SHAPING THE FUTURE OF FOOD: GLOBAL INFLUENCES AND STAKEHOLDER ROLES

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Abstract
The food and beverage industry (F&BI) has traditionally been perceived as less innovative than high-tech sectors. This perception largely stems from the critical role of food in public health, which necessitates stringent and often protracted approval processes for novel products and technologies. Additionally, consumer adoption of food-related innovations tends to be cautious, influenced by safety concerns and a general aversion to risk. Recent advancements in food processing technologies, such as automation, digitalization, and novel preservation techniques, offer significant improvements in food quality, shelf life, and production efficiency. The food and beverage industry (F&BI) demonstrates significant variation in innovation dynamics, characterized by differences in innovation focus and acceptance, as well as in the intensity of drivers and barriers across diverse environmental contexts. This study seeks to investigate the underlying factors and contextual conditions that may account for these divergences. It aims to identify and analyze the drivers shaping innovation trends and dynamics within the F&BI. Drawing on a systematic review of 48 peer-reviewed publications, the research examines these drivers at two levels: global macro-level trends and sector-specific factors influenced by key stakeholders: consumers, companies, and public authorities. The paper further introduces a conceptual model that outlines the hierarchy and interrelations among these factors, emphasizing their combined influence on the direction and intensity of innovation within the sector. The model suggests that the predominant focus - whether on consumers, businesses, or state authorities - shapes differential responses to the identified factors.
Keywords: food and beverage industry, innovation, future food trends, food-processing factors.

Introduction

The food and beverage industry (F&BI) is one of the largest manufacturing sectors globally. In Europe, it generated a turnover of €1.196 trillion and contributed €249 billion in added value in 2021, employing approximately 4.7 million people and attracting €45 billion in investments (FoodDrinkEurope, 2024).

Despite its economic significance, the industry has a substantial environmental footprint, characterized by high resource consumption and considerable greenhouse gas (GHG) emissions. It ranks as the fifth-largest contributor to GHG emissions within the EU manufacturing sector, with an estimated 59 million tonnes of food waste recorded in 2022 (FoodDrinkEurope, 2024). In response to these environmental challenges, policy initiatives such as the Farm to Fork Strategy have been introduced to promote sustainable production, reduce waste, and support the transition toward a circular economy. Concurrently, industry actors are increasingly adopting advanced technologies, such as the Internet of Things (IoT), blockchain, and artificial intelligence (AI) - to enhance supply chain transparency and reduce inefficiencies (Arowosegbe et al., 2024).

As a strategically important sector, the F&BI represents a convergence of traditional manufacturing practices and emerging technologies, aimed at improving food safety, quality, and sustainability.

This study conducts a structured literature review to examine the key factors influencing current innovation trends in the F&BI. It explores the hierarchy, interdependencies, and interactions among these factors, with a primary focus on the European context, complemented by global comparisons. The aim is to identify future opportunities for development and transformation within the industry.

Factors Influencing the Development of the F&BI

A total of 48 peer-reviewed publications were analyzed to identify the key drivers shaping the development of the F&BI. Based on the literature review, this study categorizes these drivers into two principal groups: Global Framework Factors and Stakeholder-Driven Factors, emerging from the actions and responses of key industry stakeholders: consumers, companies, and public authorities (Table 1).

This classification aims to clarify the subordination and interconnections between the global and stakeholder-level influences, thereby providing a more nuanced understanding of their collective impact on innovation within the sector.

Table 1
Number of reviewed articles

Factor	***Papers***
Global factors	**15**
Economic and Demographic Factors	5
Regional and ethnic culture	2
Climate changes	3
Global crises	5
Key stakeholders	**33**
Customer demand	14
Business interest	7
Public authorities	12

1. Global Framework Factors

Global framework factors define the structural conditions that shape the functioning of the F&BI. Within the existing literature, we have identified and categorized the following factors as global:

1.1. Economic and Demographic Factors

Economic and demographic factors significantly impact the F&BI on both global and regional scales.

