of the costs show increasing trends (land prices, machinery costs, transportation costs) and prices remain low (Figure 2), which is a potential threat.
- The farmers' association is hierarchically structured with professional representation on the local ('Kreisbauernverband') and on the level of the federal state ('Landesbauernverband'). The German Farmers' Union (DBV) is a strong and well-organised umbrella organisation engaged in national and European agricultural policy. Farmers appreciate this engagement. However, they realise that even a strong representation will be unable to tackle challenges caused and driven by international competition, the food industry or the end-consumers.
- Farmers' associations (MR, WAS, HERA), as well as the Farmers' Union (HBV) offer information and training (newsletters, brochures, information and training activities to improve farm management, production systems and fosters on-farm diversification. The vocational school of Wetterau district in Friedberg provides the related qualification opportunities (Zerger, 2006).
- Breeding and mechanisation of arable farming was a precondition for the expansion of rape cultivation during the last decades. Currently, farmers or stakeholders did not highlight any technological innovations that are expected to play a major role in the near future. In case pesticide use will be limited or prohibited (glyphosate authorisation), the economic situation of rape production could change. Alternative solutions, including innovative approaches of pest control, would become highly relevant. However, farmers or stakeholders did not mention this potential threat during interviews or group discussions.
- Agricultural engineers point out that "a simple continuation of the current developmental path in crop production, which can still be a little further advanced by means of autonomous technology and digital networking, appears however to have reached its limits." Instead, the authors project a transition in particular through 'smart farming' made

possible by autonomous machinery and a further development of the current precision farming. (Wegener et al. 2017)

- 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, bad yields and poor qualities, stakeholders of the industry claim that the availability of plant protection products is an important production factor for farming. They are concerned about an increasing limitation of active substances because this can lead to more pest resistances. Farmers particularly reaffirm the need of coherence in political decisions. Legislators could not at the same time ask for greening with more diversity in cropping on the farms, promote the interest of legumes as home grown 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)
- On one ha flowering rape, honeybees can produce around 40 kg of honey. (HBV, 2016)

5.6.3.2 Contribution to the environmental dimension of sustainability

The intensification of arable farming resulted in higher yields which was positive in the last decades. However, environmental and plant health issues developed accordingly due to reduced crop rotations, the elimination of landscape elements and a very high and undifferentiated use of fertilizers and pesticides. Disappearing species and shrinking populations of important species cause less ecosystem services such as pollination and biological pest control. These are followed not only by environmental problems but have significant economic impacts as well. (ASG 2017)

Apart from this general trend, 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 diseases 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.
- Pesticide use is a major issue in oilseed rape cultivation: Various neonicotinoids were available and did affect insects. Due to negative effects of several very strong neonicotinoids, all products have been banned in Germany.
- 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.

5.6.3.3 *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.

5.6.3.4 *Contribution to the social dimension of sustainability*

Back in time, HERA economic association helped improving the image of farming in society 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, the producer association developed alternative processing and marketing channels for the farmers. 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.

Local traditions and traditional production techniques are untouched by vegetable oil production in the Wetterau. 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.

Nowadays, the social acceptance of farming (in particular spraying) in the rural neighbourhood is a major problem. Neighbours and inhabitants of the rural towns express their attitude that they do not accept current farming practices. The reputation of farmers' activities is bad. Bulling of farmers' children in schools has always been an issue but the pressure from the public has increased. Some farmers address this social problem by inviting the groups for a farm visit. The communication with public media is very difficult because reporters have little insights and understanding in farming, in particular, the regional radio station (Hessischer Rundfunk). Even the cooperation and communication with the Hessian Ministry for Agriculture causes problems because the responsible persons have insufficient insight in the constraints and practices of agricultural industries. (Local Farmers' Union 2/2018)

This social issue is (apart from nutrient surpluses and other negative impacts on the environment) an important driver of the need to change arable farming. The acceptance in the broader society is shrinking. Urban and rural dwellers no longer support current agricultural practice. The pressure is expected to rise that questions the well-established policy support and financial payment for farming systems that large groups of the society – in particular in Germany – do no longer want to see in their regions and beyond. (ASG, 2017)

5.6.3.5 Oilseed rape in Germany is GMO-free

- Rape seeds are still free from GMO which is a chance. 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).
- 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}
- 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)
- 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)

5.7 How to proceed from here with arable farming?

‘Keep it up!’ will no longer work but arable farmers, policy makers, scientists and stakeholder are asking the question how will things proceed from here. They mainly agree on the key challenges identified for cropping but perspectives and envisaged potential solutions vary depending on the professional perspective or discipline, individual values and much more.

