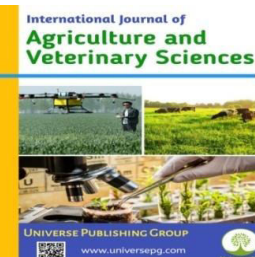




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Uncertainty in the Global Pork Market in the Context of Demographic Change over the Next Fifteen Years

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Abstract

The article analyses the uncertainties surrounding the development of the global pork market amid the demographic, environmental and geo-economic transformations anticipated over the next fifteen years. It reviews key demand-and-supply trends and emphasises the growing importance of emerging economies in Asia, Africa and Latin America as the principal drivers of pork consumption, fuelled by population growth, urbanisation and rising incomes. Particular attention is given to the risks posed by epizootics (e.g., African swine fever), environmental constraints and religious-cultural barriers, which together create a complex and highly sensitive global meat-market structure. Methodologically, the study employs a meta-analytical approach drawing on data from international organisations (OECD, FAO, UNIDO) and specialist centres, combined with statistical aggregation of regional consumption scenarios. The findings indicate rising demand in developing regions and stagnation in high-income countries, set against growing environmental awareness and shifting dietary preferences. The conclusions highlight the need for the industry to adapt through sustainable practices, innovation and strategic management of trade flows - an imperative given the sector's high production concentration and exposure to politico-economic and biological shocks. This article will be of interest to scholars of agricultural economics, food policy and international trade, as well as analysts and strategists engaged in forecasting and the sustainable development of livestock markets.

Keywords: Global pork market, Demographic change, African swine fever, OECD, Sustainable agriculture.

1. Introduction

For centuries, pork has been a fundamental element of human nutrition, remaining the leading source of animal protein and the cornerstone of many culinary traditions worldwide. This central role endures despite religious and cultural prohibitions that limit consumption in certain regions, while pig farming continues to dominate the structure of global

livestock production (Szűcs & Vida, 2017; Vida & Szűcs, 2020).

In recent years, interest in pork has risen steadily, especially in developing economies where higher incomes and rapid urbanization are shifting dietary preferences toward protein-rich foods (OECD/FAO, 2016, 2022; Yu & Jensen, 2022). Food occupies the base of Maslow's hierarchy of needs, and with the

world's population approaching 8–8.3 billion-and United Nations projections indicating growth to 10–11 billion by century's end (up to $\approx$ 15 billion in unfavourable scenarios)-it is evident that without effective development of sustainable food-supply systems this fundamental requirement cannot be met for an expanding global community.

Positive production dynamics in pig farming are accompanied by a complex set of uncertainties and constraints, including environmental threats, risks linked to the spread of animal diseases-most notably African swine fever -economic turbulence and geopolitical tensions that may destabilise international commodity flows and undermine the logistical resilience of the meat sector (Utnik-Banaś *et al.*, 2022; Vida & Szűcs, 2020; Yu & Jensen, 2022; Islampour *et al.*, 2026).

As of early 2025, the international pig-production industry continues to operate under heightened uncertainty. Producers remain cautious about expanding herd sizes amid the threat of infectious outbreaks and politico-economic factors, including China's anti-subsidy investigation into pork imports from European Union member states - an action capable of rerouting trade flows and destabilising individual national markets (Ministry of Commerce of the People's Republic of China [MOFCOM], 2024).

This study seeks to analyse the demographic and economic processes transforming the global pork market, to identify barriers to sustainable development and to formulate strategies to overcome them. The investigation is grounded in current data provided by international organisations and specialist analytical centres, aiming to develop a comprehensive understanding of demand drivers, risk structures and mechanisms for adapting industry practices in the context of global change.

2. Materials and Methods

This study was conducted using a meta-analytical approach to published forecasts and scientific materials concerning the transformation of the global pork market. Long-term consumption estimates provided by both international organisations (notably OECD/FAO reports) and national institutions were systematically analysed, alongside results from specialised analytical investigations

(OECD/FAO, 2016, 2022; Azimi *et al.*, 2025; Research and Markets, 2025).

