Review Paper

Pet food industry – current state and perspectives

Olivera Đuragić[1]* ![ORCID]

[1] *Institute of Food Technology, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Serbia*

A B S T R A C T

Pet food is more than simply a basic meal that contains the components required for an animal's growth and development. Nevertheless, it takes a human-oriented approach to food, adhering to the guidelines of a well-balanced diet that includes all necessary ingredients and supplements, being aesthetically pleasing, and concentrating on the owner who wishes to provide the best for their pet. A pet is now a part of the family with the same status as the other family members, not just an animal.

The use of natural ingredients, sustainability, and product and recipe personalization are the three main global trends in pet food production. Customers are likely to consider their pets and explore the healthiest food options for them as they continue to seek ways to customize and improve their health However, the use of natural ingredients free of artificial additives remains popular in dog and cat food, just as it is in human food. The largest obstacle to achieving "naturalness" in pet food is the distribution, storage, and transportation of frozen or chilled food. Sustainability is becoming ever more important in the pet food sector, particularly regarding packaging. In keeping with the trends in human nutrition, there are now pet food companies that focus on regenerative agriculture.

1. Introduction

The pet food industry has experienced huge growth over the last two decades, caused by increasing pet ownership, humanization of pets, and rising awareness of animal health and nutrition. Once a niche market, it has evolved into a dynamic global sector that competes with human food trends. According to data from the European Pet Food Industry Trade Association (FEDIAF) for 2022, there are 352 million pets in Europe with an annual pet food production of 9.9 million metric tons. The latest research shows that profits from the production of pet food have reached extremely high values, and it is predicted that by 2030, this market will generate earnings of $300 billion. North America remains the dominant market, followed by Europe and the Asia-Pacific region. Growth in emerging economies is particularly notable due to rising disposable incomes and changing attitudes toward pet care. The range of pet food products available on the market is widening due to differentiation based on animal attributes (e.g., size, age, species, etc.), nutritional values, and branding (e.g., private labels, multinationals). Sustainability is becoming a key element of product branding, not only for environmental protection, but also social sustainability in pet food production and animal health (*Sparacino et al.*, 2025). Similar to the human food industry, some pet food companies are accelerating their efforts towards the

green economy and are actively promoting several initiatives via their means of communication.

In today's culture, pets are an increasingly significant part of our daily lives. According to a number of studies, people can live with animals and view them as "just an animal", but they can also develop relationships with them that are comparable to those they would have with family members (*Fantechi et al.*, 2024). Many families buy presents for their pets and regularly celebrate their birthdays, even though some may only see their dog as a home protector. The primary areas where the pet food industry can make changes to lessen its environmental impact are the use of sustainable ingredients in diet formulations, resource optimization, improved waste management, and the decrease of overfeeding and excess nutrient intake (*Acuff et al.*, 2021; *Djuragic et al.*, 2023).

1.1 Market overview and product categories

The pet food markets in North America and Western Europe are still the most developed, while those in Asia-Pacific and Latin America have significant growth potential. Economy and standard products are giving way to premium, organic, and functional formulations, which is what defines the industry. Due to logistics and cost-effectiveness, dry extruded food continues to dominate the market, although wet, raw, and freeze-dried products are gaining ground. Pet food is typically divided into:

- **Dry food** (extruded kibble)
- **Wet food** (canned, pouch)
- **Raw/fresh food** (BARF – Biologically Appropriate Raw Food)
- **Treats and snacks**
- **Functional diets** (e.g., for renal disease, obesity, allergies, skin issues)
- **Nutraceuticals and supplements**

The nutrition profile, processing level, and shelf life of these categories differ (*Swanson et al.*, 2013). The Association of American Feed Control Officials (AAFCO) and FEDIAF requirements need to be adhered to by complete pet foods in order to ensure that the essential nutrient demands of different species and life stages are met. Yet with homemade and alternative diets that often do not have scientific formulation, the risk of nutrient imbalances or deficiencies exists (*Freeman et al.*, 2013). There are established health benefits associated with some modern pet food ingredients, such as probiotics and

prebiotics for gut health, omega-3 fatty acids in cognitive and dermatological functioning, joint-supporting ingredients such as chondroitin and glucosamine, and antioxidants to combat oxidative stress.