The following paragraphs collect options discussed or statements collected from the literature, presentations or interviews referring to arable farming in Germany. Since they are based on disciplinary or individual perspectives and present reflections on strategies and potential changes, they only partly represent results of scientific analyses. However, for the development of recommendations for policy and practice in the upcoming working steps of the SUFISA project (in 2018/2019), this collection of reflections from the case study analyses aims to provide input for the discussion of policy scenarios and the conclusions of SUFISA. The reflections focus on arable farming in general. Strategies and sustainability performances of oilseed rape cultivation depend on interdependencies with the other crops. They need to be assessed in the context of the crop rotation and the impacts on the economic, environmental, social and cultural sustainability as well as on its contribution to climate change mitigation and adaptation.

“Farming in the past was geared towards increasing yields, for the environment had to pay high price. The agriculture of the future will not be able to continue this pathway. Instead, the farmers and food entrepreneurs will have to meet the requirements of the society to protect the environment and use less resources. German agriculture contributed significantly to not meeting the environmental objectives as highlighted decades ago. In particular, nutrient surpluses polluting water bodies, soils and the related ecosystems are major issue. Changes have to be made – action is desperately needed! Not only the general public but the legal framework of the EU requires transition. The sooner the farming sector will be ready to

implement major changes the better and the less vulnerable it will be. After all, it is also important to be prepared to justify EU farm subsidies. About 50% of the average operating income comes from agricultural subsidies of which the direct payments represent around 40%. If farmers expect the public to continue to make direct payments, they have to adjust to the changing requirements of the German and European society.“ (Ehlers, 2017)

The national Sustainability Strategy addresses key issues that relate directly to nutrient surpluses from farming. Relevant indicators are nitrogen surplus, proportion of organic farming, greenhouse gas emissions, eutrophication trends of water bodies and terrestrial ecosystems, biodiversity losses. If we managed to control nutrient losses in the atmosphere and in water bodies, we would have reached various sustainability targets. (Ehlers, 2017)

Complex landscapes: In the past, economies of scale let farms and field sizes grow driven by higher efficiency of large machines and shorter travel and transport distances. With these structural shifts, the landscape changed. However, a greater variety of plants and animals (as known from traditional landscapes with many small fields of different crops) enhances the ecosystem services. A well-structured landscape with different ecosystems reduces the risk of pests and ensures pollination. Oilseed rape cultivations profit from complex landscapes which are a precondition for a good development of parasitic wasp populations that keep the risk of damages from the canola beetle low. Recent studies show that flora and fauna differ between areas even within the same region. For that reason, numerous landscape elements and ecosystems within a region provide a higher biodiversity than a few and similar hedgerows or bushes in a landscape with large fields and few cultures in crop rotation. The system needs about 10% of ‘true’ greening areas for landscape and biodiversity purposes (Tschardt, 2017). Rape profits in particular from forests and landscape elements that surround the field where ichneumon flies live that control rape beetle populations.

Variety in crop rotation: Changes in crop rotations with more and different crops can be a key success factor for the upcoming transition process in arable farming. Winter crops might be replaced by summer crops and more diverse cultures used in the past that help to protect and enrich the soil and improve plant health for the main crop. For that reason, breeding of non-commodity crops such as legume crops for animal feed or of old varieties of cereals, oilseeds or field vegetable needs to gain momentum. Rape is an asset for a cereal-based rotation and a replacement of rape would reduce positive effects and resilience of the production system.

Fertilizer use: Strengthening laws and administration measures for regulating and monitoring of nutrient surpluses is an important step forward. These changes are underway with a pilot period for the new law that implements European directives. Fertilizer application has to fit the crops’ need only. Some of the high-yielding varieties will be prone to diseases and pests. We might have to renounce these high performing but delicate varieties anyway. Management tools and smart farming technology will help to reduce nitrogen and phosphate emissions in the atmosphere and in water bodies. More diversity in cropping and more biodiversity will contribute significantly to the reduction of emissions (ASG Conference 11/2017). The availability of nitrogen for the development of small rape plants in spring is a key success factor for the harvest. This requires excellent management of nitrogen levels before and after the winter months.

