CODE • EFABAR

The commitment to responsible breeding

Species Specific Template
Code EFABAR

PIG
Code EFABAR 2023
7th Edition

Company: _____

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The code of good practices for pig breeding

1 Introduction

1.1 The impact and structure of breeding in the European pig sector

1.1.1 Past and Present

In the last three decades, breeding companies/organisations have evolved their breeding programmes by considering sustainability, animal health, and welfare. These aspects have been translated into six pillars, the foundation of modern responsible and balanced breeding and Code EFABAR.

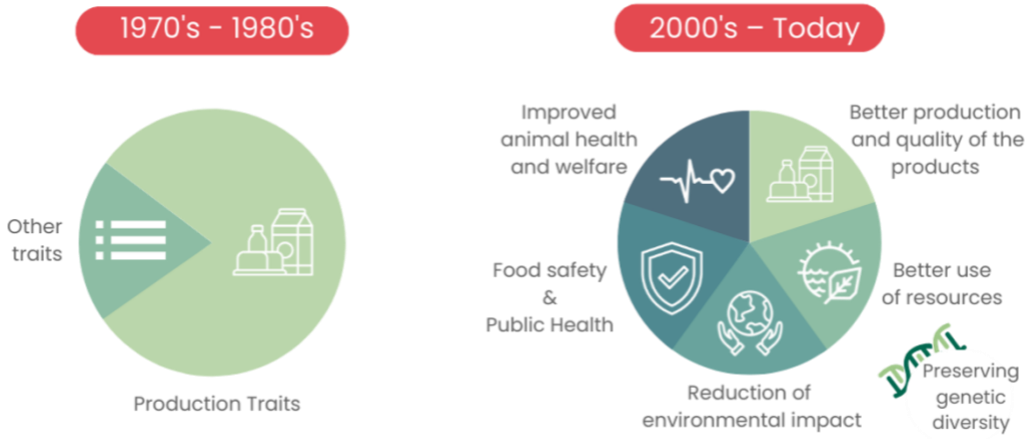

Figure 1 Pie charts representing the progress in animal breeding.

Modern breeding consists of defining a balanced combination of traits to ensure the sustainability of the different production systems. The **combination of these traits varies from region to region/country to country and production system to production system**; the choice of farmers and many other factors related to the availability of resources and other social, environmental, political, and economic situations. Modern pig breeding is based on these principles.

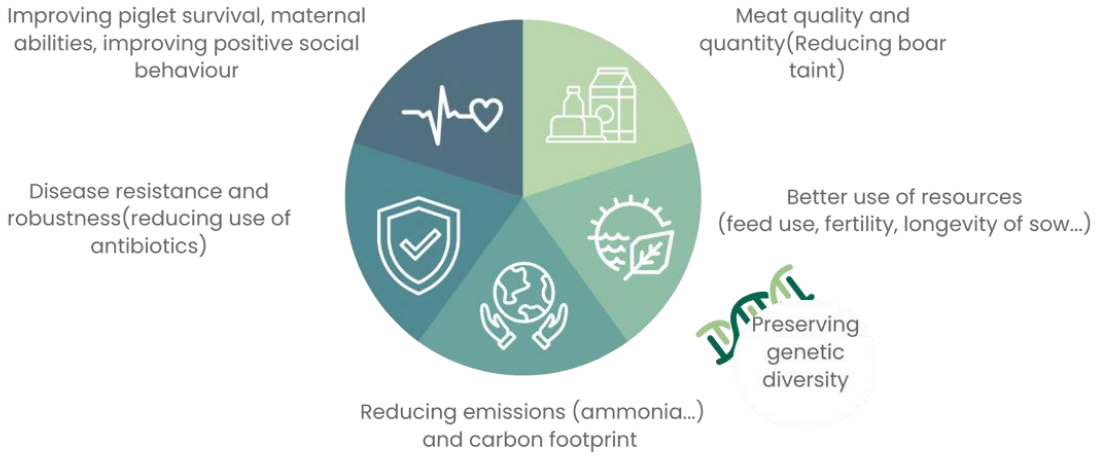

Figure 2 Modern pig breeding: defining a balanced combination of traits to ensure the sustainability of the different production systems.

1.1.2 Modern Pig Breeding

Modern pig breeding programs are developed under the concept of **Responsible and Balanced Breeding** and aim to develop healthy and robust sows, boars, and piglets for all types of pig production systems, from conventional to free-farrowing, organics and for traditional productions under high-quality schemes (PDO, PGI). Animals that are also resilient to environmental and disease challenges have improved welfare and produce high-quality meat with decreased use of natural resources (feed, water, energy) to help farmers be more sustainable.