Open statistical data and forecast indicators - including pork consumption in million tonnes and per-capita terms - from sources listed in the bibliography served as the primary information base. Demographic parameters (population growth rates and shifts in income structure) were incorporated to estimate their contribution to changes in food-demand patterns. The reimagined method for forecasting global food demand by 2050, developed by Falcon *et al.* (2022), is founded on scenario modelling and demographic-analysis tools. This framework substantiates the correlation between population growth and meat-consumption trends, forming the forecasting core of the present research.

Zhao *et al.* (2021) employed the GLOBIOM model to assess China's future food-demand requirements, allowing spatial and politico-economic parameters to be integrated into the global pork-balance projections presented here. Quantitative techniques applied in the work of Utnik-Banaś *et al.* (2022)-notably GARCH models-enabled an empirically grounded analysis of EU pork-price volatility over a decade, providing a robust methodological basis for evaluating market instability.

Environmental impacts associated with pork production and distribution were examined using the life-cycle evidence reported by Tong *et al.* (2023) and the broader sustainability analysis developed by Yu and Jensen, (2022). These studies informed the assessment of global production under climatic, land, water and feed-resource constraints. The studies by (Szűcs and Vida, 2017; Vida and Szűcs, 2020) provide a basis for assessing regional differences in pork consumption associated with cultural norms, religious prohibitions and social attitudes. The industry review Pork Market Report 2025 (Research and Markets, 2025), which presents quantitative data on production, international trade and market forecasts, served as the statistical basis for scenario development.

Daszkiewicz, (2022) examined food production under the influence of urbanisation, climate change and resource pressure, providing a methodological foundation for the construction of long-term scenarios. Methodologically, the analysis compared forecast scenarios incorporating demographic pro-

jections: one scenario drew on population-growth forecasts (e.g., UNIDO/UN projections), while an alternative focused on per-capita consumption changes under varying economic-growth parameters. Sensitivity of the final forecasts to variations in initial assumptions was explicitly evaluated.

3. Results and Discussion

Analysis of empirical data spanning sixty years of the global pork market's evolution reveals a clear upward trajectory accompanied by significant volatility, against which new challenges – environmental, demographic and institutional - have emerged.

Between 1961 and 2019, total world meat production nearly quintupled, reaching 336.6 million tonnes, with pork accounting for 32.7% of that volume. Despite pork's enduring position in global consumption, its share of the total meat supply declined from the peak recorded in the late 1990s (Utnik-Banaś *et al.*, 2022). The market's volume dynamics are presented in **Fig. 1**.

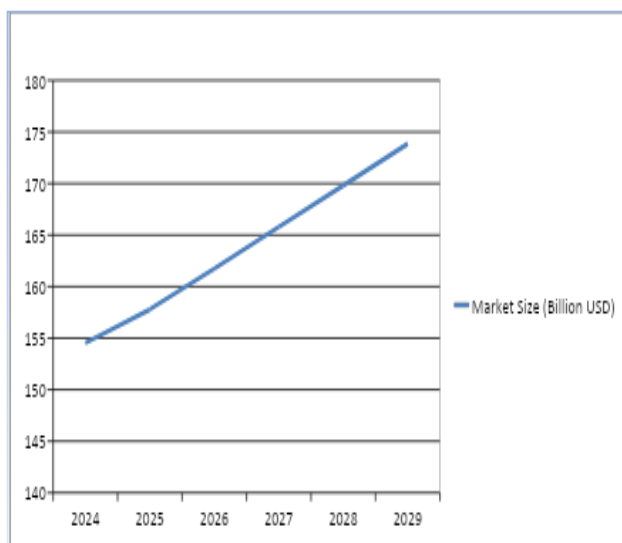


Fig. 1: Global pork market volume (Source: Research and Markets (2025)).

China, which remained the leading pork producer and consumer in 2019 (38.6 % of global output), exerts a systemic influence on trade flows. Beijing's domestic policies - aimed at herd restocking following African swine fever outbreaks and tightening environmental regulations - are poised to induce substantial shifts in the global supply-demand balance. Concurrent efforts to reduce import dependence threaten to reroute shipments from EU exporters, heightening competitive pres-

ures internationally (Utnik-Banaś *et al.*, 2022; Zhao *et al.*, 2021).