The growing population is expected to lead to a substantial increase in global food demand, projected to rise by 102% by 2050, driven by both population growth and rising per capita income, particularly in developing countries, which in turn generates heightened demand for food products and necessitates the adoption of sustainable production methods. (Fukase & Martin, 2020).

Addressing **food security** concerns requires strategies that ensure the availability of sufficient, high-quality food while addressing malnutrition and equitable distribution. This demand places pressure on land, water, and energy resources, exacerbated by climate change and the need to mitigate the environmental impact of food systems (Godfray et al., 2010).

Demographic shifts represent another global factor impacting the trends in the F&BI. The aging population stimulates the so-called 'silver economy', which encompasses the production, distribution, and consumption of goods and services tailored to the needs of older consumers. This demographic shift increases the demand for products that address health, nutrition, and quality of life (Delalay et al., 2024).

Sustained migration introduces diverse culinary traditions to host countries, leading to increased demand for a variety of food products. This diversification prompts the F&BI to adapt by expanding product lines to cater to new tastes and preferences. For instance, in the United States, demographic trends, including increased diversity brought about by immigration, may cause overall consumer demand for certain types of foods to grow faster than others. This shift necessitates adjustments in food production to meet the evolving demands of a diverse consumer base (Dong & Stewart, 2022). As immigrants acculturate, their food consumption patterns may begin to resemble those of the native-born population. This process can lead to changes in demand for certain food products.

Economic factors are the next group influencing the food-processing trends. Higher income levels lead to a shift in consumer demand from food quantity to quality, driving innovations focused on enhancing food attributes and quality (Figiel & Kufel-Gajda, 2017). **Inflation** affects the relative prices of goods, which can influence the demand for certain food products and subsequently drive innovation in those areas. A decrease in the relative price of a good due to inflationary pressures can lead to increased demand and innovation in that product category.

1.2. The regional and ethnic culture

The F&BI is deeply affected by **cultural heritage and local habits**, which shape consumer preferences and are a driver or a barrier to innovation. Food choices are deeply tied to cultural identity, values, and lifestyle. Consumers often select foods that reflect their cultural heritage, which in turn influences food production systems to cater to these preferences. This connection between food and cultural identity can drive demand for traditional and ethnic foods, impacting the types of products that F&BIs prioritize. The food industry faces the challenge of balancing innovation with the **preservation of traditional foods**. While there is a push to develop new products that align with modern trends, maintaining the authenticity and identity of traditional foods remains important. This duality influences how F&BIs innovate while respecting cultural heritage (Csergo, 2018). **Globalization** is another driver. The increasing interconnectedness of global markets fosters the spread of diverse food cultures, fuelled by immigration and travel. This process introduces new food preferences and dietary habits into local markets. For example, the influx of immigrants into Europe and the USA has expanded the demand for kosher, halal, and ethnic foods, prompting local producers to diversify their product portfolios. Furthermore, globalization stimulates innovation by facilitating cross-border collaboration between research institutions, technology developers, and food producers. Cultural globalization affects how food is marketed and consumed, blending local and global influences. This 'glocalization' can lead to the adaptation of traditional foods to fit global tastes, impacting how F&BIs develop and market their products (Csergo, 2018). The impact of globalization and innovation in the F&BI extends to social and cultural transformations. These innovations can modify consumer eating patterns and affect broader social and cultural domains, underscoring the necessity for strategies that integrate both technological advancements and social dynamics (Earle, 1997).

1.3. Climate change

Climate change exerts a profound influence on the global food supply and its future development, significantly affecting the trend in the F&BI as part of the food supply chain.

Rising global temperatures contribute to the increased frequency and intensity of droughts, wildfires, and extreme weather events such as hurricanes, floods, and hailstorms. These phenomena accelerate the depletion of natural resources, degrade arable land, and impair both the quality and adequacy of food, ultimately resulting in reduced agricultural yields. An illustrative example is the adverse impact on olive production due to persistent drought conditions in 2023. Consequently, olive oil production in Europe experienced a significant decline, with prices rising by 69.29% compared to 2022 (EUROSTAT, 2025).