The structure of the pig breeding sector is designed to facilitate the dissemination of genetic improvement and efficient pig production. It involves several key components, including the **nucleus farm, multiplication farm, and insemination centre**.

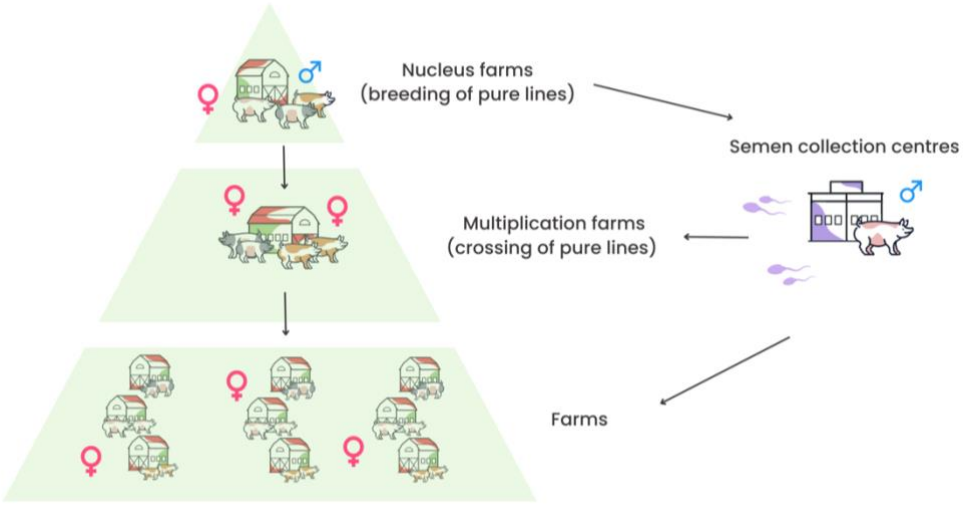

Figure 3 The Structure of the Pig Breeding Sector

The pig breeding strategies are implemented in the nucleus farms, setting breeding objectives for **paternal and maternal lines**.

- **Paternal lines** prioritise growth rate, robustness, feed efficiency, and meat quality, improving offspring performance and carcass characteristics.
- **Maternal lines** emphasise reproductive performance, mothering ability, and piglet and sow survival, ensuring the productivity and well-being of breeding females and their piglets. Additionally, breeders also focus on growth and efficiency, considering that the maternal aspect constitutes 50% of the pig's development in farms.

The breeding process ultimately generates cross lines or hybrids by strategically combining purebred paternal and maternal lines. These crossbred pigs inherit beneficial traits from both the maternal and parental lines, resulting in offspring with improved characteristics such as a balanced combination of growth rate and maternal attributes.

Establishing structured breeding systems and utilising pure lines, controlled breeding, and advanced reproductive techniques are essential in modern pig breeding. These practices contribute to genetic advancement, efficient production, improved animal welfare, and

producing high-quality pork products. The structured approach ensures continual progress and sustainability within the pig breeding sector.

1.1.3 Vision for the future

The future of the European pig breeding sector is transforming significantly. This change is driven by a **combination of genetic improvement, broadening breeding objectives, and adapting to changing environmental conditions**. However, it's important to remember that while technology plays a crucial role in this transformation, it is merely a tool. Without the knowledge and vision to guide its application, technology alone cannot bring about meaningful change.

Traditional breeding tools, refined over centuries, remain the sector's backbone. They provide a robust foundation for breeding programmes, ensuring the health and diversity of our pig species. However, these tools are not used in isolation; they are part of a larger strategy that includes **managing inbreeding, which is crucial for maintaining genetic diversity and health.**

Innovations in genomics are complementing these traditional methods, providing new tools and possibilities for breeders. But these technologies are not an end in themselves. They are a means to an end, tools that allow us to understand and utilise the genetic makeup of pig species with unprecedented precision.

Precision farming, achieved through real-time monitoring, sensor technologies, and automation, is expected to revolutionise pig management, welfare, and overall productivity. However, **expanding breeding goals to include traits** related to animal welfare, environmental sustainability, and resilience, such as robustness, heat tolerance, and reduced environmental impact, is equally important. These goals reflect the sector's commitment to responsible and sustainable pig breeding.

The health, productivity, and welfare of pig populations are at the heart of this vision. Practices **must promote the well-being and productivity of these populations,** including ensuring the welfare of pigs during transport. The focus on disease resistance, feed efficiency, and overall robustness of the pigs is paramount, contributing to global food security and sustainability.

