

LOCAL PIG BREEDS – THE MULTIFUNCTIONALITY ASSETS FOR SUSTAINABLE PORK PRODUCTION

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Abstract: This presentation analyses the role of local pig breeds within sustainable food systems, with a particular focus on their contribution to sustainable pig production. It examines how these breeds respond to evolving societal and consumer expectations regarding intrinsic and extrinsic quality attributes of pig meat and pork products. The analysis addresses critical challenges related to sustainability in livestock systems, highlighting the multifunctionality of local breeds, their environmental impact, socio-cultural significance, consumer perspectives and market potentials of their products. Public funding plays an important role in maintaining local pig breeds; however, a lasting conservation requires their integration into sustainable systems that capitalize on their distinctive qualities.

Key words: breed valorisation, ecosystem services, quality attributes, pork value chain

Introduction

Animal husbandry provides humans with foods that represent an important source of high-quality and easily digestible proteins, minerals, and vitamins, and are part of a healthy and balanced diet. The sector of pig farming holds a significant share in meat production; globally, it accounts for about one-third and in Europe, nearly half of meat consumption. Due to the global increase of human population, land availability and its use (Godfray et al., 2010) represent a limiting factor for agricultural production in particular for the share that can be used for animal production. We can expect an increasing pressure on land use and growing competition between feed and food at a global level, which in the long term leads to the increasing need for the justification for using agricultural land for livestock production (AgriResearch, 2019), and particularly for pig farming, as it delivers mainly one product – meat (meat is the primary output of pig farming, but the

sector also generates a minor share of by-products with high value (e.g. pharmaceutical industry).

The European Commission's Green Deal strategy (EC, 2019) envisions a transition to agroecological food systems, which must be designed more holistically to best balance, both now and in the future, demands for productivity, sustainability, quality, and other societal values (ecosystem services). Pork is an important source of valuable nutrients in the human diet; however, since pigs directly compete with humans for cereals and plant proteins, this sector is particularly vulnerable and increasingly subject to social pressure.

The sector's strength lies in the value of pork for consumers especially in tradition of consumption and processing into highly appreciated products. In the pursuit of sustainable food systems, some studies (Röös et al., 2016; van Zanten et al., 2018) suggest limiting livestock farming to species that can utilize grassland or by-products from the food industry. In this regard, the use of by-products is an important and underutilized feed resource in pig farming. To address this challenge, the pig farming sector will need to respond to future societal demands and integrate the various functions of the system, where the quality of products in its broadest sense will play a central role.

In this context, one of the key attributes for the sustainable development of pork supply chains lies in the tradition of pork consumption, on which pig meat production can build its *raison d'être* (reason for existence); it involves developing products that meet the high expectations of consumers. In this way, pig farmers and the meat industry can take advantage of the consumer trend toward valuing quality over quantity. The idea of "less but better" meat consumption enables producers to increase the price and profitability of their products without expanding production volume (or even reducing it), thereby also contributing to the mitigation of environmental impacts.

Today, most pork and pork products come from intensive production systems that were developed in the past century to improve meat availability/supply and efficiency of pork production. The focus of pig farming on genetic improvement and efficiency has led to certain negative effects on meat quality (technological and sensory characteristics), as well as on the nutritional properties of both fresh and processed pork (Font-i-Furnols and Guerrero, 2014). At the same time, the sector is increasingly confronted with societal demands for healthier products and more sustainable production (e.g., improved animal welfare, lower environmental impact), and the strengthening of circular and local economies (e.g., the use and valorization of by-products and alternative protein sources for animal feed) (Bilatto et al., 2024). A sustainable food system must therefore meet three conditions:

i) economic sustainability –must be cost-effective throughout the entire chain,

- ii) social sustainability – it must provide broad benefits to society, and
- iii) environmental sustainability – it must have a neutral or positive impact on the natural environment (Figure 1).



Figure 1. Sustainable food system has three pillars

An analytical review of the literature (Aboah and Lees, 2020) showed that the five most important quality characteristics of meat for consumers are of extrinsic nature, with fat content (an intrinsic trait) ranked only fifth, alongside the organic label and price. For pork, it is also important that it is convenient to prepare, tasty, and produced in line with the ethical values of consumers (Lin-Schilstra et al., 2022).

Importance of extrinsic cues for consumer

Demand for pork and pork products is increasingly shaped by societal expectations for more sustainable production systems that ensure better animal welfare, biodiversity (e.g., local breeds), reduced use of inputs (particularly veterinary drugs), and lower environmental impact (such as precision feeding, use of local feed sources, and valorisation of food industry by-products). This evolution is also supported at the European level by the Green Deal and the Farm to Fork strategy, aiming for a fair, healthy, and environmentally friendly food system. Consumers are exposed daily to meat of various origins, associating the origin of the meat with food safety (e.g., trust in domestic production), although countries differ in how much consumers trust their food safety systems (Font-i-Furnols and Guerrero, 2014). Consumer attitudes toward animal farming for meat have shifted significantly, with increasing concern about animal welfare and the environmental impacts of livestock production (Liu et al., 2023). Consumer views on pork production vary by consumer segment and country, as well as by the context of

purchase and consumption (Aboah and Lees, 2020). Quality aspects of pork are multi-dimensional and are becoming increasingly important, as a growing number of consumers prefer to eat less meat but of higher quality (Lebret and Čandek-Potokar, 2022).