The European Union, as the world's largest pork exporter (over 2.4 million tonnes in 2016), shows signs of production stagnation driven by falling profit margins and an ageing rural workforce. Although exports doubled over the past two decades, domestic consumption has stabilised or slightly declined amid growing consumer interest in poultry. Over the past two decades, the principal destinations of European pork exports have shifted toward East Asian markets, including China, Japan and Hong Kong, under the influence of changes in regional demand and trade relations (Yu & Jensen, 2022). Meanwhile, pork consumption in many African and Muslim-majority countries remains low due to religious prohibitions, forming a persistent barrier to market expansion.

Per-capita pork consumption varies markedly, reaching approximately 40–50 kg in several European and East Asian countries while remaining below 5 kg in parts of Africa and the Middle East. These differences reflect religious and cultural restrictions, household income and access to animal protein. Global average consumption, estimated at approximately 12.5 kg per person annually, has stagnated as population growth has become concentrated in regions with traditionally low pork consumption (Szűcs & Vida, 2017; Vida & Szűcs, 2020).

Global pig farming is concentrated in a limited group of economies, with China, the European Union and the United States accounting for a substantial proportion of total production (Zhao *et al.*, 2021). In the United States, production is nearly wholly dependent on large-scale industrial pig complexes - which, despite their perceived risk-management benefits, actually create a monopolistic vulnerability by placing the majority of supply in the hands of relatively few operators. By contrast, in Ukraine almost one-third of pig production occurs in household plots; although these smaller units yield lower output per holding, they provide a high degree of diversification, reduce external dependence and play a significant role in national food self-sufficiency. European equipment manufacturers, meanwhile, remain focused on large complexes but also offer modular solutions for smaller producers.

In practice, this means that systems dominated by large enterprises are sensitive to single points of failure, whereas a decentralized model of many

small producers exhibits resilience to localized disruptions. Key risks in the two systems can be summarised as follows:

Table 1: Risk Matrix of Pig-Production Systems.

Factor	Large-Scale Pig Complexes	Small Farms / Decentralized Holdings
Epidemics (ASF, foot-and-mouth disease, etc.)	Very high risk – rapid spread across entire herd	Moderate risk – outbreaks tend to remain localized
Demographic decline / demand reduction	Low adaptability – difficult to scale down volumes	High adaptability – production volumes can be adjusted
Logistics disruptions	High risk – centralized supply chains	Low risk – distributed supply and distribution
Vulnerability to geopolitical shocks	High – reliance on exports and imports	Low – focus on domestic market
Environmental load and waste	Highly concentrated – complex waste management	Moderate – lower waste volumes and easier processing
Financial resilience in crisis	Medium – capital intensive, price-sensitive	High – lower overheads, able to pause operations
Technological flexibility	Limited – standardized processes	High – processes can be rapidly reconfigured
Innovativeness / access to equipment	High – centralized automation and mass deployment	Low – lack of accessible solutions, especially in developing regions
Social resilience and employment	Low – automation reduces local jobs	High – supports local employment and community development

Industrial pig complexes benefit from economies of scale and advanced technology, yet they remain highly vulnerable to epidemic outbreaks, logistical failures and political interventions. Smallholder farms, while less productive individually, form a flexible, diversified and robust pillar of food security. The greatest system-wide reliability emerges from a hybrid model that combines the resource capacity of large nodes with decentralized rearing and distribution networks - thereby mitigating aggregate risks and enhancing sector stability amid ongoing uncertainty.

Additional uncertainty in the functioning of the global market is introduced by geopolitical clashes and trade-economic restrictions: tariff disputes and anti-dumping investigations, coupled with epizootic outbreaks (including African swine fever and foot-and-mouth disease), create instability in trade routes and compel producers to pursue short-term strategies, often to the detriment of sustainable

development. African swine fever is an exceptionally dangerous disease, causing large-scale herd die-offs; according to FAO and OIE estimates, its outbreaks inflict catastrophic direct and indirect losses, rendering industrial pig farming economically unviable in countries with advanced production systems, where infection at a single large complex can paralyse an entire regional industry.