Rising temperatures and **shifting aquatic ecosystems** are expected to alter the distribution and abundance of fish and shellfish populations, further threatening food supplies derived from marine and freshwater sources (Myers et al., 2017).

The excessive use of chemical fertilizers poses another challenge, as it contributes to environmental pollution, including soil contamination and nutrient leaching. The detrimental effects of chemical fertilizers begin with the processing of chemicals,

which release harmful by-products and gases such as NH4, CO2, and CH4, contributing to air pollution (Bisht & Chauhan, 2020). Furthermore, **the untreated disposal of industrial waste** into nearby water bodies leads to water pollution and eutrophication - an accumulation of chemical waste in aquatic environments that depletes oxygen levels and threatens biodiversity. Prolonged application of chemical fertilizers degrades soil health and quality, resulting in soil contamination and reduced agricultural productivity (Bisht & Chauhan, 2020).

Climate change not only affects food quantity but also its nutritional quality. Crops may yield smaller harvests with lower nutrient concentrations, potentially exacerbating nutritional deficiencies. The overall reduction in consumable food calories reduces the availability of energy-providing food, increasing health risks such as malnutrition and anemia (Leisner, 2020). Consequently, food scarcity and concerns about food security escalate, particularly in vulnerable communities that struggle to access essential resources such as water, fertile land, and food.

The consequences of climate change stimulate extensive research and innovation within the food and beverage industry, focusing on improving nutritional value across the entire food supply chain. Additional focal points of development include minimizing food waste, optimizing storage methods, and extending the preservation of nutritional qualities.

1.4. Global crises

The COVID-19 pandemic has posed economic and structural challenges to the F&BI, disrupting supply chains and increasing operational costs, leading to food price volatility. This volatility affected both producers and consumers, highlighting the fragility of global food supply systems under crisis conditions. Vasylieva (2021) reports stable prices for bread and vegetable oil in Eastern Europe, while fruit and potato prices declined due to distribution issues. In Ukraine, sugar prices rose amid economic hardship, while eggs became a key protein alternative, contrasting with price drops for pork, poultry, and eggs in Poland and Slovakia. Concurrently, demand for home meal replacements, meal-kit services, and online food ordering surged, driven by consumer preferences for convenience and safety (Lee & Ham, 2021).

The pandemic accelerated consumer interest in alternative proteins and sustainable food practices, leading to increased investments in bioactive food compounds and environmentally responsible supply chains (Galanakis et al., 2021).

The war conflicts further destabilized supply chains, raising food prices and exacerbating food insecurity. Ukraine's reduced capacity to produce essential crops, such as wheat and maize, and rising input costs, notably for fertilizers, have strained global food availability and increased prices (Countryman et al., 2024).

Historical evidence suggests that military conflicts drive innovations in logistics, with local food supply solutions fostering advancements later applied to civilian food systems (Danzer et al., 2023). The combined effects of the pandemic and ongoing conflicts underscore the need for innovative, sustainable, and localized food-processing solutions to ensure food security in times of crisis.

2. Stakeholder-Driven Factors

2.1. Customer demand

Global trends shape consumer preferences in the food industry. The COVID-19 pandemic, in particular, has influenced a resurgence in home cooking, increasing the demand for staple foods and healthier alternatives. Consumers now exhibit a greater preference for nutritious, sustainable, and ethically produced food options while reducing food waste. This shift aligns with changes in food choice motives, emphasizing health, natural ingredients, and ethical considerations (Borsellino et al., 2020).

Lifestyle changes, particularly in developed economies, have contributed to the increasing demand for convenience foods. Studies indicate that when selecting these products, consumers prioritize sensory appeal, nutritional value, and safety, as these factors significantly impact purchase intentions and overall satisfaction (Imtiyaz et al., 2021). The demand for high-quality, convenient meat and fish products that retain natural flavor and nutritional integrity has increased, supporting findings that highlight the importance of convenience without compromising health (Banerjee & Verma, 2014). However, research indicates that the convenience of processed foods may come at the cost of nutritional quality and safety. Regular consumption of processed convenience foods has been associated with suboptimal dietary choices, raising concerns regarding consumers' prioritization of nutrition and food safety (Jackson & Viehoff, 2016). Additionally, studies indicate that while consumers seek convenience, they frequently select foods high in sugar, fat, sodium, and cholesterol, negatively impacting dietary quality and health (Zhang & Gallardo, 2022).

