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M.A. Sustainability Economics & Management

MASTER THESIS

Promoting and inhibiting factors for the establishment of organic animal breeding - an exploratory study on initiatives from Germany and Switzerland

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Content

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List of Abbreviations

AI	Artificial Insemination
AIS	Agricultural Innovation System
AJ	Anna Jenni (project coordinator *Unser Hausschwein*)
BDZ	*Bund Deutscher Ziegenzüchter* [national association of goat breeders in Germany]
BF	Barbara Früh (project lead *Unser Hausschwein*)
BID	*Bruderhahn Initiative Deutschland e.V*. [‘Brother hen‘ initiative Germany]
BLE	*Bundesanstalt für Landwirtschaft und Ernährung*
BLW	*Bundesamt für Landwirtschaft* (Schweiz) [Federal Office of Agriculture in Switzerland]
BÖLN	*Bundesprogramms Ökologischer Landbau und andere Formen nachhaltiger Landwirtschaft* [Federal Programme for Organic Cultivation and Other Forms of Sustainable Agriculture]
BÖLW	*Bund Ökologische Lebensmittelwirtschaft e.V*. [Organic Food Production Alliance]
BMEL	*Bundesministerium für Ernährung und Landwirtschaft* (BMEL) [German Federal Ministry of Food and Agriculture]
CSA	Community Supported Agriculture
CSX	Community Supported X
EC	European council or European Commission [both used as short form in EU regulations, distinction indicated in the text]
ECO-AB	*European Consortium for Organic Animal Breeding*
ECO-PB	*European Consortium for Organic Plant Breeding*
e.g.	exempli gratia [for example]
EU	*European Union*
EURECA	short project title for the project: “Local cattle breeds in Europe“
ET	Embryo Transfer
et al.	et alii / et aliae [and others]
FAO	*Food and Agriculture Organization of the United Nations*
FiBL	*Forschungsinsitut für Biologischen Landbau* [Research Institute of Organic Agriculture]
gGmbH	‘gemeinnützige Gesellschaft mit beschränkter Haftung‘ [non-profit private limited company]
GO	*GoOrganic* [project title]
GZPK	*Getreidezüchtung Peter Kunz*

HLPE	*High Level Panel of Experts on Food security and Nutrition of the Committee on World Food Security*
i.e.	id est [that is to say]
ibid.	ibidem [in the same place]
IFOAM	*International Federation of Organic Movements*
IG	Inga Günther [chief executive officer of *Ökologische Tierzucht gGmbH*]
IPCC	*Intergovernmental Panel on Climate Change*
ML	Mariateresa Lazzaro [coordinator of *Engagement.Biobreeding Europe project*]
MLR	*Ministerium für Ländlichen Raum und Verbraucherschutz* [Ministry of Rural Affairs, Food and Consumer Protection Baden-Württemberg]
NÖTZ	*Netzwerk Ökologische Tierzucht*
ÖTZ	*Ökologische Tierzucht gGmbH*
p. /pp.	page / pages
PH	Pera Herold [coordinator of GoOrganic]
SNA	Social Network Analysis
SP	Svenja Puls [author of this thesis]
SUISAG	*SUISAG AG für Dienstleistungen in der Schweineproduktion* [corporation for services in pig production]
TierZG	Tierzuchtgesetz
TIS	Technological Innovation Systems
TP Organics	Technology Platform Organics
TZV	Verordnung über die Tierzucht [Swiss regulation on animal breeding]
UH	*Unser Hausschwein* [project title]
vs.	versus [against]

1. Introduction and Research Objective

The agricultural livestock sector is currently facing multiple challenges: animal husbandry has been identified to be an important direct and indirect contributor to adverse environmental effects (e.g. eutrophication or climate change) (IPCC, 2019; Leip et al., 2015). The amount of animal source food consumption exacerbates conflicts around the competing use of scarce resources, such as arable land for feed or food production (Röös et al., 2017; Smith et al., 2014). At the same time, there is growing criticism and societal concern about animal welfare issues in productivity focused systems (Kompetenznetzwerk Nutztierhaltung, 2020). Thus, livestock plays a key role in a sustainable design of future food and farming systems.

Organic and agroecological farming practices are considered as farming approaches that will play an important role in the establishment of sustainable food and farming systems (Freyer et al., 2016; HLPE, 2019; Reganold & Wachter, 2016). However, feeding the world with agroecological and organic farming methods while staying within the planetary boundaries might not only require a reduction in the total stock of animals; alternative feed sources and the careful use of locally adapted animal species will also be necessary to reduce adverse environmental impacts and food-feed competition (Muller et al., 2017; van Zanten et al., 2018). Accordingly, livestock is also considered as one of the main action areas when searching for more sustainable practices within the organic movement (Rahmann et al., 2017).

Due to their background values, agroecology and organic agriculture have specific goals and requirements in terms of livestock systems, putting forward animal welfare as well as integration of cropping and animal systems among their central aims (see e.g. IFOAM, 2017, 2018; Migliorini & Wezel, 2017). Despite the existence of various movements, associations, standards and guidance documents, the translation of the different organic and agroecological principles into practice remains an important task for researchers and practitioners (Altieri & Nicholls, 2012; Padel, 2019). Issues like feather pecking in poultry (Schumacher et al., 2011; Vaarst & Maurer, 2019) or higher piglet mortality (Früh & Holinger, 2019; Schumacher et al., 2011) show, that some gaps between the theoretical ambitions and the practical reality and of organic agriculture remain. As of today, many organic farmers rely on animal breeds from conventional breeding companies or associations (Nauta et al., 2012; Padel, 2019). In extensive farming contexts, with outdoor husbandry, dependence on regional feed sources or reduced application of medical treatments, the use of highly specialized breeds that have been selected for high performance under highly controlled conditions can lead to various problems (e.g. health issues, feed requirements and land use conflicts, behavioral disorders) (Nauta et al., 2012; Reuter, 2007c; Schumacher et al., 2011). At the same time, growing market concentration in animal breeding (especially pig and poultry) (Gura, 2015; Hendrickson et al., 2017) reduces the influence of

individual farmers on breeding goals and processes, making them increasingly dependent on conventional breeding goals. The focus on productivity traits and the intense development of few high-performing breeds has significantly reduced farm animal diversity in the recent decades (FAO, 2015). Especially for farming systems which are aiming at local adaption and diversity, this is an alarming development.

Additionally, some of the selection and reproduction technologies that are already applied by some conventional breeders are considered as incompatible with or at least questionable with regards to organic standards and ideals (IFOAM, 2017). Remaining completely reliant on conventional breeding stock might therefore reduce organic farmers' possibilities in breed choice in the future. Additionally, it can reduce credibility of the organic sector (Reuter, 2007a). Consumers and society expect an organic origin for all inputs to organic agriculture and they expect organic farming systems to give priority to animal welfare (Brümmer, 2019; Rahmann & Godinho, 2012; von Meyer-Höfer et al., 2015). Hence, the organic livestock sector is in need for new and innovative ways of conducting and organizing animal breeding systems, in order to solve existing problems and to adhere more consequently to the organic and agroecological values and principles.

While the above-mentioned issues have not been the center of discussion for a long time, awareness for the importance of organic breeding has started to grow in recent years. In as position paper from 2017, the IFOAM emphasizes that "the organic sector must continue to gain self-reliance concerning the availability of acceptable genetic resources, […]" (IFOAM, 2017, p. 9) and that there has to be a "[r]enewed emphasis on development and expansion of organic breeding efforts[…]" (ibid.). The new European Union (EU) organic regulation ((EU) 2018/848), puts a stronger focus on the kind of animals that is used in organic production as well. For example, it states the objective to phase out "the derogations concerning the use of […] non-organic livestock for breeding purposes" (Preamble 105, (EU) 2018/848) and obliges the EU member states to establish databases on available "organic animals" and available "breeds and strains adapted to organic production" (Art. 26, (EU) 2018/848).

However, an extensive legal or scientific definition and a shared vision of what 'organic animal breeding' ideally looks like, is still lacking (e.g. Nauta et al., 2012; Padel, 2019; Reuter, 2007b). While in plant breeding, some alternative networks and organizations have already been established over the last years (e.g. *Kultursaat e.V., Saatgut e.V., ECO-PB, GZPK*, …[1]), the alternative approaches in organic animal breeding are less visible. In recent decades, there have

[1] See e.g. https://www.biobreeding.org/breeding.html [last access 25th Feb 2021] or https://www.organic-plant-breeding.org/breeders [last access 25th Feb 2021] for an overview

been attempts to establish networks and working groups for exchanging knowledge on organic animal breeding and for developing shared strategies across different animal species: the German project *Netzwerk Ökologische Tierzucht* (NÖTZ) (2002-2007) or the *European Consortium for Organic Animal Breeding* (ECO-AB) both aimed at developing standards and strategies as well as initiating discussions and practical activities for organic animal breeding (ECO-AB, 2011; Reuter & Roeckl, 2007). In their work, first hints on factors that can be relevant for the further development of the sector, have been collected. However, little is known about the current status of the sector as both networks seem to be inactive since several years.

As stated by the final NÖTZ report, one of the inhibiting factors for the development of the whole sector is the lack of projects and actors being active in organic animal breeding (Reuter et al., 2007). It also states that analyses on supporting conditions will be needed so that those projects can gain greater relevance (ibid.). This indicates that further research on factors that foster or hinder the work of existing organic animal breeding initiatives is still needed.

Hence, this thesis wants to contribute to a renewed uptake of the discussion by shedding light on the current status of organic animal breeding activities and by presenting selected cases of existing initiatives. After a review of organizations and projects that are currently active, it was decided to limit the scope to Germany and Switzerland (see chapter 4.1). Through the in-depth analysis of selected cases, the thesis aims to contribute to a deeper understanding of the reasons for the low number of organic animal breeding activities in Europe and provide insights on how more initiatives could be promoted. Accordingly, the following research question has been defined:

> *Which factors influence the success (in terms of growth and long-term establishment) of organic animal breeding initiatives?*

This research question will be answered along the following sub questions:

- *Why and how are initiatives founded?*
- *Which breeding approaches and strategies do currently existing organic animal breeding initiatives pursue?*
- *How are organic animal breeding initiatives structured and organized?*
- *In which way are organic and agroecological principles reflected in the initiatives' approaches and structures?*
- *Which internal and external factors influence establishment and development of such initiatives?*

The thesis is structured as follows: First, the framework for the thesis will be set by introducing the terminology around breeding and breeds, by reflecting on the term of 'organic animal breeding' against the background of agroecological and organic principles, and by collecting first hints on promoting and inhibiting factors from past discussions. Subsequently, the topic will be

embedded in the context of Agricultural Innovation Systems, which provide theoretical framework for answering the research questions in the empirical data collection. Afterwards, the method for data collection and analysis will be introduced and the following chapters will first display and then discuss the results, by reviewing their 'organic characteristics' and by comparing promoters and inhibitors across cases. After a critical discussion of the theoretical and methodological approach, the thesis will close with a conclusion and an outlook on further research potentials.

2. Background on Organic Agriculture and Animal Breeding

As breeding systems are an integral part of animal production systems, their goals, methods and structures ideally match the goals of the targeted farming systems (Willam & Simianer, 2017). Organic agriculture is based on a broad set of ethical values (Freyer et al., 2016; Klint Jensen, 2012). Thus, when conducting research on organic animal breeding and husbandry, it needs to be kept in mind which principles, values and standards form the basis for discussion.

In order get a clearer picture of the values and attitudes that are behind scientific, political and practical discussions in organic agriculture, this chapter shortly reviews the basic organic and agroecological principles. Furthermore, a short introduction into the terminology around animal breeding is given and potential characteristics of organic animal breeding programs are collected.

2.1. Principles and Standards in Organic Animal Husbandry

Organic Agriculture has originated from different social movements (mainly in Europe and the US) which have formed around 1900 in response to environmental problems, intensification in agriculture and developments in the food system (Willer & Schmid, 2016). Throughout the 20th century, the movement has developed further – from the first idealist pioneers through a phase of standardization and regulation towards its role in solving contemporary sustainability challenges at a larger scale (see e.g. Willer & Schmid, 2016; Haller et al., 2020; Vogt, 2000). The organic movement is still developing further: Under the notion of “Organic 3.0” (Rahmann et al., 2017, p. 175) the sector discusses how organic agriculture contribute to a sustainable development of the global food system.

On a global level the *International Federation of Organic Movements* (IFOAM) has been connecting different organic movements from around the world since 1972 (IFOAM, 2018). The IFOAM norms and principles currently constitute one of the most important references in discussions on ethical questions in organic agriculture (Freyer et al., 2016; Freyer & Bingen, 2015). Thus, the IFOAM principles and positions are applied as the general frame of reference in this thesis. The IFOAM definition of organic is based on four principles: Health, Ecology, Fairness and Care (IFOAM, 2018).

In Europe, the minimum standards and technical details of organic food production and processing are laid down in the EU organic regulation (accompanied by executive orders, guidelines and national translations of the EU legislation) (Vogl & Axmann, 2016).

Throughout Europe, different organic farming associations develop further standards and rules beyond the minimum requirements of the EU organic regulation (Haller et al., 2020; Willer & Schmid, 2016). Over time, organic regulations have become more detailed and specified, especially with regards to organic animal husbandry (Willer & Schmid, 2016).

Organic Agriculture and Agroecology

Organic agriculture and organic principles have high synergies with the concept of agroecology (TP Organics, 2019). Agroecology is a transdisciplinary concept that combines "ecological, sociocultural, technological, economic and political dimensions of food systems" (HLPE, 2019, p. 13). It can be considered "a science, a set of practices and a social movement" (ibid.). There is no clearly defined set of principles and practices for Agroecology, yet (HLPE, 2019; Migliorini & Wezel, 2017; TP Organics, 2019). Existing sets of principles encompass agricultural management principles as well as socio-economic principles (HLPE, 2019; Migliorini & Wezel, 2017).

TP Organics[2] (2019) sees organic agriculture as one form of an agroecological farming system. In the TP organics research agenda both organics and agroecology play a major role in a transformation to sustainable food systems (TP Organics, 2019). As this thesis aims to examine organic animal breeding against the background of the sustainable development of the global food system, it looks on breeding initiatives from the perspective of organic and agroecological principles.

Organic and Agroecological Principles for Organic Animal Husbandry

In organic animal husbandry, the concept of 'animal welfare' (including 'naturalness') plays an important role (Padel, 2019; Vaarst & Alrøe, 2012). At the same time, these central concepts have not yet been clearly defined for organic agriculture (ibid.). Padel (2019) argues that more research is needed on assessment methods and criteria for animal welfare in organic farming. Animal welfare can include feelings of the animal (preferences, experience, emotions), function (meeting needs, maintaining health) and a naturalness (adaption to a certain type of natural environment throughout evolution and the possibility to exercise 'typical' behaviors) (Vaarst & Alrøe, 2012; Winckler & Leeb, 2016). The human animal relationship and the way in which humans care for animals also plays an important role in this regard (Vaarst & Alrøe, 2012; Winckler & Leeb, 2016).

Dumont et al. (2013) have specified some principles for agroecology, specifically for animal production systems: "Integrated management of animal health", "Reduce inputs needed for production", "Reduce pollutions", "Take advantage of system diversity" and "Preserve biological diversity" (p. 1035).

The IFOAM norms and the EU organic regulations include different principles and standards specifically targeted at livestock production, as well. In a comparison of EU organic regulation, IFOAM standards and publications from agroecology, Migliorini and Wezel (2017) structure their

[2] "TP Organics is one of the 40 European Technology Platforms recognized by the European Commission" (TP Organics, 2019, p. 1)

findings on different rules and principles for animal husbandry along different topic areas as displayed in Table 1.

Table 1: Topic areas addressed by organic and agroecological principles
(based on Migliorini and Wezel (2017, p. 8, 10-12))

Topic area	Examples (see Migliorini and Wezel (2017) for a full list)
Integration of cropping and animal systems	relation of livestock production to agricultural land, aiming at closed matter and nutrient cycles
Animal management	generally referring to the below mentioned specifics, e.g. with regards to facilities, stocking density and flock size, housing conditions and outdoor access, disease prevention and parasite control
Breed choice	preference to indigenous breeds, selection to avoid health problems, reproduction without human involvement, dual purpose breeds, breeds adapted feeding conditions
Animal housing	ensure adequate temperature, insulation, ground surface, building materials, bedding, space and outdoor access
Animal welfare	related to housing, nutrition and health: free movement, expression of natural behavior, no mutilations
Animal nutrition	priority to feed compared to food, allow to exhibit natural feeding behavior, respect physiological needs, feed from own farm or the same region
Veterinary management	disease prevention rather than treatment, no preventative use of chemically synthesized allopathic medicinal products

They conclude, that the details vary across the different frameworks (Migliorini & Wezel, 2017). While the EU organic regulation and IFOAM apply rather concrete rules (e.g. maximum stocking densities or input restrictions) or prohibitions (e.g. prohibition of landless animal husbandry; prohibitions of mutilations or certain medical treatments), agroecology is rather based on more general principles (ibid.). Despite that, the above-mentioned topic areas can serve as a point of reference in the further search for organic animal breeding characteristics and the contextualization of the data from the empirical cases studies of initiatives. Before the implications of organic and agroecological principles on animal breeding and breeds are examined, the following section will shortly introduce the understanding on these terms in this thesis.

2.2. Animal Breeding and Breeds

There is no uniform definition of what constitutes a **breed** as this is mainly dependent on subjective or cultural judgements (Willam & Simianer, 2017). In general, term 'breed' refers to "a group of domesticated animals of the same species that are similar in morphological, physiological or ethological traits, that are similar in their performance or behavior, or who have a common breeding history"[3] (Willam & Simianer, 2017, p. 24).

[3] Translated from German to English by the author

In the EU animal breeding directive, a 'breed' is defined as

> *"a population of animals sufficiently uniform to be considered to be distinct from other animals of the same species by one or more groups of breeders which have agreed to enter those animals in breeding books with details of their known ascendants for the purpose of reproducing their inherited characteristics by way of reproduction, exchange and selection within the framework of a breeding programme."* (Art. 2, 2 (EU) 2016/1012)

Furthermore, the regulation defines "a genetically stable and uniform subpopulation of purebred breeding animals of a particular breed" as a **line** (Art 2, 11, (EU) regulation 2016/1012). Today, the act of **breeding** is in general based on activities related to animal performance testing, targeted selection and planned mating activities of animals in order to work towards a previously defined breeding goal (e.g. in terms of phenotypic and/or genotypic traits) (Willam & Simianer, 2017; Art. 2, 26, (EU) 2016/1012; BMEL, 2021b).

Different steps associated to breeding form **a breeding program**. In a breeding program, breeding animals are selected according to "objectives that are commonly accepted by the participating breeders" (Preamble 20, (EU) 2016/1012). Willam and Simianer (2017) propose different steps for describing animal breeding programs: formulation of breeding targets, keeping records of breeding animals in a herdbook, conducting performance testing and performance estimation and evaluations, selection of animals, mating, passing on success to production step (see Willam and Simianer (2017, pp. 258–290) for details on the different steps). A breeding program can be conducted by several independent organizations (such as breeding associations, performance testing organizations, artificial insemination stations, …) which is why the roles need to be clearly defined when setting up a new program (Willam & Simianer, 2017). Depending on the animal species, there are different models for transferring breeding progress to the production step (ibid.). Legislative frameworks such as the EU breeding regulations (directive, implementing regulations and delegated acts) (European Commission, 2019), the German breeding law implementing the EU breeding regulation (TierZG 2019), national or federal states' directives (see e.g. LfL, 2021), or the Swiss animal breeding regulation (TZV, 2012/SR 916.310) define requirements for officially registered breeding organizations, breeding programs or breeding related services. Furthermore, they impose rules on trade of breeding animals and reproduction material or define responsibilities in for control or financial support of breeding organizations and services.

As one goal of this study is to identify reasons for the low degree of development of organic animal breeding, all kinds of breeding activities related to the organic sector are of interest for the analysis. In the context of this thesis, the term 'breeding initiative' is therefore used to refer to different kinds of actor networks and organizational forms (research projects, breeding associations, informal groups of farmers, breeding companies, multi-stakeholder networks, etc.)

that are managing a breeding program or at least engage in some of the activities which can become part of a breeding program.

2.3. Characteristics of Organic Animal Breeding

A uniform sector wide definition for organic animal breeding has not been achieved, yet. In order to obtain clearer understanding of the research object – organic animal breeding initiatives – within this thesis, hints from existing principles, rules and standards in terms of animal breeding are collected in the following subchapters. Additionally, this is backed with insights from discussions of scientists, practitioners and sector experts which have been presented in the literature and conference reports.

According to the IFOAM organic plant and animal breeding "support[s] sustainable food security, food sovereignty, secure supply of […] products […] and the common welfare of society by satisfying nutritional and quality needs of animals and human beings", "sustains and improves the genetic diversity", "respects the reproduction system of ani given species […] as part of its integrity", contributes to the "adaption [of species] to future growing conditions" and "ensures the circulation and accessibility of genetic resources and rejects patents on life, and edited or genetically engineered forms thereof" (IFOAM, 2017, pp. 9–10).

Spengler Neff (2011) concludes that organic animal breeding can be described on different levels: breeding goals and selection criteria, choice of animal breeds and lines as well as choice of breeding techniques. Similarly, Nauta and Spengler Neff (2012) base their understanding of organic animal breeding on specific selection traits, selection practices, and reproduction methods and technologies and highlight the role of farmer breeding. Herold (2016b) highlights that all goals and decisions in a breeding program respect the integrity of the animal. She also mentions dimensions such as breeding goals and the resulting prioritization of traits in breeding value estimation and selection, the selection of animals from organic farms and the involvement of farmers in different breeding steps (ibid.). The NÖTZ conference report suggests to further examine concepts, goals, methods and technologies and their impact on animal health and organizational structures in breeding when gathering knowledge about organic animal breeding (Reuter, 2007b).

The structure of the following sections is thus based on the dimensions breeds and breeding goals, breeding process and organizational structures.

2.3.1. Breeds and Breeding Goals

With regards to breeds in organic farming, existing rules and standards give rather general aims and recommendations rather than specifying detailed requirements. The general IFOAM norms (IFOAM, 2018) state the adaption of chosen breeds to local conditions as a general principle with

regards to breeds and breeding. Concretely "breeds that can reproduce successfully under natural conditions without human involvement" are required (IFOAM, 2018, p. 47). Similarly, the EU organic regulation of 2007 (Council Regulation (EC) 834/2007) already required "the choice of breeds having regard to the capacity of animals to adapt to local conditions, their vitality and their resistance to disease or health problems;" (Art. 5, j) The choice should also ensure the "prevention of any suffering and to avoid[…] the need for the mutilation of animals" (Art. 14, c, iv, (EC) No 834/2007). The implementing regulation (Commission Regulation (EC) No 889/2008) added the requirement to "avoid specific diseases or health problems associated with some breeds or strains used in intensive production" (Ch. 2, Art. 8) in selection. The new organic regulation ((EU) 2018/848) extended these aspects by a greater emphasis to "genetic diversity", "breeding values", "longevity" and "animal welfare" (Preamble 18). In accordance to the IFOAM position and the EU organic regulation, organic farming associations laid down corresponding rules with regards to breeding activities in their norms (Bioland e.V., 2019; Demeter e.V., 2020). *BioSuisse* (2020, p. 127) highlights that animals should be bred "within the planetary boundaries and adapted to the different needs and conditions of organic farms" [4] and aim at a high lifetime performance. In general health and productivity should be ensured through the choice of adequate breeds (BioSuisse, 2020). In addition to the priorities mentioned in the EU organic regulation, *Bioland* stresses "the conservation of regionally distributed breeds of domestic animals […] wherever possible" (Bioland e.V., 2019, p. 26). Furthermore, it is explicitly stated that "animal species and breeds that are not suitable for the above described housing systems (…) [Feed, exercise, ...] may not be kept."[5] (Bioland e.V., 2019, p. 26). Beyond that, *Demeter* explicitly promotes the use of multi-purpose breeds (Demeter e.V., 2020).

The importance of local and native breeds and the adaption to different social, cultural and economic circumstances is also stressed by Nauta and Spengler Neff (2012). The report from the NÖTZ working group states that a high variety of breeds is needed for the high variety of local conditions, farming systems and farm sizes and concludes that a high diversity across and within breeds would be necessary (Reuter et al., 2007). The role of organic agriculture in using and preserving old breeds and genetic diversity is also highlighted (ibid.). Phocas et al. (2016) stress as well that agroecological systems require to promote more genetic diversity instead of striving for one perfect genotype as overall solution.

The definition of a breeding goal for a certain breed is an important basis of a breeding program (Willam & Simianer, 2017). Traditionally, the it has been based on certain threshold values of different traits while more modern approaches formulate a more general orientation towards the

[4] Translated from German to English by the author
[5] Both quotes have been translated from German to English by the author

economic parameters and try to balance production traits and functional traits accordingly (ibid.). In discussions on organic breeding, additional aspects (beyond economic parameters) can be observed. According to IFOAM (2017) the Principle of Health implies that "useful organisms need to be robust, dynamic, and resilient, able to benefit from interactions with the surrounding biome in which they grow, and to reproduce themselves and to produce high quality, nutritious food"(p. 6). The Principle of Ecology implies "decentralized breeding for regional adaptability, the enhancement of genetic diversity and [the adaption of the] organism to the environment" (ibid.). It is also stated that "match the respective species and the needs of the complete value chain" and "aim at the sustainable use of natural resources" (IFOAM, 2017, p. 10). Beyond that, there is no specification on which kind of traits or selection criteria could be targeted.

Referring to different animal sectors, Nauta et al. (2012) state that potential selection criteria such as "longevity, vitality, fertility, milk production persistency, roughage converting efficiency, foraging ability, temperament and body condition" (p. 313) have been mentioned as especially relevant in discussions around organic breeding. In the context of the NÖTZ project, Reuter et al. (2007) have derived general organic breeding goals as well. They include longevity and high lifetime performance; good basic food intake and a good feed conversion; multipurpose breeds (usually dual purpose: meat and milk in cattle, eggs and meat for poultry); robustness, vitality, social behavior and affability (also of male animals); adaptability to changing (environmental) conditions (feed availability, weather,…); suitability for free range management (across all species), daylight and sun tolerance (Reuter et al., 2007, p. 13)[6]. Phocas et al. (2016) conclude that especially interesting traits might be "those that affect the robustness of animals, especially their health and ability to reproduce well in more fluctuating environments, and their feed efficiency" (p. 1752) but at the same time they highlight that these might prioritized differently in different production systems.

2.3.2. Breeding Process

As mentioned above, breeding activities do not only include the definition of a breeding goal and monitoring of animal data but also involve testing, evaluating and, selecting and mating the breeding animals. Furthermore, different pure line breeding and cross breeding strategies can be found in different animal breeding programs (see Willam and Simianer (2017, p. 227) for an overview). Depending on the type of breeding organization, selection (= choosing animals for targeted mating) might take place either on-farm or in a separate breeding herd (see Willam and Simianer (2017, pp. 218–244) for an overview on different methods and technologies). In

[6] The list of different aspects has been summarized and translated from German by the author

selection decisions, phenotypic[7] or genomic[8] information is drawn from results of performance tests that are either conducted 'in the field' (in (re)production farms) or in specific testing stations (see Willam and Simianer (2017, p. 258) for details). The IFOAM position paper on breeding and reproduction technologies highlights that the interaction of animals with local conditions is important and that the selection should take place "under organic production methods" (IFOAM, 2017, p. 9). As mentioned above, Herold (2016b) points out animals are selected from organic farms, performance tests are adapted to organic target traits and the traits themselves are prioritized accordingly in the overall breeding value.