Addressing challenges associated with negative genetic correlations between antagonistic traits is being **tackled through genomic selection and marker-assisted breeding techniques**. These techniques allow **breeders to make informed decisions that improve multiple traits, leading to more balanced genetic progress.**

Research and development play a pivotal role in this transformation. **Collaboration with researchers and academia is crucial to spur innovation and keep the sector at the cutting edge of technological advancements.** This collaboration extends across the agrifood value chain, promoting a comprehensive approach to sustainable pig farming.

Continued research and development in novel traits, developing omic technologies, and gene editing hold immense promise. They can accelerate pig resilience and adaptability to changing environmental conditions. Advanced data analytics, including machine learning and artificial intelligence, enable breeders to extract valuable insights from extensive datasets. By analysing

genomic, phenotypic, and environmental data, breeders can make informed decisions, accelerate genetic progress, and optimise overall efficiency.

As we look ahead, we are excited to witness the positive ripple effects of these commitments on the European pig breeding sector.

Further details and examples can be found in Section 7.2

1.2 Contribution to the United Nations Sustainable Development Goals (UN SDGs)

Sustainable production is becoming a major focus across the farmed animal sector to ensure that efficient and high-output systems are environmentally friendly. The United Nations have agreed on 17 sustainability development goals to be addressed by production systems (https://sustainabledevelopment.un.org/). Pig breeders aim to support and directly address 6 of these goals, as summarised below:

Figure 4 The Pig Breeding Sector contributes to these six UN SDGs

1.3 The vision and role of _____ on this journey towards sustainable and balanced breeding

This section asks Breeding Companies (BC) to describe their vision and how they implement it through breeding goals. It's important to mention the variety of livestock systems to which the companies provide genetics and which are the difference between breeding programs and goals for those different systems, if any.

1

2 Responsible and balanced pig breeding

Responsible and balanced animal breeding in aquaculture encompasses strategies to maintain the long-term well-being of aquatic animals, the environment, and expectations from the food supply chain and society. It emphasises achieving a balance between genetic improvement and preserving **genetic diversity**. Additionally, it prioritises the **efficient utilisation of resources**, **improving animal health and welfare**, **safeguarding the environment, and ensuring public health and food safety**.

These principles, collectively known as the six pillars of Code EFABAR, form the foundation of responsible aquaculture breeding practices.

Guidelines and Instructions for Breeders

This section will explore the breeding and management elements incorporated into your breeding company's (BC) breeding programme for each of the 6 pillars:

1. We will examine the implementation of specific breeding and management elements and request detailed information on how each element is incorporated. If any elements still need to be implemented, we encourage you to share the reasons behind this decision, fostering a transparent understanding of your breeding practices.
2. Additionally, we kindly request data showcasing the progress made; this can be confidential data or published papers. Please note that **EFFAB respects confidentiality**, and all information provided will be considered confidential unless explicitly stated otherwise.
3. Alternatively, describe the current progress and provide insights into the expected advancements for each breeding element.