Plant protection: Biodiversity is a production factor because it helps with cropping; diversity ensures diversity; Plant production is more than spraying. Pesticides have to be used like medicine instead of spoiling them. Future oriented plant protection systems enable biodiversity. There is sufficient biodiversity on the field that can ensure keeping harmful organisms manageable. Plant protection is more than spraying. However, various instruments are neglected. The system of plant protection needs adjustments with a significant

reduction of pesticide use (ASG Conference 11/2017). Oilseed rape production faces various risks from harmful organisms. Plant protection is a cost factor and insufficient protection reduces yields.

Vegetable oil from organic farming requested: Rapeseed oil cultivation fit well into organic systems but currently, Brassicaceae are a lacking element in organic crop rotation. Returns for organic oilseeds are high. Even low yields from around 2.5 tonnes would cover costs. First, main problem is the sufficient N-nutrition of the young plants in spring which requires excellent conditions of N-availability after the winter months. Second, damages by rape beetle when the plants are in buds. Altitude of the site with retarded plant development and surrounding forests and hedgerows helps to reduce the pressure from the beetles.

Plant breeding: Plant breeding was a precondition for the use of rape (00-varieties). Plant production will continue to be crucial for the solution of major problems, in particular the adaptation to climate change, resistance against diseases and pests, efficiency of nutrient use and product qualities. Plant breeding based on GMO is not accepted by the society. If genome editing as a new technology will be approved by the German society is not yet clear. There is no public debate on the method so far. Only organic farming organisations have declared to refuse genome editing in organic plant breeding. In any case, future oriented plant breeding has to be driven by the sustainability concept: recurrent selection, use of elites and varieties for recombination (ASG Conference 11/2017). However, the processes itself require further refinement and innovation. Overall, the acceptance of chosen methods by the broad public will be crucial. Plant breeding is a major investment in the future and requires reliable legal and financial conditions: the breeder needs to be protected instead of only the patents; fair financing concepts that enhance the financial engagement of seed users; public funding for research in plant breeding (including varieties with reduced yields and higher resistance properties), and research programmes with a long-term funding. Permission of breeding and using own seeds on the farm level is very important. For the protection of traditional varieties and locally or system-adapted varieties (organic production) small scale breeding on the private level is important. The current European system has proved to be successful (other than the regulation in the US) and therefore, needs to continue. (ASG Conference 11/2017)

Smart farming: New technologies such as large-scale precision farming or small-scale robot-based weed or pest controls offer opportunities to reintroduce complex landscapes and/or site specific cropping without efficiency losses. Mixed cropping and precision fertilizer and pesticide application can reduce nutrient leaching and contribute to the conservation of natural resources. Digital tools are at hand (Lorenz, 2017). However, they are often capital intensive and require specific knowledge. Currently, the machinery industry, policy makers and advisors mainly focus on large-scale, intensive farms for the application of precision farming applications but small-scale, large numbers of smaller machines offer a potential that tends to be underestimated at the moment. However, weeding and other robots might help to replace the use of large-scale tractors and high volumes of broadly-spread pesticides (Erdle, 2017).

Cooperation, communication and excellent management: The production and sales of arable crops such as cereal crops, oilseed rape or sugar beet will (due to a highly aware society) require strong cooperation and good cooperation between farmers and along the supply chain from farm to fork. This is even more difficult for dry commodity goods than for regional specialities or products from animal production such as milk or meat.

Training and professional education: All efforts mentioned require well-educated farmers who are aware of their responsibility for soils, plants, animals, and natural resources. For that reason, the teaching of professional ethics, maybe in cooperation with the catholic and protestant church could be part of farmers' training and education. Since regional churches are land owners in engage in rural areas and communities,

they could supported such an effort of rising awareness and ensuring ethical standards in farming that were lost in recent decades. (ASG Conference 11/2018)

On the EU policy level, the role of strategic goals need to be discussed (and fostered). Until now, the EU Commission defined more and more practical procedures that fit more or less on the situations for local farming practices. Instead, Member States and regions would be able to develop site-specific and flexible solutions following the overarching strategic goals set by the EU (ASG, 2017).