When it comes to the step of mating, several artificial reproduction methods which influence or increase the reproduction rates of breeding animals are available beyond 'natural mating' (see Willam and Simianer (2017, pp. 287–293) or BLW (2017, pp. 39–43) for an overview). The IFOAM position paper points out that the Principle of Care implies the enhancement of "efficiency and productivity in a precautionary and responsible manner" (IFOAM, 2017, p. 7). This also includes that "breeding techniques that interfere directly at DNA level" should not be used while transparency and collaboration should be promoted in breeding processes (IFOAM, 2017, p. 7). Furthermore, the is evaluated which organic breeding techniques are acceptable in organic systems: With regards to selection and evaluation, marker assisted selection, proteomics and metabolomics are accepted (IFOAM, 2017). Artificial insemination (AI), eco tilling, hybrid breeding, targeted crossing within a species and targeted crossing between species (e.g. mules) are among the accepted reproduction methods and breeding approaches (ibid.). However, it is stressed that the evaluation is not final and needs to be subject of further discussions (IFOAM, 2017). Currently, the IFOAM norms permit AI while embryo transfer (ET) techniques, cloning or use of hormones to induce ovulation and birth are explicitly prohibited (IFOAM, 2018). The EU organic regulation (2007 and 2018) and different organic farming associations (e.g. *Demeter, Bioland, Naturland* and *BioSuisse*) followed the IFOAM norms in this regard. Additionally, they explicitly promote "natural methods" (Part II, Art. 1.3.2, (EU) 2018/848) or natural mating (e.g. Bioland e.V., 2019; BioSuisse, 2020; Demeter e.V., 2020; Naturland e.V., 2020). *BioSuisse* (2020) and *Demeter* (2020) prohibit the use of semen from ET (bulls) and *Demeter* explicitly prohibits in-ovo-selection (in chicken) as well as the use of breeding animals that are bred from sperm sexing (Demeter e.V., 2020; Herold, 2016b). Nauta et al. (2003) also argue for natural breeding techniques and the adaption of animals to the organic environments as central aspects in organic animal breeding. Another assessment of the different reproduction methods (based on the example of cattle breeding) from an organic sector perspective is offered by Bapst (2007). He

[7] Visible physical characteristics (e.g. color) (Willam and Simianer, 2017)
[8] Genetic features of a specific animal (Willam and Simianer, 2017)

concludes that most reproduction technologies or methods (except for natural mating and AI) caused at least partial rejection by different working group members in the corresponding NÖTZ conference and stresses that the organic sector needs further discussions on its position towards the different methods and technologies (Bapst, 2007).

In the discussions around breeding and reproduction methods it is also acknowledged that technological advances might be beneficial in terms of efficient breeding for 'organic traits' their application but that they can also have problematic implications, e.g. with regards to animal integrity, farmer autonomy or genetic diversity (Bapst, 2007; Michalopoulos, 2012; Nauta et al., 2012)

2.3.3. Organizational Structure

Breeding programs can be organized in different ways, either sharing tasks among several actors or vertically integrating several steps of the breeding process (Willam & Simianer, 2017). With regards to breeding, the IFOAM Principle of Fairness is translated to a claim for developing new socio-economic structures in breeding that should ensure "free access to genetic resources, no patents of life, for breeding approaches that involve all value chain actors, equal benefit sharing among chain partners, and maintenance and accessibility of diversity for future generations" (IFOAM, 2017, p. 6). On a general level it promotes the relevance of scientific, practical and indigenous knowledge in the development of new solutions for organic agriculture (IFOAM, 2018). The IFOAM also calls to prioritize non-hybrid breeding in order to enable farmers to reproduce plants and animals on their own (IFOAM, 2017).

Similarly, Idel (2007b) states that economic independence of breeders and farmers should be envisioned as a long term goal. Herold (2016b) concludes that one major difference between organic and conventional breeding (besides the above-mentioned characteristics of organic breeding goals, selection in organic farms,…) is the participation of organic farmers in the breeding process and, the integration into local value chains. This understanding also reflects socioeconomic aspects which are especially highlighted in agroecological principles. Examples for this are "create collective knowledge and coping ability", "foster farmers' independence from the market", "value of diversity of knowledge and know-how" (Migliorini & Wezel, 2017, p. 5); "cultural coherence", "human and social values", "connectivity" or "participation" (HLPE, 2019, p. 67).

2.3.4. Synthesis

Concluding the insights from the previous subchapters, some general aspects and characteristics with regards to organic animal breeding can be described: In general, organic animal breeding aims at producing animals, which show sufficient performance under fluctuating environmental

conditions and in a diversity of organic farming systems (i.e. farming systems that are designed according to principles and norms of organic production). Therefore, the organic sector can benefit from the preservation and development of a high diversity of breeds and genotypes that are adapted to different local conditions and husbandry systems. This can also be ensured through an adequate choice of suitable genotypes, the definition of breeding goals and selection priorities that include characteristics like e.g. longevity, robustness and adaptability, health and body conditions, fertility, feeding requirements, social behavior or multipurpose breeding (i.e. traits that ensure animal welfare but also sufficient productivity under organic management conditions). At the same time, the prioritization of concrete traits always depend on the species and the respective context. Furthermore, the previous paragraphs have shown, that organic animal breeding might also include a **process dimension**: 'Organic target traits' are explicitly prioritized in different steps of the breeding process, e.g. in performance evaluation and selection decisions and achieved by selecting animals from organically managed systems. The exclusion of (or critical reflection on) specific **breeding technologies** from the breeding process was also identified as one characteristic of organic breeding processes. Additionally, socio-economic aspects such as fostering systematic participation of farmers in the design of **organizational structures** and **processes** and ensuring the free access to genetic resources as well as the involvement of value chain actors can characterize organic and agroecological approaches to animal breeding.

However, the previous subchapters have also shown that the details for each of the above-mentioned characteristics need to be further elaborated in discussions among and between different stakeholders. Therefore, being fully aware of the fact that there is no consensus among practitioners and scientists on the characteristics of organic animal breeding, this summary of the existing norms and discussions should be seen as an interim working definition that served as a guidance for achieving a better tangibility of the research object in this thesis. Initiatives which aim to showcase innovative solutions to current problems in the organic sector by reaching beyond current threshold requirements in organic norms and regulations were of special interest in this regard.

2.4. First Hints on Promoting and Inhibiting Factors

The practical implementation of one or several of the above-mentioned characteristics can have different practical implications for animal breeding systems. Already in 2003, Nauta et al. (2003) have defined several possible scenarios for organic animal breeding and discussed them with Dutch organic livestock farmers[9].

[9] Representing the average size of organic farms in the Netherlands at that time, with slightly less animals

As general scenarios they list:

"I. Continue to use conventional breeding;
II. as in I. but without artificial reproduction techniques;
III. adapt conventional breeding to organic requirements;
IV. breeding based on organic principles;
V. regional breeding: breeding based on specific conditions and requirements of organic farms in a given region;
VI. farm-specific breeding: breeding based on specific conditions and requirements of an individual farm" (Nauta et al., 2003, p. 12)

The scenarios represent different levels of ambition in terms of the integration of organic ideals in breeding structures and processes (Nauta et al., 2003). In the discussions with farmers they were slightly adapted to the respective circumstances in different animal sectors (ibid.). The outcomes indicate that the strategies to foster organic animal breeding activities might vary significantly due to the reproductive characteristics of an animal species and the significant differences in historically grown structures in the respective sectors and regions (ibid.). The authors conclude that, "[m]ost of the people involved see the ideal form of breeding, with natural reproduction and regional or farm specific selection, as standard to be achieved in the distant future" (Nauta et al., 2003, p. 5).

Some first hints for promoters and inhibitors for the establishment of different forms of 'organic animal breeding' can be derived from other past discussions: As mentioned in the introduction, there have already been some networking activities on this topic in Germany and Europe (especially NÖTZ and ECO-AB). For example, it was stated that one important framework condition that inhibits the foundation of separate organic animal breeding initiatives is the comparatively low market share of organic products in the overall livestock sector (combined with the fact that high 'efforts' are necessary starting breeding activities) (Kalm et al., 2003; Reuter, 2007a; Reuter & Roeckl, 2007). Furthermore, gaps between conventional and organic production systems differ considerably across species (Schulte-Coerne, 2007) and also across countries and regions (Nauta et al., 2012). The fact that also the conventional sector broadened its breeding goals for some species (e.g. by putting a stronger emphasis on robustness) didn't contribute to a feeling of urgency among organic farmers for a long time (Nauta et al., 2012).

Furthermore, high direct[10] and indirect[11] costs hinder the setup of trials and separate organic programs (Nauta et al., 2003; Nauta et al., 2012). Companies that were involved in the above-mentioned discussions on organic breeding indicated that a complete exclusion of artificial reproduction techniques would negatively affect their competitiveness (Nauta et al., 2003). Legal

[10] Costs that are directly related to the steps in the coordination and implementation of a breeding program (e.g. human resources ore technical equipment for performance testing, selection, …)
[11] Costs that arise from different characteristics of the organically bred animals (e.g. higher forage input)

obligations in breeding processes (e.g. on quality control mechanisms) or high quality standards in retail might also play a role in this regard (Nauta et al., 2003). Additionally, Reuter (2007b) considers consumers' willingness to pay for breeding approaches that are appropriate to the species as an important influence. Existing funding schemes, for example by private foundations or public programs have also been considered as helpful (Reuter et al., 2007). At the same time, it is pointed out that project funding is often only short term oriented (does not cover the whole breeding process over years) and former public services in breeding and performance testing have been privatized in Germany (Kalm et al., 2003; Reuter et al., 2007; Reuter, 2007c; Reuter & Roeckl, 2007).

The limited availability of breeding animals that are suitable for organic breeding can be considered as another challenging aspect (Barth et al., 2004a; Idel, 2007b). This is due to a loss of species diversity which in turn is caused by the focus of breeding programs on few breeds and few performance traits over decades (Idel, 2007b). Schumacher (2007) points out a need for an increased data collection on traits and breeding values in farms and their coordination in breeding associations and companies.

So far, the different actors involved in discussions around organic breeding were not able to obtain an agreement on key traits, appropriate breeding and selection systems or reproduction and distribution technologies across sectors and countries (Nauta et al., 2012). There is also no consensus on the appropriate (and technically feasible) size and diversity of breeding organizations and approaches as well as necessary population sizes (with regards to inbreeding issues) (Nauta et al., 2003; Nauta et al., 2012). A high diversity of farming systems and marketing structures, complicates the formulation of overall breeding goals for the whole sector (Schumacher, 2007). The fact that organic standards and regulations did (and still do) not state a clear vision for organic breeding was also considered as inhibiting (Nauta et al., 2003; Nauta et al., 2012) .

'Social aspects' like the hesitance of farmers to participate in organic breeding activities due to their trust in existing breeding organizations (Nauta et al., 2003; Nauta et al., 2012), the habit to use existing conventional breeding stock (Nauta & Spengler Neff, 2012) as well as a lack of interest to have a deeper look into breeding issues (Reuter, 2007a) also hamper the implementation of organic breeding initiatives. Beyond that, adequate consultancy on breeding is often lacking, as existing consultants often see breeding as a 'side topic' at best (Reuter et al., 2007; Reuter & Roeckl, 2007). On the other hand, cooperation of practitioners, scientists and associations in joint projects have been especially highlighted as promoting factors (Reuter et al., 2007). In general, public interest in the topic of organic animal breeding (especially from actors who engage in animal protection) is regarded as important (Reuter et al., 2007).

3. Organic Animal Breeding from the Perspective of Agricultural Innovation Systems

As outlined in chapter 2, animal breeding based on organic and agroecological principles might not only involve specific breeding goals but also different processes and organizational set ups. Thus, this thesis focuses on initiatives that develop innovative[12] breeding approaches to solve current challenges related to breeding and breeds in organic agriculture. Chapter 2.4 that different scenarios are possible and at the same time it was already indicated that promoters and inhibitors for organic animal breeding might originate from various thematic areas (such as resources, political priorities or knowledge gaps). It was also highlighted that animal breeding is usually not conducted by one single organization but relies on the contributions of different actors.

Based on these considerations Agricultural Innovation Systems (AIS) were chosen as a suitable theoretical orientation for the analysis: AIS research focuses on "[…] multi-actor interactions and structures (infrastructures, policies, institutions)" that help to promote innovation (Klerkx et al., 2012, p. 464). An AIS can be characterized as a "[…] network of organizations, enterprises, and individuals focused on bringing new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect the system's behavior and performance" (Rajalahti et al., 2008, p. 3). Therefore, when conducting an exploratory study on factors that influence the success of organic animal breeding initiatives, an AIS perspective helps to take a variety of potentially relevant aspects into account. Beyond that, it allows to broaden the view on relevant context[13] factors that promote or inhibit the implementation of innovative processes and organizational set ups in (organic) animal breeding. The thesis does not claim to make significant contributions to the AIS literature or the AIS concept as such – it rather uses insights from AIS research as a guidance for answering a practical research question in a field that has not been broadly discussed in the scientific literature, yet.

3.1. Different Approaches to Agricultural Innovation System Analysis

An AIS can consist of people or organizations that are active in the same sector, in the same geographic area or work on the same specific problem – therefore it can be analyzed at different

[12] According to the understanding of TP organics, organic and agroecological innovation is not only about technology development and technology transfer but also about social innovations (TP Organics 2019). Inspired by the innovation definitions of TP organics (2019, p. 11) and The world Bank (2006, p. 15), in this thesis, innovation is not only understood as development of new or improved technologies, institutions, processes or organizational structures but also as the new application or recombination of technologies, institutions, processes or organizational set ups in specific contexts and by specific actors

[13] Context is understood here as influence factors with regards to the initiatives goals, development and long-term establishment that are considered as relevant/important by the initiative itself; the system boundaries are therefore rather soft, accounting for the exploratory nature of the study

levels: “national, sectoral, commodity or intervention based” (Anandajayasekeram & Gebremedhin, 2009, p. 10). The concept has often been used for the analysis and strategic development of agricultural sectors in developing or industrializing countries (Anandajayasekeram & Gebremedhin, 2009; Hall et al., 2006; Rajalahti et al., 2008; Spielman et al., 2009). In these contexts, the analysis mostly focuses on the whole agricultural sector in the respective country. However, according to The World Bank (2006) the innovation systems framework as such has its origins in industrialized countries. In the agricultural context, it has recently been applied in ‘developed countries’, e.g. for the analysis of environmental cooperatives the Netherlands (Hermans et al., 2013), for comparing Dutch and Scottish agrifood sectors (Lamprinopoulou et al., 2014), to analyze innovation projects in three different agricultural subsectors in New Zealand (Fielke et al., 2017) or for comparing the uptake of a specific breeding method in three different Scottish livestock sectors (Borthwick et al., 2014).

These examples confirm the observation by Klerkx et al. (2012), who conclude that different perspectives on system boundaries do exist in AIS research: with regards to elements that are considered as parts of the system but also with regards to geographical and technological boundaries. The analysis of organic animal breeding initiatives might come closest to what Anandajayasekeram and Gebremedhin (2009) refer to as “intervention-based innovation system” or “problem focused innovation system” (p. 17): a system which is designed to work on a particular problem or which is “constructed for a purpose”(ibid.). This view focuses on how different relevant actors interact with regards to the problem in question (Anandajayasekeram & Gebremedhin, 2009). The particular ‘problem’ to be solved in this case is the dependence of organic animal production (especially organic livestock farmers) on animals that are not bred according to organic principles and therefore not adapted to the conditions in a high diversity of organic farming systems. Or in other words: the purpose to be followed is to change existing breeding structures according to the needs of organic farming systems and a better adherence to organic principles in all steps of the breeding and production chain (potential implications for different steps and aspects have been outlined in chapter 2). As mentioned in the introduction, the system boundaries in this thesis are drawn around specific initiatives from different sectors and their direct context.

According to the integrated analytical framework for the assessment of AIS performance by Lamprinopoulou et al. (2014), AIS analysis can be conducted in different forms, that can be combined or built up onto each other: A “structural-oriented analysis” (micro level), a “functional analysis” (micro level) and a “transformation-oriented analysis” (macro level) (p. 43). Schiller et al. (2020) define agroecological innovation systems as “subset of the national agricultural

innovation system" (p. 90) and conduct a structural analysis as well as a functional analysis[14]. As mentioned above, this thesis restricts its focus to single initiatives who are located in the center of an innovation process and their direct context and - for the sake of a simple and structured overview - focus on the structural oriented micro level analysis (not systematically covering the different functions). This is in line with what Klerkx et al. (2012) refer to as "infrastructural view of AIS" (p. 464)[15]. Therefore, the analysis is restricted to a rather static analysis of presence of actors and structures and the way in which they enable, support or hinder innovative practices in terms of (organic) breeding while only tapping upon the interactions between and qualities of different elements.

3.2. Application of AIS Elements in the Analysis of Organic Animal Breeding Initiatives

The choice of thematic areas for the analysis of organic animal breeding initiatives is inspired by the study from Schiller et al. (2020) who have coined the term "agroecological innovation systems" (p. 91) in their research on agroecological innovations in Nicaragua. As this thesis also focuses on initiatives that integrate organic and agroecological principles in their sectors, this was found to be a suitable guidance. The authors apply the elements and functions of so called "Technological Innovation Systems" (TIS) as (defined by Wieczorek Hekkert (2012)[16]) and base their analysis on elements from four main areas: actors, interactions, institutions and infrastructure (Schiller et al., 2020).

Schiller et al. (2020) and Wieczorek and Hekkert (2012) indicate that the presence or absence of elements from these four main areas as well as the quality or capacity of different elements are important determinants for the functioning and performance of an innovation system. Their presence or quality can explain the evolvement of "systemic problems" (Wieczorek & Hekkert, 2012, p. 79) or "blocking mechanisms" (Schiller et al., 2020, p. 93) which hinder the wider application of innovative practices (e.g. agroecological practices). Hence, the focus in the empirical data collection can be put on the presence of actors, interactions, institutions and infrastructures and the way in which they enable, support or hinder the initiatives in their work on establishing innovative approaches for organic animal breeding.

[14] From systematically examining the influence of the presence and capacity of the elements Schiller et al. (2020, p. 92) derive the fulfillment of seven "functions" that have been defined by Wieczorek and Hekkert (2012, p. 78): "Experimentation by entrepreneurs"; "Knowledge development"; "Knowledge exchange"; "Guidance of the search"; "Market formation"; "Resource Mobilization" and "Creation of legitimacy"

[15] The authors differentiate between the "infrastructural view on AIS", "the process view of AIS" and the "functionalist view of AIS" (Klerkx et al., pp. 464-467). However, they also recognize that all views entail similar enabling factors for innovation (Klerkx et al., 2012)

[16] According to Wieczorek and Hekkert (2012), TIS are not limited by national borders but in contrast to sectoral innovation systems, they have a more specific scope by focusing on a certain technology.

This approach is supported by the fact that these and similar 'categories' can also be found in further AIS related studies. For example, The World Bank (2006) suggests four similar dimensions ("Actors and their roles", "Attitudes and practices", "Patterns of interaction" and "The enabling environment for innovation", including technology and legal policy context (p. 43)). The analysis by Rajalahti et al. (2008) or the review on key enablers and key disablers for AIS performance conducted by Klerkx et al. (2012) show similar topic areas as well. The categories are also partly reflected in the evaluation of the German innovation system (on national, sectoral, innovation field or single innovation level) (Bokelmann et al., 2012). Additionally, the categories can also be found in studies that explicitly deal with the analysis of animal breeding organizations[17]: In the EURECA project which analyses local European cattle breeding systems (Martín-Collado et al., 2010) or in the work of Rößler et al. (2012) who analyze smallholder pig breeding in Vietnam. Thus, the four topic areas with the respective subcategories as applied by Schiller et al. (2020) and Wieczorek and Hekkert (2012) were complemented by aspects and categories the above-mentioned studies and used in the analysis organic animal breeding initiatives in this thesis. A summary of the identified aspects is provided in Table 2. A detailed review of the listed aspects can be found in Appendix 1.

Table 2 Elements of an innovation system
(own collection, based on Schiller et al. (2020, p. 91) and Wieczorek and Hekkert (2012, pp. 76–77), supported and complemented by aspects from Bokelmann (2012, pp. 25–26), Klerkx et al. (2012, pp. 469–470), Martín-Collado et al. (2010, pp. 129–130), Rajalahti et al. (2008, p. 4), Rößler et al. (2012) and The World Bank (2006, p. 43))

Structure/Element	Subcategories	Details and potential aspects
Actors	individuals, organizations, networks	types of actors and their roles; examples: farmer organizations, civil society organizations, companies, government agencies, knowledge and research institutes, financial organizations, and donor organizations, consultants, transport
Interactions	market structure, informal interactions, formalized interactions	power structures in markets, competition, relationships and dependencies, patterns of interaction, knowledge flows, resource flows
Institutions	hard / formal institutions	rules, laws, regulations, fiscal and legal policy context, administrations
	soft / informal institutions	customs, routines, established practices, traditions, ways of conduct, common habits, attitudes, norms, expectations
Infrastructures	physical infrastructures	technology, machines, artefacts
	financial infrastructures	costs, grants and subsidies
	knowledge infrastructures	expertise, know how, capabilities

[17] In general, breeding programs and organizations as such, have not been subject to many non-zootechnical analyses, yet. Therefore, they literature did not provide many reference examples for comparison

4. Methodology and Qualitative Research Design

For the study of the rather unexplored research topic of organic animal breeding initiatives, a qualitative research approach was chosen. This kind of research design is often applied in generating new knowledge in a certain field rather than on confirming existing theories of cause-effect relationships (Flick, 2017). In contrast to quantitative research it is not restricted to standardized processes or few specific variables but allows to account for the complexity and interdependencies of research objects (ibid.). Thus, it matches the explorative character of the research in this thesis. In qualitative research, different basic research designs can be applied, which vary for example in terms of depth, breadth or considered time horizons (see Flick, 2017, p. 187 for an overview). For the purpose of this study, it was decided to focus on a few existing cases of existing animal breeding initiatives for an in-depth analysis. This is also in line with an inductive research logic of qualitative research approaches, meaning that findings from few specific cases are used to describe a specific context in detail and to derive new insights or theories (Döring & Bortz, 2016). The research process in qualitative studies follows the principles of openness, but at the same time it is led by theory and follows rule-based procedures (Gläser & Laudel, 2009). Therefore, the data collection process in this thesis is guided by existing knowledge from the information on organic animal breeding (as presented in chapter 2) and is structured by theoretical implications from the AIS literature (as presented in chapter 3). The application of general theoretical concepts to a specific observation is a feature of deductive research approaches (Döring & Bortz, 2016). Thus, this thesis applies a mix of inductive and deductive elements.

Based on the considerations from chapter 3, the respective initiatives are considered as small innovation systems and are thus analyzed along the categories made up by different innovation system elements. Wieczorek and Hekkert (2012, p. 84) suggest to use “literature, internet searches and interviews with actors” for starting an AIS analysis, (i.e. mapping AIS elements). In qualitative research, different types of interviews are used that vary in terms number and kind of interviewees and also with regards to their standardization (Döring & Bortz, 2016; Gläser & Laudel, 2009). For the purpose of this thesis semi-structured expert interviews (mainly following the instructions by Gläser & Laudel, 2009) backed with online research on the initiatives and their sector contexts were chosen as data collection method. This allowed to get in depth insights on each initiative on the one hand while enabling a comparison across cases on the other hand. This is also in line with the approaches in other AIS studies which have made use of semi-structured (expert) interviews with actors from the system in question (e.g. Bokelmann et al., 2012; Borthwick et al., 2014; Fielke et al., 2017; Hermans et al., 2015; Schiller et al., 2020).

In order to stay within the scope of a master thesis, it was decided to interview one central person per case (ideally the initiative's coordinator), contributing expert knowledge on the specific initiative and relevant context factors. An expert is someone who has special knowledge on a specific context, process or social constellation (Bogner et al., 2014; Gläser & Laudel, 2009). Expert interviews can be used to explore a certain field, drawing from this specific knowledge (Gläser & Laudel, 2009). The expert knowledge can also be derived from the professional role of a person and the professional knowledge which is tied to it (ibid.). For the purpose of this thesis, initiative coordinators were expected to have a sufficient overview about the broad range of different topic areas that are of interest for the study. They are supposed to know internal processes, actors' constellations and social relationships as well as the most relevant influences from the external environment of the initiative. Thus, it was decided to conduct semi-structured interviews with coordinators.

Semi-structured interviews are based on an interview guideline which ensures that all relevant topic areas are covered (Gläser & Laudel, 2009). At the same time, this type of interviews leaves flexibility to address the topics in an order that ensures a natural flow of conversation (ibid.). It allows the interviewer to spontaneously include additional or in depth questions that arise in the specific interview context and to adapt the exact wording of questions to the interview situation and the interviewee (Döring & Bortz, 2016; Gläser & Laudel, 2009). At the same time, it ensures that all topics that are relevant for answering the research questions are covered (ibid.). Furthermore, it guarantees that the same kinds of information are collected throughout different interviews and prevent an implicit shift of research interest (Gläser & Laudel, 2009). Hence, the interviews with the initiatives were based on an interview guideline to ensure that the cases were examined in a similar way and to enable the subsequent comparison. An interview guideline should be designed as a 'model interview' in which a natural sequence of topic areas would be ensured if the interviewee reacts as expected (Gläser & Laudel, 2009). However, the qualitative nature of the research implies the openness towards new aspects and topic areas which are mentioned by the interviewees (ibid.).

The interview results were processed through a qualitative content analysis. In contrast to a free interpretation of results, qualitative content analyses systematically derive relevant information from the material (Gläser & Laudel, 2009). There are slight variations within the approaches for conducting qualitative content analyses that are proposed in the literature (see e.g. Flick, 2017; Gläser & Laudel, 2009; Kuckartz, 2018; Mayring, 2015). For the purpose of this thesis the approach by Kuckartz (2018) was chosen (see chapter 4.3) as it offered comprehensive step by step instructions.

4.1. Choice of Cases and Interviewees

Before choosing the cases and experts for the thesis, a mapping of existing initiatives was conducted in the framework of the *Engagement.Biobreeding Europe* project. One part was the preparation of an online survey (by Mariateresa Lazzaro (ML) and Svenja Puls (SP) which was published at the *Engagement.Biobreeding* website and was distributed across Europe (the list of questions is included in Appendix 2). The results were supposed to provide first data on the type of initiative, including breeds and general approaches. In parallel, online research and personal contacts and recommendations complemented list of currently active organic animal breeding initiatives. The resulting set of initiatives was supposed to serve as a basis for choosing cases for an in-depth analysis for the thesis. During the search it became clear, that there are very few initiatives which are trying to develop new or existing breeds explicitly towards the needs of organic agriculture. There were current or already concluded research projects that worked on the suitability of breeds and genotypes for organic or low input[18] systems (e.g. by developing selection instruments for social-ecological systems), as well as several conservation breeding associations or initiatives (e.g. an association for breeding and preserving of the East Balkan Swine). A list of the collected initiatives can be found in Appendix 3.

However, while some organic farmers seem to use traditional or pure line hobby breeds (e.g. *Vorwerk* or *Sundheimer* chicken (Hörning, Kaiser, Schmelzer, et al., 2020)), *Schwäbisch Hällische* or *Bunte Bentheimer* pigs (Baulain, 2007) it was decided that breeding associations that do not explicitly focus on organic farmers would be excluded from the thesis' research focus. Conservation breeding is usually not directed at developing a breed further but rather preserving specific characteristics of a breed and is focused on the avoidance of inbreeding in the small remaining populations (Barth et al., 2004b; Willam & Simianer, 2017). Thus, it is not necessarily suitable for organic agriculture. The criteria for choosing the initiatives were set as follows:

- the initiatives' explicit focus on the organic sector; goal to develop and implement a breeding program (or activities related to a breeding program) for organic farms
- Priority on initiatives with participatory organizational structures were prioritized (based on the considerations from chapter 2.3.3)
- choose cases from different animal species (in order to identify potential differences and commonalities across sectors)
- priority on cases that were established since longer time (richer experience to learn from)
- focus on Germany and Switzerland (due to the necessary limitations for the scope of a master thesis and the fact that most advanced cases could be found in those two countries)

[18] Organic animal production is often seen as one form of low input animal production (e.g. Klint Jensen, 2012)

Based on these considerations, three case studies have been chosen for an in-depth analysis in the thesis:

The ***Ökologische Tierzucht gGmbH*** **(ÖTZ)**[19], which aims to develop laying hens and double use breeds for the organic sector (ÖTZ, 2020h), involving a set of different stakeholders and actors (ÖTZ, 2020f). Inga Günther as the chief executive officer was considered as suitable interview partner to represent the initiative: She represents the company in various events and communication channels and has also been involved in the foundation.

GoOrganic **(GO)** is the title of a joint project, which aims at establishing a sustainable, resource-efficient and ecological breeding program in the goat sector (MLR, 2020c). It is conducted by a consortium of different partners (research and practice) from southern Germany. One of the main tools to build up organic breeding programs is to motivate organic farmers to get involved in the definition of breeding goals (Pera Herold's answer in the above-mentioned online survey). Pera Herold was chosen as interviewee for the project as she is the project leader and was thus considered to have a good overview on all the information that was needed in the data collection.

Unser Hausschwein **(UH)** is a project in which pig farmers (together with FiBL[20]) aim at developing a new pig breed for organic agriculture and free-range husbandry systems which can be fed from regional feed sources. Barbara Früh (employed at FiBL) is the official project leader, while Anna Jenni (employed at FiBL) is responsible for the day to day project management. For the interview, Anna Jenni was chosen as she has been part of the project a long time and has more direct contact with the farmers in the project.

4.2. Data Collection

The following chapters will present the data collection for answering the research question. The processes of conducting background research and developing the interview guideline are presented and the implementation of the interviews as well as the subsequent transcription are described.