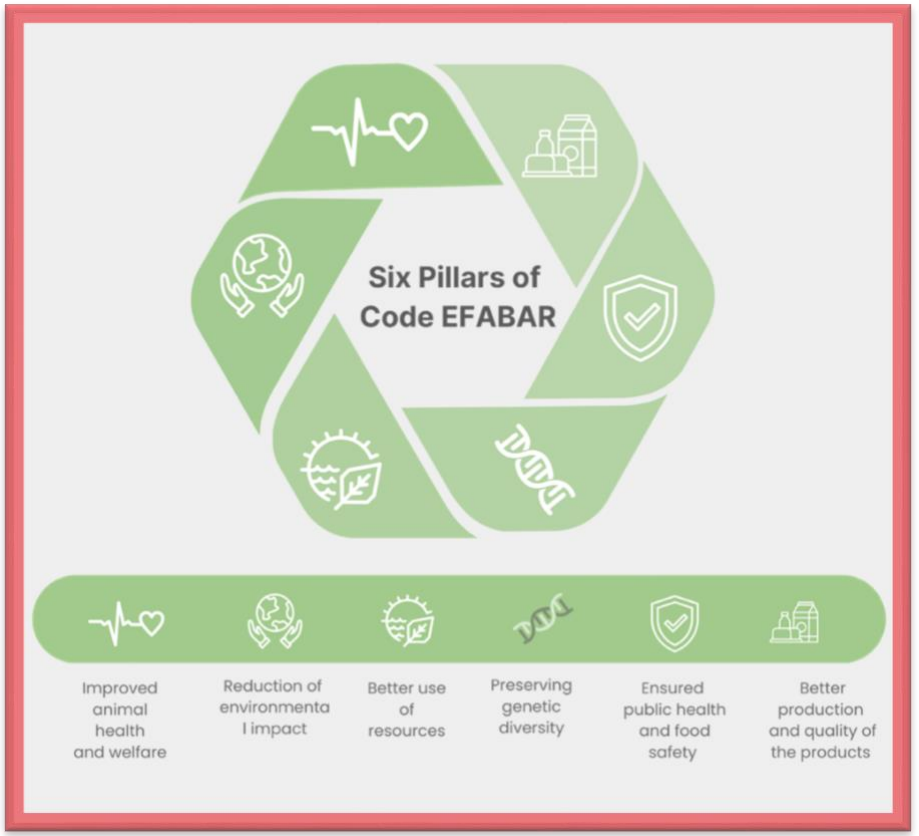

Figure 5 The six pillars of Code EFABAR

These questions aim to facilitate a comprehensive understanding of your breeding programme and its achievements. By sharing your self-regulated practices, we can collectively promote the importance of balanced and sustainable breeding programmes to a wider audience, including stakeholders, policymakers, and the broader society.

2.1 Health and welfare of sows and piglets

Breeding and management elements work together to ensure the health and the welfare of breeding pigs. By focusing on traits like disease resistance and reproductive efficiency during breeding, pigs with improved immunity are bred, reducing the need for antibiotics, and supporting the welfare of piglets and sows. In addition, effective management practices such as providing proper housing, ventilation, and hygiene and implementing regular health monitoring contribute to optimal well-being. These combined efforts minimise stress, promote natural behaviours, and ensure pigs' overall health and welfare in pig breeding systems.

Has the breeding company (BC) implemented the following breeding elements directly and indirectly in its breeding programme? (Yes, No or Not Applicable (NA))		Can you provide more details about how the breeding element has been implemented? And if not, why not?	Can you provide data to show progress in the last 3 years and include the animal's stage of life the data is relevant? Alternatively, describe the current and expected progress.
Fertility	☐Yes ☐No ☐NA		
Maternal abilities: - Neonatal survival - Percentage of Piglets Weaned	☐Yes ☐No ☐NA ☐Yes ☐No ☐NA ☐Yes ☐No ☐NA		
Teat number & quality (related to piglet health & welfare)	☐Yes ☐No ☐NA		
Milk production/availability for piglets	☐Yes ☐No ☐NA		
Litter Survival	☐Yes ☐No ☐NA		
Decrease of congenital defects with a genetic component (like Atresia Ani, Cryptorchidism, Splay leg, Hermaphrodism and Hernia)	☐Yes ☐No ☐NA		
Disease resistance	☐Yes ☐No ☐NA		
Leg and back problems (skeletal, injuries, infections)	☐Yes ☐No ☐NA		

Selection on boar taint to reduce Castration of piglets	☐Yes ☐No ☐NA		
Negative Behaviour: - Tail biting, - Ear biting - Flank chewing - Other: _____	☐Yes ☐No ☐NA ☐Yes ☐No ☐NA ☐Yes ☐No ☐NA ☐Yes ☐No ☐NA		
Overall Positive Behaviour: - Interaction with humans - Sociability/interaction within the flock - Play behaviour Sow Positive behaviour: - Sow x Piglet interaction - Nest building - Estrus Behaviour - Other: _____	☐Yes ☐No ☐NA ☐Yes ☐No ☐NA ☐Yes ☐No ☐NA ☐Yes ☐No ☐NA ☐Yes ☐No ☐NA ☐Yes ☐No ☐NA		
Elimination of stress susceptibility	☐Yes ☐No ☐NA		
Ability to perform in lose housing gestation and farrowing pens	☐Yes ☐No ☐NA		
Ability to perform in organic farming and outdoor rearing systems	☐Yes ☐No ☐NA		
Monogenic traits/defects (Can BC provide examples of the genetics test done that are relevant to animal health and welfare?)	☐Yes ☐No ☐NA		
Are there any other breeding elements that are important to your BC and should be considered?	☐Yes ☐No	List here:	

Have the following management elements been implemented in the BC breeding programme?		**If yes, give a short explanation and provide supporting documents if possible.**	**If no, can you explain why? Is there a possibility for these management elements to be implemented in the next 3-5 years?**
Has the BC implemented a biosecurity policy on its own premises (to avoid diseases and the spreading of diseases to other premises)?	☐Yes ☐No ☐NA		
Has the BC a welfare policy on its own premises making a reference to the Five Freedoms[1] : Or Five Domains[2] : and is the welfare policy implemented?	☐Yes ☐No ☐NA ☐Yes ☐No ☐NA		
Has the BC procedures to minimise stress when handling individuals?	☐Yes ☐No ☐NA		
Has the BC implemented a procedure for emergency killing and to minimise animal suffering according to legislation in place?	☐Yes ☐No ☐NA		
Has the BC a policy on how to handle its animals prior to and during transport and is it implemented?	☐Yes ☐No ☐NA		
Has the BC a policy in place to periodically train and update its animal care takers on how to	☐Yes ☐No ☐NA		