A new approach to improve the impact of CAP: Following the social and political goal to link the future agriculture with the provision of public goods and services through farming, the German Association for Landscape Management e. V. (DVL) developed a new concept for the CAP. The discussion paper suggests a reward system for the provision of non-marketable public goods. The Common Good Payment aims to pay for biodiversity services or climate and water protection. The farmer with his entrepreneurial spirit has a central position in this approach that aims to optimize environmental performances of the farms and enhance biodiversity, improve water qualities and reduce climate gas emissions. The new concept is different to the current system because so far, farmers only need to comply with minimum standards. Beyond these, agri-environmental payments compensate for lost income but do not pay for the provision of public goods. The current CAP system is insufficient because major environmental threats worsened. Farmers who wanted to work up to higher environmental standards had no financial incentive. The basic idea of the Common Good Payment of DVL is the safeguarding of the most important landlocked public goods in agrarian landscapes and in agricultural production systems. A catalogue of environmental services allocates points depending on the value of the measure provided. According to their evaluated effects and size of the land allocated to the measure, the farmer can calculate the financial payment for the set of public services provided in the particular area. Based on such a system of public payments for common goods provision could change the understanding of the farming community and its image in the wider public. (Beckmann, 2017)

In the past, Wetterau farmers founded the producer organisation based on the opportunities of the alternative energy law in the 1990s. That was excellent and worked out nicely. Later the group was smart and lucky and changed to HERA. The cooperation with the large food corporation for an agri-environmental rape production concept based on high sustainability standards was a great strategy and (although ending after three years) it turned out to be a success story that could be a model solution for other crops in other areas!

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6.1.1 Statistics, legislation and other literature on aquaculture

International data and information on aquaculture

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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.

<http://www.nature.com/news/fishy-limits-1.19069>

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

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

Other literature on fish production in German

Landwirtschaftskammer Niedersachsen (20xy) Ordnungsgemäße Fischhaltung <http://www.lwk-niedersachsen.de/index.cfm/portal/tier/nav/231/article/15641.html>

List of relevant international 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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BR (12/2016). Telephone interview on the 20/12/2017. Field of expertise: aquaculture, research, administration.

FN (6/2016). Personal interview on the 28/06/2016. Field of expertise: aquaculture

HZ (2/2017). Personal interview on the 09/2/2017. Field of expertise: aquaculture, research, extension, administration.

KT (7/2016). Personal interview on the 01/07/2016. Field of expertise: aquaculture

LR (5/2016). Telephone interview on the 07/05/2017. Field of expertise: aquaculture, research.

LR (6/2016) Personal interview on the 29/06/2016. Field of expertise: aquaculture, research.

ME (2/2017). Personal interview on the 09/02/2017. Field of expertise: aquaculture, research, extension.

OE (6/2016). Personal interview 30/06/2016. Field of expertise: aquaculture, research, extension, administration.

ST (6/2016). Personal interview on the 30/06/2016. Field of expertise: aquaculture, agriculture

SR (7/2016). Personal interview on the 01/07/2016. Field of expertise: rural development, administration, marketing.

Focus Group (FG) Aischgrund (6/2016). Traditional carp production in Middle Franconia. On the 28/6/2016, Neustadt/Aisch. Bayrische Landesanstalt für Fischereiwirtschaft. Target group: fish farmers

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6.2 References - Oilseed rape

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6.2.1 Individual interviews and group discussions

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DL (5/2017). Telephone interview on the 22/05/2017. Field of expertise: agriculture, extension, administration

MM (4/2017). Personal interview on the 06/04/2017. Field of expertise: agriculture, research.

ASG Conference (11/2017). Herbsttagung der Agrarsozialen Gesellschaft e.V. Annual ASG Conference in Göttingen, on the 8. and 9. November 2017. <http://www.asg-goe.de/>. Target group: decision makers in policy and administration, national and regional, regional managers, farmers, researchers, NGOs in nature conservation/rural development.

Focus Group (FG) Wetterau (4/2017). Rapsproduktion in der Wetterau: Wirtschaftliche Situation und Strategien der Betriebsentwicklung und Vermarktung, on the 6th of April 2017, Friedrichsdorf/Taunus. Target group: farmers

Local Farmers' Union, annual crop farmers' meeting (2/2018). „Sehen und Gesehen werden“ – Öffentlichkeitsarbeit im Verband. (Professional communication by the Farmers Union), on the 19.2.2018, Bürgerhaus Assenheim, Wetteraukreis. Target group: farmers

Workshop (WS) Wetterau (5/2017). Welche Perspektiven bieten sich für die Vermarktung von qualitativ hochwertigem und nachhaltig erzeugtem Rapsöl aus der Wetterau? on the 30/05/2017, Friedrichsdorf/Taunus. Target group: representatives of the value chain oilseed rape.