4.2.1. Background Research and Additional Information

In addition to the interviews, information on the respective initiatives was collected from content of reports, newspaper articles, websites or publications by the initiatives. They were used to complement the data collection on each initiative and to prepare the interviews. As in most cases, no scientific publications on the initiatives were available, mainly grey literature was used.

[19] In the following chapters, the initials of the initiatives' names will be used to ensure a better reading flow
[20] FiBL (*Forschungsinstitut für biologischen Landbau* [Research Institute of Organic Agriculture]) is an independent research and information center for organic agriculture, conducting projects in research, education and consultancy. It is which is present in different European countries (see https://www.fibl.org/en/locations/switzerland/about-us-ch.html [last access 25th Feb 2021] for details)

Additionally, a background research on the respective animal sector was conducted. The overview on the current status of organic animal breeding in Nauta et al. (2012) highlighted that different types of breeding initiatives might develop depending on the respective species or regional context. Thus, giving a rough overview on the current situation in the sector was considered necessary to provide some context for each case. A first search was conducted prior to the interviews in order to prepare the interviewer for the specific interview and to enable sector specific questions. Subsequently, the most relevant background information, (occasionally backed up by additional information given by the interviewees) was summarized in small sector background sections to 'set the stage' for the specific case study examples (chapters 5.1-5.3, 6.1-6.3; 7.1-7.3). For this background research, conference reports, market analyses, websites (e.g. of ministries, companies or associations) and scientific publications were consulted.

In case of the ÖTZ, a second interview on the specific question of financing was conducted by Mariateresa Lazzaro (translated by SP) as part of the *Engagement.Biobreeding Europe* project. Some relevant information from this interview were also included in the analysis. Prior to the interview on GO in October, a first phone call with Pera Herold had taken place in July 2020 (in the context of the *Engagement.Biobreeding Europe* project) in which ML and SP asked general first questions on the initiative. This was used for complementing information from the actual interview for the thesis, where necessary. Furthermore, a phone call with Barbara Früh (project lead of the UH project) on 5th February 2021 contributed some background knowledge on the Swiss organic pig sector. A transcript of the second ÖTZ interview as well as notes from the other phone calls are included in the Appendix (Appendix 7.2 and 11).

4.2.2. Interview Guideline

The interview guideline for the semi-structured expert interviews was prepared according to the instructions of Gläser and Laudel (2009) and contained open questions as well as questions that were based on the previous theoretical considerations. In order to ensure comparability of the information from the different interviews, the questions were based on predefined categories for topic areas (from the AIS framework) in which the relevant aspects could be located. Insights from chapter 2 as well as the general description of the elements of a breeding program by William and Simianer (2017) have also been considered as they help to understand the structures of the examined initiative or program.

The Interview was started with a warm up question in which the interviewee was asked to introduce herself/himself and describe her/his background in organic animal breeding. According to Gläser and Laudel (2009) starting with a question which is easy to answer helps the interviewee to get used to the interview situation. In order to ensure a natural flow of conversation, the questions on the foundation phase and a question concerning the confirmation of the

organizations' goals were asked prior to the main thematic block. The specific questions on the foundation phase were expected to yield important information on factors that promote and inhibit breeding activities in their start-up phase. Before addressing issues related to the different topic areas from the AIS literature, a general question on the interviewees' opinion concerning major promoters and inhibitors was asked. This was to avoid an influence on the interviewee's priorities concerning promoting and inhibiting factors. The topic areas for the main part of the interview were constructed according to the categories that have been developed in chapter 3.2. The final phase of the interview was dedicated to sum up the previously mentioned driving and inhibiting factors and to broaden the view on the whole sector. Further, the interviewees' opinion on the central characteristics of organic animal breeding were detected in order to set their other statements and views into context and in order to explicitly confirm/reject the collected characteristics of organic animal breeding from chapter 2. Due to the potential for emotional discussions/long answers, this question was placed at the end of the interview on purpose. The full interview guideline can be found in Appendix 5. All three interviews were based on this guideline.

4.2.3. Visualization of Actors during the Interview

As described in chapter 3.2 the collection of relevant actors is an important element in the analysis of positive and negative influences on an AIS. In order to help the interviewee in remembering relevant actors and their interactions, it was decided to visualize the most relevant actors during this part of the interview. This procedure was inspired by the social network analysis (SNA) method, which is listed among the potential AIS research approaches by Klerkx et al. (2012) and has already been used in AIS related studies (e.g. Asres et al., 2012; Clark, 2011; Hermans, 2011; Hermans et al., 2013; Wood et al., 2014). It has also been applied for analyzing animal breeding organizations (Kury, 2011). However, the aforementioned examples apply SNA focusing on specific aspects in innovation systems or organizations (e.g. the role of networks, power structures or knowledge exchange). As this is beyond the scope and capacities within this thesis, the visualization was only used as a tool to support the discussions on relevant actors and interactions, without systematically quantifying frequency of interactions or amount of influence of individual actors (as it has been done by Hermans et al. (2013) or Kury (2011)). Despite the huge variety actors that is potentially relevant for an innovation system (see chapter 3.2), the interviewees were asked for 'important' or 'directly relevant' actors.

4.2.4. Implementation of the Interviews

The interviews were conducted between end of August and middle of October 2020. The interviewees were contacted via email or telephone and subsequently provided with a data use consent, together with a one-page outline of the thesis' goal (see Appendix 4). The interviews

were conducted on site (ÖTZ) or via online meeting (UH and GO). Conducting interviews face-to-face usually yields richer information and ensures better control of the interview situation (Bogner et al., 2014; Gläser & Laudel, 2009). However, due to logistical issues (and due to the COVID-19 situation in Europe in fall 2020), the other interviews needed to be implemented as online interviews. The interviews were conducted in German as this was the mother tongue of the interviewees. Each interview took 1,5 – 2 hours and was recorded for subsequent transcription.

For mapping the relevant actors for each initiative colored post-its and a white paper were used for the on-site interview and in the online interviews, a screen with a white *PowerPoint* slide was shared. Prior to the interview, a first list of potential actors was prepared collected on a separate sheet to compare them with the given answers, speed up the visualization during the interview. The outcomes of the actor visualization are displayed in Appendix 8.

Once the interviews had been analyzed, the interviewees were contacted again for confirming and – if necessary – completing the results with additional comments. The feedback was given in short phone calls. This was done to double-check that no important aspect was forgotten in the main interview. The results were mostly confirmed by the interviewees, only some minor comments were given. Additional information or statements from this feedback round are explicitly marked with a note (‘pers. comm., [date]’) in the result section. Notes on from these phone calls are included in Appendix 11.

4.2.5. Transcription

The interviews were recorded and subsequently transcribed with the F4 software. The transcription process followed the instructions of Rädiker and Kuckartz (2019), with a slight adaptation and extension of the rules for the purpose of this study. The transcripts include the exact wordings from the interviews and each text block (after each speaker change) is numbered. In some cases, double sentences were left out or wording orders were slightly adapted to ensure a better reading flow. A list of the applied rules can be found in Appendix 6. Due to the low number of organic breeding initiatives in Germany and Europe, it was not possible to completely avoid a connection of the collected data to the respective organizations which is why the interviews were not anonymized. This aspect was also included in the data use consent and confirmed by the interviewees. In case information on other people or companies was given in the interview, their names were only included if the information could also be found publicly. The transcripts of the three interviews can be found in Appendix 7.

4.3. Qualitative Content Analysis

For analyzing the material, qualitative content analysis has been conducted. Following the approach of Kuckartz (2018) the analysis consisted of different steps. Initially, the text was read, important passages were marked and first thoughts were written down in the form of comments and memos. A case summary for each interview helped to get an overview of the content and the main topics that were mentioned.

Subsequently, a mix of deductive and inductive approaches was chosen for forming thematic coding categories to be applied in the text analysis. The categories were formed in order to ensure a structured display of the results and to ensure a comprehensive comparison of information across cases. The first set of categories was formed based on the theoretical background and prior theoretical considerations (deductive approach). Each category was specified in a short definition and was tested in a first coding process. The coding was conducted by using the software MAXQDA. The coding units consisted of several words up to several paragraphs that were referring to the same topic and that were giving enough context to understand the coded passage individually. In some cases, one sentence contained information on different categories. Therefore, double coding of sentences was applied, if necessary.

A second step included the formation of further subcategories for the existing main categories. The material gathered for each of the main categories in this first coding process was reviewed again. Further subcategories were formed from thematic implications that resulted from the content, where necessary (inductive approach). For example, it turned out that some actors interacted more regularly and were involved in strategic decisions and practical breeding work while others only had occasional contact or had an indirect relevance. Thus, actors, interactions and institutions were subcategorized accordingly. All categories were specified by a small description and backed with examples from the transcripts to ensure their consistent application. The detailed table of coding categories can be found in Appendix 9. The text was coded again, according to these new subcategories. In order to further structure the information and reduce them to the most relevant information for answering the research questions, the coded passages were paraphrased and summarized.

The following chapters present the results which have been gathered from the interviews and the preparatory background research. Every case is presented in an individual chapter in which respective information on the sector background is also given. The cases are presented along the coding categories by subsuming results from several categories under one thematic headline. In the end of each chapter, the promoting and inhibiting factors for the success of the initiative that have been more or less explicitly mentioned by the interviewees are shown. A table which

summarizes the promoters and inhibitors along the thematic categories that were used in the result chapters can be found in Appendix 10.

5. Results from the Poultry Sector

Organic poultry production has a share of 2% in the total poultry production in Europe (Willer & Lernoud, 2019). In Germany, 11% of all consumed eggs and 1,4% of broiler meat have been certified organic in 2018 (BÖLW, 2020a). Also within the organic sector, egg production has a comparatively high share among the different product groups (12,9%) (BÖLW, 2020a). Just like in the conventional sector, egg and broiler production is separated and conducted in specialized farms in the organic sector (Hörning, Kaiser, Schmelzer, et al., 2020). The minimum standard for organic production in Germany is the EU organic regulation. Beyond that, some organic farmers are organized in different farming associations (*Bioland, Naturland and Demeter* being among the largest) (Haller et al., 2020). Around 78% of organic eggs are produced under association standards (Leopold et al., 2016). In 2016, the majority of organic farms had stock sizes of 1-99 animals (2869 farms) (destatis, 2017). However, the majority of organic poultry was kept by few, large farms with 10.000 or more animals (destatis, 2017).[21]

5.1. Poultry Breeding in Germany

For poultry, the EU organic regulation ((EU) 2018/848) explicitly requires the choice of breeds that "come from slow-growing poultry strains adapted to outdoor rearing" or at least adhere to minimum age for slaughter (81 days for poultry) (Annex II, Part II, 1.9.4.4). Beyond the general requirements on breeds that have been stated in chapter 2.3.1, no further 'organic' requirements with regards to poultry breeds can be found. Young laying hens for organic farms need to be bought from organically managed parent herds and raised under organic conditions[22] (exceptions are possible in case no organic animals are available on the market) (Leopold et al., 2016; Annex II, Part II, Art. 1.3.4.3 (EU) 2018/848). Around 90% of the current demand for chicks can be covered from organic herds (Leopold et al., 2016). With regards to the breeding and production chain, the new EU organic regulation ((EU) 2018/848) has introduced new requirements for parent herds, young chicken and brother hens (esp. with regards to stocking densities and outdoor run) (see a summary at BÖLW, 2020b). Beyond that, it does not contain specific requirements for poultry with regards to the different breeding and production steps. Merely *Demeter* has stated the preference for natural mating in poultry (Leopold et al., 2016) and prohibits in-ovo-selection[23] (Demeter e.V., 2020).

[21] According to organic standards the maximum size of one organic laying hen herds is 3000 (broilers 4800), while several separate herds can be kept in one farm (Art. 15, b, (EU) 2020/464; Bioland e.V., 2019; Demeter e.V., 2020)

[22] Additionally, the new organic regulation includes specific regulations for housing in parent herds and rearing farms (Annex I, Part IV, (EU) 2018/848)

[23] The term in-ovo-selection describes different methods to detect the sex before hatching (allowing to stop the breeding process for male chicks of laying hens). In Germany, research and development on in-ovo-selection technologies have been subsidized by the government in recent years (BMEL, 2021a)

In the organic sector, the majority of farms currently uses hybrids from conventional breeding companies (multiplied under organic conditions) (Hörning, Kaiser, & Böttcher, 2020). Currently, there are no detailed statistics with regards to the shares of different breeds that are actually used Hörning et al. (2020). Worldwide, poultry breeding is mainly conducted by four large corporations with significant market power (Gura, 2015; Willam & Simianer, 2017). The companies have developed specialized breeds which are either focused on laying performance or meat production (Hörning, Kaiser, Schmelzer, et al., 2020; Preisinger, 2017). Their 'products' are hybrid animals which are bred in nucleus breeding programs[24] from several pure line breeds (four way crosses in laying hens, three way crosses in broilers) (Hörning, Kaiser, Schmelzer, et al., 2020; Willam & Simianer, 2017). The poultry breeding and production process organized in several specialized steps (see Figure 1). Different steps are sometimes integrated in one company (Hörning, Schmelzer, et al., 2020). Due to the organic sectors' reliance on the above-mentioned companies, most steps are still organized as in the conventional production chain (Hörning, Kaiser, Schmelzer, et al., 2020; Kaiser et al., 2020).

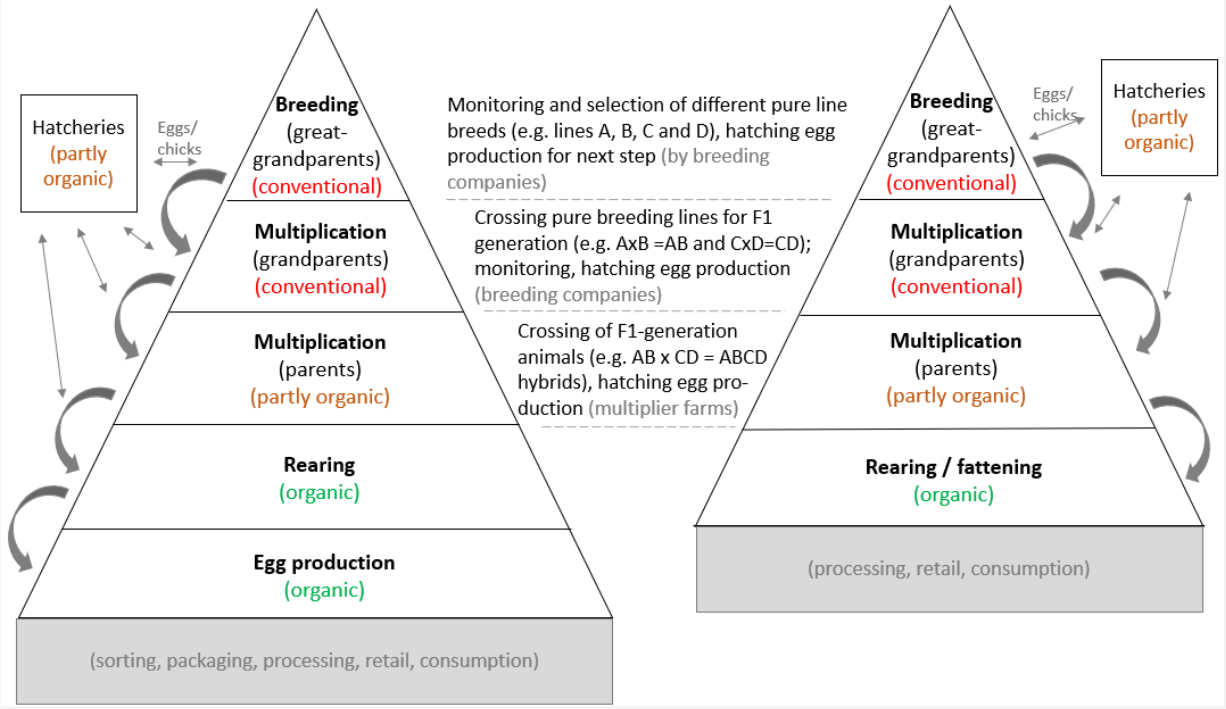

Figure 1 Visualization of different steps in poultry breeding (laying hens and broilers)
(Own illustration based on Brade, 2008, p. 60; Hörning, Kaiser, Schmelzer, et al., 2020, pp. 3, 30; Kaiser et al., 2020, p. 13; William & Simianer, 2017, pp. 244, 296, 311)

Besides the commercial poultry breeding, several associations of pure line breeders can be found in Germany: They are organized on federal state, regional, and city level, manage their breeds in

[24] In nucleus breeding programs, selection is conducted in a comparatively small population (usually applied in animal species with a high female reproduction rate, such as poultry or pigs) (Willam and Simianer, 2017)

herd books[25] (federal state level) and offer consultancy services (Hörning, Kaiser, Schmelzer, et al., 2020). In contrast to other agricultural livestock, poultry breeding associations are not covered by the European and German animal breeding legislation (ibid.). Due to the high degree of vertical integration, only few impendent test stations for poultry have remained (ibid.). Most association members are hobby breeders who do not focus on productivity traits (Barth et al., 2004c; Hörning, Kaiser, Schmelzer, et al., 2020). However, some of the pure line breeds are also used in organic agriculture or might be interesting for organic breeding (Hörning, Kaiser, Schmelzer, et al., 2020; Idel, 2007a).

5.2. Current Issues in Organic Poultry Husbandry with regards to Breeds

Some examples of current issues that are caused by the circumstances described above include killing of male chicks and health problems in organic livestock systems: For many years, one of the most discussed ethical issues in organic and conventional poultry sectors has been sexing[26] and killing day old chicks resulting from the specialization of the currently used hybrid lines (Barth et al., 2004b; Maurer, 2012; Reuter, 2007c). As organic farms mostly use conventional breeds, the discussion affects both sectors alike (Hörning, Kaiser, Schmelzer, et al., 2020). The high public awareness – and the legislators reaction[27] – has triggered several initiatives who aim to raise the "brothers" of laying hens in organic and conventional markets (Hörning, Kaiser, Schmelzer, et al., 2020; Schaack et al., 2018). However, fattening the slow growing males of layer breeds is considered to be costly and inefficient in terms of feed (Idel, 2007c; Schaack et al., 2018; Weigend, 2007). Thus, alternatives for determining the sex before hatching (in-ovo-selection) are considered among potential alternatives (BMEL, 2021a; Schaack et al., 2018). In the organic sector it is questioned whether this is in line with organic ideals (BLE, 2020a; LWK NRW, 2020). In public statements (Bioland e.V., 09th 2020), official decisions (Naturland e.V., 20th 2020) or guidelines (Demeter e.V., 2020), the German organic farming associations clearly reject in-ovo-selection. Thus, the development of double use breeds who show moderate performance in meat and egg production is discussed as another alternative, especially in the organic sector (Idel, 2007c; Vaarst & Maurer, 2019).

Another important challenge in organic poultry farming includes acquiring sufficient amounts of locally sourced protein in organic quality (esp. in rearing farms and broiler production) (Schaack et al., 2018; Schumacher et al., 2011; van Krimpen et al., 2016; Witten et al., 2014). The EU

[25] Herd books/ breeding books are a systematic documentation of pure line breeding animals and their pedigrees for a specific breeding population. This allows a clear identification of the animals as basis for targeted mating (Willam and Simianer, 2017)

[26] Sorting animals or reproductive material by sex (Willam and Simianer, 2017)

[27] In 2021 a law on banning killing day old chicks (entering into force in 2022) was passed in Germany (including a stricter rules on in-ovo-selection from 2024 on (BMEL, 20th 2021)

organic regulation requires, “at least 30 % of the feed shall come from the farm itself […]” or at least “from the same region” (Annex II, Part II, 1.9.4.2., a, (EU) 2018/848). Until 2025, an exemption on the use of conventional protein is in place (applicable in situations where there are not enough protein compounds available) (Art. 53, b, 4. (EU) 2018/848). Problems like metabolic disorders, feather pecking or cannibalism can occur if the high requirements for stable management conditions or nutritious feed of conventional breeding lines are not met in organic systems[28](Maurer, 2012; Reuter, 2007c; Schumacher et al., 2011) .

As mentioned above, not all steps in breeding and production can be realized under organic conditions, yet. For example, this can mean that line breeding animals in the nucleus herds are kept in single or group cages, or aviaries for monitoring and selection purposes and fed with conventional feed components (Brade, 2008; Tsehay, 2005). The conventional breeding companies do not necessarily prioritize traits which are especially relevant for organic farms (Hörning, Kaiser, & Böttcher, 2020; Padel, 2019). There is a variety of traits which are included in conventional breeding. However not much is known about the prioritization of those traits (Hörning, Kaiser, Schmelzer, et al., 2020). According to Preisinger (2019) they are adapted to the needs of the market. Thus, many organic farmers currently depend on the decisions and priorities of a few large players.

5.3. Current State of Discussions and Activities in Organic Poultry Breeding

Due to the above-mentioned challenges with existing breeds in organic agriculture, there are ongoing discussions on what separate ‘organic’ poultry breeding programs could or should look like. Within the recently concluded *ÖkoHuhn* project from Germany a concept for a potential national organic poultry breeding program (with a special focus on double use) was developed (Hörning, Kaiser, Schmelzer, et al., 2020). Another recently started project (*Regio-Huhn*) aims to develop double use poultry breeds by crossing conventional breeds with traditional breeds (BLE, 2020b; Naturland e.V., n.d.). In their study in 2003 (introduced in chapter 2.4), Nauta et al. (2003) also involved some Dutch poultry farmers in their discussion. The farmers preferred to start separate organic breeding programs according to organic criteria but at the same time, they acknowledged the difficulties in terms of costs and unequal market power (ibid.).

Indeed, some actors have also questioned in which way separate organic poultry breeding programs would be necessary or feasible at all (Leenstra & Sambeek, 2014; Weigend, 2007). For example, one of the NÖTZ working groups on poultry came to the conclusion, that existing breeds might be sufficient (instead of developing new organic programs) which is why the focus should

[28] Due to specific organic requirements on kind and origin of forage and proteins, feeding components in organic agriculture differ from the ones in conventional agriculture and are less constant in their composition (Schaack et al., 2018)

be on the (organic) evaluation criteria and on the establishment of organic parent herds (Weigend, 2007). This is also why some projects focus on testing performance of existing breeds and genotypes in organic farming under different management conditions (Bestman et al., 2012; Hörning, Kaiser, & Böttcher, 2020; Leenstra et al., 2014) (see as well the lists of projects by Zukunftsstiftung Landwirtschaft, 2007 or Hörning, Kaiser, & Böttcher, 2020). Along with that, there are ongoing discussions on suitable traits and indicators for organic poultry (mentioning traits like e.g. low mortality, feeding efficiency, persistency, (protein) feed use, outdoor behavior, double use, body weight, nesting behavior, social behavior or robustness and health traits) (Hörning, Kaiser, Schmelzer, et al., 2020; Leenstra et al., 2014; Reuter, 2007c; Roeckl, 2003).

Despite the above-mentioned doubts, an initiative from Germany has started a separate organic breeding program – the ÖTZ gGmbH. It has also been part of the *ÖkoHuhn* project (as well as the follow up project *Öko2Huhn*) and aims to solve several of the afore mentioned issues in organic poultry breeding. The following subchapters will display the results from the interview with the project coordinator, Inga Günther (IG)[29], with regards to the initiative's structures and current promoting and inhibiting factors. The information from the interview are supported by information on the initiative from the accompanying online research.

5.4. The Case of Ökologische Tierzucht gGmbH

The *Ökologische Tierzucht gGmbH* (ÖTZ) has been founded officially in 2015 by the organic farming associations *Bioland* and *Demeter* (IG, Pos. 37; ÖTZ, 2020h). It is located in Germany and its main purpose is to develop robust, healthy laying hens and double use breeds for the organic poultry sector that show an economically sound performance and that can mostly live on local organic feed components (Günther, 2015; Plagge et al., 2016). Further, the initiative's aim is to establish sustainable organic breeding structures that are independent from large breeding companies (IG, Pos. 57-58; ÖTZ, 2020h). In its breeding priorities, the ÖTZ aims to put 'ethical considerations' at the same level as economic requirements (IG, Pos. 360; IG in Härter, 2017). The initiative currently works on the poultry breeds *Bresse, White Rock* and *New Hampshire* and develops those breeds in nucleus herds that are located in one farm[30] (IG, Pos. 70; Günther et al., 2020). The pure line breeding is combined with cross breeding (Günther et al., 2020) and currently the ÖTZ offers both, pure bred animals as well as cross breeds, to farmers (IG, Pos. 185). The animals in the nucleus breeding are kept in groups (instead of single cages) (ÖTZ, 2016), under natural climatic and light conditions / with outdoor access (IG, Pos. 2; Günther, 2015), and are fed with 100% organic feed (Günther et al., 2020). As of 2020, the cross bred animals that are offered for sale to producers are the double use breeds *ÖTZ COFFEE* and *CREAM*, and the double

[29] In the following, all interviewees' will be referred to by their initials to ensure a better reading flow
[30] With a gene reserve in another farm (IG, Pos. 84)

use and fattening breed *ÖTZ BRESSE* (ÖTZ, 2020g, 2020d). *CREAM* is a cross of *Bresse* and *White Rock* while *COFFEE* is a cross from *Bresse* and *New Hampshire* (Günther et al., 2020). Currently, the animals are mostly used by small organic farms (many CSA [community supported agriculture] farms with 200-300 animals) and systems with mobile stables in smaller units (IG, Pos. 297).

5.4.1. Foundation History and Motives

The foundation of the ÖTZ gGmbH was triggered by the sudden availability of valuable animal genetic resources: The organic breeding program in *Domäne Mechthildshausen* (*Bioland* farm), needed a new breeder for their stock of animals, which had been developed independently from large corporations over 25 years[31]. In 2014, when the breeder from *University of Halle* retired, the farm approached the organic farming associations *Bioland* and *Demeter* (due to a lack of own human resources and funding) (IG, Pos. 33-35).

Thus, the main motivation of the founders (*Bioland* and *Demeter* and its members) was to preserve the unique stock of breeding animals (IG, Pos. 43). Along with that, Inga Günther (IG) saw the need to become independent from conventional corporate breeding programs as one of the strongest motivations (IG, Pos. 51). In this context, she also mentioned the conflict of priorities between the breeding approach of the existing corporations and organic goals: Not only with regards to feed and feed additives but also with regards to killing of male chicks (which is due to the high specialization of the common breeds) (IG, Pos. 53).

The stock from *Domäne Mechthildshausen* consisted of three herds for the three breeds (two have been integrated into the ÖTZ program) (IG, Pos. 47). The decision for the foundation of the gGmbH (German: ‚gemeinnützige Gesellschaft mit beschränkter Haftung' [non-profit private limited company]) was made by the boards and committees within the farming associations (IG, Pos. 43-45). The farming associations also provided the required funds to set up the company (ÖTZ, 2016). Additionally, the ÖTZ applied for public and private funds (ÖTZ, 2016).

Further, activities that can be considered as relevant for foundation of the ÖTZ were IGs previous projects in organic poultry breeding (starting in 2012 (IG, Pos. 19)). She had been granted funds by *Zukunftsstiftung Landwirtschaft* (foundation) and a large organic retailer to start her own small breeding project with 150 animals of a French poultry breed (IG, Pos. 15-17, Pos. 47; IG, 2nd Interview, Pos. 109). Her networking activities during this time (e.g. discussions on farmer conferences and contact with the funders) helped her build up a network already (IG, Pos. 13-17). This was why she was approached by the farming associations for the foundation of the ÖTZ as

[31] Due to the German division until 1990, these animals had been bred for performance traits independently from influence of large western cooperation for over 25 years (IG, Pos. 33). The breeding process had been documented by a Professor from *Martin-Luther Universität Halle Wittenberg* (Günther et al., 2020)

well (IG, Pos. 33). IG had been interested in organic poultry breeding since university (IG, Pos. 13) and had collected theoretical - and also first practical – experiences due to her own interest (IG, Pos. 27). Her motivation to continue engaging in organic breeding no matter in which context made her accept the offer from the farming associations to manage the new company (IG, Pos. 39). IGs existing breeding stock was included into the ÖTZ breeding program (IG, Pos. 47).

Geflügelhof Bodden, a farm from North Rhine-Westphalia, had been a cooperation partner of Domäne Mechthildshausen for raising the hens before and now agreed to get involved in a newly formed breeding company (IG, Pos. 37; Günther, 2015). The availability of stables and human resources in the farm enabled IG to lead the breading program from southern Germany (IG, Pos. 37). However, the breeding facilities which allowed to keep the stock in groups and reliable data collection had to be financed and set up (Günther, 2015).