[1] Five Freedoms: https://www.woah.org/en/what-we-do/animal-health-and-welfare/animal-welfare/
[2] Five Domains: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5575572/

manage and handle the animals and is it implemented?			
Has the BC a monitoring programme or staffs dedicated to welfare to ensure welfare of animals - During their life cycle - during transportation	☐Yes ☐No ☐NA ☐Yes ☐No ☐NA		
Can the BC list the bio-securities measures applied during the safe transport of the animals?	☐Yes ☐No ☐NA		
Does the BC have its own internal transportation protocol?	☐Yes ☐No	Given yes, please fill in the annex A2	
Are there any other management elements that are important to your BC and should be considered?	☐Yes ☐No	List here:	

2.2 Environment

To mitigate environmental impact, breeders focus on breeding robust and resilient pigs with traits like efficient feed conversion and a low environmental footprint. Management practices encompass sustainable approaches such as optimising feed rations, implementing effective waste management systems, and reducing greenhouse gas emissions. These measures promote an eco-friendlier and resource-efficient approach, supporting pig well-being and environmental sustainability.

Has the following breeding elements been implemented directly or indirectly in the BC breeding programme?		Can you provide more details about how the breeding element has been implemented? And if not, why not?	Can you provide data to show progress in the last 3 years and include the animal's stage of life the data is relevant? Alternatively, describe the current and expected progress.
Reduction of N and P emission (considering the reusability of these elements in the manure)	☐Yes ☐No ☐N		
Reduction in greenhouse gas emission, (N_2O, CH_4 and CO_2)	☐Yes ☐No ☐NA		
Reduction in NH_3	☐Yes ☐No ☐NA		
Adaptation of pigs to different environments disturbances associated with climate change	☐Yes ☐No ☐NA		
Are there any other breeding elements that are important to your BC and should be considered?	☐Yes ☐No		
Have the following management elements been implemented in the BC breeding programme?		**If yes, give a short explanation and provide supporting documents if possible.**	**If no, can you explain why? Is there a possibility for these management elements to be implemented in the next 3 years?**
Has the BC an environment policy on its own premises and is it implemented?	☐Yes ☐No ☐NA		
Has the BC a policy to reduce carbon footprint?	☐Yes ☐No ☐NA		

Are there any other management elements that are important to your BC and should be considered?	☐Yes ☐No	List here:

2.3 Better use of resources

Better use of resources is a key consideration in pig breeding. Breeders emphasise the development of pigs with improved resource efficiency and adaptability traits. Through meticulous management practices such as vigilant monitoring of resource consumption, breeders ensure optimal utilisation of feed, water, and energy resources. This approach minimises waste and maximises resource allocation, supporting pig well-being and optimising resource utilisation for a sustainable and efficient operation.

Has the following breeding elements been implemented directly or indirectly in the BC breeding programme?		Can you provide more details about how the breeding element has been implemented? And if not, why not?	Can you provide data to show progress in the last 3 years and include the animal's stage of life the data is relevant? Alternatively, describe the current and expected progress.
Longevity of the sow	☐Yes ☐No ☐NA		
Maternal fertility	☐Yes ☐No ☐NA		
Paternal fertility	☐Yes ☐No ☐NA		
Survival of piglets/pigs - at birth - at weaning - at rearing - until slaughter	☐Yes ☐No ☐NA ☐Yes ☐No ☐NA ☐Yes ☐No ☐NA ☐Yes ☐No ☐NA		
Efficiency - Feed efficiency - Water efficiency - Energy efficiency - Protein efficiency	☐Yes ☐No ☐NA ☐Yes ☐No ☐NA ☐Yes ☐No ☐NA		
Daily gain	☐Yes ☐No ☐NA		
Breeding of pigs that could be fed with alternative feed materials	☐Yes ☐No ☐NA		
Are there any other breeding elements that are important to your BC and should be considered?	☐Yes ☐No	List here:	

Have the following management elements been implemented in the BC breeding programme?		If yes, give a short explanation and provide supporting documents if possible.	If no, can you explain why? Is there a possibility for these management elements to be implemented in the next 3 years?
Has the BC a policy monitoring the better use of resources on its own premises and is it implemented?	☐Yes ☐No ☐NA		
Has the BC procedures for processing of or reuse of residual products?	☐Yes ☐No ☐NA		
Are there any other management elements that are important to your BC and should be considered?	☐Yes ☐No	List here:	