By contrast, dispersed small farms - while suffering losses on a limited scale - lower aggregate damage and preserve system resilience. Their proximity to end consumers facilitates the reconfiguration of logistics to local market requirements and fosters cooperative structures and networks, such as the American “Appalachian Sustainable Development” initiative, thereby enhancing supply flexibility and resistance to disruptive shocks, whereas large agro-enterprises remain vulnerable to immediate collapse in the event of isolated epidemic or infrastructure crises.

A further source of uncertainty stems from mounting pressure on natural resources. At current technological levels, projected growth in pork demand will increase the use of arable land, water and feedstocks and intensify emissions and nutrient losses throughout the supply chain (Tong *et al.*, 2023; Yu & Jensen, 2022). In this context, ensuring the resilience of global production-and-trade mechanisms under resource constraints and escalating environmental requirements becomes strategically critical.

To enhance production flexibility, it is advisable to organise the supply chain into discrete stages. In the “farrow-to-feeder” model, large specialised enterprises concentrate on breeding and caring for piglets during the first three weeks - producing stock weighing 30–60 pounds - before transferring them to smallholder farms (the so-called “finishers”) for growth to slaughter weight. These small farms use their own resources-such as on-farm feed, pasture and local facilities - for final fattening, after which the animals are sent to specialised slaughterhouses for veterinary inspection and processing under established sanitary protocols, including chilling, cutting, packaging and storage. This staged approach combines the efficiency of large complexes (in terms of genetic selection and initial productivity) with the operational adaptability and logistical agility of small producers, manifesting in a three-phase structure: first, farrowing and lactation under a high-tech industrial complex optimised for selection and piglet care during the initial 21 days; second, on-farm fattening to 100–120 kg using local infrastructure and feed; and third, slaughter and processing at specialised facilities followed by distribution of pork products.

Demographic change exerts a substantial influence on future demand. Asian and African economies are expected to account for much of the growth in pork consumption due to population expansion and rising incomes, while per-capita consumption in high-income countries is projected to stabilise or decline under the influence of environmental, ethical and health considerations (OECD/FAO, 2022; Research and Markets, 2025; Yu & Jensen, 2022).

An illustrative example from demographic research is John Calhoun’s “mouse utopia” experiment - particularly the “Universe 25” scenario - in which a UniversePG | www.universepg.com

mouse population, upon reaching 2,200 individuals, entered a phase of precipitous decline due to social disorganisation (including the abandonment of reproduction and parental care). Calhoun himself interpreted this outcome as an allegory for human societies, emphasising that extreme population density lacking consideration of social variables can lead to internal decay and “spiritual death.” Within the scientific discourse on food security, this metaphor serves as a reminder that mechanistic increases in production volumes cannot be considered in isolation from behavioural, cultural and social factors. Consequently, mathematical models of demographic dynamics and resource-consumption estimates (including per-capita meat intake) must incorporate these aspects by analysing societal adaptation mechanisms under conditions of overpopulation or resource scarcity.

Under a high-growth scenario in which the global population reaches 11 billion - primarily due to increases in African and South Asian countries - the strain on the global food system intensifies, especially in provision of protein sources such as pork. Demand for pork is particularly pronounced in emerging economies, placing the principal production burden on industrial pig complexes capable of rapid scaling and high productivity. However, their excessive concentration renders the system vulnerable to the spread of infectious diseases (such as African swine fever), logistical disruptions and climatic anomalies, sharply increasing the risk of widespread supply failures. In contrast, optimising the production structure by including smallholder farms - which offer local adaptation and partial risk mitigation - yields a more resilient configuration. A balanced distribution of capacity (approximately 70 % in large complexes and 30 % in small farms) is projected to enhance stability.

Over the next fifteen years, the main sources of instability in the global pork market will include: demographic growth in low-consumption regions, which reduces pork’s share in the global diet; cultural and religious barriers limiting market expansion; the high concentration of production and consumption in a few regions, heightening vulnerability to systemic shocks; the impact of trade agreements and sanction regimes (e.g., JEEPA and the Russian embargo); and environmental and economic constraints - particularly in the EU, where

these factors act as brakes on industry growth. **Table 2** presents forecasts for consumption and

production dynamics across the main categories of agri-food products.