A growing trend towards healthier and more pleasurable eating experiences is driven by **increased health awareness**. The food industry is responding by reformulating products with healthier ingredients and leveraging health claims to attract consumers. For example, beverages labeled as 'no/low sugar' or 'no artificial sweeteners' have gained popularity (Zhou & Liu, 2024). Younger consumers, particularly university students, prefer functional beverages aligned with their health values. Studies indicate a willingness to pay a premium for healthier food options, particularly those rich in whole grains, reduced fat, and added fruits and vegetables, with variations based on age, gender, and health consciousness (Alsubhi et al., 2022).

Consumer preference for healthy food is closely linked to ingredients and production process transparency. **Concerns over food safety, environmental impact, and ethical production** drive the demand for clearer labeling and supply

chain traceability (Meijer et al., 2021). Transparency plays a critical role in restoring consumer trust, particularly regarding food processing and ingredient sourcing (Meijer et al., 2021). In complex food supply chains, transparency is essential for ensuring food quality and safety. Sustainability and clean-label products are gaining traction, requiring simpler ingredient lists and transparent sourcing practices (Choi et al., 2023). This trend has led companies to adopt more responsible ingredient sourcing and production methods. For instance, clean-label antimicrobials in dairy products reflect this shift toward consumer-friendly labeling (Choi et al., 2023).

Animal welfare considerations are also playing an increasing role in consumer purchasing decisions. Studies indicate that many consumers are willing to pay a premium for products that meet higher welfare standards (Napolitano et al., 2010). Labels indicating compliance with animal welfare standards are gaining relevance in the retail sector, enhancing informed consumer choices and positively impacting sales (Akaichi & Revoredo-Giha, 2020). The rise of innovations in alternative protein sources, particularly plant-based products and cultured meat, is driving a significant transformation within the food industry. These advancements address the concerns related to animal welfare and also environmental and health challenges associated with conventional meat production. **Sensory attributes, such as taste and color,** also influence consumer acceptance of new food products with preferences shaped by demographic factors including age, health status, and cultural background (Ueland et al., 2020).

Food customization is emerging as a trend allowing consumers to tailor products to their preferences, thereby increasing purchase intentions. Research indicates that consumers with greater food expertise exhibit a stronger inclination toward customized products, making personalization strategies an effective market approach (Li et al., 2022). This shift is driving mass customization within the food industry, balancing product variety with efficient production processes to cater to diverse consumer demands (Kanama, 2018).

2.2. The business perspective

In their innovation and business strategies, producers in the F&BI are influenced by factors such as **operational efficiency, profit margins, overall profitability, market share, and long-term strategic objectives**. These determinants drive innovation, strategic partnerships, and competitive positioning.

Manufacturers within the F&BI prioritize both profit expansion and customer profitability, though the emphasis varies according to specific strategic approaches and prevailing market conditions (Wetzel et al., 2024). The focus on profitability is influenced by various factors, including operational efficiency, market power, and financial management.

Technological determinants, including the availability of research infrastructure, resources, and complementary expertise, are other factors influencing the trends within the F&BI. These elements facilitate the adoption and advancement of innovative technologies, which, in turn, influence industry evolution. Firms with strong technological capabilities and absorptive capacity are more likely to integrate new technologies, thereby enhancing food preservation, quality, and safety (Priyadarshini et al., 2018). Industry 4.0, characterized by advancements such as artificial intelligence (AI), the Internet of Things (IoT), and robotics, is transforming food production, distribution, and consumption. These technological advancements have enabled the emergence of novel food trends, including 3D-printed foods and personalized nutrition while addressing global challenges such as climate change and food security (Hassoun et al., 2022).