2.4 Genetic diversity

Safeguarding and enhancing the genetic diversity of pig populations through pig breeding that incorporates diverse genetic lines and breeds to improve hybrid vigour, disease resistance, meat quality traits, and adaptability to different production systems or environmental conditions. Breeders place great importance on maintaining diverse genetic lines and aligning with the Food and Agriculture Organization (FAO) recommendations. Through collaboration with breed associations and the implementation of conservation programs, breeders actively safeguard genetic diversity. By valuing and promoting diverse genetic resources, pig breeds remain robust and adaptable, contributing to long-term animal welfare and preserving valuable genetic traits.

Has the following breeding elements been implemented directly and indirectly in the BC breeding programme?		Can you provide more details about how the breeding element has been implemented? And if not, why not?	Can you provide data to show progress in the last 3 years and include the animal's stage of life the data is relevant? Alternatively, describe the current and expected progress.
Is the genetic diversity within purebred lines recorded? (Preventing inbreeding at population and individual levels)	☐Yes ☐No ☐NA		
Is the conservation of alleles of purebred lines implemented? (in situ or ex situ)	☐Yes ☐No ☐NA		
Is there a programme for conservation of alleles of rare and threatened breeds?	☐Yes ☐No ☐NA		
Does the BC provide a mating program for farmers to manage inbreeding? (rate of inbreeding per year, FAO)	☐Yes ☐No ☐NA		
Has the BC implemented optimum contribution selection (or other methods to balance genetic progress and rate of inbreeding increase)?	☐Yes ☐No ☐NA		

Is a genomics-based parentage testing implemented (using STR or SNP markers)?	☐Yes ☐No ☐NA		
Are there any other breeding elements that are important to your BC and should be considered?	☐Yes ☐No	List here:	
Have the following management elements been implemented in the BC breeding programme?		How is the breeding element implemented? And if no, why not?	If no, can you explain why? Is there a possibility for these management elements to be implemented in the next 3 years?
Does the BC operate its own or contribute to a public gene bank for commercial pig breeds/lines?	☐Yes ☐No ☐NA		
Does the BC contribute to the conservation of alleles of rare and threatened pig breeds?	☐Yes ☐No ☐NA		
Are there any other management elements that are important to your BC and should be considered?	☐Yes ☐No		

2.5 Product Quality

Breeders aim to produce pigs with desired meat quality attributes, such as tenderness, flavour, and marbling. Through meticulous management practices, including providing appropriate nutrition, implementing careful handling and transport procedures, and maintaining stringent quality control measures, breeders consistently produce high-quality pork products. In addition, many breeders integrate a high-quality EU Scheme into their practices, which sets stringent standards and regulations for pig breeding and production. By adhering to this scheme and valuing genetics, breeders meet consumer expectations and contribute to the well-being of pigs, ensuring that the entire process, from breeding to final product, aligns with the highest quality standards and promotes sustainable and welfare-oriented pig farming practices.

Has the following breeding elements been implemented directly or indirectly in the BC breeding programme?		Can you provide more details about how the breeding element has been implemented? And if not, why not?	Can you provide data to show progress in the last 3 years and include the animal's stage of life the data is relevant? Alternatively, describe the current and expected progress.
Carcass quality (carcass composition - lean to fat ratio, cut sizes)	☐Yes ☐No ☐NA		
Meat quality (nutritious value, shelf life, appearance, taste/flavour, PSE, Acid Pork)	☐Yes ☐No ☐NA		
Reduction of boar taint in meat	☐Yes ☐No ☐NA		
Specific products for specific consumers (E.g. lean genetics for dry cured ham)	☐Yes ☐No ☐NA		
Are there any other breeding elements that are important to your BC and should be considered?	☐Yes ☐No		
Have the following management elements been implemented in the BC breeding programme?		If yes, give a short explanation and provide supporting documents if possible.	If no, can you explain why? Is there a possibility for these management elements to be implemented in the next 3 years?

Are there any management elements that are important to your BC and should be considered?	☐Yes ☐No	#Provide list

2.6 Food Safety and Public Health

Breeders focus on breeding robust pigs with traits such as disease resistance and high meat quality. Breeders implement strict biosecurity protocols, rigorous quality assurance programmes, and comprehensive traceability systems to ensure public health. These measures prevent disease transmission, guarantee safe and wholesome food production, and protect both consumers' and pig well-being.

