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REVIEW ARTICLE

Comparative Perspectives on the Production, Commercialization, and Governance of Functional Foods: Global Trends and Vietnam's Emerging Framework

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Abstract

Functional foods, positioned between conventional foods and health-oriented supplements, are experiencing significant global growth. However, production techniques, commercial systems, and regulatory structures remain markedly diverse. This report synthesizes worldwide trends and provides a focused examination of Vietnam. We compile evidence from peer-reviewed studies, market analyses, and policy documents to define the attributes of manufacturing and supply chains, including ingredient sourcing, quality assurance, and innovative technologies, along with commercialization strategies across fast-moving consumer goods, direct-to-consumer and e-commerce channels, and governance frameworks that encompass notification systems, pre-market authorization, and post-market surveillance. Globally, prevailing themes encompass increasing demand for scientifically substantiated claims, a shift towards risk-based regulation, and ongoing difficulties in claim verification, adulteration management, and transnational online commerce. Vietnam has evolved from an import-reliant economy to one marked by diversified domestic production, improved labeling standards, Good Manufacturing Practices (GMP), and product registration, alongside opportunities for increased nutritional oversight, digital traceability, and collaborative enforcement. Evidence gaps include inconsistent clinical validation, variable product quality, insufficient adverse event reporting, and fragmented consumer information. We support a policy and research strategy that emphasizes transparent claims frameworks, interoperable surveillance data, capacity building for laboratories and inspectors, and incentives for industry compliance and innovation. These steps can align consumer protection with the sustainable development of the functional food sector, both globally and in Vietnam.

Keywords: Functional Foods, Manufacturing, Supply Chain, Quality Assurance.

1. Introduction

Functional foods occupy a dynamic space between conventional foods and health-oriented supplements, promising physiological benefits beyond basic nutrition (Table 1). Demand growth is fueled by aging populations and the global rise of noncommunicable diseases (NCDs), which account for roughly three-quarters of deaths worldwide, sharpening consumer interest in prevention and "food-as-medicine" (WHO, 2024). On the supply side, manufacturers are adopting advanced technologies to improve product performance and credibility. Microencapsulation, for example, helps stabilize and control the release of sensitive bioactive and probiotics, improving shelf stability and bioavailability (Rezagholizade-shirvan et al., 2024; D'Amico et al., 2025).

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Table 1. *Global overview of functional food categories and their claimed health benefits*

Category	Example Products	Key Bio-actives	Health Benefit
Probiotic foods	Yogurt, kefir	Lactobacillus, Bifidobacterium	Gut health, immunity
Fortified beverages	Omega-3 drinks, vitamin waters	ω-3, vitamins A-E	Cardiovascular support
Functional snacks	Protein bars, fiber biscuits	Proteins, prebiotics	Weight management

Meanwhile, research on food-derived bioactive peptides continues to expand the evidence base for specific physiological effects (antihypertensive, antioxidant, and immunomodulatory activities), though translation to authorized claims remains selective and jurisdiction-dependent (Peighambardoust et al., 2021; Zaky et al., 2022). Commercialization has diversified from pharmacy and grocery channels into e-commerce and direct-to-consumer models, intensifying cross-border trade and complicating oversight. Post-market vigilance is therefore essential. In the U.S., adverse events for foods and supplements are captured in the FDA's CAERS/HFCS systems, highlighting the need for nutritious vigilance and transparent safety monitoring. Quality challenges persist with records recurring adulteration and misbranding in segments like weight-loss, sexual-enhancement, and sports supplements, underscoring the public-health value of robust surveillance and risk-based enforcement (Tucker et al., 2018; FDA, 2022).

Concurrently, digital traceability is reshaping supply-chain assurance. Global GS1 standards, such as GTIN/GLN identifiers and EPCIS event data, provide a common language for end-to-end visibility and faster, more precise recalls, while pilots and reviews indicate blockchain can enhance data integrity and multi-party trust when layered atop sound traceability design (GS1, 2017; Ellahi et al., 2023). For functional foods and supplements, where authenticity, ingredient provenance, and cold-chain control affect both safety and efficacy, these tools can complement pre-market controls and post-market surveillance.