5.4.2. Organizational Structure

The ÖTZ is organized 'decentrally' and consists of different actors and partners. Besides the chief executive (Inga Günther (IG))[32] and her assistant, a large part of the administrative work is shared between the two shareholders: While *Bioland* is mostly responsible for business administration and financial planning (2 employees), *Demeter* is in charge of marketing activities, public relations and fundraising (1 employee) (IG, Pos. 260) (ÖTZ, 2020f). Additionally, the ÖTZ has one shared employee with *Bruderhahn Initiative Deutschland e.V*. (BID)[33] who is responsible for coordinating the marketing of broilers to (larger) processors (IG, Pos. 226-228) and conducts trainings for retail staff (ÖTZ, 2020f). Questions on financing and the overall business model are annually discussed within a shareholder meeting (ÖTZ, 2020f). The legal form of the gGmbH implies that the ÖTZ is a non-profit-organization with economic activity (Weidmann & Kohlhepp, 2014). In comparison to foundations or associations, gGmbHs have direct decision-making structures which avoids bureaucracy and hierarchies (ibid.).

Physically, the basic breeding activities take place at *Geflügelhof Bodden* in Goch in North Rhine-Westphalia (IG, Pos. 194-195). Seven full time workers and some auxiliary staff members conduct the practical everyday work and Andrea Bodden is responsible for ÖTZ animals on her farm (IG, Pos. 258; ÖTZ, 2020f). IG is responsible for the theoretical breeding planning and selection and is also involved in the regular health monitoring (IG, Pos. 37, Pos. 307). Further, the work of the ÖTZ is regularly supported by Dr. Birgit Zumbach and Dr. Christiane Keppler who are consulting the

[32] In autumn 2020, Carsten Scheper joined the ÖTZ (being responsible for cattle) (IG, Pos. 412; ÖTZ, 2020b)
[33] The BID has been founded in 2012 by organic retailers and an organic farm to stop killing of male chicks, raise awareness among consumers and to support the development of alternatives. Since the foundation, further farmers, processors and retailers joined (see https://www.bruderhahn.de/initiative/ [last access 25th Feb 2021] for details)

ÖTZ with regards to animal genetics and evaluation (IG, Pos. 260). Additionally, the veterinarians from *University of Gießen* are contracted regularly to investigate specific questions with regards to the ÖTZ breeding activities (IG, Pos. 277). Together with Dr. Keppler, they support the ÖTZ with health monitoring and performance evaluation (ÖTZ, 2020a). Another freelance employee supports the ÖTZ with processes- and quality management and questions around contractual relationships with organic retailers (IG, Pos. 262-264). Furthermore, two coaches with specific expertise on CSX business models[34] have been contracted for consultancy (see also chapter 5.4.5 (IG, Pos. 274, Pos. 277).

5.4.3. Network and Value Chain

The ÖTZ cooperates with some main partners who are located all over Germany. Through personal contacts and networks, the group of partners along the value chain has grown over time (IG, pers. comm., 02nd Feb. '21). Two major rearing farms are currently part of this network (IG, Pos. 214) and beyond that, a close cooperation with farmers who want to multiply (and hatch) their own breeding stock of ÖTZ animals (parent herds) is fostered (IG, Pos. 61-65). Pure bred animals can be sold to farmers with a small extra fee (covering the fact that those farms can then independently use those animals for their further multiplication) (IG, Pos. 185). IG is willing to establish an increasing number of multipliers with parent herds in different regions, for example in Switzerland (IG, Pos. 70) or even in Kamerun (IG, Pos. 74-80).

For hatching the breeding eggs for the nucleus herd, a large hatchery is contracted (IG, Pos. 173, Pos. 258). For marketing cross bred ÖTZ animals, hatcheries are contracted for the hatching process while the chicks are sold by the ÖTZ (IG, Pos. 156). IG highlighted the importance of smaller, independent hatcheries who buy breeding eggs and market the animals on their own (IG, Pos. 156). As the ÖTZ wants to support small-scale farming structures, it tries to support these hatcheries by offering them a specific financial model: The ÖTZ eggs are offered to the hatcheries at a minimum price (below the actual cost covering price) and the hatcheries can decide to pay the difference to the *Tierzuchtfonds*[35] (IG, Pos. 156).

As mentioned above, many CSA farms with 200-300 hens and farms with mobile stables (200-1000 hens in smaller units) buy ÖTZ animals. Recently some bigger farms started to order chicks as well (IG, Pos. 296-297). IG highlighted the importance of a large producer association (*Biohennen AG*) who is purchases larger amounts of ÖTZ chicks for own rearing (IG, Pos. 214-218).

The produced eggs and broilers are distributed to end consumers via different channels: via large organic retailers (incl. *Basic, EWL, Bio Company (*IG, Pos. 120, 128)) or farm box schemes (IG, Pos.

[34] IG was referring to "community supported X" models (see e.g. Rommel, 2017)
[35] Animal breeding fund, managed by the foundation *Zukunftsstiftung Landwirtschaft*

134). Large conventional and mixed retail (*Edeka, tegut,* etc.) also sell ÖTZ products due to their cooperation with organic farmers who keep ÖTZ animals (IG, Pos. 134). With regards to the long-term establishment of the ÖTZ, IG emphasized the importance of organic retailers with presence in different regions as important communication channel towards end customers (IG, Pos. 132-134). Therefore, the ÖTZ implemented a product logo (or "brand") in 2019, which is used to label products from ÖTZ animals (ÖTZ, 2020c, IG, Pos. 142; IG, pers. comm. 02nd Feb '21). It facilitates the communication and contributes to the refinancing of breeding costs from the end product sales egg (ÖTZ, 2020c) (IG, Pos. 142). Already in 2017, the '1-cent-campaign' has been started to extend the communication to retailers who do not sell ÖTZ products yet (ÖTZ, 2020c, 2021) (IG, Pos. 148, Pos. 222). The partner company is allowed to use the '*1-cent- per-egg'* logo in its stores and in its general communication and can make use of other marketing materials which are provided by the ÖTZ (ÖTZ, 2020c).

Retailers are also supported by educational offers for staff (due to COVID-19 as online format) (IG, Pos. 340). The ÖTZ also offers information and communication materials[36] to partners and retailers (IG, Pos. 344), and also develops own videos and short films in cooperation with external marketing service providers (IG, Pos. 346). Especially with regards to meat, processors (including also processors for old laying hens (IG, Pos. 237-240)) play an important role (IG, Pos. 230). Thus, the ÖTZ and the BID help farmers to bundle their animals and to find butchers and processors (IG, Pos. 226, Pos. 228, Pos. 264).

According to IG, the employees do not conduct any active 'acquisition'. Instead, she counts on people's own interest: Farmers can call ÖTZ employees or closely associated partners (hatcheries, multipliers, …) and ask their questions (IG, Pos. 342). Additionally, the ÖTZ offers breeding farm visits for every interested actor in order to create transparency about the breeding process (IG, Pos. 88). Furthermore, the results of the *ÖkoHuhn* project (which also include information on the breeding process) have been presented on various occasions (Günther et al., 2020, 65).

IG is convinced, that workshops for interested actors (breeders / farmers) to share ideas (IG, 2nd interview Pos. 128) can be helpful for promoting the ÖTZ's approach further. She considers this as part of the obligations that come with the charitable purpose of the gGmbH (IG, 2nd interview, Pos. 128-138). IG also mentioned that she would be willing to support other interested breeders with knowledge and experience (IG, Pos. 114-15).

In the beginning, an ÖTZ council ("Beirat") had been established for providing professional support and discussing the current status and results of research projects within the ÖTZ (IG, Pos.

[36] See https://www.oekotierzucht.de/vermarktung/werbematerial/ [last access 25th Feb 2021] for concrete examples

277). Over the years, it has grown more and more and will now be changed to a bigger expert forum ("Fachforum") in the context of the *Eurotier* exhibition (IG, Pos. 227-280). This allows the ÖTZ to better interact with farmers (IG, Pos. 281) and this format could also be used for presenting performance test results (in the future) (IG, Pos. 392). In parallel, an "internal" breeding council ("Zuchtbeirat") has been established for advising the ÖTZ with specialist input with regards to genetics and breeding (IG, Pos. 281).

Furthermore, ÖTZ has taken up the general breeding goals for organic poultry breeding which have been developed in cooperation with a variety of stakeholders (retailers, funders, citizens, politicians and farmers) in the *ÖkoHuhn* project (IG, Pos. 278-291). As the company aims to fulfill different stakeholders' expectations alike, the opinions on breeding goals of different experts from the sector have been collected by an online survey and the resulting criteria have been evaluated and weighed in a project council and 3 project workshops (Hörning, Kaiser, Schmelzer, et al., 2020, 16). The resulting guidelines and priorities are now taken up by the ÖTZ and translated to specific criteria for the different breeds (IG, Pos. 289-291). IG mentioned that she regularly interacts with scientists (animal breeding and genetics) from universities or ministries in order to further develop criteria for selecting the breeding animals (IG, Pos. 361-362, Pos. 368). She also pointed out that the ÖTZ cooperates with multipliers but also other initiatives that work on other breeds (mostly "hobby") (IG, Pos. 60-61) and will be part of the *Öko2Huhn* project[37] (IG, Pos. 404).

5.4.4. Resources and Infrastructure

Several types of resources, such as human resources, knowledge, or physical resources are directly linked to financial resources and the corresponding infrastructures. The main elements with regards to financial resource needs that were mentioned by IG belong to the categories human resource costs and physical infrastructure (IG, Pos. 321). Human resource costs result from the extensive monitoring activities, different kinds of research and administration (IG, Pos. 86 ; IG, 2nd interview Pos. 23; ÖTZ, 2016). The ÖTZ does not only have a digital monitoring for performance data of each animal in place but also regularly monitors health traits in a manual assessment of all animals (IG, Pos. 307). According to Günther et al. (2020, 25) the latter is especially relevant for reaching the ÖTZ goals with regards to animal health.

With regards to physical infrastructure, the ÖTZ mainly needs stables (hired from Bodden farm) and feed (IG, Pos. 321). As the nucleus breeding herd should be managed under organic conditions, the animals are kept in groups instead of single cages which requires specific infrastructure for single animal monitoring (ÖTZ, 2016). Thus, hardware and software to monitor

[37] Will be running from 2020 to 2023 (see as well: https://orgprints.org/38340/)

performance data and feed intake for the individual animals has also been a large cost factor in the start-up phase (ibid.). As this way of managing breeding animals had not been applied by the poultry breeding sector so far, the technology needed to be developed individually (ibid.).

IG mentioned that besides the breeding performance tests in the breeding farm, further independent field performance tests would be necessary in the future (IG, Pos. 319). Some comparative tests with other breeds are already conducted by the *Thünen Institute* (IG, Pos. 386). Data availability on the breeding animals was low in the beginning, due to gaps between the end of breeding activities in Domäne Mechthildshausen and the start of the ÖTZ (Günther et al., 2020, 8; 10). With regards to selection data, IG reported that by now, data collection mechanisms are properly in place (IG, Pos. 367). According to Günther et al. (2020) the selection is based on performance data (including egg numbers, egg weight, animal weight, egg stability etc.) and health traits (according to MTool[38] criteria + additional criteria for broilers). The ÖTZ also plans a PhD position to gather more insights about selection traits for lifetime performance (IG, Pos. 319).

The needed funds for the different kinds of resources are collected via different channels. The two owners, *Demeter* and *Bioland* provided the initial funds for founding the gGmbH and confirmed to support the common project with 100.000 Euros per year until 2019 (ÖTZ, 2016). Another source of income are donations and funds from private foundations (IG, Pos. 148-155, IG, 2nd interview, Pos. 7). In the course of different public research projects, the ÖTZ also receives public funds from the national or regional governments (IG, 2nd interview, Pos. 7). Another pillar of the funding is the income from the sales of animals and hatching eggs, the label fees and the 1-cent-campaign (IG, Pos. 148; Pos. 185-189; IG, 2nd interview Pos. 7). As mentioned above, the ÖTZ started to involve the value chain – namely the organic retail sector – by giving them the opportunity support the company through the *1-cent-campaign* (Plagge et al., 2016). Since 2019, actual ÖTZ products (eggs or meat from ÖTZ breeds; processed products with a minimum share of ÖTZ eggs or meat) can be marketed under the ÖTZ label if one actor in the value chain is paying a fee per egg (ÖTZ, 2020c). Depending on the step in the value chain, different amounts are charged for producers, processors and retailers (ÖTZ, 2020c).

The legal form of the gGmbH allows the ÖTZ to apply for charitable funds as well[39]. Additional benefits result from the low tax burden which is imposed on gGmbHs (e.g. corporate income tax, trade taxes, property tax…) (Weidmann & Kohlhepp, 2014). Compared to an association (German "e.V."), it is allowed to generate economic profits from its activities (ibid.). However, these need

[38] Tool for monitoring animal health and performance in laying hens (see https://www.mud-tierschutz.de/mud-tierschutz/beratungsinitiativen/etablierung-eines-managementtools-bei-legehennen/mtool-fuer-jung-und-legehennen/ [last access 25th Feb 2021] for details)

[39] A gGmbH can issue donation receipts to donors (Weidmann and Kohlhepp, 2014).

to be fully used for the charitable purpose of the company and cannot be issued to the shareholders (ibid.).

5.4.5. Internal (Hard and Soft) Institutions

The values that influence the strategy and orientation of the initiative can be observed best in IGs explanation of central aspects of organic animal breeding and further principles that the ÖTZ wants to fulfil: IG and also the ÖTZ stand for a clear opposition against in-ovo-selection (IG, Pos. 98; ÖTZ, 2020h). Further, she highlighted, that in her selection decisions health traits were more important than performance traits (IG, Pos. 307, Pos. 360) and that breeding should not create a system that produces 'waste animals' (males and females need to be raised and used; current fattening breeds in organic should ideally be abandoned) (IG, Pos. 53). Further she pointed out that organic chicken farms differ from conventional ones in terms of animal feed (IG, Pos. 53) and that she sees searching for environmentally and resource efficient solutions for food production and food waste reduction as a key task (IG, Pos. 309) (including alternative protein or phosphate sources in feed (IG, Pos. 309, Pos. 313, Pos. 315)). According to Günther (2015), the ÖTZ aims for breeds that can cope with organic housing conditions. Beyond that, IG is interested in new forms of economic cooperation along the value chain (e.g. CSX) and also sees these alternatives as future characteristic for the organic sector (IG, Pos. 152; 156). Support of small-scale independent actors along the value chain is considered as important (IG, Pos. 164). Currently the ÖTZ is starting and internal discussion and development process with regards to its central values and its future plans for internal cooperation and new ways of collaboration with external actors (IG, Pos. 270). In the first step, this process involves only the two chief executives, the two ÖTZ employees and two coaches with specific expertise on CSX business models (IG, Pos. 274, Pos. 277).

The activities and strategies of the ÖTZ are also steered by the opinions and positions that are taken by the two farming associations. For example, the members agreed not to include conventional farmers and retailers into the label program (IG, Pos. 303-305; IG, 2nd interview Pos. 42-45). Therefore, the official rules of the ÖTZ with regards to the label program have been defined accordingly (IG, Pos. 140): conventional farmers are allowed to buy and market ÖTZ animals and products but without the official logo (IG, Pos. 299). This is due to the concern that the retailers' expectations might conflict with the ÖTZ values in the long term (IG, 2nd interview, Pos. 45).

Other explicit rules that were referred to in the interview include the guidelines on organic animal breeding target traits which have been defined in the *ÖkoHuhn* project (IG, Pos. 287-291). Some general self-defined rules on organic animal breeding can be found on the ÖTZ website: organic management of breeding animals (including organic feeding without synthetic amino acids), no AI, no in-ovo-selection or genome editing, no preventative use of antibiotics, no use of synthetic

substances for increasing productivity or fertility, no mutilations, chicks are only sold with their 'siblings', no performance increase that interfere with animal health and welfare (ÖTZ, 2020h).

All activities and all assets of a gGmbH need to be dedicated to the charitable purpose which is officially written down in the partnership agreement (charter) between the shareholders (Weidmann & Kohlhepp, 2014, p. 28). The company is explicitly obliged to fulfill charitable goals for the broader society which means that it is not designed to fulfill the specific (economic) interests of members/shareholders or staff (Weidmann & Kohlhepp, 2014). IG did not see the need to highlight specific aspects from the charter as the actual process of internal value definition is only starting at the moment (IG, Pos. 268-270). However, she pointed out that the charitable purpose is also connected to a high level of transparency about the processes (IG, Pos. 88) and the aim for keeping/building up independence of farmers, multipliers and hatcheries (IG, Pos. 78-82).

5.4.6. External (Hard and Soft) Institutions

IG mentioned that she observed a shift in large retailers' priorities caused by consumers' rising opposition to killing of male laying hens (IG, Pos. 53). As already mentioned in chapter 5.4.3 consumers' attitudes and knowledge about breeding processes and their relevance for the agricultural system were considered as key (IG, Pos. 86). IG remarked that large retail chains' definition of purchasing standards (allowing in-ovo-selection) has a large influence on the application of in-ovo-technology in EU certified organic farms (IG, Pos. 106). The ÖTZ itself has taken up values and opinions of different practitioners from the sector through their inclusion within the *ÖkoHuhn* project (IG, Pos. 287). IG also highlighted that the cooperating scientists bring in scientific expertise but are at the same time willing to consider parameters that are relevant for organic agriculture (IG, Pos. 368).

With regards to the legislative framework conditions, the EU organic regulation (IG, Pos. 55), the EU animal health regulation for production and trade of hatching eggs (IG, Pos. 72), and the animal feed legislation (in Germany and Europe) (IG, Pos. 309, Pos. 313-315) were mentioned in the interview (see chapter 5.4.7 for details).

5.4.7. Promoting and Inhibiting Factors

In the interview, some promoters and inhibitors for the ÖTZ could be identified. They have either been mentioned as answers in direct questions (on promoters and inhibitors) or in the context of other questions (on the initiative' structure and the initiative's context).

According to IG, a major inhibiting factor was the lack of awareness of end customers and farmers with regards to the 'process quality' of organic breeding (and the low willingness to pay for that) (IG, Pos. 86-88). Many consumers do not draw the connection between the production of eggs

and the existence of male laying hens or do not know the difference between double use breeds and 'brother hens' (IG, Pos. 89-90, Pos. 108). Similarly, she highlighted that many organic farmers have lost interest in organic animal breeding (IG, Pos. 336). IG considers the low willingness to buy the animals or products and to "reward higher quality products" as an important inhibitor (IG, Pos. 86). In this regard, she also pointed out that she considered labeling in-ovo-selection as 'no killing of chicks' was misleading for consumers (IG, Pos. 96). IG has the impression that political priorities with regards to research and funding are clearly directed towards in-ovo-selection (and not towards double use breeds) (IG, Pos. 93-94). Thus, the success or failure of the current financing models along the value chain can be seen as a test whether society is willing to implement the breeding and farming system which is envisioned by the ÖTZ (IG, 2nd interview, Pos. 28-31).

Another inhibitor in the sector context was the lack of knowledge with regards to multiplying and rearing chicken (caused by decades of dependence on large companies with long and in transparent value chains) (IG, Pos. 336). Currently, many organic farmers depend on the two big organic rearing farms as few actors in the sector possess the specific skills that are needed in chicken rearing (IG, Pos. 338, 214). IG mentioned a need for better education structures with regards to animal breeding and husbandry and a need for increased farmers' interest in the animals and in breeding (IG, Pos. 336, 338). With regards to the whole sector, she highlighted that – except for the large companies – there are currently few or no organic chicken breeders (beyond hobby breeders) and that therefore, it might not be possible to establish farmer breeder networks (IG, Pos. 61). At the same time IG confirmed that knowledge exchange and exchange of animals with farmers from other countries as well as stronger networks of interested breeders across Europe would be helpful (IG, Pos. 74; IG 2nd interview, Pos. 138).

IG also pointed out the low number of potential partners in the meat processing sector (IG, Pos. 230; Pos. 232-236). For example, the physical infrastructure along the value chain, especially in meat processing was considered as a challenge, as the ÖTZ animals do not fit in the existing processes and machines in butcheries (IG, Pos. 230-232). On the other hand, she highlighted the positive influence of a well-functioning network of small independent business partners in the value chain: Especially small private hatcheries play an important role in further spreading ÖTZ communication in small scale farming networks (IG, Pos. 156, Pos. 166) which supports the acquisition of new farmers (IG, Pos. 173). On top of that, IG stressed the professionality of PR structures of the ÖTZ cooperation partners in the organic retail sector (IG, Pos. 132). Furthermore, she mentioned the importance of open-minded organic wholesalers who are willing to implement new forms of cooperation and financing along value chains (IG, Pos. 156).

IG did not directly refer to promoting or inhibiting aspects with regards to interaction among the directly involved actors. However, her reference to the different skills that are brought in by the various experts shows, that the ÖTZ benefits from the different types of actors that are closely involved. For example, she highlighted the expertise in process development of one of her freelance employees (IG, Pos. 260) or that the presence of skilled people in the Bodden farm allow her to manage the company from southern Germany (IG, Pos. 37).

Attitudes towards animal breeding strategies and organic animal husbandry within and beyond the initiative also have an influence on the ÖTZ. As not all organic farmers share the opinion that double use breeding should be the prioritized solution for the sector, larger associations like *Bioland* take longer to clearly position themselves against in-ovo-selection (IG, Pos. 108). At the same time, IG considered a clear position of the associations as important for the ÖTZ (IG, Pos. 106-108). However, public statements (Bioland e.V., 09th 2020) and the joint initiative of *Bioland* and *Demeter* to engage in ÖTZ were seen as a positive statement towards organic and double use breeding (IG, Pos. 108; IG, pers. comm. 2nd Feb ’21)). According to IG, the remaining challenge is an unclear position of the EU organic regulation on this issue (IG, pers. comm., 2nd Feb ’21).

Due to high investments in the beginning and a high need for human resources in the breeding and monitoring process, the ÖTZ always needs to figure out ways for accessing sufficient amounts of funds. The high amount of needed human resources and infrastructure to run a chicken breeding program was considered as one of the main reasons for the lack of other further organic breeding programs (IG, Pos. 74). While the ÖTZs legal form enables access to charitable funds, IG estimated that accessing public funds might become more difficult in the future: Public funders expect the ÖTZ to become financially self-sufficient (IG, Pos. 11-13; IG2nd interview). She considers this as problematic in the short term as breeding for animal welfare (e.g. group housing instead of single cages) while keeping wages at a sufficient level would not be feasible at the moment (IG, Pos. 11-13; 2nd interview: Pos. 23, Pos. 95). With regards to income sources, the exclusion of conventional retail combined with the fact that roughly 50% of the ÖTZ products are sold by conventional retailers lowers the ÖTZs own income significantly (IG, Pos. 136, Pos. 142). Additionally, IG pointed out that excess breeding eggs cannot be marketed (due to their status as breeding eggs) and need to be given away for free (IG, Pos. 321-323).

At the moment, the ÖTZ would need more funds to set up a full lifetime performance testing (especially for human resources) (IG, Pos. 319). The support in data collection on lifetime performance traits which will be conducted in the upcoming year (in a doctoral thesis) considered as helpful for developing the program further (IG, Pos. 319). In general, IG pointed out that data collection on relevant traits is especially difficult in chicken compared to other animal species which is also seen as a reason why there are only few other breeders (IG, Pos. 420).

On top of that, the lack of external field performance testing service providers (private nor public) was considered as an important bottleneck (IG, Pos. 382). Independent performance data of ÖTZ animals for farmers are urgently needed as farmers should have access to independent information on the animals' performance in different environments (IG, Pos. 386-388). The data from the small field tests in the *Thünen institute* are a valuable starting point and the planned public testing facilities that are planned in Bavaria were also considered as a positive signal (IG, Pos. 382, Pos. 386). But the general testing infrastructure was still considered as weak (IG, Pos. 382, Pos. 386, Pos. 392).

With regards to the feeding of waste products, IG sees the need for further research on feeding technologies which allow adequate processing of food waste products for chicken (IG, Pos. 313). However, the legal ban on feeding of waste products causes high hurdles for testing alternative feeding infrastructure (technologies for feeding bread) (IG, Pos. 313-315). Especially the legal ban on feeding protein from animal origin to poultry prevents the research on alternative feed sources from the food industry (IG, Pos. 309). The ÖTZ's aim for finding new ways with regards to sustainable feed sources and to obtain funding for such projects is thus hampered by the current feeding legislation (and corresponding criteria in project funding) (IG, Pos. 309).

Another major challenge with regards to legislation was a conflict between the EU organic regulation and EU health regulation for hatching eggs: the organic regulation requires outdoor access while the hygiene regulation for hatching eggs prohibits it (IG, Pos. 72). This made compliance to both regulations challenging as, due to the absence of a separate organic regulation for organic breeding hens, the ÖTZ hens are treated like organic laying hens (IG, Pos. 72). Thus, the ÖTZ had to develop a specific hygiene management plan with the local veterinary and had to conduct some changes in its stables in order to ensure compliance to both regulations (IG, Pos. 72)[40].

With regards to legal definition of organic animal breeding, IG mentioned that the fact that there is no binding definition of organic animal breeding can have negative influence on the sector as the absence of specific criteria or prohibitions can create a lack of orientation (IG, Pos. 349-350). At the same time, this absence of criteria allows the initiative to pioneer in defining those criteria (IG, Pos. 349-350).

[40] IG confirmed that the ÖTZ will be able to comply to both regulations throughout 2021. However, this could only be achieved through in cooperation with the local veterinary. Thus, similar initiatives would also need to find similar agreements and develop specific hygiene concepts with their responsible veterinary. (IG, pers. comm., 02nd Feb '21)

6. Results from the Pig Sector

Organic pig production has a comparatively small share in the total pig production in Europe (0.6% in 2017)[41] (Willer & Lernoud, 2019). In Switzerland, this share amounts to 2,4% of the national pig production in 2017 (33.984 organic animals in total) (Willer & Lernoud, 2019). The majority of Swiss organic pig farms have 1-50 animals (2018) while approximately 19% have 51-500 animals (2018) (BLW, 2020)[42]. Organic production in Switzerland is based on the national organic regulation (Bio-Verordnung SR 910.18, 1997). Switzerland has equivalence agreements with the EU, which means that the respective organic standards are mutually accepted as equal (BLW, 2021). Most Swiss organic farmers are also part of a private farming association. The majority works according to the standards of the private label *BioSuisse* (BioSuisse, 2019a).

6.1. Pig Breeding in Switzerland

With regards to pig breeds, the *BioSuisse* regulation does not contain specific requirements beyond the ones stated in chapter 2. In general animals for organic production need to be purchased from organically certified farms – (exceptions are possible, especially for male breeding animals)[43] (BioSuisse, 2020). Furthermore, the regulation contains specific rules for breeding sows and piglets with regards to suckling periods, housing and outdoor run while boars need to have permanent access to outdoor run (ibid.).

As in many other European countries, most organic pig farmers in Switzerland, use breeds that are also used in conventional farms (with some exceptions) (Früh, 2011; Früh et al., 2014; Wallenbeck, 2012). In modern pig production systems, the majority of fattening pigs in industrialized countries are hybrids (Willam & Simianer, 2017). Pig breeding is usually conducted in nucleus breeding programs which are either organized in national/regional breeding associations or (international) private breeding companies (Schreider, 2019; Willam & Simianer, 2017) (see as well Figure 2). In these systems, three or four pure line breeds are used for the crosses and only a few boars are used for generating the majority of pigs (Schreider, 2019; Willam & Simianer, 2017). The different lines which are used within these programs are often specialized in terms of mother or father lines (Willam & Simianer, 2017).

With a market share of 94% the Swiss breeding company *SUISAG* supplies the majority of Swiss pig producers (Freitag et al., 2013). Officially registered organizations and breeding companies in

[41] „Please note there is no consistent reporting in the official statistics. […] Therefore, the data should be treated with caution." (Willer & Lernoud, 2019, p. 232)

[42] According to the *BioSuisse* standard, the maximum number of animals is calculated according to the agricultural land area of a farm (2,5 fertiliser produced per livestock unit ('DGVE') per ha) (BioSuisse, 2020)

[43] However, since 2020, the Swiss organic regulation and *BioSuisse* are phasing out exemptions (BioSuisse, 2019a)

Switzerland (like *SUISAG*) are regulated by the Swiss animal breeding regulation (Tierzuchtverordnung (TZV) SR 916.310). The company is owned by the *Suisseporcs* association and offers different services such as breeding, managing the herdbooks, performance testing, AI or health service (Python et al., 2019; SUISAG, 2020). *SUISAG* uses crosses from three pure line breeds (one boar line x F1 gilts[44] from two mother lines). Usually each step is conducted by specialized contracted farms coordinated by the *SUISAG* data management system and mating planning (including elite breeding) (SUISAG, n.d.–a, n.d.–b). *SUISAG* operates two AI stations and since 2017, genomic selection[45] methods are applied (SUISAG, n.d.–a).