Has the following breeding elements been implemented directly or indirectly in the BC breeding programme?		Can you provide more details about how the breeding element has been implemented? And if not, why not?	Can you provide data to show progress in the last 3 years and include the animal's stage of life the data is relevant? Alternatively, describe the current and expected progress.
Reduction of antimicrobial usage by selecting more disease resistant and robust animals	☐Yes ☐No ☐NA		
Reductions of other drugs/medications (eg. Painkillers)	☐Yes ☐No ☐NA		
Food safety (e.g., minimizing the spread of diseases through meat)	☐Yes ☐No ☐NA		
Are there any other breeding elements that are important to your BC and should be considered?	☐Yes ☐No		
Have the following management elements been implemented in the BC breeding programme?		If yes, give a short explanation and provide supporting documents if possible.	If no, can you explain why? Is there a possibility for these management elements to be implemented in the next 3 years?
Has the BC a biosecurity policy on its own premises (to avoid spreading zoonoses) and is it implemented?	☐Yes ☐No ☐NA		
Has the BC an antimicrobial resistance policy on its own premises and is it implemented?	☐Yes ☐No ☐NA		
Has the BC, as part of their biosecurity processes, procedures to	☐Yes ☐No ☐NA		

reduce the potential risk of contamination from staff and equipment?			
Are there any other management elements that are important to your BC and should be considered?	☐Yes ☐No	List here:	

3 Responsible use of technologies

Modern animal breeding comes with advancements in tools and technologies used for breeding and reproduction. Therefore, prioritising the conscientious and ethical application of technologies in breeding, considering the welfare of the animals, their genetics, the environment in which they evolve, the resources available and their optimal use, the quality of the products, the one health concept, and broader ethical implications are crucial.

- Is the BC responsibly using established breeding and reproduction technologies(e.g., Genomic Selection, BLUP, Artificial Insemination, Embryo Transfer, Performance and Progeny testing)?
- If yes, which ones and for which purpose

Technology used	Purpose (Benefits)

- What does responsibly mean in this context for the BC?

- Is the BC responsibly using new breeding or reproduction technologies (e.g., Novel Traits, Precision Livestock Farming for new traits in welfare, or product quality, Marker Assisted Selection, Genomic Prediction, Gene Editing, Cloning)?

  ☐Yes ☐No

  If yes, which ones and for which purpose?

Technology used	Purpose (Benefits)

- Is BC excluding any technologies? Why?

4 Research, innovation, and public perception

Research, innovation, and public perception are vital in modern pig breeding. Research contributes to advancements in genetics, health, nutrition, and breeding technologies, enabling the identification of desirable traits and the development of efficient breeding strategies. Innovation introduces new tools and practices that enhance productivity, sustainability, and the welfare of pigs. Additionally, public perception guides the sector towards transparent and ethical practices, aligning breeding systems with societal values and fostering trust between breeders and consumers. Integrating research, innovation, and public perception ensures modern pig breeding practices' continuous improvement and responsible development.

- Does the BC invest in research and development in new breeding and reproductive technologies and novel traits?

  ☐Yes ☐No

  - Which ones and for what?

- In your opinion, what novel traits or breeding goals should be considered for pig breeding in the future?

- Is the BC aligned with the principle of the Three Rs principle[3] (3Rs)/Responsible research and innovation[4](RRI) when using animals for research and innovation (RI)?

  ☐Yes ☐No

[3] The three Rs (3Rs): https://ec.europa.eu/health/scientific_committees/opinions_layman/en/non-human-primates/glossary/tuv/three-rs-principle.htm

[4] Responsible Research and Innovation (RRI): https://op.europa.eu/en/publication-detail/-/publication/ee9bacdf-fdad-46eb-8cd8-32879e310191/language-en

- If not, what is the BC's current policy to ensure welfare and ethics are applied during RI?

.,

☐ Yes ☐ No

- Could you give some examples on how?

5 Breeding policy declaration

Company Name:
Manager/CEO Name:

We are committed to ensuring that the rules of Code EFABAR are implemented and maintained throughout our operational and producing activities related to animal breeding and reproduction.
This is achieved by:

1. Compliance and implementation of the relevant and applicable legislation.
2. Implementation of Good Practices for Responsible and Balanced Breeding and Reproduction as indicated in the Code EFABAR, Version 2023.
3. Information and training our staff in Code EFABAR requirements to ensure it is continuously implemented.

Date:
Signature:

6 Declaration of approval by the EFFAB director

Having evaluated the indications as provided by _____, I have come to a conclusion and propose that the certificate of compliance, according to the regulations of Code EFABAR shall be issued to the applicant.