1.2 Sustainability challenges and innovations

1.2.1. Environmental footprint

The production of pet food has a substantial negative impact on the environment because of its high meat content and energy-intensive processing. Research indicates that 20% of the world's meat and fish are consumed by pets, which raises questions about resource efficiency (*Okin*, 2017). The production of dry pet food worldwide is linked to 56–151 Mt CO_2 equivalent emissions (1.1%–2.9% of global agricultural emissions), 41–58 Mha of agricultural land use (0.8–1.2% of global agricultural land use), and 5–11 km^3 of freshwater use (0.2–0.4% of agricultural water extraction). According to *Alexander et al.* (2020), these effects amount to an environmental footprint that is roughly twice the land area of the United Kingdom. Among the sustainable tactics are:

- Using co-products and by-products
- Utilizing insect protein (such as *Hermetia illucens*)
- Investigating plant-based and cultured meat substitutes

1.2.2. Circular economy and waste reduction

The pet food industry is investigating the concepts of the circular economy, specifically in the area of repurposing agro-industrial waste for the extraction of functional compounds, protein, or fibre (*Aleisa & Alsaleh*, 2024). Cereals, fruits, and vegetables are usually thrown away along with their skins, peels, seeds, and leaves. Because of their poor nutritional value, the presence of dangerous substances, or their unfavourable sensory attributes, these materials are frequently rejected as human food. The enormous amounts produced each year present environmental hazards, and their high moisture content encourages microbial growth. Because they contain beneficial substances, like dietary fibre, polyphenols, and antioxidants, fruit by-products are nevertheless receiving more attention in the fields of human and animal nutrition (*Čolović et al.*, 2019; *Aït-Kaddour et al.*, 2024).

1.2.3. Technological advances and industry 4.0

The growing global population and increasing consumer demand present major challenges for the feed industry, particularly in reducing feed costs while maximizing production efficiency. Important areas for advancement in the animal feed industry include the search for alternative raw materials, the creation of technological equipment, the integration of new technologies, the use of natural additives (as alternatives to antibiotics), and the automation and digitization of feed management. Predictive analytics, automation, and real-time monitoring are all integrated into modern pet food production to optimize the process. Nutrient bioavailability and consistent quality are guaranteed by sophisticated extruders, drying systems, and coating technologies (*Cannavacciuolo et al.*, 2023; *Aït-Kaddour et al.*, 2024).

1.2.4. Personalized pet nutrition

Emerging pet food trends focus on precision feeding based on breed, activity, genetics, and microbiome profiles. Start-ups are developing digital feeding tools and custom diet plans using artificial intelligence (AI) and big data analytics. For decades, pet food formulation has been generic and based on market trends and historical data—overlooking a particular pet's specific or essential health needs. The most important lesson learned has been the advantage of creating recipes using real pet health data that yield measurable health outcomes (*Zhang et al.*, 2023). This approach is timely, especially as pet owners are increasingly looking for the highest calibre ingredients and observable health benefits. In the pet industry, differentiation increasingly relies on the demonstrable impact diet has on improved measurable health outcomes (*Buff et al.*, 2014).

1.2.5. Regulatory landscape and quality assurance

The pet food industry is regulated by national and international rules to ensure food safety, traceability, and proper nutrition. The pet food regulatory landscape includes various agencies and organizations that set and enforce standards for pet food. Important bodies include the Food and Drug Administration (US FDA) in the US, the European Food Safety Authority (EFSA) in Europe, and AAFCO. Quality assurance in pet food manufacturing requires strict controls throughout the entire production process. This includes sourcing and processing ingredients, inspecting the final product, and labelling it to meet regulatory requirements and consumer needs. Major challenges include the lack of consistency, unclear labelling, and oversight of new ingredients (*Buchanan et al.*, 2011).

2. Future perspectives

The future of the pet food industry is dependent on ongoing innovation in product, packaging, and distribution. To capture more sophisticated consumers, brands are pursuing new protein sources, functional ingredients (prebiotics, probiotics), and eco-friendly packaging options. The experience will also be elevated by technological innovations like AI-driven customer service and customized dietary recommendations based on pet analytics. There are issues, nonetheless, such as managing customer expectation for delivery timescales, ensuring quality control over disparate supply chains, and being able to compete favourably with established brands with large retail chains. The pet food industry is at a point of intersection where science, consumer demand, and sustainability must meet. Cross-disciplinary collaboration between nutritionists, food technologists, veterinarians, and environmental scientists is necessary to provide safe, nutritious, and environmentally friendly pet food systems. Continued investment in research and regulatory consistency will be critical to bringing the full potential of this industry to fruition.

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Authors info

Olivera Đuragić, https://orcid.org/0000-0003-3189-5057