There is few information on the status quo of the organic breeding and production chain in Switzerland: Until 2020, few organic farms were specialized on multiplication of breeding sows while the majority of piglet producers still used either their own reproduction or bought sows from conventional farms[46] (Barbara Früh (BF), pers. comm., 05th Feb '21). The *SUISAG* breeding progress is introduced into the organic population through semen from the *SUISAG* core breeding programs (BF, pers. comm., 05th Feb '21.). Recently, the *SUISAG* has introduced an organic index for its boars from *Schweizer Edelschwein* and *Schweizer Landrasse* (Hofer, 2017). Figure 2 displays an overview on the current steps in pig breeding.

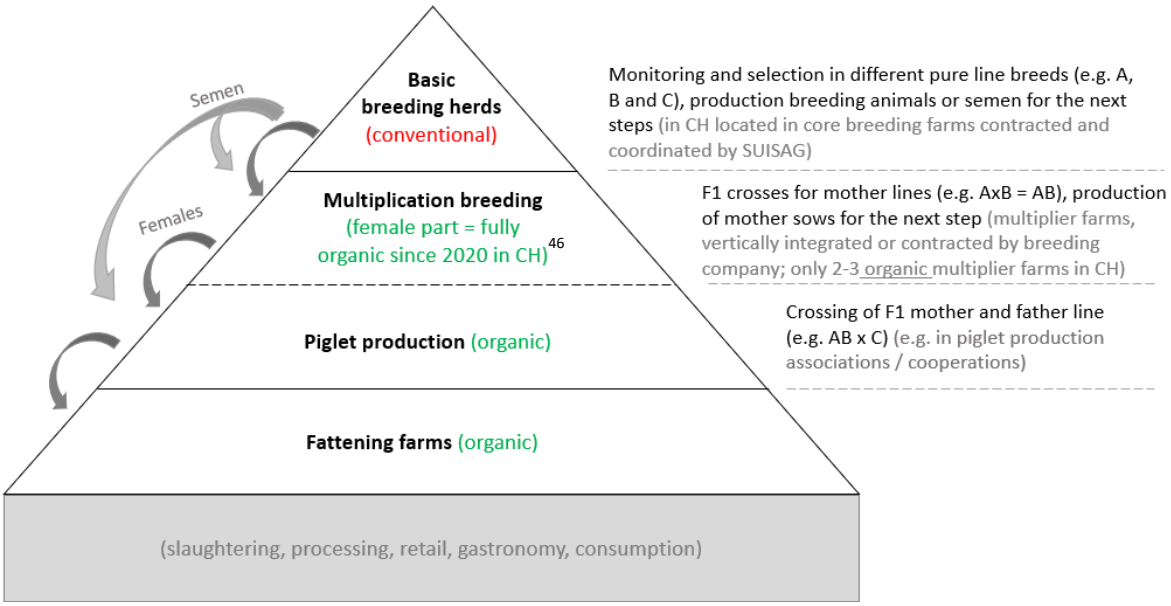

Figure 2 Visualization of different steps in the pig breeding sector (based on nucleus breeding).
(Own illustration, based on Barth et al., 2004d, pp. 20-21; BioSuisse, 2019b, 2020; Schreider, 2019, p. 34; SUISAG, n.d.-a; Willam & Simianer, 2017, p. 244, 309; BF, pers. comm., 5th Feb'21)

[44] F1 animals are animals that result from a two-way cross of two pure line breeds (Willam and Simianer, 2017)
[45] Selection based on a huge set of genomic data (Willam and Simianer, 2017)
[46] Only 2-3 organic farms were present in the multiplication breeding step in CH; however, the purchase of conventional animals has been phased out until 2020 (see as well BioSuisse, 2019b); thus new organic multiplication breeders need to be established and own reproduction of sows by organic piglet producers needs to be promoted (BF, pers. comm. 05th Feb 2021)

Apart from the commercial breeding companies, some initiatives on traditional pigs breeds are still present in Switzerland: e.g. *Wollschwein* (*Schweizerische Vereinigung für die Wollschweinzucht*) or *alpine black pigs* (*Pro Patrimonio Montano*) (ProSpecieRara, n.d.). Some farmers also work on *Turopolje* (Kutzer, 2018) and one farm specifically breeds and sells *Hampshire* animals (*Ueli Hof*). However, traditional breeds are often unattractive for producers as they are suited to very extensive environments and grow comparatively slowly (Früh, 2011; Früh & Holinger, 2019).

6.2. Current Issues in Organic Pig Husbandry with regards to Breeds

As the organic pig production only constitutes a small part in the overall pig sector, priorities of larger breeding companies and associations lie in conventional pig production. Thus, in some aspects the developments and goals of the conventional sector do not match the ones in organic. For example, increasing litter sizes in conventional breeds cause difficulties in organic farms in terms of health problems and higher piglet mortality rates (Edwards, 2012; Früh & Holinger, 2019; Schumacher et al., 2011).

Furthermore, the *BioSuisse* standard requires at least 90% *BioSuisse* certified forage (BioSuisse, 2020) which should mainly come from the farm itself (BioSuisse, 2020)[47]. However, in Switzerland, currently only 29% of all feed components for organic pigs can be sourced domestically (Alföldi & Nowack, 2017) and most organic pig farmers purchase feed instead of producing their own feed (Früh et al., 2014). Similarly to the poultry sector, the sufficient supply of important nutrients (esp. protein) in organic qualities is an issue (Crawley, 2015; Schumacher et al., 2011; Witten et al., 2014). Until 2022, the use of 5% non-organic protein forage is allowed for pig and poultry in Switzerland (BioSuisse, 2020; Quander-Stoll et al., 2020). Currently, organic farmers face difficulties to obtain enough locally sourced, organically certified feed with necessary nutrient content to ensure healthy animals and sufficient meat qualities (Früh & Quander-Stoll, 2021a; Merks, 2012; Schumacher et al., 2011). Even though possible feeding alternatives for piglets have already been identified, problems in meeting the high quality requirements of Swiss processors with 100% organic feed in fattening pigs still remain (Früh & Quander-Stoll, 2021b; Quander-Stoll et al., 2020). Thus, 100% organic feeding can also have significant economic implications for organic farmers.

Further challenges are connected to housing conditions: Organic pig farmers in Europe are required to give their animals access to outdoor runs (Annex I, Part III, (EU) 2020/464; BioSuisse,

[47] exceptions need to be applied for

2020)[48]. Challenges for organic pig producers which are connected to outdoor housing are environmental impacts (emissions to air and soil), health issues due to higher exposure to abiotic (climate) and biotic stress factors (Früh & Holinger, 2019; Merks, 2012). Due to prohibitions in terms of medical treatment, organic farmers rely even more on preventive measures for animal health (Früh, 2011).

6.3. Current State of Discussions and Activities in Organic Pig Breeding

Due to the aforementioned challenges with conventional breeds in organic systems, different researchers engage in questions around organic pig breeding and breeds. While some doubt the need or feasibility of own organic programs (see below), others see a clear need to set up separate organic structures (Kuhn, 2007). According to Früh and Holinger (2019) organic breeding goals should not only consider the targeted housing systems but also the available feed as well as required meat qualities. Also Schumacher et. al (2011) state that organic agriculture is in need for breeds with smaller litter sizes, healthy feet and higher meat qualities.

In their study, Nauta et al. (2003) (introduced in chapter 2.4), also involved Dutch pig farmers regarding their preferred future scenarios. A slight majority preferred breeding on organically certified farms (Nauta et al., 2003). Napel et al. (2009) model and evaluate three possible breeding scenarios and conclude that using rotational crosses with non-organic AI boars would be "the only feasible option at this moment" (rather than an organic breeding line) (Napel et al., 2009, p. 10). Kalm et al. (2003) and Rydhmer and Gourdine (2013) also suggest to continue using conventional breeds and to choose suitable animals based on 'organic priorities'. Brandt (2007) opt for organic basic breeding and multiplication farms for providing pure line sows and F1 crosses to organic farmers, along with combining them with boars from other breeds. In 2004, a German project in cooperation with the *Schwäbisch Hällisches Schwein* pig breeding association developed an organic breeding value for its breed: several characteristics which are to be considered as organic traits in the selection of animals for organic systems were identified (e.g. different indicators for robustness, longevity, fertility, feeding efficiency or suitability for pasture systems) (Bühler & Postler, 2004; Postler, 2003). At the same time, it is also highlighted that the data collection methods for some of these traits and characteristics are still to be worked out (Bühler & Postler, 2004; Postler, 2003). In 2007, a further project continued to develop the breeding value for this breed, stating that the insights could serve as example for developing and preserving other endangered breeds (Bühler & Zimmer, 2007). A project from *University of Giessen* has recently worked on breeding concepts for self-removal in organic farms (König, 2018).

[48] The implementation of this rule differs across Europe which is why a huge variety of systems can be found across Europe (Früh and Holinger, 2019). In Switzerland, most organic farmers use indoor housing with a concrete outside run (instead of pasture) (Früh, 2011; Früh et al., 2014)

Within the European *LowInputBreeds* project, different trials with different genetics for organic fattening pigs have been conducted[49]. In Switzerland, the project *Bioschwein 100.0* (FiBL) recently examined the suitability of different breeds for 100% organic feeding (Früh & Quander-Stoll, 2021a). The animal protection organization *KAGfreiland* has conducted a project to test extensive pig husbandry in the alps, by using the traditional *Turopolje* breed (Kutzer, 2018).

Despite the above-mentioned discussions around the necessity to separate organic programs, a small group of Swiss organic farmers has decided to start their own organic animal breeding program and to develop a new pig breed for organic farms. In order to find out the motives, structures, drivers and barriers of such a separate organic program, one of the central coordinators, Anna Jenni (AJ), was interviewed. The following subchapters present the results from the interview and the accompanying online research on the initiative.

6.4. The Case of Unser Hausschwein

Unser Hausschwein (UH) is a project (2017-2021) from Switzerland in which pig farmers aim at developing a new pig breed for organic agriculture and free range husbandry systems, which can be fed with food waste and by products (FiBL, 2021). The core of the project is a farm-based breeding program with a centrally coordinated rotational crossbreeding program (AJ, Pos. 20, 24) which should eventually result in a new pure line breed (AJ, Pos. 20). The project works with five different breeds: *Buntes Distelschwein* (farm breed from Switzerland), *Duroc, Turopolje, Schwäbisch Hällisches Landschwein* and *Schweizer Edelschwein* (sire stain) (FiBL, 2019c). Each of the five rotational crossing plans has one focus breed which has the highest share in the respective crosses (FiBL, 2019c). Occasionally, additional animals from other organic farms are bought in for the breeding program and additionally, semen for *Schäwbisch Hällisches Landschwein* have been imported (AJ, pers. comm., 01st Feb. ’21). At the moment, the different crossing plans are in different generation intervals (AJ, Pos. 36). The project members aim for a prolongation of the centrally coordinated project for approximately four to five years in order to build up a sufficient genetic basis and a self-sufficient organizational system (AJ, Pos. 72). In this case, scientific monitoring of achieved breeding progress will be further intensified (AJ, Pos. 80). The project especially breeds for extensively managed, diversified[50] organic farming systems with small scale pig production (FiBL, 2019b). As a result, the main focus is on bioorganic and biodynamic farming systems (FiBL, 2019b). The project has a regional focus on Switzerland and therefore, requirements of Swiss organic farmers are explicitly targeted (AJ, Pos. 2).

[49] A list can be found at https://orgprints.org/view/projects/eu-lowinputbreeds-pigs.html
[50] With different animal species and different branches of production in one farm (AJ, Pos. 2)

6.4.1. Foundation History and Motives

The foundation of the project resulted from the initiative of three *Demeter* certified farmers who approached FiBL Switzerland to search for alternative pig genetics (AJ, Pos. 10). These farmers already either had some experience in breeding (AJ, Pos. 109) or had even developed their own farm breed (AJ, Pos. 167). Existing commercial breeds were considered as 'too intense' by these farmers (e.g. too many piglets, too 'intense' feed requirements) and domestic traditional breeds were not sufficiently productive (e.g. took to long for reaching slaughter age) (AJ, Pos. 10). At the same time, many bigger organic farms (200-300 animals) in Switzerland are satisfied with or accept genetics from *SUISAG* (AJ, Pos. 211)[51].

The foundation of the initiative resulted from previous activities of its founding members: Different individual farmers, especially the ones who sell their products via direct marketing, had been searching for alternative breeds for years (FiBL, 2020; Kottmann, 2014)[52]. Subsequent to the initial request by the three farmers at FiBL, another project ("Alternative Schweinerassen für Biobetriebe" – "Alternative pig breeds for organic farms") was started and the newly founded working groups on an alternative organic pig breed were conducted, involving actors like *BioSuisse, Demeter* and FiBL (Kottmann, 2014; Schröder, 2014). After an attempt to import *Schwäbisch Hällische Landschweine* and *Bunte Bentheimer* had failed due to high health status requirements (AJ, Pos. 10, 18; Kottmann, 2014), some of the involved *Demeter* farmers decided to develop their own breed[53] (AJ, Pos. 12). This was the starting point for UH. They jointly chose the five breeds (see above) (AJ, Pos. 12) and defined the breeding goals (AJ, Pos. 97-99). The breeding activities started with the animals which were already present in the participating farms. Some additional animals were also bought (*Duroc, Edelschwein* sire stain, *Schwäbisch Hällisches Landschwein*) (AJ, pers. comm., 1st Feb. '21). The breeding method of rotational cross breeding has been inspired by the historical developments in pig breeding, as the current pure lines have been developed through historical crossing activities, as well (AJ, Pos. 20).

6.4.2. Organizational Structure

Currently the project is coordinated by two FiBL employees (AJ, Pos. 4, 6, 80). Two of the farmers from the beginning of the initial project along with 20 other farmers (*Demeter* and *Biosuisse*) are part of the initiative (as breeding farmers) (AJ, Pos. 54-56, 60, 113-166). One of the core elements

[51] For bigger organic farms, the advantages of conventional breeds (quality, management) outweigh disadvantages (e.g. high number of piglets) (AJ, pers. comm., 01st February 2021)

[52] BF added that she had been approached by individual organic farmers over years who had been desperate about the high piglet numbers and the intense feeding requirements. She also explained that these farmers constitute the majority of farms in Switzerland (however the majority of organic meat are produced by comparatively few larger organic farms) (BF, pers. comm., 5th Feb '21). (see chapter 6 as well)

[53] Background information: In total, 325 Swiss farms have been part of the *Demeter* farming association in 2019 (Schweizerischer Demeter-Verband, 2020)

of the project is the involvement of these farmers into the breeding process and the development of a breed according to their joint decisions (FiBL, 2019a). The FiBL employees, the two 'founder farms' as well as a representative of the *Demeter* association regularly meet in 'core group' (AJ, Pos. 56; Pos. 60, 167, 169) and discuss about strategic decisions (AJ, Pos. 96-99). Anna Jenni (AJ) works at FiBL and is responsible for coordinating the exchange of the breeding animals among the participating farmers (AJ, Pos. 4). The animals are owned, kept and exchanged among the farmers, without financial involvement by the project or FiBL (AJ, Pos. 24, 109, 177).

The participants conduct the rotational crosses according to five different crossing plans (for crossing in five different breeds) (AJ, Pos. 36) with performance evaluations based on exterior traits (AJ, Pos. 103)[54]. AJ is involved in the selection of breeding animals (AJ, Pos. 4, 106-111) and mating planning (AJ, Pos. 110-111, 171) (in cooperation with the involved farms (AJ, Pos. 121-125)). Relevant data for breeding and selection are jointly monitored by the farmers and FiBL (FiBL, 2019a). The breeding value estimation is mostly conducted by the farmer breeders in their own farms (in cooperation with AJ) (AJ, Pos. 106-111) - the concrete selection decisions with regards to a specific litter is often decided among the two farmer breeders that are going to be involved and the decisions are subsequently verified by AJ (AJ, Pos. 109; Jenni, 2018).

During the course of the project, AJ also regularly began to provide spontaneous consultancy on husbandry questions which led to the creation of a new, parallel project on consultancy for organic free-range husbandry systems (AJ, Pos. 133). The farmers are supported by FiBL (and by each other) with information on husbandry (e.g. feeding) (AJ, Pos. 137; 179). Additionally, regular meetings in 'farm groups' for knowledge exchange among farmers (mostly on husbandry, esp. feeding) had been planned (AJ, Pos. 126-127). Since the begin of the COVID-19 pandemic, AJ started to connect project participants via phone instead, thus giving them the possibility to exchange experiences (AJ, Pos. 127-131, 137). Beyond that, a network homepage with information on the participating farms, providing contact details of the farmers is planned in order to facilitate the exchange of breeding animals among participants (AJ, Pos. 36). According to AJ, this might also become the basis for sustaining the project organization beyond the project period by reducing the required human resources as well as the time for coordinating the selection and mating (self-sufficiency of the project group in the long term) (AJ, Pos. 40).

6.4.3. Network and Value Chain

As mentioned above, all activities related to breeding, multiplication and production are conducted by the UH project group (farmers and FiBL). With regards to interactions beyond the

[54] Further performance tests are planned for the future (AJ, Pos. 80, Pos. 103), for example meat performance tests (AJ, Pos. 102-103)

project group and along the value chain, the initial idea was to establish contacts with meat processors and to develop suitable processed products (Jenni, 2018). The majority of the 'project-animals' is currently processed by the farmers themselves (or by small local butchers who are contracted by the project farmers) (AJ, Pos. 30, 49-50; 183) and directly sold to end consumers by the farm (AJ, Pos. 30, 167, 217). Furthermore, some cooperate with partner farms for marketing their products or they sell parts of the breeding stock as fattening pigs to other farms (AJ, Pos. 217). Additionally, the project group was able to establish a cooperation with a local butcher (AJ, Pos. 30; Pos. 180-185), who is "interested in free range systems and alternative breeds"[55] and who is willing to purchase a certain number of animals from the breeding program (AJ, Pos. 48). This butcher will also sell the products via his own channels) (e.g. small organic retailers, direct marketing, local markets) (AJ, Pos. 48, 87-95). Some consumers already contacted the project via mail and enquired where they could buy the meat from the project (AJ, Pos. 161).

Further relevant actors are input providers for feed from whom AJ obtains information on ingredients and suitability of specific feed components for the project breeds (AJ, Pos. 197). Additionally, the exchange and cooperation within FiBL - namely between the coordinators of UH and FiBL experts/scientists from the animal sciences department – was mentioned (AJ, Pos. 79-80).

The communication of information on the project to interested parties and the broader public is conducted via FiBL channels (organic pig conference, *BioAktuell,* newsletter and homepage) (AJ, Pos. 132-133), the homepages of the individual farmer breeders (AJ, Pos. 221) and the *Demeter* associations' homepage (AJ, Pos. 60). Through this, interest is raised and farmers contact AJ in order to enquire about the current status or ask for specific information (AJ, Pos. 132-133). AJ mentioned that especially the consultancy on free range husbandry serves as an entrance for potential new members for UH (AJ, Pos. 133).

6.4.4. Resources and Infrastructure

Several types of resources, such as human resources, knowledge provision, or physical resources are directly linked to financial resources as well as the required infrastructures. While *Demeter* Switzerland was the main funder in the beginning of the project (AJ, pers. comm. 1st Feb. '21), two thirds of the project is currently funded by *Foundation sur la Croix* (AJ, Pos. 66; AJ, pers. comm., 1st Feb. '21). Further funders are *BioSuisse* (AJ, Pos. 62), *Demeter Switzerland* and *Edith*

[55] Translated from German to English by the author

Maryon foundation (FiBL, 2021). At the time of the interview, the core team was trying to obtain further funding (AJ, Pos. 70)[56].

With regards to the physical infrastructure, the project relies mostly on infrastructure provided by participating farmer breeders: Stables and specific facilities for piglet production (piglet areas, heating etc.) as well as outdoor areas that are consistent with organic requirements need to be provided by the farms (AJ, Pos. 22; Pos. 30; Pos. 44). Small infrastructural items for the breeding process (e.g. a semen freezer) are provided by the project funds (AJ, Pos. 137). For future performance tests, the corresponding infrastructure can be accessed via respective FiBL laboratories (AJ, Pos. 80).

The human resources required for the overall coordination (AJ's and BF's role) are covered by the project funds (AJ, Pos. 73-74; Pos. 40) while the participating farmers work on their own expense (only financed by sales of breeding animals) (AJ, Pos. 21-214). With regards to knowledge resources, participating farmers bring in knowledge on organic breeding (AJ, Pos. 149). However, as already mentioned, a need for 'external' knowledge in terms of organic pig husbandry (esp. housing and feeding) was also identified in the project (AJ, Pos. 40; Pos. 127). Further expertise on breeding or performance testing can be accessed via the FiBL animal sciences department in the future (AJ, Pos. 80).

AJ also highlighted that a rotational cross breeding approach requires a broad base of genetic resources for achieving breeding progress (AJ, Pos. 40). In addition, she mentioned the relevance of data on performance traits: In the beginning of the project, performance and pedigree data was only available for some of the animals (AJ, pers. comm., 1st Feb. '21). Currently mainly exterior traits are documented by the farmers (e.g. number of piglets, weaning, fitness, litter size, body condition) (AJ, Pos. 201). More traits such as fattening performance, slaughter weight and feed (AJ, Pos. 4) are also monitored. Measures to monitor further criteria e.g. meat quality (AJ, Pos. 103) (incl. backfat content (AJ, Pos. 44)) will be developed in the future (AJ, Pos. 80).

6.4.5. Internal (Hard and Soft) Institutions

When asked on her view on organic animal breeding, AJ mentioned the following components: breeding should be based on "naturalness" (oriented towards typical characteristics/behavior of animals before they were domesticated). This includes free range systems for pigs (with the possibility for digging and tolerance for local climate and feeding conditions) and therefore, relevant parameters in breeding decisions should be robustness, stress tolerance and roughage intake (AJ, Pos. 34, 159, 231-233). The corresponding genetic traits (such as increased fat content,

[56] If additional funds will not be granted, the coordination will rely completely on the participating farmers. The farmers would form an 'interest group' or an association which would finance breeding planning and data collection via membership fees (AJ, Pos. 40; AJ, pers. comm., 1st Feb. '21)

different taste) as well as higher breeding and management costs (e.g. due to longer fattening periods) would need to be accepted by the society as well as the consumers (AJ, Pos. 223, 231). The system (and also the corresponding breeding goals) should be based on local feed as well as farm resources (i.e. low import of feed) (AJ, Pos. 122, 159, 229) or ideally on waste products (AJ, Pos. 167). AJ pointed out that such a system should ideally neither waste resources nor produce animals that cannot be used (i.e. double use breeding as solution) (AJ, Pos. 229). With regards to breeding technology, AI is generally acceptable (avoids unnecessary transport of boars) but other artificial reproduction methods should not be applied (AJ, Pos. 237).

With regards to the project participant's attitudes, AJ highlighted the farmers' view on the animal as user of waste products (AJ, Pos. 167) and their goal to feed as much local or regional resources as possible (AJ, Pos. 127, 12, 189, 197). The direct connection to free range husbandry also stood out (AJ, Pos. 133). She also referred to the personal attitudes and opinions of the two 'founding farms': 'strong orientation towards direct marketing, best adaption to local conditions, feeding with waste products, avoiding of food-feed competition, less intense breeds' vs. 'local feed and free range husbandry but at the same time not losing sight of customer preferences, economic meat production' (AJ, Pos. 166 - 169). However, the primary focus is on the develop a breed that suits a 'healthy' management system and rather than adhering to specific customer preferences (AJ, Pos. 195).

Some of the aforementioned attitudes and viewpoints within the project group also materialize in its written 'rules': According to the project agreement on breeding and the information from AJ, the project aims at animals that are efficient food processors (with feed from the local farm or by products), possess good health traits and robustness (no vaccinations) (AJ, Pos. 23, 34, 195; FiBL, 2019a). They are suitable for free range (e.g. through stable body conditions or sun tolerance), have a good meat quality and show a moderate reproduction performance (10 piglets per litter) (ibid.). Accordingly, specific breeding goals for the new breed have been written down (e.g. traits on fattening performance in terms of weight before slaughter, piglet weight, etc.) (FiBL, 2019d). The project also requires an organic certification (at least *BioSuisse*) (FiBL, 2019a), which includes the use of organically certified feed for the breeding animals (AJ, Pos. 197). The use of regional feed (or feed from the own farm) which reduces the food-feed competition between humans and animals is explicitly targeted (AJ, Pos. 197; Pos. 192; FiBL, 2019a). The pigs should also have outdoor access during the vegetation period (AJ, Pos. 192-199; FiBL, 2019a). As AI is prohibited, the mating is conducted naturally (FiBL, 2019a). Thus, the participating farms are obliged to keep at least one boar for keeping the diversity (AJ, Pos. 22).

6.4.6. External (Hard and Soft) Institutions

AJ recognized an increased interest in alternative breeds within niches (AJ, Pos. 211), especially farmers, consumers and medium sized meat processors (AJ, pers. comm., 1st Feb. '21). But she also pointed out that the main standards and breeding goals are still shaped by the 'big players' '[57] targets which are oriented towards the needs of the market (AJ, Pos. 223). Further, she indicated that expectations of the processors as well as the consumers with regards to meat quality, taste and prices also have an influence on the success of the breeding program (AJ, Pos. 178, 223). Some of these expectations are also reflected in formalized rules of the 'bigger players', for example, large food retailers do not allow for high fat contents in pig meat (AJ, Pos. 152-154).

In terms of legal requirements, the role of hygiene regulations for multiplier farms (AJ, Pos. 22, 26, 30, 202-203) as well as the regulations on free range housing systems (permissions, emissions) were mentioned (AJ, Pos. 187). Additionally, the import regulations for living animals as well as the regulations on exchanging semen within CH regions are of relevance for the project (AJ, Pos. 22, 26, 30, 202-203). Due to the internal rule to adhere to *BioSuisse* (or stricter) standards, the Swiss organic regulations and standards also indirectly affect the project. Once, the breed reaches a certain degree of homogeneity, the group will register as official breeding organization according to the Swiss animal breeding regulation[58] (AJ, pers. comm., 1st Feb.'21).

6.4.7. Promoting and Inhibiting Factors

Promoting and inhibiting factors were either mentioned as answers to direct questions or have been mentioned in the context of other questions (e.g. on the initiative' structure and the initiative's context). When explicitly asked for inhibitors, the absence of a sufficient amount of farmer breeders who are willing to participate and have sufficient space for breeding (and the resulting limits in physical infrastructure) was mentioned as the initiatives' main problem (AJ, Pos. 44). The possibility of the participating farms to provide (or extend) this infrastructure is directly linked to their limited possibilities for marketing the heterogenous breeding animals to end consumers or processors (max. 50-60 per year) (AJ, Pos. 149; Pos. 44). This in turn limits the size of the overall breeding stock in the project and slows down the breeding progress (AJ, Pos. 44). Furthermore, a large part of the meat processing sector is not willing or able to process the heterogenous meat qualities which are currently produced by the project (AJ, Pos. 44, 157). This makes marketing of the current project animal to new butchers a challenge (AJ, Pos. 44, 157). In general, the presence of small local butchers in CH who slaughter for direct marketing farms is

[57] Large slaughters/processors and large breeding companies (AJ, pers. comm., 1st Feb. '21)

[58] Officially registered animal breeding organizations need to fulfill several obligations (e.g. established performance testing structures). At the same time, they can benefit from public funding. The details can be found in the Swiss animal breeding regulation (TZV, 2012/SR 916.310)

considered as a promoting factor for a project like UH (AJ, Pos. 183). When explicitly asked for promoting factors, AJ highlighted that the cooperation with more butchers who show a certain openness and tolerance towards heterogenous meat qualities from a breed which is still under development would be beneficial for the project (AJ, Pos. 46). There was no explicit reference to positive or negative influence of consumers' attitudes or retailers' purchasing standards. AJ merely mentioned that the project animals could not be marketed in retail, due to the quality standards (e.g. fat content) (AJ, Pos. 153)[59]. At the same time, it was also pointed out that some consumers have already showed their interest in the future products from UH (AJ, Pos. 161).

AJ explained that many potential participating farmers needed further knowledge on the required form of organic husbandry (esp. with regards to free range housing or local feeding) (AJ, Pos. 133). A lack of physical capacity for breeding or a lack of certain skills and knowledge on organic husbandry has already hindered some farmers to join the initiative (AJ, Pos. 22). AJ assessed the network among the farmers, which is built up by the knowledge exchange via phone as a positive aspect in the project (AJ, Pos. 127-131, Pos. 204-205). She also assumed that the comparatively small number of actors in the project are facilitating the exchange of breeding animals among the farmers (AJ, Pos. 143) (along with AJ's suggestions on sales prices (AJ, Pos. 141)). However, the share of organic pig production in Switzerland and the relative importance of larger organic producers within the Swiss pig sector[59] might be reasons for the low number of similar organic breeding initiatives in Switzerland (AJ, Pos. 223).