6.2.2 Additional literature related oilseed rape

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/>

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

[http://www.raps-aktuell.de/Rapsstatistik and DESTATIS\)](http://www.raps-aktuell.de/Rapsstatistik%20and%20DESTATIS)

7 Annex – Aquaculture

List of aquaculture operations in Germany

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

Table 24: 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. Stür	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“

Source: [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 25: 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 (Nov 2015)

Table 26: Dictionary – scientific terminology and names of aquatic species commonly used in EU fisheries and aquaculture

English	German	Scientific
Alaska pollock	Alaska-Seelachs	<i>Theragra chalcogramma</i>
Arctic Char	Seesaibling, Wandersaibling, Rotforelle	<i>Salvelinus alpinus</i>
Brill	Glattbutt	<i>Scophthalmus rhombus</i>
Brook trout	Bachsibling	<i>Salvelinus fontinalis</i>
Brown trout	Bachforelle	<i>Salmo trutta</i>
Carp	Karpfen	<i>Cyprinus carpio</i>
Cods, codfishes or true cods	Dorsche	Gadidae
Cusk	Lumb	<i>Brosme brosme</i>
Grayling	Äsche	<i>Thymallus</i>
Haddock	Schellfisch	<i>Melanogrammus aeglefinus</i>
European hake	Hechtdorsch, europäischer Seehecht	<i>Merluccius merluccius</i>
Lemon sole		
Ling	Leng, Lengfisch	<i>Molva molva</i>
Meagre, shade-fish, salmon-basse or stone basse	Adlerfisch, Umerfisch	<i>Argyrosomus regius (sciaena)</i>
Megrim or whiff	Flügelbutt	<i>Lepidorhombus whiffiagonis</i>
Northern pike	Hecht	<i>Esox lucius</i>
Pangasius	Pangasius	<i>Pangasius</i>
Plaice	Scholle	
Pollock	Steinköhler, Kalmück	<i>Pollachius pollachius</i>
Salmon	Lachs	<i>Salmo</i>
Salmonids	Salmoniden	Salmonidae
Salvenius, char, charr	Saibling	<i>Salvelinus</i>
Sea basses	Wolfsbarsche	Moronidae
Sea breams	Meerbrassen	Sparidae
Seithe	Köhler, Seelachs	<i>Pollachius virens</i>
Sole	Seezunge	
Tench	Schleie	<i>Tinca tinca</i>
Trout	Regenbogenforelle	<i>Oncorhynchus mykiss</i>
Turbot	Steinbutte	Scophthalmidae
Wels catfish	Europäischer Wels, Waller	<i>Silurus glanis</i>
Zander or pikeperch	Zander	<i>Sander lucioperca</i>

Sources: Wikipedia English, Wikipedia Deutsch (2015)

8 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-Kabinettt-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/agrarpolitik-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/rukwied-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/rukwied-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	Kükentöten ist mit Tierschutz vereinbar	http://www.deutschlandfunk.de/oberverwaltungsgericht-kuekentoeten-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-wetterisiko-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_Haeusling.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-allen-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-unerwuenscht-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-gemischer-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-Pachtpreishoehe-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.topagrار.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.topagrار.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.topagrار.com/news/Home-top-News-Schlechte-Stimmung-Biobranche-besorgt-ueber-Billigkonkurrenz-1062027.html
TOP18	2012	Reportage entzaubert Bio-Mythos	http://www.topagrار.com/news/Home-top-News-Reportage-entzaubert-Bio-Mythos-931640.html
TOP19	2016	Molkereien suchen in Heu- und Weidemilch ihr Heil	http://www.topagrار.com/news/Rind-Rindernews-Molkereien-suchen-in-Heu-und-Weidemilch-ihr-Heil-3944862.html
TOP20	2016	Agrarminister fordern Neugestaltung der Lieferbeziehungen	http://www.topagrار.com/news/Rind-Rindernews-Agrarminister-fordern-Neugestaltung-der-Lieferbeziehungen-3074959.html
TOP21	2015	DBV: Positionspapier zum Quotenende	https://www.topagrار.com/news/Rind-Rindernews-DBV-Positionspapier-zum-Quotenende-1734032.html
TOP22	2016	Noch große Gegensätze bei der EU-Ökoverordnung	http://www.topagrار.com/news/Home-top-News-Noch-grosse-Gegensaetze-bei-der-EU-Oekoverordnung-3152580.html