Date:

Place: Brussels
Period of validity:
EFFAB Director Signature:

7 ANNEXE

7.1 Animal Health and Welfare: Transport of breeding animals

Has the following transportation policy element been implemented in the BC?		If yes, give a short explanation and provide supporting documents if possible.	If no, can you explain why? Is there a possibility for these management elements to be implemented in the next 3 years?
Are all persons involved with the transport of breeding animals **aware of and comply** with any current EU/National/international Legislation and Codes of Practice that apply to the movement of breeding animals? And in particular to **1/2005 EC**	☐Yes ☐No ☐ NA		
Does the Breeding Company (BC) have an appointed Animal Welfare Officer that put in place and supervises the transport procedures and contingency plans?	☐Yes ☐No ☐ NA		
Is the BC checking all the certificates and authorizations of the operator transporting livestock on behalf of the BC?	☐Yes ☐No ☐ NA		
Is the vehicle in use being maintained and kept in a condition which ensures that all animals can be transported under the expected conditions to which it was designed to ensure biosecurity and animal welfare?	☐Yes ☐No ☐ NA		
Does the BC check that transport and resting times are respected?	☐Yes ☐No ☐ NA		
Are all relevant legislation in relation to stocking density during transport of any species applied?	☐Yes ☐No ☐ NA		

Has the BC a robust policy to check that breeding animals are fit for transport before leaving?	☐Yes ☐No ☐ NA		
Has the BC put in place ways to ensure that the temperature in the means of transport is in the range foreseen in the legislation?	☐Yes ☐No ☐ NA		

7.2 Glossary

Here's a brief introduction to some of the breeding technologies adapted for the European pig breeding sector:

• **Gene Editing**

Gene editing, while not currently in use due to regulatory constraints, is a promising area of research in the European pig breeding sector. This technology could potentially enhance disease resistance and overall well-being in pigs by incorporating advantageous genes. For instance, scientists have used gene editing to make small precise modifications to pig DNA, which could significantly impact the health, welfare and resiliency of pig populations. However, the application of gene editing faces regulatory challenges. Despite these hurdles, the sector is committed to conducting research responsibly under the Responsible Research and Innovation (RRI) framework.

• **Genomic Selection**

Genomic selection, a modern breeding approach, involves the analysis of individual pig DNA to identify valuable genetic traits at an early stage. This enables the selection of pigs exhibiting the most desirable characteristics.

• **Gut Microbiota**

The gut microbiota in pigs plays a significant role in their health and productivity. The initial intestinal microbiota in pigs is acquired from different sources, including environmental bacteria. This microbiota has profound impacts on pig health and productivity. Advanced techniques are being used to study the gut microbiota, such as metagenomic association analysis, which can help identify potential biomarkers to differentiate breeds of pigs. Understanding and managing the gut microbiota can improve pig health and productivity.

• **Marker-Assisted Breeding**

Marker-assisted breeding, a technique that uses molecular markers identifiable DNA sequences located near a gene of interest on a chromosome, is used to select individuals carrying desirable traits. Once reliable markers are identified, early marker-assisted selection can be performed with great selection accuracy. This technique is used responsibly, considering the welfare of animals.

• **Selective Breeding**

Selective breeding, a traditional method, involves choosing parent organisms with traits desirable to the breeder to produce offspring that inherit these more favourable characteristics. The sector's focus remains on using this tool responsibly, considering the diversity of the population, and managing inbreeding levels.

Epigenomics, Functional Annotation and Novel Traits in Pigs

• **Epigenomics** These studies show how the environment can change how genes work in pigs. Understanding these changes can help us learn how to create better conditions in pig farming, contributing to the welfare of the animals and the sustainability of the sector.

• **Functional annotation** This process, akin to assigning a job description to each gene in a pig, helps us understand what each gene does and how it affects the pig's characteristics. This understanding is crucial as it allows us to make informed decisions about which traits to select for breeding, ensuring the health and productivity of future pig populations.

• **Novel traits** These are new characteristics that scientists are trying to develop in pigs. The exploration and development of these novel traits are vital for the sector's adaptability to changing environmental conditions and consumer demands.

Precision Livestock Farming (PLF) in Pigs

Breeders are investing in and incorporating various advanced technologies:

• **RFID tags** (Radio Frequency Identification tags) use radio frequencies to provide information on the pigs' movement, behaviour, and feeding habits.

• **Biosensors** can detect pathogens in the air or the stool, contributing to disease prevention and control.

• **Artificial Intelligence** and **Machine Learning (AI-ML)** are used to analyse the vast amounts of data collected by sensors and other technologies.

These technologies can identify patterns and predict, contributing to more efficient and effective management practices. AI-based systems can optimise breeding processes by automating tasks like identifying live embryos, controlling incubation conditions, and predicting outcomes.