Regarding the access to potential funds, the overall situation was assessed as "difficult" (AJ, Pos. 211). However, a general openness for small alternative projects was also recognized (AJ, Pos. 211). Furthermore, AJ pointed out that there is still a need for human resources in coordinating the program in the future (AJ, Pos. 40). Currently the coordination workload is too high to be managed by the group of farmers alone (without additional financial compensation) (AJ, Pos. 40). Structures for providing (or financing) the needed resources and for lowering the workload are yet to be figured out (AJ, Pos. 40).

According to AJ, the domestic access to organically certified female animals has been challenging (AJ, Pos. 189). The project would achieve better progress if it was easier to import "interesting" genetic resources from abroad (AJ, Pos. 26). AJ considered the existing genetic base within the project as too narrow to breed efficiently towards the projects breeding goals (AJ, Pos. 44). Thus,

[59] BF confirmed that in Switzerland, large processors' and retailers' request for conventional breeds (due to high requirements on fat quality) significantly lowers larger organic farmers' interest for alternative breeds. At the same time, these farmers produce the majority of organic pig meat and thus have a high impact on sector wide discussions (BF, pers. comm., 5th February)

by the official end of the project, the envisioned breed will still be in an immature stage which is why the farmers ask for further support (AJ, Pos. 40).

The project is also influenced by the personal opinions and attitudes of its members: The controversial discussions in the core group meetings between the two 'founder farmers' are considered as positive by AJ as it creates a balance between the interests of the other partners (AJ, Pos. 166 - 169). In general, AJ highlighted that the 'hardcore organic mindset' and that the existing management practices of participating farms match the overall project goals (AJ, Pos. 149). In her opinion, farmers who are open to alternative husbandry and marketing practices can benefit from the project (AJ, Pos. 221). Access to rare genetic resources and the possibility to communicate pictures of colorful piglets can be a reason to participate (AJ, Pos. 221). Additionally, the absence of a lot of strict internal rules supports farmers in pursuing their own approaches and keeps them motivated (AJ, Pos. 197, 200-204). At the same time, the lack of rules on tasks and responsibilities has also caused conflicts: AJ pointed out that in the beginning the unclear definition or acceptance of roles and tasks (e.g. responsibility for mating decisions) inhibited the progress of the project (AJ, Pos. 171, 174-175). Due to the ownership structures in the consortium (animals owned by the farmers), the mating plans and mating decisions can only be 'suggestions' to the farmers (AJ, Pos. 177).

One challenge for the initiative with regards to legislation results from the Swiss organic farming standards which require exemptions for purchase of female breeding animals from conventional sources. This limits the project participants' access to local animal genetic resources (e.g. *Turopolje* animals from a nearby farm) (AJ, Pos. 188-189). With regards to imports, the Swiss hygiene regulations make the access to genetic resources from abroad (e.g. from Germany) very difficult (AJ, Pos. 10; Kottmann, 2014). Furthermore, the hygiene regulations prevent multiplier farms from participating[60] and even made one farm leave the project again (AJ, Pos. 22). AJ could not name an explicit aspect from the organic rules or legislative frameworks that do explicitly push farmer demand for UH animals (AJ, Pos. 190-191, 206-207).

[60] breeding animals from the project do not possess the origin/health certificates (AJ, Pos. 22, 26, 30, 202-203)

7. Results from the Goat Sector

Across different animal sectors, the relevance of goat production is comparatively low in Europe (Willam & Simianer, 2017). Among German organic farms, goat farms have a share of approximately 0,6 % in 2016 (destatis, 2017). However, the share of organic farms within the German goat sector is comparatively high (approximately 65% in 2014) (Manek et al., 2017). While the minimum standard for German organic production is the EU organic regulation, most of the organic farms are organized in farming associations (mostly *Bioland*) (ibid.). The majority (approx. 87%) of the German farms had 1-19 goats (26% of the total stock) while only 11 farms had more than 500 animals (destatis, 2017)[61]. However, Manek et al. (2017) point out that there are high uncertainties about the correct amount and the types of use in the German sheep and goat sectors.

7.1. Goat Breeding in Germany

Beyond the characteristics that have been presented in chapter 2.3.1, the EU organic regulation 2018/848) has no specific requirements regarding the choice of goat breeds. Only *Demeter* has an additional rule on a maximum percentage of genetically hornless goats (15%) (Demeter e.V., 2020). Organic goats need to be born and raised under organic conditions while exemptions for the introduction of non-organic males (and a maximum of 20% non-organic females) are possible for breeding purposes (Art. 9 (EC) No 889/2008). However, these rules might also be affected by the plans to phase out the exemptions on non-organic livestock for breeding purposes (Preamble 105, (EU) 2018/848).

German Fawn and *German White* are the most used breeds in Germany (Manek et al., 2017; Willam & Simianer, 2017). Worldwide, goats are mostly used for milk and meat production[62] which is why many breeds can be seen as double use breeds (Willam & Simianer, 2017). In Europe and Germany, single use breeds (only milk) or double use breeds (milk and meat) with a focus on milk can be found in agricultural production (ibid.).

Goat breeding and reproduction is conducted decentrally, as female animals are located in the respective farm and rams are bought by the farmers for natural mating (Manek et al., 2017). In some cases, AI is applied (ibid.). In Germany, breeding activities are coordinated by breeding associations on federal state level (BDZ, unpublished manuscript; Herold, 2008). On national level, these associations are organized in a roof organization (Herold, 2008). The respective associations' breeding activities are regulated by the European and national legal frameworks on breeding that have been mentioned in chapter 2.2. Initially, each association had defined herd

[61] This might include non-agricultural / non-commercial goat farms as well
[62] Other uses are wool and landscape maintenance

book chartas (BDZ, unpublished manuscript). As a reaction to the new breeding regulation, the German associations agreed to include specific rules for breeding programs in their respective chartas (ibid.). This includes for example breeding goals, target traits, a definition of the population, selection criteria, rules on performance testing and evaluation, rules on the herdbooks and rules on reproduction technologies[63] (ibid.). Currently, mostly animals from smaller farms are registered in the associations' herd books, while only a minority of larger German goat farms (>15 animals) is using animals that are part of associational breeding programs for their restocking activities (Manek et al., 2017). The current structure of goat breeding in Germany is illustrated in Figure 3.

One important performance trait is milk performance (Dutt & Haug, 2020; Herold, 2010). In Germany, milk performance tests for goats are conducted by the regional performance testing service providers (German: Landeskontrollverbände) (Manek et al., 2017). However, large variations with regards to organization, quality and costs and subsidization of milk performance tests for goats was found across federal states in Germany (ibid.). The German animal breeding legislation (TierZG, §9, II) gives each federal state the freedom to decide whether the performance testing and breeding value estimation can be conducted by public bodies, by private companies or associations. According to BDZ (unpublished manuscript) only Bavaria and Baden Württemberg are currently conducting breeding value estimations.

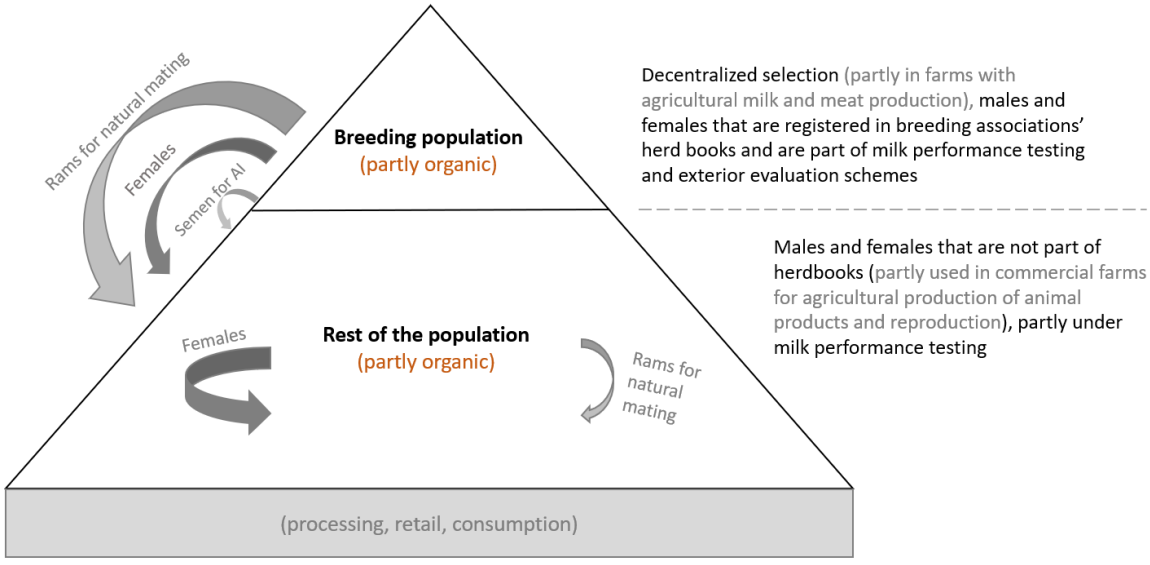

Figure 3 Current structures in goat breeding in Germany
(Own illustration based on Manek et al., 2017, p. 15; Schreider, 2019, p. 35; Willam & Simianer, 2017, p. 296; PH, pers. Comm. 8th Feb '21)

[63] Due to the introduction of the new animal breeding regulation, the different associations agreed on breeding programs and officially introduced them in their associations chartas. They also include AI and ET as allowed reproduction technologies (BDZ, unpublished manuscript)

7.2. Current Issues in Organic Goat Husbandry with regards to Breeds

As of now, the differences between organic and conventional goat milk production are rather small in Germany (both systems rely mostly on natural mating and large parts of the population have access to outdoor run) (Manek et al., 2017). Hence, most issues are relevant for all (organic and conventional) commercial goat milk farmers. Nutrient deficiencies (due to site specific variations in forage quality), parasite diseases (especially connected to outdoor systems), udder diseases, lameness and leg problems have been identified as central issues in the (organic) sheep and goat sector (Arsenos et al., 2019). Many goat farmers face challenges with regards to parasites as the standards in the organic regulation reduce the choice of treatment methods (Manek et al., 2017). If goats are kept on pasture, additional parasite pressure is put on the herds (Koopmann, 2009). The organic regulation requires at least outdoor access on concrete run, preferably access to pasture (Art. 6, l and Annex II, Part II, 1.4.1., (EU) 2018/848). Most goats in Germany are given access to pasture at least in the summer months (Manek et al., 2017). Health traits are also directly connected to a sufficient milk performance, which is an important characteristic for commercial dairy goat farmers (Herold, 2010; Herold et al., 2013). In general, the economic situation and the workload in goat farms was found to be unsatisfactory in many farms (Manek et al., 2017).

Another important topic in goat farms is the potential for social stress and injuries in herds with horns (Manek et al., 2017). In smaller goat farms, the majority of goats has horns while with increasing farm sizes, dehorning is more common (ibid.). However, according to the organic regulation (Annex II, Part II, 1.7.8. (EU) 2018/848), dehorning is not allowed (exemptions are possible). There are ongoing discussions around the necessity of horns, which mainly conclude, that in general, keeping goats with horns does not necessarily have negative impacts on animal welfare or performance (given adequate management and housing conditions) (Keil & Aschwaden, 2008; Waiblinger & Binder, 2011). However, Manek et al. (2017) request further research in this area.

With regards to organic goat breeding, Nauta et al. (2012, p. 312) observed insufficient coordination in the “the collection of data for genetic evaluation and selection of breeding bucks and rams” in some European countries. Similarly, Manek et al. (2017) identify a low degree of professionalization and gaps in documentation of pedigrees, performance data and evaluations. As mostly smaller breeders are part of the associations’ programs, the breeding is poorly adapted to large commercial farms (ibid.). In addition to the above-mentioned differences in milk performance testing across counties, Manek et al. (2017) found that only a few goat farmers make use of the existing services for milk performance testing.

Another issue in the milk goat sector is the raising of male goat kids (i.e. the marketing of goat meat) (Manek et al., 2017). Currently, goats are marketed to conventional raising farms, sold via direct marketing channels or are processed in the animal feed sector (ibid.). Heid and Hamm (2012, p. 214) conclude that in raising of goat kids "ethical and animal welfare standards of organic farming set limits [to cost reduction]" and instead suggest to improve marketing strategies instead. However, there do not seem to be many discussions on the role of breeding and breeds in this issue. Regardless of the breed, the costs and the effort for raising goat kids with milk and the general absence of a market for goat meat in Germany are prioritized in the discussions (Heid & Hamm, 2012; Mack, C., Enzler, J., 2018; Manek et al., 2017; Wiesinger & Heuwinkel, 2018; Zenke et al., 2009)

7.3. Current State of Discussions and Activities in Organic Goat Breeding

In the light of the above-mentioned issues in goat farming, there is a specific aim in the goat sector to improve breeds with regards to health and performance traits (Herold, 2010; Manek et al., 2017). The breeding goal 'high lifetime performance' may include traits like milk performance, health, fertility and longevity and is therefore considered as a very important breeding goal in the light of the holistic nature of organic agriculture (Herold, 2010). Beyond that, information on organic goat breeding activities or discussions around specific breeds for organic are hard to find. Research projects related to the organic goat sector rather focus on possibilities for marketing of male milking goat kids (see above) or on management solutions for health issues (e.g. Stuhr et al., 2012), nutrition (e.g. Smolders et al., 2012) or milk performance and quality (Rahmann, 2009; Sporkmann et al., 2012). A comprehensive overview is also given by Arsenos et al. (2019).

The sector overview shows that – compared to poultry and pig sectors – breeding structures in the goat sector (organic and conventional) are less advanced. From this starting point, the research project *GoOrganic* has been set up, which aims to improve the German goat breeding structures and – along the way – better adapt these structures to the needs of organic farmers. In the following sections, results from the expert interview with the project coordinator, Pera Herold (PH), and the online research on the project are presented.

7.4. The Case of GoOrganic

GoOrganic (GO) is a joint project, which has been ongoing since 2016 until end 2021, is conducted by different partners (research and practice) from southern Germany (MLR, 2020c). The overall goal is to develop strategies to establish and implement a sustainable, resource-efficient organic breeding program in the German dairy goat sector (ibid.). To achieve this, the project aims to build up a network of actors in the goat sector (e.g. breeders, farmers, scientists, breeding managers, breeding associations, processors), improve information for breeders through a digital

data management system, further develop breeding value estimation (with focus on performance and robustness) and implement a consultancy service concept for organic goat breeding (PH, Pos. 76; MLR, 2020b). A central element is individual herd development by location based breeding planning (MLR, 2020a). The project does not aim to develop a new or separate breed for the organic sector but to rather promote a better involvement of organic farmers in existing breeding associations (Herold, 2016a). Hence, the project works especially on three breeds: *German Fawn, German White* and *Thüringer Wald Ziege* (Herold & Wolber, 2020). The high share of organic farmers in the overall sector and their involvement in breeding should ideally contribute to sector wide organic breeding goals and strategies (Herold, 2016a; PH, Pos. 24-26). Thus, the targeted farm types cover all types of milk goat farms which are currently present in Germany organic (and conventional) goat farms, including small, extensive farms as well as larger farms with 500-1000 animals (PH, Pos. 18).

7.4.1. Foundation History and Motives

The implementation of the GO project in 2016 was mainly induced by PH, who had observed the need for an organic goat breeding program (PH, Pos. 8-12). This was due to her contact with different actors (goat farmers, members of associations, breeding experts) in her different roles: her work at LGL (*Landesamt für Geoinformation und Landentwicklung Baden Württemberg*), her work at *University of Hohenheim* and her coordinator role in the goat farming association of Baden Württemberg. Thus, she regularly encountered the request for better coordination in breeding and the need for better adaption of existing structures to the needs of organic famers (PH, Pos. 8). Her personal interest in organic animal breeding and her experience with participatory breeding research at *University of Hohenheim* motivated her to test and showcase a sector wide organic breeding program (PH, Pos. 8). After she experienced difficulties in implementing organic elements into the cattle breeding sector, she considered the goat sector with its comparatively low intensity (PH, Pos. 207) and the low degree of development to be particularly suitable: Tightly established breeding programs and central coordination of performance testing and data monitoring are still absent in goat breeding (PH Pos. 8, 16). At the same time, the German milk goat sector is characterized by a high share of organic farms including many organic farming association members (PH, Pos. 8).

Further partners involved in the foundation of the project were goat breeding associations of Baden Württemberg and Bavaria and the performance evaluation associations from Baden-Württemberg and Bavaria (PH, Pos. 22). According to PH, they were motivated to start the project because they had realized the future importance of organic goat farmers in their work (PH, Pos.

24). The possibility to apply for public funds for organic animal breeding (announcement of BÖLN[64]) helped the project partners to finally implement the project (PH, Pos. 8).

The project could build on previous activities: Since 2013, measures for improving breeding value estimation had taken place: At first, dairy traits were defined, in a second step linear type traits were developed to finally define productive lifetime / lifetime efficiency (Herold et al., 2017). The implementation of a central health and fitness monitoring tool for goats within the project had been inspired by the successful tools from the cattle sector in Austria, Baden-Württemberg and Bavaria (Herold, 2016a; Herold et al., 2017)[65]. Before the project started, a workshop involving organic goat farmers was conducted where the farmers explicitly emphasized the priority of the lifetime performance trait. Thus, this trait had a clear priority for the first part of the project (PH, pers. comm., 28th Jul '20).

7.4.2. Organizational Structure

The project is led and coordinated by two researchers from *University of Hohenheim* and LGL BW (*Landesamt für Geoinformation und Landentwicklung Baden-Württemberg, Zuchtwertschätz-stelle* [breeding estimation service]) – PH and MW (PH, Pos. 2). In the first project phase, MW was working on her PhD on the lifetime performance trait and is now responsible for network and consultancy tasks (PH, Pos. 2; Pos. 6). Further partners in the consortium include the goat breeding associations of Baden-Württemberg and Bavaria (*Ziegenzuchtverband Baden-Württemberg, Landesverband Bayerischer Ziegenzüchter e.V.*), the performance testing units of Baden-Württemberg (*Landesverband Baden-Württemberg für Leistungs- und Qualitätsprüfungen in der Tierzucht e.V.)* and Bavaria (*Landeskuratorium der Erzeugerringe für tierische Veredelung e.V.*). New partners since 2020 are the goat breeding association of Thuringia, VIT w.V. (*Vereinigte Informationssysteme Tierhaltung*)[66], *entra agrar*[67], Andreas Kern (special consultant for goats and sheep). (PH, Pos. 2, 22; Herold et al., 2017; Herold & Wolber, 2020; MLR, 2020c; Universität Hohenheim, n.y.)

The first part of the project focused on southern Germany, while in the current project phase, the activities are expanded to the rest of Germany as well (PH, Pos. 161; Herold & Wolber, 2020). In the second part of the project, decisions, especially concerning the involvement of farmers are taken by a small 'planning group' consisting of MW, PH, *entra agrar* consultants, two breeding

[64] *Bundesprogramms Ökologischer Landbau und andere Formen nachhaltiger Landwirtschaft* [Federal Programme for Organic Cultivation and Other Forms of Sustainable Agriculture]
[65] *GMON Rind* in Baden-Württemberg and Austria, *ProGesund* in Bavaria
[66] Commercial association which provides a central database for breeding data and breeding management (see https://www.vit.de/wir-sind-vit/unser-unternehmen/ [last access 25th Feb 2021] for details)
[67] e*ntra agrar* is a consultancy/coaching service and contributes in terms of breeding organization as well as coaching of the farm group moderators.

directors and two farmers from a core team to give feedback and discuss suggestions of MW and PH (PH, Pos. 153-155). The participants of this core team were chosen by PH and MW (PH, Pos. 156-159). The group is moderated by one of the *entra agrar* coaches (PH, Pos. 159). It collects ideas and suggestions on strategic topics like the long-term visions and discusses on goals for the goat breeding network, financing strategies after the end of the project period as well as potential facilitators for famer participation groups (e.g. PH, Pos. 34, 183). Additionally, a workshop on these and other questions is planned for 2021 (MLR, 2020a).

The GO project does not possess its own animals and is yet to identify specific farms to explicitly test breeding according to the new organic breeding value estimations or new organizational set ups (PH, pers. comm., 28th Jul '20). In the current breeding system, (publicly employed) breeding consultants conduct exterior performance evaluation on farms as basis for inclusion into herd books (PH, Pos. 34, 38, 41). The breeding managers are responsible for planning the breeding program (however, not very advanced compared to other animal sectors) (ibid.). Mating decisions are taken by the respective farmers who occasionally buy a new ram for reproduction (PH, Pos. 18). Animal data for performance evaluation are collected in central IT-data bases which are managed by breeding associations and performance testing providers. Currently, not all databases across Germany are connected to each other (PH, pers. comm., 08th Feb '21). This is why connecting the separate systems and the improvement of the overall data management system is one of the *GoOranic* goals (ibid.).

One central characteristic of the project is to actively involve farmers in the overall breeding programs (PH, Pos. 28; Herold, 2016a). Their explicit involvement in the development of organic breeding goals in the associations by making use of their quantitative impact in the goat sector is considered as key for actively developing (organic) goat breeding structures (PH, Pos. 43). In the first project period it was planned to involve them by offering so called "stable schools", moderated by breeding managers from breeding estimation service providers (PH, Pos. 34). After this attempt failed – due to the hesitation of the breeding managers to moderate the farm groups (PH, Pos. 34) – the new during the second project period is to offer trainings for people who are interested to become moderators of local farm groups (PH, Pos. 30, 34). These farm groups are supposed to meet regularly on different farms from a region to discuss on self-chosen topics such as breeding value estimation, performance testing methods, individual challenges of the (organic) farms and to develop farm individual strategies (Wolber & Herold, 2020; PH, Pos. 165). According to PH, no explicit discussion on organic breeding or organic breeding goals is foreseen (however, this might happen automatically due to the fact that the farmers are organic farmers) (PH, Pos. 163-165). The results from those farm groups should ideally be set on the farming associations' agendas by the farm group moderators (and as a result have an impact on the associations'

breeding strategies as well) (PH, Pos. 163-165, 167). The improved data availability on animal health, character and performance (gathered through a central monitoring tool), will support the groups' work. Farmers and veterinarians will be involved in filling in the required information (Herold, 2016a). The data tool has been developed in the first project period (*GMON Ziege*) and is available for testing (Wolber & Herold, 2018). The project consortium currently calls on farmers who are part of the milk performance testing schemes in Bavaria and Baden-Württemberg to participate and to give feedback (ibid.).

7.4.3. Network and Value Chain

One of the main aims of the project is to include organic farmers in breeding activities (breeding goal definition, data collection, performance evaluation, selection, …) one central activity of the project is the acquisition and motivation of farmers and farm group moderators (PH, Pos. 34, Pos. 163-165). The project core group promotes these farm groups via different channels: newspaper articles, communication towards the national goat breeding roof association, and communication towards the goat breeding associations in each federal state. Additionally, the *Bioland* consultant has spread the call over his network, several associations have put it on their websites and it is published at the GO project website (PH, Pos. 161). At the time of the interview (October 2020), the success of these calls could not be assessed as they had just started[68]. According to PH, the organic consultant plays a relevant role for the project due to his large network in organic goat farming (PH, Pos. 112; PH, pers. comm. 28th Jul '20). Further relevant actors are the organic farming associations *Demeter* and *Bioland* as most of the organic farmers are either *Bioland* or *Demeter* members (PH, Pos. 8).

As the project focuses on the entire dairy goat sector (breeding and production), the relevant actors in the network and environment of the project can be found all across Germany. PH emphasized that the entire sector is comparatively young which is why a comparatively high amount of farm processing and direct marketing is present in this sector (PH, Pos. 18). With an increasing number of dairy plants, farm sizes have increased as well (between 80 und 500 animals, or even 1000 in east Germany (PH, Pos. 18). She also mentioned that the presence of organic processors can trigger the foundation of new organic farms in a region (PH, Pos. 118). Not only dairy plants but also some of the direct marketing farmers also supply retail stores and retail chains (PH, Pos. 177). However, PH did not see an influence of retailer's standards on the project, yet (PH, Pos. 178-189). Furthermore, consumers did not seem to be involved into breeding related

[68] Update: In February 2021, 31 farmers from different regions in Germany had registered. Many others were interested but still hesitating (PH, pers. comm, 8th Feb '21)

issues either. PH mentioned that further research on consumer willingness to pay might be needed in case donations or price increases would become necessary (PH, Pos. 194-197).

7.4.4. Resources and Infrastructure

For the GO project and the long-term establishment of its structures, the main resources in need are human resources (i.e. for coordination tasks) (PH, Pos. 30). Additionally, the core group has decided to pay a small financial compensation to farmer group moderators (to motivate people to apply) (PH, Pos. 143-151). Further, the database was partly financed by GO and partly by the farming associations (PH; Pos. 82). Currently, the project is funded through the BÖLN program (PH, Pos. 8, 180-181).

As there are no breeding activities specifically attributable to the project, yet (PH, pers. comm. 28th Jul '20), not many physical facilities are needed at the moment (PH, Pos. 188-189). As a theoretical scenario for the distant future, PH mentioned the possibility to set up a central pool for best rams with quarantine facilities in the context of the breeding associations - males would be bought and kept by breeding associations (PH, Pos. 189). As mentioned above, a central database for farmers to enter data on robustness monitoring is being set up in the context of the project (one part of the database will be also needed for the usual work in breeding associations) (PH, Pos. 78).

According to PH, the focus of the first part of the project was collecting data on performance traits as well as on the definition of genetic parameters (PH, Pos. 6). Knowledge on lifetime performance traits was lacking at the start of the project and was acquired through the PhD thesis (PH, Pos. 6). Further data for health and robustness monitoring from the above-mentioned database are needed to develop concrete breeding goals with regards to robustness (PH, Pos. 76). Delays in the programming process prevented farmers from entering their data[69] which is why the data collection had only started at the time of the interview (PH, Pos. 87-82). Beyond that, the general connection of the different databases on pedigrees was considered necessary for a coordinated breeding program (PH, pers. comm., 08th Feb '21).

With regards to genetic material, most farmers use the native German breeds that are represented in the project and can therefore source domestically (PH, Pos. 61). Additionally, PH mentioned that they have an easy access to genetic material from Austria (higher hygiene status) and France (PH, Pos. 61). Currently, an increasing number of farmers buy semen from a French farming association as there are no established AI stations in Germany (PH, Pos. 119-126).

[69] important features (information on births, dead animals, new animals…) which are needed for the breeding associations were not working)

7.4.5. Internal (Hard and Soft) Institutions

There are not many aspects about the breeding program which have been laid down in formalized rules in the beginning of the project (PH, Pos. 75-76). Details seem to be negotiated among the members of the project consortium. Furthermore, the above-mentioned workshops in the beginning of the project as well as the planned workshop in 2021 (MLR, 2020a) might shape the breeding goals and strategies in the sector.

PH mentioned controversial discussions among goat keepers with regards to access to pasture and dehorning: While some argue that access to pasture is important in terms of naturalness others argue that it could compromise animal welfare in terms of feeding and health (PH, Pos. 76)[70]. Furthermore, dehorning is considered as necessary by some farmers as, for them, it is connected to animal welfare in their herds (PH, Pos. 76)[71] (see as well 7.2). However, these controversies are not actively discussed within the project: Until now, the highest priority has been to improve knowledge about lifetime performance traits and its inclusion into breeding value estimation (PH, Pos. 76). Furthermore, monitoring and improving robustness traits (especially with regards to outdoor husbandry) is theoretically pursued but due to practical reasons (i.e. the lack of data on these traits, caused by delays with regards to the central database) they have not been relevant for the project, yet (PH, Pos. 76). Therefore, no information on the way in which the above-mentioned 'conflict issues' influence the project was available at this stage. Furthermore, an explicit search for a common definition of organic animal breeding in the goat sector cannot be observed in the project. Potential 'organic' topics like double use breeding are not actively discussed – PH mentioned that she regularly tries to bring up this aspect but as most farmers do not want to take the economic risk of lower milk production PH doubts whether an active discussion on double use breeds will take place (PH, Pos. 89-92).