However, it should be noted that for a significant portion of the population, meat price remains a very important purchasing factor, even in countries with higher consumer purchasing power (Aboah and Lees, 2020; Liu et al., 2023). Furthermore, the views of citizens (on animal welfare and environmentally friendly food production) and those of consumers may differ; for instance, what people support in their role as citizens does not always influence their actual purchasing and consumption decisions regarding pork (Krystallis et al., 2009). The dimensions of quality that influence repeated purchase are linked to demand, trust, and experience (Grunert et al., 2004). Research shows that health, natural attributes, sensory quality, price, and animal welfare are key factors for consumers in various countries. Consumers differ and can be segmented as demanding, average, low-ecological, and indifferent (Lin-Schilstra et al., 2022). Consumers of the modern developed world with adequate purchase power increasingly focus on what they eat. They expect choice and transparency in the supply chain; they want to know where their food comes from and who produces it and how. They are interested in sustainable practices of companies and farms, but often do not want to pay more for products based on sustainable approaches. Regarding pork, it is important to consider whether pork has a future as an accessible and affordable protein source. Expanding sustainable practices and effective communication of sustainability stories, seeking diversity and profitable niches, and especially educating future generations to recognize and appreciate product quality linked to pig farming will be crucial.

Future pig farming systems will need to incorporate and address the complexity of consumer perceptions of meat quality, which, within the context of pig production, means aligning production systems with available natural resources and focusing on delivering high-quality products.

Local pig breeds and their value for sustainable food system

The United Nations organisation has set 17 sustainable development goals focused on human health and environmental sustainability, and the livestock sector must also adapt to these goals (FAO, 2018). These goals address a sustainable food system, which is not sustainable today because food production does not align with or follow healthy human diets (Benton et al., 2018). Therefore, the food system needs to be transformed to provide healthy nutrition and more sustainable and circular food production (reducing food wastes). In this context, European

autochthonous (or local) pig breeds and their specific production systems have great potential due to:

- consumers prefer local food (Holloway et al., 2007),
- consumers prefer food coming from farms with high animal welfare standards (Alonso et al., 2020),
- consumers prefer outdoor extensive farming systems, and environmentally friendly farming (Krystallis et al., 2009).

Meat from local pig breeds is perceived by consumers as better because it possesses desired intrinsic quality traits. These breeds and their (usually extensive) farming systems represent agricultural and biological diversity and are also a prerequisite for unique high-quality regional products. Such products are part of culinary heritage and "traditional" knowledge, often recognized by official quality marks, including geographical indications. Local pig breeds are also associated with extrinsic qualities important to consumers. They are mainly raised in extensive production systems, often outdoors and in organically, meaning their farming ways align better with societal expectations regarding extrinsic quality attributes such as animal welfare and environmental impact. Furthermore, local breeds are mostly fed on local feed resources, are more resilient, and adapted to local agro-climatic conditions. These characteristics make production systems with local pig breeds highly aligned with the concept of sustainable food systems.

There is limited literature data on the environmental footprint of production systems using local pig breeds. Some sources analyzing different farming systems (Dourmad et al., 2013; Dourmad et al., 2014; Espagnol and Demartini, 2014; Lamnatou et al., 2016) indicate that traditional, less intensive farming systems (including organic) generally have a higher potential for global warming per unit of product due to lower efficiency, but environmental impacts related to eutrophication and acidification per hectare of cultivated land are 10–60% lower. Similar findings emerged from research conducted under the H2020 TREASURE project, which analyzed three local breeds—Krškopolje pig, Gascon, and Mora Romagnola (Monteiro et al., 2019). This research found significant differences in environmental footprints between farms, suggesting potential for improvements. The farms with the lowest environmental footprint were those using their own feed resources, with key improvement areas including diet composition and feed origin, feeding efficiency, and adjustment of nutrition to the needs of these breeds.

Conclusion – future perspectives for pig farming

Land availability and its use are recognized as key limiting factors for global food production (Godfray et al., 2010). In a global context, competition for

available land between animal feed and human food will in the long term require limiting animal production to natural capacities and sustainable nutrition (Mottet et al., 2017; Van Zanten et al., 2018). Pork production is particularly challenged in this regard, as pigs provide mainly one food product, meat, and are besides direct competitors with humans for available cereals and plant protein sources. However, local specifics will also be important for sector development. Self-sufficiency in feed resources for pigs will be one of the key factors for sustainability in pig farming systems (Van der Werf and Petit, 2002). A positive aspect is that pigs can be fed by-products, and residues from the food industry that are unsuitable for humans also referred to as low opportunity cost feeds (Schader et al., 2015; Mottet et al., 2017). These feed potentials are still far from fully utilized. Considering the low amount of pork in the reference healthy diet (Willett et al., 2019), which amounts to only 0.6% (15 kcal, i.e., 10–15 g/day), there will likely be very little room in the human diet for pork. Therefore, small-scale but high-quality production is a sustainable long-term approach. The pig farming of the future will have to rely on its own feed resources, provide broader social benefits and ecosystem services, and produce products whose quality will be aligned with consumers' demands for safe, tasty, and socially responsible food (Font-i-Furnols and Guerrero, 2022).

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Conflict of interest

The authors declare no conflict of interest.

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