The impact of a **skilled workforce** on trends within the European F&BI is substantial, as it influences innovation, strategic management, and overall sector performance. Skilled employees are fundamental drivers of innovation, facilitating the development of differentiated, high-value products that enhance competitiveness in the European market (Brickau et al., 1994). Moreover, skilled labor enables firms to respond effectively to evolving consumer preferences and market dynamics. This adaptability is crucial for addressing emerging trends in food supply chains and consumer expectations.

Pressures from large retailers and the dynamics of open markets further influence the European F&BI. The high concentration of retailers exerts considerable influence on food processors, fostering intense competition and reducing profit persistence relative to other sectors (Hirsch & Gschwandtnerq, 2013). Retailer dominance necessitates continuous innovation and product differentiation among manufacturers to maintain market share (Brickau et al., 1994).

Firm size is a key determinant of profitability and competitive advantage within the F&BI. Larger firms generally exhibit higher profitability due to economies of scale, enabling them to allocate greater resources toward innovation, workforce development, and market resilience. Consequently, they are better equipped to withstand market fluctuations (Hirsch et al., 2014). Conversely, small and medium enterprises (SMEs) frequently encounter challenges related to resource allocation, thereby constraining their competitive capabilities. To maintain competitiveness, SMEs in the F&BI are increasingly engaging in strategic alliances to augment internal competencies and enhance market management capabilities (O'Dwyer & Gilmore, 2018). Strategic alliances enable firms to strengthen internal capabilities, foster innovation, and differentiate their products, which is essential for sustaining competitiveness in the European market (Brickau et al., 1994).

2.3. Public authorities

Regulatory frameworks shape the F&BI by establishing food safety, quality, and sustainability standards. European legislation enforces stringent requirements concerning traceability, production practices, and consumer protection, often exceeding international benchmarks (Curtis, 2019). Compliance requires substantial effort from businesses, impacting resource allocation and operational strategies (Curtis, 2019). However, regulatory harmonization across the European Union (EU) fosters trade, competition, and industry efficiency (Vancauteren & Henry de Frahan, 2011). The EU regulations emphasize sustainability, encouraging food businesses to adopt environmentally responsible practices, such as utilizing food processing by-products and integrating sustainability criteria into food safety standards (Rao et al., 2021).

Regulations can either facilitate or hinder innovation. Legal clarity supports high food safety and consumer protection standards, fostering an environment conducive to innovation, as seen in the dairy alternatives sector (Leialohilani & De Boer, 2020). Additionally, the revised Novel Food regulations incentivize innovation by enhancing data protection (Grimsby, 2022). However, regulatory constraints, such as high compliance costs, may impede the adoption of novel products, particularly for SMEs (Lähteenmäki-Uutela et al., 2021).

A comparative analysis of global regulatory environments reveals differing approaches. The U.S. regulatory framework is generally more flexible, fostering rapid adaptation and innovation (Roberts & Leibovitch, 2010). China's regulatory measures prioritize economic development, influencing investment in food-processing technologies (Song & Zhang, 2023). While European regulations focus on consumer protection, their complexity may slow innovation compared to more adaptable frameworks in the U.S. and China.

State support strategies also impact innovation. In Europe, collaboration with universities and industry stakeholders plays a crucial role in fostering innovation, whereas financial support mechanisms have been less effective (Ciliberti et al., 2015). Eco-innovation is central to transitioning towards a circular economy, with product and process innovations shaping sustainability efforts (Hamam et al., 2022). In the U.S., market-driven strategies and substantial private-sector R&D investments dominate (Mohamedshah et al., 2020). Meanwhile, China's innovation-driven economic policies emphasize high-tech sectors, influencing food-processing advancements (Xiao et al., 2022). These regulatory and economic dynamics highlight the intricate relationship between policy, innovation, and market development in the global food industry.

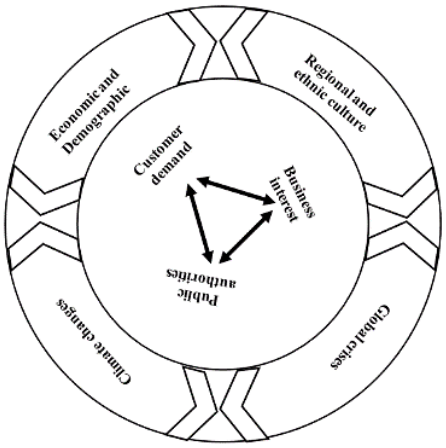
Results and Discussion

The analysis aims to systematically structure the factors influencing trends in the food and beverage industry, drawing on a comprehensive systematic literature review. The proposed framework, illustrated in Figure 1, outlines the hierarchical relationship and interdependence between global drivers and stakeholder-dependent factors.