7.4.6. External (Hard and Soft) Institutions

With regards to external soft institutions, the only hint in the interview was that PH mentioned a strong focus of the sector on milk performance (also due to economic reasons). As mentioned above, this means that discussions on double use breeding traits or other traits that would impede productivity might be difficult to introduce (PH, Pos. 89-92). PH also explained that the high representation of non-commercial breeders and their priorities on 'aesthetical' traits have significantly shaped the breeding goals of farming associations (PH, pers. comm. 28th Jul '20). Beyond that, she added that the opinions on the importance of organic breeding drastically vary across associations and within the national roof association (PH, pers. comm., 8th Feb 2021).

[70] PH mentioned that, in her own opinion, organic goats should ideally have access to pasture (PH, Pos. 74).
[71] Breeding for hornless goats is genetically not possible (PH, Pos. 76)

With regards to hard institutions, PH could not think of specific legal frameworks that are explicitly influencing project goals and project work (PH, Pos. 58-59). She merely mentioned that most regulations focus mostly on main animal species (not on small ruminants) and that therefore, the sector needs to find its own way in many cases (PH, Pos. 63). Due to the extensive character of the sector in Germany, many general principles of the organic regulations are already adhered to in the entire sector and are not a relevant subject for the project (yet) (PH, Pos. 59). The only aspects which could be observed in the interview for this category were the organic regulation and its prescriptions with regards to outdoor run (might become 'stricter' in the future) (PH, Pos. 55) and PHs mentioning of the fact that dehorning is forbidden in Germany[72] (PH, Pos. 76). However, she also pointed out that these aspects might only have an indirect influence on the project (and organic goat breeding). In general PH, saw no need for stricter rules on organic breeding for the goat sector (PH, Pos. 65-66).

7.4.7. Promoting and Inhibiting Factors

Promoting and inhibiting factors were either mentioned as answers to direct questions or have been mentioned in the context of other questions (e.g. on the initiative' structure and the initiative's context). As the project theoretically covers the entire sector, some aspects that relate to the overall sector were mentioned as well (due to their potential impact on the breeding structures and goals).

According to PH, a high share of organic farmers in the sector can be very promoting for the development of the project in terms of the organic breeding program (PH, Pos. 43). She considers the chances to develop the entire sector "in an organic direction" to be higher than in other animal sectors (PH, Pos. 207-209). Furthermore, networks of organic practitioners who are able to articulate their needs as well as an exchange of practitioners and service providers is key for this development (PH, Pos. 203-205). Along this line, the engagement of (organic) farmers in farming associations is seen as an important step for implementing and establishing an organic breeding program for the sector (PH, Pos. 43).

At the same time, this inclusion of farmers into the project and the development of an organic breeding program is yet to be realized (PH, Pos. 30). The lack of self-confident and skilled facilitators in the project consortium (and the lack of funds to engage external facilitators) hampered the establishment of central part of the project in the first place (PH, Pos. 30, 35-36). Only a low number of (organic) farmers is involved in coordinated breeding activities and discussions at this stage (PH, Pos. 44-48). PH sees the lack of interest of organic farmers in

[72] Some farms do it based on exceptional regulations (PH, Pos. 76); in France dehorning is allowed (PH, Pos. 128)

breeding as an inhibitor (PH, Pos. 49). She pointed out that many organic goat farms just started freshly and that the farmers (often young families, who face a high workload), currently have a rather low priority on breeding (PH, Pos. 49, 51). If they are not part of the breeding associations, their breeding activities will have no effect on the overall goat population (PH, pers. comm. 28th Jul '20). However, the high amount of young, fresh starting farmers can also be considered as an opportunity (PH, pers. comm. 28th Jul '20).

PH considers the general framework conditions in the dairy goat sector as a promoting factor for an organic animal breeding initiative (PH, Pos. 207-209). There is not much competition with large companies (as it is the case for other animal species) but rather the extensive structures in Germany and the fact that breeding is still organized in regional associations (PH, Pos. 207-209, 43). However, she also pointed out the low amount of dairy plants as a general challenge for the German goat sector (PH, pers. comm., 28th Jul '20).

PH mentioned the access to financial resources (especially in the area of small ruminants) as one of the major challenges for a project like GO (PH, Pos. 43). In another context she also pointed out that specifics of small ruminants are often underrepresented (in terms of specific regulations but also in the design of funding schemes) (PH, Pos. 63). With regards to human resources, PH considered the project core group as quite small. She stated that this (combined with a too short project timeframe) makes it hard to figure out and implement long term sustaining mechanisms for the program (especially the self-sufficiency of the farm group in terms of skills and funds) (PH, Pos. 30, 183). Funds will be needed for a continuous payment to moderators of farmer groups as well as for the overall coordination of farmer groups and for coaching the moderators (incl. education of new moderators) (PH, Pos. 184-185). Additionally, a lack of publicly paid breeding managers and performance testing infrastructures in some regions of Germany (along with the limited funding capacity of breeding associations) [73] were considered as an inhibitor for maintaining the breeding structures which are currently set up in GO (PH, pers. comm., 28th Jul '20).

With regards to data, PH highlighted that even if the sector already has a good milk performance testing infrastructure, the testing structures for health traits were still lacking (and were thus among the central project goals) (PH, pers. comm., 28th Jul '20). The delays in the programming process have delayed further work on the robustness traits (PH, Pos. 87-82).

[73] In general, the main recourse need in existing breeding structures, are human resources for breeding coordination and performance evaluation (in farms). On associational level membership fees are collected. The associations and mainly use their (financial) resources for managing breeding data (in herdbooks). Sometimes they pay premia to breeders to incentivize them for conducting specific mating combinations. (PH, pers. comm., 8th Feb 2021)

8. Discussion

The results from the three sectors and cases provided several insights on the current structures and approaches of existing initiatives. In the analysis, several promoting and inhibiting factors with regards to the initiatives' growth, long-term establishment and achievement of their own goals became visible. In the following chapters, the general approaches and foundation histories of the initiatives are compared first. This is to highlight structural similarities and differences that are relevant for a contextualization of the identified promoters and inhibitors. Then, the results are also reflected against the background of the characteristics of organic animal breeding that have been identified in chapter 2. Subsequently, the identified promoting and inhibiting factors are compared across initiatives and discussed along different topic areas that have become evident in the comparison of the results. Finally, the theoretical and methodological approach is critically discussed.

8.1. General Comparison of the Initiatives

Generally speaking, the three initiatives have in common that they want to breed for better adaption of breeds and animals to organic farming environments. All of them try to tackle current problems that they have identified with existing breeds in organic farming contexts or in existing breeding structures. However, they differ in their main **activities** as well as the **target groups.** In line with the current practice in the conventional sector - the ÖTZ works with a combination of nucleus and cross breeding (differing from the rest of the poultry breeding sector in terms of lower degree of vertical integration along the breeding pyramid (see as well chapter 5.1)). By contrast, UH and GO chose more decentralized approaches. While farm-based breeding is still common in the overall goat sector (chapter 7.1), the UH structure differs significantly from the status quo in the rest of the Swiss pig breeding sector (see chapter 6.1). The ÖTZ and UH have set up separate breeding programs, while GO aims adjust existing structures in the sector to needs of organic farmers by encouraging and enabling those farmers to exert an influence the general breeding strategy.

When comparing the initiatives to the different breeding scenarios by Nauta et al. (2003) (introduced in chapter 2.4), the ÖTZ and UH resemble scenarios IV ("Breeding based on organic principles"), V ("Regional breeding") or VI ("Farm specific breeding") while GO might need to be placed in scenario III ("Adapt conventional breeding to organic requirements ") (Nauta et al., 2003, p. 12). However, as the entire goat sector is still conducting farm specific breeding (or no population-wide, targeted breeding activities at all), the GO approach might result in scenario V or VI at the same time (depending on how the regional farm groups and associations decide to organize breeding in the future).

It can also be observed that in contrast to GO, ÖTZ and UH concentrate only on a group of pioneering organic farms instead of the whole sector. AJ (UH) has made clear, that – due to the current sector structure[74] - the ambition of UH is not to transform the whole pig sector or the whole organic sector, but rather to find better solutions for the existing niche that the participating farmers represent. The ÖTZ seems to have broader ambitions: Theoretically, the company and its partners sell ÖTZ animals to any interested farmer[75] and farms of different types and sizes are already buying ÖTZ animals. Thus, the initiative does not only limit itself to the niche farms but wants to remain open for expanding its activities and pushing changes on sector level or at least within the involved farming associations.

The different approaches are already reflected in the initiatives' **foundation histories**: The main trigger for UH was the dissatisfaction of a specific group of farmers with the existing conventional breeds breeding goals of the major breeding company in the Swiss pig sector. Similarly, the ÖTZ founders' main motivation was to become independent of conventional structures as the high degree of consolidation and the companies' breeding goals were considered to be incompatible with organic systems. Accordingly, they aim at an entirely separate breeding program despite the potential difficulties that already have been identified by other actors (e.g. high costs, regulative barriers, societal priorities, different opinions within the organic sector, a poor genetic base or the lack of independent field performance tests) (Hörning, Kaiser, Schmelzer, et al., 2020; Leenstra & Sambeek, 2014; Reuter, 2007c). In contrast to that, the gap between the existing breeds and management practices in the overall goat sector and organic principles and regulations had been significantly smaller. The problems to be tackled were mostly concerning all commercial farmers in the goat sector which is why GO's foundation was triggered the general need to improve the sector wide breeding structures. This underlines the conclusion by Nauta et al. (2012) who argue, that some species or organic systems, require separate breeding programs and that this necessity is related to the differences between organic and conventional systems in a specific country or region.

Accordingly, the actors who initiated the respective breeding activities and the concrete **trigger events** differ across initiatives: The ÖTZ was founded mostly on the initiative of the two farming associations, triggered by the sudden access to a valuable genetic resource (and individuals within the associations that saw a chance in developing those resources). In the case of UH, the main trigger was a few farmers' effort to connect to each other and to seek help of facilitators, namely

[74] The majority of organic pigs is produced by larger organic farms who supply large processors and retailers and need to adhere to their high-quality standards (see chapter 6.1 and 6.2)

[75] However, the use of the label is restricted to organic farmers and organic retailers (IG, Pos. 142) which might hinder conventional actors or suppliers of large retailers to introduce ÖTZ animals

a research/consultancy intermediary (FiBL) and organic farming associations (*Demeter* and *BioSuisse*). By contrast, central actors from the existing national breeding system (breeding associations and performance testing service providers) were among the founders in GO. The main trigger was not only the motivation of an individual researcher with a good network but also an increasing awareness on the established actors' side that commercial organic farmers are not considered sufficiently in the current system combined with the availability of a suitable public funding scheme. In ÖTZ and UH, previous activities in terms of breeding (IGs own breeding activities, breeding experiences of UH farmers) or networking (IGs network, Germany trip by UH farmers, …) facilitated the foundation, as well. The same can also be observed in GO, which resulted from PHs previous research on organic animal breeding her close contact to farming associations and performance testing service providers.

The initiatives currently differ in terms of their **level of maturity**: While the ÖTZ is established in terms of the organizational form of a gGmbH, UH and GO are still at project level. However, both projects aim to set up structures which can be sustained beyond the project periods. When comparing the results in terms of organizational structures and interactions, it can be seen that the ÖTZ has already built up a comparatively large network (also along the value chain). Furthermore, the ÖTZ and UH have already started their breeding activities, while GO is still in the phase of setting up framework structure; breeding according to specific 'organic goals' or along specific types of organizational structures has not been tested, yet. The ÖTZ is already able to sell animals to producers which have not directly been involved in the breeding process. The breed in UH is still at an earlier stage and quite far from reaching the ultimate goal of a pure line organic breed which can be used more broadly by farmers.

In a cross-sector comparison, it also needs to be considered that the analyzed animal species have different **biological characteristics**. IG explicitly pointed out that in laying hens, monitoring organic relevant traits is explicitly complicated compared to broilers or other animal species such as pigs (IG, Pos. 420). At the same time, she highlighted that in poultry, many generation intervals can be realized in a comparatively short time (IG, Pos. 367). These statements underline that on a broader, cross sector level, the biological characteristics of the respective animal species influence which kind of hurdles are encountered in the establishment of new structures and processes for the organic livestock sector. They also determine which kinds of organizational set ups are possible (see as well Willam & Simianer, 2017). Thus, this aspect always needs to be kept in mind when conducting cross sector comparisons of organic animal breeding.

The general comparison shows that current status, approaches, motivations and specific triggers vary across initiatives. However, the existence of motivated actors which are connected to various stakeholders such as farmers, retailers, breeding associations or organic farming associations

seemed to be a key promoter in all cases. Additionally, one of the initiatives' main motivations was the impression that, in existing breeding systems, organic farmers have insufficient possibilities to exert influence on the breeding process. Additionally, some aspects in prevalent breeding approaches and structures in the respective sectors were considered as insufficient for meeting organic goals and ideals. Before analyzing the which factors promote or inhibit the initiatives' ability to achieve their goals and establish in the long-term, the following subchapter reflects in which way these goals correspond to the characteristics that have been collected in chapter 2.

8.2. Characteristics of Organic Animal Breeding

In order to set the context for the discussion of promoters and inhibitors for organic animal breeding initiatives, this section examines to which extend organic and agroecological characteristics along the dimensions **breed and breeding goals, breeding process,** and **organizational structure** can be found in the empirical data.

Carefully choosing animals from different existing **breeds**, a high diversity within and across **breeds** and caring for the local adaption of breeds have been identified as important preconditions for organic livestock systems (chapter 2.3.1). This aspect was only indirectly addressed within the interviews. One reason is that the initiatives have limited capacities in terms of members and resources which is why they are not able to work on a high diversity of different breeds for different purposes (see e.g. ÖTZ, 2020e). However, the aspect of diversity within breeds as well as their local adaption was accounted for by all initiatives, for example with the inclusion of different breeding farmers from different regions (UH), the establishment of decentralized parent herds (ÖTZ) or the development of location-based breeding estimation (GO). At the same time, the dimension of specific 'organic' **breeding goals and target traits** was reflected in all initiatives. Breeding is closely related to the desired characteristics of the food and farming systems and therefore, breeding goals constitute a central part of the breeding program (chapter 2.1 and 2.2). Thus, the centrality of animal health and welfare in organic animal husbandry was also reflected in the initiatives' breeding goals e.g. by prioritizing health traits over performance traits (ÖTZ), focusing on a moderate reproduction rate to avoid piglet mortality (UH) or to prevent existing disease/parasite problems by developing trait complex for robustness (GO). Furthermore, all initiatives aim for a 'moderate performance' (e.g. in terms of eggs / fattening period (ÖTZ), reproduction and growth (UH) or milk yield (GO)). Also with regards to animal housing, the organic priority on 'naturalness' and the corresponding importance of access to pasture (see chapter 2.3.1) were also directly highlighted as an important characteristics of organic systems by AJ and PH. Accordingly, robustness regarding outdoor conditions is explicitly included GOs and UHs goals as well. The ÖTZ breeding goals indirectly reflect the high relevance

of outdoor run by pointing out that breeds for the organic farming sector need to be suitable for housing conditions in organic farms (which includes outdoor access (see e.g. Annex II, Part II, Art. 1.9.4.4., (EU) 2018/848). In the ÖTZ and the UH interview, it can also be observed that the initiatives try to foster "integration of cropping and animal systems" (Migliorini & Wezel, 2017, p. 70), e.g. in terms of animal nutrition. The current issues with regards to environmentally sustainable local protein feed in the national organic sectors (see chapters 5.2 and 6.2.) were among the main motivations for UH and ÖTZ to start their work. For example, they search for alternative feed sources (e.g. from by-products), a sustainable way of a 100% organic feeding (ÖTZ) and breeds that can be fed from regional organic feed sources (UH). This also matches the considerations of the organic Principle of Ecology which promotes "site specific ecological production systems" (IFOAM, 2017, p. 6) as well as the results in Muller et al. (2017), stating that the reduction of food competing feed is one important precondition for feeding the growing world population with organic agriculture. In GO, local feeding sources were not explicitly mentioned as a central goal. While most milk goat farms feed a certain percentage of concentrates, no detailed information on amounts, kind and origin of currently used forage are available (Manek et al., 2017). Thus, it remains open if feeding and origin of feed components will be an issue in the goat sector in terms of organic and agroecological principles. Similarly, while double use was also among potential characteristics of organic breeding (see chapter 2.3.1), upcoming issues in the goat sector with regards to raising of male goat kids were not among the breeding priorities in GO, yet. In contrast, the double use aspect was one of the central characteristics in the ÖTZ breeding goals and among the main motivations to start the initiative. Thus, several aspects that have been mentioned as general organic breeding goals in chapter 2.3.1 were found in the case study examples. However, depending on the initiatives' individual perceptions concerning most urgent issues in the sector, some aspects have different relevance or are not considered at all. For example, the aspect of environmental pollution (Dumont et al., 2014) (or connected to that: high feed conversion (Reuter et al., 2007)) was not explicitly mentioned in any of the cases.

The above-mentioned perceptions about desired farming systems and the corresponding breeding goals are also reflected in the initiatives' **breeding processes,** as the initiatives manage their breeding animals under the desired conditions (e.g. group housing with outdoor access and 100% organic feed (ÖTZ) or mandatory outdoor access and organic regional feed for breeding animals (UH). Another central characteristic with regards to the breeding process is the decision for or against certain **selection or reproduction technologies** (see chapter 2.3.2). In the interviews, selection methods were not explicitly discussed and priorities or opposition against specific methods were also not actively addressed by the interviewees. This might be due to the

fact that in all cases, the initiatives are quite young and infrastructures for health and performance data collection as well as breeding value estimation were only starting to develop. With regards to reproduction methods, all initiatives were adhering to the current organic standards and regulations, with the ÖTZ and UH going beyond the minimum by excluding AI. All initiatives had a specific focus on natural mating, which also reflects the prioritization of naturalness in organic and agroecology.

Some special features in the **organizational structures** also became evident from the results: Especially in the light of the current situations in the pig and poultry sectors, with basic breeding activities in the conventional sector are concentrated on few major actors, the more decentralized approaches of the initiatives stood out: The ÖTZ aims to support small scale hatcheries or to install decentralized parent herds and UH fosters farmer- based breeding and farmer involvement in breeding decisions. In GO, the importance of keeping and improving decentralized structures and further farmer involvement were highlighted as central aims of the project. This does not only underline the centrality of value chain involvement and access to genetic resources but also feeds into the agroecological principle, the "Co-creation of knowledge" (and the explicit promotion of farmer-to-farmer exchange) (HLPE, 2019, p. 41) and the IFOAM Principle of Fairness (see chapter 2.3.3). In UH and GO, the farm groups and exchange formats were explicitly designed for co-generation of knowledge. IG stressed the high value of a transparent breeding process as well by emphasizing that she is willing to show all interested actors how the ÖTZ breeding program works (IG, 2nd Interview, Pos. 115). Beyond that, she repeatedly mentioned that these ambitions are also supported by the legal form of the gGmbH as this 'forces' the company to primarily aim at general societal benefit.

In practice, several **trade-offs between** organic goals and principles might occur. In the analyzed cases, this was visible from PH's explanations about the current discussions on access to pasture or dehorning and animal health[76]. Furthermore, tradeoffs between animal welfare and economic viability in the breeding process can occur: IG (ÖTZ) highlighted that animal welfare measures in the breeding process are not financially rewarded, yet (IG, 2nd interview, Pos. 23, 95). In this regard, it needs to be kept in mind that the IFOAM Principle of Fairness does not only imply respect and stewardship in relation to "all living beings" (IFOAM, 2018, p. 10), but also contains a socio-economic dimension by requesting to "provide everyone involved with a good quality of life" (ibid.), which can also include a sufficient farmer or breeder income. Padel (2019, p. 26) underlines again, that "earn a living from farming" is one central and legitimate goal to be considered by organic farmers. Beyond that, the double use approach might also raise questions

[76] However, further research is needed assess these tradeoffs from a scientific point of view (Manek et al., 2017)

in terms of resource use and socio-economic implications of farm level, if double use poultry breeds are less productive (Schaack et al., 2018; Vaarst & Maurer, 2019) and therefore require more feed per produced unit (meat or egg) or cause more emissions per produced unit. The above-mentioned focus on moderate performance in all initiatives shows, that there is a need to balance animal interests in terms of welfare and farmer interests in terms of productivity and economic viability. Hence, the careful weighing of human and animal interests will continue to be a relevant issue for the breeding initiatives. In general, it can be observed, that some (potential) tradeoffs remain and that they are only partly reflected upon by the initiatives.

The previous paragraphs have pointed out that the three initiatives correspond to the characteristics from chapter 2.3 in many ways. 'Organic characteristics' can not only be found in their breeding goals but also become visible in the breeding processes that are applied and in the organizational structures that have been chosen. To some extent, existing standards and regulations seem to guide the practical implementation of these characteristics. However, in some aspects, the initiatives also try to think beyond existing minimum standards and set their own priorities, based on 'organic ideals' and on their perception of urgent priorities that arise from problems in their respective sectors. Thus, the differences in defining and implementing 'organic animal breeding' across initiatives might be partly attributed to their different approaches and sector contexts (see chapter 8.1). The discussion on tradeoffs shows that the prioritization of different organic principles might also affect the initiatives' ability to establish in the long term. It remains to be seen how they manage to continue their work without abandoning some of their principles. As outlined in chapter 2, the discussion on the 'typical characteristics' of organic animal breeding is far from being concluded. Similarly, this chapter also highlighted again that the sector wide debate on those characteristics needs to be continued.

8.3. Promoters and Inhibitors for the Establishment of Organic Animal Breeding Initiatives

Main promoting and inhibiting factors varied across cases and could be found in all of the applied thematic categories (which had been inspired by the AIS elements introduced in chapter 3). Overall, they confirm the collection of previously mentioned promoting and inhibiting factors from chapter 2.4. The following sections discuss and compare the factors that have been mentioned by the interviewees, structured along different tropics that have become visible in the analysis of the results.

Sector Context

As a positive factor for the GO project the high share of organic farmers in the overall sector was mentioned. The market share of organic products in the respective sector was also identified as an important factor for the realization of organic breeding activities in the NÖTZ report (Reuter,

2007a, 2007b; Reuter & Roeckl, 2007). Due to their low market shares in the respective animal sectors, ÖTZ and UH had to start from entirely different framework conditions. In UH, it was highlighted that the organic sector has a very small relevance in the overall pig sector and that most farmers accept the currently available breeds. This is also in line with the information from the majority of sources on organic pig breeding in chapter 6.3: an entirely separate organic breeding program is not considered as a realistic and feasible option for most organic farmers, due to the size of the sector. The different issues related to the small size of the UH project (see aspects discussed below in this chapter) and the initiative's problems to include further farmer breeders shows that separate organic breeding programs for the pig sector remain a challenging endeavor. At this point, it cannot be assessed whether their initiative will be successful in the long term.

On top of that, in the poultry sector, organic farmers are a minority (see chapter 5). However, the issues and the prominent public discussions with regards to killing day old chicks in organic and conventional systems as well as specific animal welfare problems with regards to organic feed support the claim for separate organic structures. Furthermore, compared to organic pig meat, egg production has a significant market share within the German organic sector and thus exposes issues from this sector to public attention.

Hence, generally speaking, a high share of organic farms in the overall animal sector can be a promoting factor while a low relevance of organic agriculture in the respective sector can lead to several difficulties for initiatives who aim to establish organic breeding programs. For example, this can manifest in terms of a small breeding population or in terms of access to breeding infrastructure (see paragraphs below). At the same time, not only the share of organic farms in the sector but also the prevalent value chain structures and attitudes of different actors along the value chain play a decisive role (see part on awareness along the value chain below)

Knowledge within the Initiative and on Farm Level

Across the three interviews, the role of different types and sources of knowledge can be identified as essential factor in a promoting as well as an inhibiting way. For example, the above-mentioned knowledge exchange among farmers (especially with regards to organic management practices) was considered as one of the most promoting aspects for the UH project. At the same time, the foundation of a consultancy project beyond the UH project underlines that there are still significant knowledge gaps that need to be filled in order to ensure good framework conditions for the project. This also highlights that in the UH case, not only new breeding structures but also new organic management practices need to be developed in order to reach the overall goal of a sustainable, regional pig husbandry practice.

A lack of breeding and management related knowledge was also mentioned in the context of the ÖTZ case when IG complained about a tremendous loss of knowledge in terms of breeding and reproduction in the production throughout the last decades. Hörning, Kaiser, Schmelzer, et al. (2020) state that this development is mainly attributable to the high degree of consolidation in breeding combined with a high intransparency about breeding methods, monitoring and selection criteria. Additionally, the high specialization along the value chain contributed to a loss of overall process knowledge for the individual actors (Hörning, Kaiser, Schmelzer, et al., 2020). Hence, existing knowledge structures which result from developments in the entire poultry sector negatively impact the ÖTZ's potential to establish a broader network of decentralized value chain structures.

As farmers in the goat sector are already involved in mating decisions, the potential for farmer involvement in breeding might be higher than in sectors in which farmers are used to be fully excluded from breeding and mating decisions (e.g. poultry). However, in GO it was also mentioned that most (organic) farmers do not have enough interest and knowledge in breeding. This is also reflected in the low membership in existing breeding organizations and the general low development in breeding structures (Manek et al., 2017). The importance of further knowledge generation is underlined by the fact that especially in the beginning of the GO project, research on traits and the setup of data monitoring systems were fostered. This is also in line with the findings of Manek et al. (2017), who found that on sector level, much more research on animal management measures and breeding, especially with regards to health issues is considered necessary by sector experts.

The relevance of knowledge development and exchange in organic agriculture and agroecology (see chapter 2.3.3) is thus underlined by the observation that knowledge gaps on farm and on sector level (and mechanisms that have caused these gaps) have an inhibiting impact on organic animal breeding initiatives. Consequently, viable measures to build up and exchange knowledge were considered to be supportive. Across all initiatives, knowledge gaps within the initiative as well as on the general sector level were identified. Those did not only include knowledge on organic breeding traits and methods but also on the design of organic husbandry systems. The lack of breeding knowledge has also been identified as an inhibitor by Nauta and Spengler Neff (2012) who state that many organic producers are not used to breeding with their own stock anymore. The lack of knowledge on practical questions around management practices (that consistently follow all organic principles) seems to constitute a relevant bottleneck for organic breeding projects as well. Thus, an increased knowledge in animal breeding and innovative organic management practices in the production stage (farmers) might be positive in two ways: It does not only broaden the base of potential future farmer breeders and create a fertile soil for

similar organic animal breeding initiatives but it might also increase farmers openness to work with breeds that are developed by existing organic animal breeding initiatives like the ones that have been interviewed for this thesis. Nauta et al. (2003) and Nauta et al. (2012) have also recognized that social aspects such as personal relationships to established conventional breeders lowers farmers' openness to experiment with new breeds. At the same time, knowledge about their own herds and farming conditions can enable farmers to develop their individual breeding goals and to choose breeds and animals accordingly (Padel, 2019). The planned (or already implemented) exchange formats for farmers and between farmers and scientists in the three cases may serve as practical role models to overcome the inhibiting influence of knowledge gaps for future breeding initiatives.

Animal Data

Closely related to the importance of knowledge is the availability of data on animal traits, which is a relevant influence factor in all cases. In a breeding program the availability of phenotypic performance data is a key precondition for further steps in breeding process (Willam & Simianer, 2017). Accordingly, knowledge generation and research on new traits or evaluation schemes require a comprehensive database on existing animals' traits and pedigrees. Especially in ÖTZ and GO, the trait of lifetime performance was highlighted by the interviewees. At the same time, both projects first needed (and still need) to build up knowledge about indicators that help them to select animals for this important trait. Padel (2019) also highlighted that especially the aim for longevity poses specific challenges in breeding as recording animals' entire life span needs a lot of time and effort and slows down the breeding progress. This also underlines the relevance of the above-mentioned tradeoff between animal welfare and economic viability (chapter 8.2).

In general, from both interviews (ÖTZ and GO) it can be seen that more (public) performance testing services and a better availability of suitable animal data for the respective breeding stock would be helpful. While in the goat sector, at least some public performance testing structures are present (Manek et al., 2017), only very few independent test stations for poultry have remained (Hörning, Kaiser, Schmelzer, et al., 2020; Leenstra & Sambeek, 2014). The remaining testing facilities mostly lack specific test capacities for organic animals or 'organic traits' (Hörning, Kaiser, Schmelzer, et al., 2020). In the UH interview, the data availability did not seem to be a major issue, yet. However, this was mainly due to the early stage of the breeding activities – the interview could also show that data on traits might gain more relevance in the future. On a sector level, for some traits, no adequate tests are available, yet (chapter 6.3). Baulain (2007) remarks that the number of traits to be considered in a performance test is also dependent of the amount of available funding.

However, the example of the goat sector shows that the mere availability of infrastructure does not seem to guarantee a sufficient database: Despite the theoretical availability of herd management software and performance testing infrastructure, only around one third of German goat farmers use milk performance testing (Manek et al., 2017). Different factors such as low customization of equipment and analyzing methods, high effort, or costs are reasons for this low number of users (ibid.).