Table 2: Dynamics of global consumption and production of major agri-food categories (million tonnes) (Source: Zhao *et al.* (2021)).

Year	Cereals (cons/prod)	Oilseeds (cons/prod)	Other Crops (cons/prod)	Dairy (cons/prod)	Ruminant Meat (cons/prod)	Pork and Poultry (cons/prod)
2010	421.5 / 414.4	110.8 / 50.6	67.8 / 62.1	44.7 / 39.1	10.8 / 10.1	98.0 / 96.2
2020	501.3 / 487.2	167.7 / 53.7	67.6 / 60.2	54.0 / 44.8	13.8 / 12.0	117.3 / 114.2
2030	566.9 / 550.7	204.8 / 57.5	74.7 / 64.8	64.0 / 51.1	16.8 / 13.9	132.1 / 130.8
2040	567.9 / 556.7	211.1 / 60.2	76.8 / 65.7	70.6 / 56.2	18.8 / 15.2	134.2 / 133.3
2050	528.1 / 516.0	199.9 / 59.9	72.6 / 62.7	71.2 / 56.9	19.3 / 15.4	128.0 / 127.0

Near-term uncertainty in the global pork market will be shaped by economic fluctuations, changes in regional demand, technological development, resource constraints and disruptions to production and trade networks (Tong *et al.*, 2023; Yu & Jensen, 2022). If the demographic curve reaches a plateau at approximately 9.5 billion people, meat demand is likely to stabilise and decline in some high-income economies where plant-based dietary patterns and environmental considerations increasingly influence consumer behaviour (Gibbs & Cappuccio, 2022). Although industrial complexes will remain significant, sustainability and social acceptability will assume greater importance as consumers increasingly favour products aligned with environmental and ethical standards. Under these conditions, a production split of approximately 60 % in large complexes and 40 % in small farms appears most appropriate.

In the demographic-decline scenario projected after 2050, the interpretation partly draws on the population-collapse pattern described in the Universe 25 experiment (Calhoun, 1973). Falling birth rates across China, Europe and Latin America would contribute to the stabilisation or reduction of aggregate pork consumption. Large production hubs would face declining profitability, excess capacity and limited flexibility, whereas small and medium-sized farms could reduce output, develop co-operative distribution systems and expand direct sales. Public attitudes toward farm size, animal welfare and environmental sustainability would

influence the social acceptability of this transition (Busch *et al.*, 2022). In the scenario constructed for the present study, small farms account for 60% of production, while industrial complexes retain a 40% share oriented toward export and specialised production.

Under any of these demographic trajectories, the architecture of pig production must be diversified: large enterprises should provide a stable production backbone, while smallholders serve as the adaptive reserve, ensuring flexibility, local responsiveness and sector resilience during crises. Such a configuration not only mitigates vulnerability to epizootics and logistical breakdowns but also reinforces social stability in rural areas and satisfies modern demands for environmental stewardship, localisation and social legitimacy of production.

4. Conclusion

Amid intensifying demographic, environmental and geopolitical transformations, the global pig-production system faces an imperative to strategically reassess its approach to sustainable development. Pork - while remaining a fundamental source of animal protein and a key element of the food balance in many countries -demonstrates high sensitivity to structural shifts driven by demand instability, logistical disruptions and epizootic threats. The analysis indicates that excessive concentration of production capacity within large industrial hubs markedly increases system vulnerability, whereas the inclusion of small and medium-sized farms creates a more resilient,

adaptive and socially inclusive configuration. In these circumstances, the most effective model is a mixed structure: industrial complexes function as the genetic and rearing core for the initial stages of production, while decentralized smallholders assume responsibility for the final fattening phase, tailored logistics and local distribution. This configuration achieves an optimal balance among scalability, flexibility and environmental sustainability, enabling the system to adapt to a range of demographic trajectories - from growth and stabilization to a projected decline after 2050 - while preserving the functional resilience of the food-supply framework over the long term.

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6. Conflicts of interest

The author declares that there are no conflicts of interest related to this study.

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