The framework serves as a foundation for forecasting the future development of food technologies and products, while also enhancing the understanding of existing constraints and barriers.

Figure 1

Subordination and Interdependence of the factors



Key emerging trends include a growing focus on environmental sustainability, enhanced quality of life, and a transition toward healthier dietary patterns. The aging population - linked to the concept of the 'Silver Economy' - further underscores the relevance of personalized nutrition. Current market dynamics reflect a heightened demand for convenient yet health-conscious food options, including functional foods, reduced meat consumption, and personalized diets. These changes are motivated by both ethical concerns and a broader pursuit of healthier lifestyles. The increased access to information and advancements in artificial intelligence are expected to accelerate these shifts.

Cultural and traditional values play a significant role in shaping regional regulatory frameworks. For instance, Europe generally adopts a more conservative regulatory approach, particularly in limiting the adoption of technologies such as genetically modified organisms (GMOs), despite potential inefficiencies and elevated costs. Conversely, the United States maintains a more liberal regulatory environment, where innovation is often driven by business interests rather than consumer demand. While this facilitates technological progress, it can also lead to the production of nutritionally suboptimal or potentially harmful food products. In China, a centralized, state-driven policy model prioritizes food security and economic growth, influencing the direction of industry development.

These divergent policy approaches are reflected in the intensity of regional R&D activities. In 2021, R&D expenditures in the food and beverage industry as a percentage of turnover were 1.6% in China, 0.7% in

the United States, and 0.3% in the EU27 (FoodDrinkEurope, 2024).
Potential limitations of this study include the omission of certain influencing factors and the need for further refinement of the framework's classification and hierarchy. Future research should aim to expand and validate the model through empirical investigation and the integration of additional variables.

Conclusions

1. Global factors (Table 2) - economic and demographic trends, regional and ethnic cultures, climate change, and global crises—collectively shape the environment in which the F&BI evolves. These factors influence the direction, dynamics, and impact of key stakeholders, namely consumers, companies, and state authorities (Table 3).

2. The predominant stakeholder focus - whether on consumers (as in the EU), businesses (as in the US), or the state (as in China) - further defines the response to changes in these global factors.

3. The proposed model provides a framework to explain the varying dynamics, priorities, and levels of acceptance of innovation within the F&BI across different regions. Despite Bulgaria's integration in the EU and access to the Single Market, including support mechanisms for innovation and R&D, companies in the sector invested on average only 0.06% of their output in R&D between 2019–2021 - well below the EU average of 0.24% (FoodDrinkEurope, 2024). This disparity may reflect the influence of factors outlined in the proposed model. Further research is required to test this hypothesis and substantiate the observed trends.

Table 2

Global Factors

Economic and Demographic Factors	***Regional and ethnic culture***	***Climate changes***	***Global crises***
• growing population • rising income per capita • food security • demographic shifts • sustained migration • inflation	• cultural identity, values, and lifestyle • preservation of traditional foods • globalization and 'glocalization'	• rising global temperatures • shifting aquatic ecosystems • excessive use of chemical fertilizers • untreated disposal of industrial waste	• the COVID-19 pandemic • the war conflicts

Table 3

Stakeholder-Driven Factors

Customer demand	***Business interest***	***The state authority***
• demand for nutritious, sustainable, and ethically produced food • lifestyle changes • increased health awareness • concerns over food safety, environmental impact, and ethical production • animal welfare considerations • sensory attributes, such as taste and color	• operational efficiency • profit margins • overall profitability • market share • long-term strategic objectives • technological determinants • skilled workforce • pressures from large retailers and the dynamics of open markets • firm size	• regulatory frameworks • state support

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