Overall, the findings from the interviews confirm the claim by (Schumacher, 2007): the collection of breeding data, especially at farm level, still bears a high potential for organic animal breeding. Also Padel (2019) points out that "[b]reeding for any goal will […] only be possible if performance data in relation to the required trait is collected systematically from both males and females" (p. 23). At the same time, it became clear that the ability to obtain the necessary data is also dependent on the availability and accessibility of performance testing and data management infrastructure – not only on initiative level but also on national and sector level.

Awareness and Knowledge along the Value Chain

The interviews did not only reveal the importance of knowledge on initiative and farm level; awareness about current issues in husbandry and breeding, acceptance of new approaches, and knowledge and skills along the entire value chain down to the consumer level also seemed to have an important influence on the success the organic animal breeding initiatives. IG pointed out the low awareness on the retail and consumption step as a main challenge. This is also connected to her impression that there is still a low willingness to financially reward the products from organic breeding. At the same time, the sale of animals and breeding eggs belongs to one of the ÖTZs main financial income sources. This means that a low consumer knowledge or a low acceptance of higher product prices has direct influence on the long-term establishment of the initiative. While UH also heavily relies on the farmers' capacities to finance the breeding work from sales of breeding animals, the consumer awareness was not mentioned directly with regard to promoting and inhibiting factors. One of the reasons might be that UH mainly specializes on direct marketing farms with regional short supply chains. At the same time, the limited possibility to market a certain number of animals via those channels and the fact that sales via larger retail was not possible was among the mentioned inhibitors. Accordingly, the awareness for breeding related issues on consumer level might become more relevant in case UH farmers might also want to target longer value chains and larger retailers. Consumers would then need to accept a higher fat content, higher prices (due to slower growth) and a different taste (AJ, Pos. 44, 223). In GO, the question of consumer awareness for organic breeding did not seem to be a central topic, either. This might be due to the early stage of the project in which breeding activities explicitly including 'organic traits' are yet to be started. Another reason might be that, the a significant

share of goat milk is still processed and marketed via on farm or very small regional structures (Manek et al., 2017). Manek et al. (2017) found, that organic retailers trust in their closer relationship to customers (e.g. when it comes to price increases or new products). Thus, it might be easier for goat famers to justify potential changes or price increases towards their customers. However, PH also remarked that goat products are already comparatively expensive and highlighted that the question of consumer willingness to pay would need further investigation (chapter 7.4.3). At the moment acceptance of organic farming methods within existing associations seems to be of higher importance for GO.

Beyond that, the presence and capacities of processors for the products from organic breeding were a subject of discussion in all interviews, especially for the ÖTZ and UH. Both interviewees consider the lack of processors or the lack of knowledge, flexibility or physical capacities of existing processors as important inhibitors. AJ considered a comparatively high presence of small local butcheries in CH as valuable precondition for developing further marketing channels in the future and highlighted that a more intense cooperation would be promoting for the project. While processing structures were also mentioned in the interview on GO, it was also made clear that the shortage of dairy plants is not only a challenge for organic breeding but rather a general issue in the German goat sector. This is also confirmed by Manek et al. (2017) who state that there are only few dairy plants in Germany (most in southern Germany) mostly cooperating with farmers in their respective region. As the implications of additional 'organic' breeding goals for further process steps are not entirely clear yet, it is difficult to assess which role processing structures will play for the establishment of organic breeding programs in the goat sector. Especially the cases of ÖTZ and UH show that, availability and capabilities of processors play an important role in establishing value chains for organically bred products due to their intermediary role between farmers and end customers and their influence on the quality of final products. Similarly, consumer awareness about the necessity of organic breeding is currently of different relevance for the three initiatives. However, it is also apparent, that in the end, it might become a decisive factor for all of them.

Chapters 8.1 and 8.2 have already highlighted, that the initiatives choose their priorities not only based on existing organic standards but also based on their own value systems and their perception of current sector issues. While in the case of UH, the specific animal welfare related problems were mostly related to farming approaches that reach beyond organic minimum standards (access to pasture, explicit aim to lower piglet mortality and to use farm own feed), the issues that are tackled by the ÖTZ (especially killing of male chicks) seemed to be relevant for a larger group of farmers and consumers. Thus, the success of an organic animal breeding initiative within a specific sector might also be dependent on its concept of 'organic animal breeding' in

relation to the general feeling of urgency among a majority of stakeholders within a sector. Padel (2019, p. 26) highlighted that "[p]ractising organic livestock farming according to organic principles is likely to involve the observational skills, creativity and dedication of all concerned". There have been several studies to classify different types of farmers or consumers within the organic sector, along their values, motives and practices (e.g. Cranfield et al., 2010; Freyer et al., 2015; Karali et al., 2013). The ambitions to search for alternative breeds within the sector might thus – among other factors – depend on the prevalent types of famers (i.e. the share of 'idealists' or 'activists'), especially in a situation in which mere compliance to organic minimum standards is already possible with existing breeds in the market. Due to their different levels of 'maturity' only time will show in which way awareness of value chain actors influences the initiatives' development. Similarly, it also remains to be seen in which way the initiatives succeed in highlighting their distinctive 'organic' characteristics of their work towards processors, retailers and consumers.

The cases have also shown that, more insights on adequate communication measures, consumer willingness to pay for products from organically bred animals or the influence of price levels in the respective markets need to be collected to broaden the knowledge on promoters and inhibitors for organic animal breeding in different species. In depth studies on existing initiatives' strategies and measures to increase knowledge and awareness along the value chain might therefore provide better insights on this important factor.

Long-term Financial Perspective

Chapter 8.2 has highlighted that the three initiatives have several other priorities next to economic efficiency or economically self-sufficient breeding processes. At the same time, it was highlighted that this might also lead to trade-offs between different organic principles. Nauta et al. (2003) and Nauta et al. (2012) have pointed out the inhibiting role of high direct and indirect costs in organic breeding. With regards to direct costs of breeding, insecurity about the financing the breeding activities in the long-term was also mentioned as an inhibiting factor in all interviews. However, the total financial needs and the ways of covering them varied significantly across sectors and cases.

In GO, the animals are mostly bred for own use while at the same time important breeding steps such as performance testing and evaluation are currently conducted by public service providers. Thus, the costs along the breeding process (at least in the present form) are mostly covered by the farmers (or the state). Similar to the prevalent structures in the German goat sector, pig farmers in the UH project are legal owners of the breeding animals and are responsible for selling the breeding animals among each other, sell excess animals to other farmers (beyond the project) or market them to end customers and to finance the required infrastructure. Thus, in GO and UH,

covering costs for project coordination in the long run was considered as potentially inhibiting for a long term establishment of the initiatives' structures. AJ reported that a prolongation of financial support (mainly for coordination) was desired by the farmers. Similarly, PH mentioned access to financial resources, the small size of the project group and the short time frame for the project as inhibiting factors. As the ÖTZ has set up a completely new breeding structure, many expenses that are covered by farmers or external service providers in the other two cases (e.g. housing, feeding, monitoring) need to be covered by the company itself (e.g. stables, feed or monitoring infrastructure). Thus, the need for funds is not comparable with the other projects. Furthermore, in comparison to the conventional sector, the ÖTZs high priority on single animal health monitoring as well as the organic feeding and housing conditions for breeding animals cause particularly high costs (see as well ÖTZ, 2016).

The ÖTZ and UH at least partly cover breeding expenses by sales of (breeding) products already. However, an extension of current marketing structures might become necessary in the future in order to extend the breeding program and to cover costs of coordination, breeding work and infrastructure. When comparing the three initiatives, it can be seen that the ÖTZ has the most diversified financial income structure (own sales and label program, public and funds granted by foundations). In GO, the transfer of additional costs to further production steps has not been seriously considered, yet (PH, Pos. 190-195). Thus, public funding will still be needed in the medium term in order to provide human resources for the coordination of farm groups and education of moderators.

An inhibiting role of indirect costs was not explicitly mentioned in the interviews. However, the initiatives' goals in terms of moderate (instead of maximum) performance or the specific implications with regards to processing infrastructure might increase costs in other value chain steps as well. For example, AJ mentioned that organic pigs that are fed from local resources might take longer and cause more work than other animals (AJ, Pos. 231). In the poultry sector, Hörning, Kaiser, Schmelzer, et al. (2020) expect additional costs on all steps in the value chain for double use poultry as significant transformations will be needed in all steps.

The comparison of the three cases shows that, financial needs are highly dependent on the existing public infrastructures and on the resources that are brought in voluntarily by project partners (esp. by farmers). It also turned out that ÖTZ does not only seem to have the highest need for funds, but also its attempts to develop different financing opportunities seem most advanced. Observations from all three projects show, that currently, only parts of costs for breeding and coordination can be covered through the sales of the breeding products. Thus, the availability of external funding from public and private sources remains an important constraint for organic animal breeding initiatives potential to establish in the long term. In this regard, short

term project funding as one of the challenges (Reuter et al., 2007; Reuter, 2007c; Reuter & Roeckl, 2007) remains a valid inhibitor in all sectors. With regards to indirect costs, the economic implications of alternative breeds for organic also remain relevant in the light of the above-mentioned tradeoffs between different organic principles. Therefore, the issue of balancing human interests along the value chain with considerations on animal health and welfare in every production step will need to be actively addressed in future sector wide discussions.

Availability of Genetic Resources

In UH, the lack of suitable genetic resources and the narrow genetic base for the project was mentioned as a major inhibitor for reaching the project goal of a new pure line breed for organic. Idel (2007b) had also identified the availability of breeding animals that are suitable for organic breeding as one of the bottlenecks to organic breeding. Due to the different approaches that have been compared in chapter 8.1, the interviewed initiatives had different starting points with regards to genetic resources.

In the poultry sector, the overall genetic diversity is high (due to the breeding associations) (Hörning, Schmelzer, et al., 2020) but at the same time the number of breeds that has actively been developed for commercial production is comparatively low (Hörning, Kaiser, Schmelzer, et al., 2020; Idel, 2007a). The difficulties with regards to suitable genetic resources in the poultry sector are underlined by the fact that the sudden availability of the large numbers of suitable animals from Domäne Mechthildshausen was one of the main triggers for the ÖTZ. However, the availability of genetic resources was not explicitly mentioned by IG. In the GO interview, the general availability of genetic resources was not mentioned among the important bottlenecks in the project, either. This might be due to the fact that the focus in GO is on the main breeds which are currently used in goat milk production.

Thus, depending on the sector and case, the general availability of genetic resources can be an issue. Especially the examples of ÖTZ and UH show that new initiatives that try to develop breeding programs with new priorities, heavily rely on the availability of a diverse pool of breeds and genetics. The foundation history of the ÖTZ can highlight that it is not only important to preserve a diverse set of breeds, but that it is equally important to maintain and develop different genotypes for agricultural production purposes: The initiative was able to benefit from three decades of breeding work when it started in 2014. This underlines the importance of the organic and agroecological principles of system diversity and biological diversity (see chapter 2.1 and 2.3) in breeding: the contribution of a diverse group of breeders with varying priorities can provide a valuable genetic basis for organic animal breeding activities.

Legislative Context and Institutions

The AIS literature and chapter 2 (especially the 'first hints' in chapter 2.4) suggested that legal framework conditions might have an influence on agricultural innovation systems and breeding organizations, this was also discussed in the interviews. Across cases, no clear statement on the impacts of specific legislative frameworks can be made as the answers with regards to relevant legal requirements varied. While hygiene regulations for breeding animals turned out the be especially challenging in case of UH, the ÖTZ had to solve issues with regards to the current hatching egg trade regulations (which also indirectly relates to hygiene) as well as feeding legislation. In GO, the ban on dehorning in Germany was shortly mentioned but in general, PH could not think of a specific influence of legal requirements on the project. Hence, potential promoters and inhibitors regarding regulation might need to be examined on sector level rather than across sectors. Especially the conflict of organic regulation and breeding related regulation in the case of the ÖTZ shows that an entirely organic breeding chain, from basic breeding to farm production, is not sufficiently considered in existing legal frameworks and pioneers need to make a larger effort to ensure compliance. At the same time, the case shows, that solutions can be worked out. With its current solution the ÖTZ might have created a precedent for similar initiatives in the future.

Across all initiatives, the public and private standards on organic agriculture, especially in terms of animal husbandry and breeding had at least an indirect. While organic standards and regulations had an impact on practical questions around housing and feeding in the respective member farms in UH (see chapter 6.4.7), the absence of clear rules on breeds or breeding technologies were a subject of discussion in case of the ÖTZ: IG's claim on the importance of a clear position of the EU organic regulation against the in-ovo-selection technology shows that the presence of certain rules or standards might be relevant for supporting the work breeding initiatives. In the pig sector, the phase out of derogations on the purchase of non-organic breeding sows as well as the phase out of derogations on non-organic protein feed, indicate that changes in hard institutions can push the search for alternatives and incentivize the establishment of solutions within the organic sector. Accordingly, existing standards, derogations or changes in standards can also have an impact on the breeding goals or breed choice of a majority of farmers in the sector.

At the same time the interviewees seemed to consider the absence of a clear legal definition for organic animal breeding also as an opportunity to test their own approaches and values (see chapter 5.4.7 and 7.4.7). As mentioned in chapter 8.2 the initiatives partly reach beyond existing organic standards or try to implement them in parts of the breeding and production chain but they also try to keep the formalized internal rules with regards to organic goals and principles in

a rather general manner. For example, GO organic did not define any concrete rules beyond the focus on lifetime performance and health and robustness traits (see chapter 7.4.5) and AJ (UH) argued, that a lesser number of clear rules and standards keeps the farmers motivated to experiment with alternatives (see chapter 6.4.7). This shows, that the initiatives (especially UH and GO) rely heavily on the involved stakeholders' interpretations and ambitions on organic characteristics in breeding and husbandry. In general, this is in line with the idea that organic standards and regulations are only a means for achieving the goal of a sustainable agricultural system (Padel, 2019) – not an end in themselves. From the interviews it can be seen that the number and kind of actors that are involved in the initiatives' strategic decisions on organizational matters or breeding goals varies significantly. Hence, the absence of hard institutions currently seems to have a promoting influence on the establishment of the initiatives. This in combination with the absence of legal standards on organic breeding allows pioneers to experiment with new organizational forms and ambitious goals. On the other hand, this bears the risk that if other value chain actors are not closely involved, the pioneers jeopardize the implementation of their ideas on a broader scale. As mentioned above (in 'awareness along the value chain') this question still deserves further attention. Furthermore, different actors' priorities and the general level of ambition might also be influenced by other factors, such as economic pressures at farm or sector level. Padel (2019) points out that, with regards to organic principles, current organic livestock rules and standards already constitute practical compromises that have been shaped by consumers and society. This underlines again that innovating towards organic principles, balancing tradeoffs among different organic goals and principles while including a majority of stakeholders in the sector will remain one of the important challenges for organic animal breeding initiatives.

8.4. Discussion of Theoretical and Methodological Approach

The discussion of the results is now concluded by a critical discussion on the methodological approach and the theoretical framework chosen for this thesis. Additionally, limitations in the research process are reflected upon.

8.4.1. Critical Reflection on the Suitability of the AIS Framework

Due to the exploratory nature of the study, the low amount of previous knowledge on the specific topic of organic animal breeding and the huge differences in sector contexts, the challenge was to find a suitable theoretical framework for a comprehensive analysis of promoting and inhibiting factors. The AIS framework has served as a helpful guidance as the AIS elements enabled a structured presentation of the initiatives, the consideration of a broad range of topics and revealed important internal and external influence factors on the initiatives' success. The systems approach also accounts for the specific characteristics of organic agriculture: organic agriculture

is based on a systematic understanding of problems and strives for systematic designs of solutions (Fiala & Freyer, 2016). However, due to the fact that the AIS framework is often applied on a broader level (sector, national) (see chapter 3.1) it could only give limited guidance for the empirical research on the initiative level. On the other hand, the exploratory nature of the study necessitated a broad framework to remain open for new insights. Sometimes, the close interconnection of the AIS elements (e.g. actors and their interactions) made clear distinctions difficult. Additional information from specific studies on animal breeding organizations and reviewing current discussions on organic animal breeding could partly fill this gap and guide the construction of an interview guideline.

8.4.2. Critical Reflection on the Scope of the Study and the Research Process

The aim of this study was to draw a comparative picture across animal species while focusing on specific case study examples. Hence, the general status of organic animal breeding in the different sectors and countries could only be touched upon. It needs to be kept in mind that the shown initiatives represent only one among several possible ways and scenarios that might be feasible to solve problems with existing breeds in organic agriculture. Some of the mentioned promoters and inhibitors might thus only be partly applicable to similar initiatives (even if these are located in the same country or sector). The study was also limited to three animal species (pig, goat and poultry) and two countries (Germany and Switzerland). Initiatives working on other animal species (e.g. as cattle) as well as further geographical regions should therefore be subject of further studies to complement the picture. Within the analyzed sectors, initiatives from other countries might face different promoting or inhibiting context factors (e.g. other legal requirements). Thus, the factors that have been identified in this study within and across cases might not be exhaustive yet.

8.4.3. Critical Reflection on the Chosen Method and its Implementation

Due to the resource constraints in a master thesis, the focus was on one interviewee for each case, assuming that this person has the best overview on the entire initiative and its context. For this purpose, the interviewees seemed to be well chosen as they were able to answer on most of the topics that were covered in the interview. However, one needs to be aware of the subjectivity which might be brought in by the individual persons. To mitigate this effect, the interviewees were explicitly made aware that they speak in their professional role as a coordinator and not as a general sector expert and not as a private person. On the other hand, it can also be argued that the interviewees are the ones who significantly shape the initiatives' development which is why their subjective perception has an explicit value when it comes to assessing promoters and inhibitors for their initiatives. However, it needs to be kept in mind that, as coordinator of the initiative, they stand behind the initiative's goals and approach and might be biased by the

attempt to create a positive image of the initiative. Thus, in future studies this effect could be mitigated by additional interviews with other members of the initiative or actors that have been identified in the respective 'networks and value chains'.

The background research on each of the animal sectors in the respective country has turned out as helpful to see the results from the interviews in their geographical and sector context. Due to the scope of the thesis, current issues in each sector could only be mentioned exemplary. It turned out, that condensed information on the current situation with regards to organic breeds and breeding is still rare. For similar studies it is thus suggested to substantiate this part of the data collection by additional expert interviews with key persons, focusing on the current situation in the sector or country as preparation for a case study interview. As all interviewees that were included in this study possessed a vast experience in animal breeding within their respective sectors, information given in the interviews as well as the subsequent phone calls could complement the picture.

Despite the general experience that on-site visits usually provide more detailed data (Gläser & Laudel, 2009), two of the three interviews needed to be conducted online. Nevertheless, the interviews provided rich information and even the planned visualization of actors could be conducted in all cases. However, the 'touchable' version of the actor map enabled a better involvement of the interviewee in case of the ÖTZ. As some actors and actor groups for the visualization had been prepared in advance (even if not shown to the interviewee in the first place), an influence on the interviewee cannot be entirely eliminated. Despite that, the visualization was helpful in supporting the questions on interactions and important relationships.

In some situations suggestive questions were asked (e.g. PH, Pos. 73) which interferes with the required neutrality of interview questions (Gläser & Laudel, 2009). As these indirectly suggest the answer to the interviewee, the resulting answer by the interviewee could not be included in the analysis. However, sometimes this stimulated other relevant pieces of information which could be included (e.g. PH, Pos. 74 (2nd part of the answer)). Due to the differences in the initiatives itself and due to time constraints not all topics were covered to the same extent in all interviews. In case important pieces of information were missing for adequate comparison or understanding, a question on the respective topic was included in the subsequent contact with the interviewee (chapter 4.2.4).

8.4.4. Critical Reflection on Analysis and Interpretation

As mentioned above, the nature of qualitative research implies a certain subjectivity, as it is shaped by the previous knowledge and personal attitudes and impressions of the researcher and the research object(s) (Flick, 2017). Also Freyer (2016) highlights that in research on organic

agriculture, scientific and practical innovations need to be reflected with regards to organic standards and principles (while the principles themselves are in turn the result of (political) negotiations). This underlines again, that the application and interpretation of the general organic and agroecological principles always depends on the interpretation of different stakeholder groups. Similarly, Klerkx et al. (2012, p. 458) point out that "agricultural innovation is not an inherently good and value free process, but normatively laden and driven by different worldviews and visions." Thus, it needs to be kept in mind that this thesis is based on the assumption that innovation in organic agriculture is generally oriented towards a 'better' fulfilment of organic and agroecological principles. Furthermore, it is assumed that 'the organic movement' can play an important role in developing solutions for existing sustainability challenges in the global agricultural food system.

The issue of subjectivity is partly mitigated by the systematic analysis of the qualitative data along a transparent category system. Still, the definition of coding categories as well as their application in the material is shaped by the interpretation of the individual researcher. Thus, an extensive description of the research process and the reasoning behind the formation of categories was conducted in chapters 3 and 4 in to create transparency and to enable the reproducibility of the process.

The coding system as such has been designed in a very detailed manner. While this could not fully be reflected in the structure of the result chapters, the detailed analysis along these categories supported the structure within these chapters.

9. Conclusion

This thesis has aimed to outline the current status of organic animal breeding activities and to identify factors that positively or negatively influence the success of existing initiatives (promoting and inhibiting factors). A review of current standards and recent discussions has shown that there is no fixed definition of characteristics of 'organic animal breeding', yet. However, the existing frameworks for organic and agroecological principles provided valuable guidance with regards to breeding goals, breeding processes and organizational structures. At the same time, it has become visible that only few initiatives explicitly target the organic sector in their entire breeding process and organizational set up, yet.

Three cases from Germany and Switzerland were chosen for an in-depth analysis. The initiatives, which explicitly target the organic sector and which represent three different animal species, were examined from the lens of Agricultural Innovation Systems. This was done in order to identify relevant topic areas for promoting and inhibiting factors. Interviews with the coordinators as well as accompanying background research on the initiatives and their sector contexts provided the basis for insights on similarities and differences across initiatives and sectors. A specific consideration of foundation histories underlined, which factors trigger the initiation of organic animal breeding activities. It was evident, that all three initiatives were founded in a joint effort of different actors, trying to address existing challenges in the current breeding and farming systems. All of them try to design breeding programs which are oriented at the fulfillment of organic standards and principles (e.g. in their organizational set ups and on different steps in the breeding process), sometimes already thinking beyond existing legal minimum requirements. However, the empirical results have also shown that they differ from each other in many ways, due to their individual approaches and strategies, and the respective context factors that they face in their respective sectors and countries. This is also reflected their foundation histories, target groups and the involved actors.

Hence, it is not surprising that there is no single answer to the question 'Which factors influence the success (in terms of growth and long-term establishment) of organic animal breeding initiatives?'. The discussion of the results has shown that depending on the sector context and case, the importance of different promoting and inhibiting factors varies. The factors that were found in the empirical analysis relate to different elements of an Agricultural Innovation System and can be grouped in a set of overarching topic areas: availability and exchange of knowledge on breeding and animal husbandry on farm level, initiative level and sector level, public performance testing infrastructure and data management, financial support of breeding work, awareness and capabilities along the value chain, availability and exchange of genetic resources and the design of soft and hard institutions (especially legal framework conditions). The relevance

of these different topics differed in each of the cases: For example, the long-term success of the organic breeding program in UH is threatened by a small genetic base and a small number of farmers that participate in the breeding activities. At the same time, one of the main topics on the ÖTZ's agenda is to create a stronger awareness for the importance of organic poultry breeding along the entire value chain and to test collaborative business models.

Some of the identified issues, such as internal knowledge exchange structures can be influenced by the initiatives themselves while others, such as legal framework conditions or the preservation of a diverse set of genetic resources, need to be tackled on a broader scale. Furthermore, the comparison of UH and GO shows that a high share of organic farms in a specific animal sector can facilitate the foundation and establishment of organic animal breeding initiatives, but at the same time it is not an imperative prerequisite. It was evident that practices in organic animal breeding are still significantly shaped by individual attitudes and priorities of specific groups of pioneers. This underlines the necessity for broader discussions on potential tradeoffs that are faced in the practical implementation of organic principles in animal breeding and husbandry.

Overall it can be said, that the initiatives already show how organic animal breeding activities can be realized in practice and how some of the identified inhibitors in the foundation and development of an initiative can be coped with. However, transdisciplinary research on the promoters and inhibitors of a long-term establishment of organic animal breeding initiatives in different sectors, countries and value chains needs to be continued in order to gain deeper insights on each of the identified aspects.

10. Outlook

The thesis has demonstrated that there still remains some work in research on organic animal breeding initiatives. Beyond the three sectors that have been examined here, further relevant animal species and other countries can complement the insights on promoting and inhibiting factors. In that regard, the cattle sector will constitute one of the sectors that deserves further attention as it has already brought up some promising approaches to establish organic breeding practices as well, e.g. *Bio-KB-Stiere,* the *Ecological Total Merit Index* (ÖZW) or the *Dutch Organisation for Organic Animal Breeding* (see overview in Appendix 3). Furthermore, the status quo of the current breeding and value chain structures in the cattle sector include a 'mix' of characteristics that have been observed in the goat and pig sectors[77] which makes an analysis on cattle breeding initiatives particularly interesting.

As this study has opened up an array of potential identified promoters and inhibitors, it can be worthwhile to conduct an even more detailed investigation each of the identified topics. For example, such a detailed analysis could include innovation system functions (see chapter 3.2), for example focusing on "knowledge creation" and "knowledge diffusion" (Wieczorek & Hekkert, 2012, p. 85) in innovation systems. Furthermore, it was apparent that a stronger inclusion of actors from the value chain is a relevant starting point for examining promoters and inhibitors for existing initiatives (see chapter 8.3). Hence, a parallel investigation on different value chain steps can add further knowledge on how value chain structures can facilitate organic animal breeding activities. Existing insights with regards to farmer and consumer perceptions on the advantages of traditional breeds (e.g. Efken, 2008; Menger et al., 2020) might be a valuable input to further investigations on consumer willingness to pay products from organic animal breeding. At the same time, current discussions on animal welfare and financing of animal welfare measures in Germany (Kompetenznetzwerk Nutztierhaltung, 2020) can create a valuable momentum for the establishment of innovative practices along agricultural value chains.

The thesis also underlined that breeding as an input provider for agricultural production is highly dependent on general societal attitudes towards desired agricultural systems and desired forms of animal husbandry. Discussions on organic animal breeding are closely connected to broader discussions on organic principles and the organic sectors' contribution to a sustainable design of food and farming systems. Thus, further discussions on societal level (or at least on organic sector level) on organic animal husbandry and organic animal breeding in the light of organic and agroecological principles seem urgently necessary. A long-term task (such as animal breeding) is

[77] Females are mainly kept in producer farms and farmers choose mating partners for their animals. At the same time strong conventional breeding associations and elite breeding programs determine the general development of the whole population (see e.g. Willam and Simianer, 2017, pp. 298–308 or Schreider, 2019)

dependent on a clear, shared long term vision. Only then, general 'directions' can be taken in developing existing animal populations.

As only some first hints in terms of scaling up[78] innovative animal breeding initiatives could be given in the discussion, a detailed analysis in terms of their transformative impact might be an interesting subject for further research. Hence, larger projects or studies that aim to take an AIS perspective on this topic as well, could draw broader system boundaries and aim for a transformation oriented analysis at the macro level of the agricultural innovation system within a specific sector and country (see Lamprinopoulou et al., 2014).

Concluding it can be remarked, that despite the lack of a sector wide strategy in organic animal breeding, the three analyzed initiatives were able to test and showcase alternatives in practice already, and in doing this, they were able to make valuable experiences. At the same time, all of them are in the middle of dynamic development processes (esp. GO and UH are in a very early stage) and it remains to be seen how organizational set ups will evolve and whether all envisioned activities will work out as planned. Thus, the promoters and inhibitors that have been found in this study will need to be addressed in a joint effort by farmers, scientists, farming and breeding associations, politicians and the entire value chain in order to push these and similar initiatives and to support the organic livestock sector in constantly moving towards organic and agroecological principles.

[78] See as well a conceptualization by Wigboldus et al. (2016)

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Appendix

Overview

Eidesstattliche Erklärung

Hiermit versichere ich an Eides statt, dass ich diese Arbeit selbstständig verfasst und keine anderen als die angegebenen Quellen und Hilfsmittel benutzt habe. Außerdem versichere ich, dass ich die allgemeinen Prinzipien wissenschaftlicher Arbeit und Veröffentlichung, wie sie in den Leitlinien guter wissenschaftlicher Praxis der Carl von Ossietzky Universität Oldenburg festgelegt sind, befolgt habe.

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