Vietnam offers a timely case study of rapid market growth under a strengthening regulatory framework, with food safety management having been moved toward risk-based controls and, crucially, made GMP compliance mandatory for health-supplement manufacturers since July 1, 2019, as subsequent MOH circulars detail GMP implementation and ongoing updates. Recent policy proposals aim to tighten oversight of counterfeit and substandard products and close legal loopholes as the market matures and online distribution expands. This review synthesizes global production practices (quality-by-design, authenticity testing, encapsulation technologies), commercialization trends (omnichannel and personalization), and governance (claims, traceability, and nutritious vigilance), then situates Vietnam's trajectory within that landscape. The goals are to map manufacturing and supply-chain practices that underpin quality, safety, and consistency; analyze business models and demand drivers; (iii) compare regulatory and post-market approaches across major jurisdictions; and identify evidence gaps and propose a policy–research agenda to align consumer protection with sustainable industry growth globally and in Vietnam.

Focusing on Vietnam, where agriculture contributes about 15% to GDP and employs a significant portion of the workforce, post-harvest challenges are particularly acute owing to the tropical climate, fragmented smallholder farming, and expanding export markets. High humidity accelerates spoilage in key crops like rice, fruits, and seafood, resulting in losses estimated at 20-30% for perishables, which hampers economic growth and food availability (Sakata, 2023). AI's potential in this context is immense, with emerging implementations in automated sorting, predictive modeling for storage conditions, and logistics forecasting tailored to local needs. Vietnamese research emphasizes AI's applications in monitoring crop health, yield forecasting, and pest prediction to ensure safer food supplies, as seen in initiatives boosting coffee yields through smart management systems (Nguyen, 2025). Advanced tools like drones for disease detection and robots for harvesting further illustrate AI's capacity to reduce risks and enhance sustainability in food production (Mana et al., 2024). This review synthesizes global AI advancements in post-harvest management while spotlighting Vietnam's unique opportunities and barriers, including data accessibility and technological adoption. Through case studies and analysis, it explores how AI can drive innovation, reduce inequalities, and support Vietnam's agricultural modernization. Ultimately, this article aims to inform stakeholders about leveraging AI for equitable and efficient post-harvest strategies, contributing to broader sustainable development objectives.

2. Global Trends in Functional Food Production and Innovation

Functional foods, defined as products that provide

health benefits beyond basic nutrition through added bioactive compounds, have become a cornerstone of the modern food industry. These include fortified items like probiotic yogurts, omega-3-enriched beverages, and protein-enhanced snacks, driven by consumer demand for preventive health solutions amid rising healthcare costs and an aging global population (Grand View Research, 2025a). The sector's growth is fueled by advancements in science, technology, and shifting dietary preferences, with a focus on personalization, sustainability, and efficacy (Glanbia Nutritionals, 2025). The functional food market is experiencing robust expansion, reflecting broader trends in health-conscious consumption and innovative production methods.

Market dynamics underscore the industry's vitality. The global functional food and beverage market was valued at approximately $281 billion in recent years and is projected to exceed $500 billion by 2028, highlighting its potential as an economic powerhouse (Eastlake, 2024). More precise forecasts indicate growth from $398.81 billion in 2025 to $793.60 billion by 2032, achieving a compound annual growth rate (CAGR) of 10.33% as described in Table 2 (Fortune Business Insights, 2025). Alternative estimates suggest the market will rise from $279.79 billion in 2024 to $310.68 billion in 2025, with a CAGR of around 11%, driven by increasing awareness of wellness through diet (The Business Research Company, 2025). In the U.S., functional food and drink sales reached $83 billion in 2021, up 6.8% from the previous year, and dietary supplements, a key predictor of food trends, hit $64 billion in 2024, growing 4.9% (Sloan, 2022).

This surge is attributed to factors like the COVID-19 pandemic's emphasis on preventive healthcare, rapid technological progress, and demographic shifts toward older populations seeking improved quality of life. Regions like North America lead due to established players such as Tyson Foods and General Mills, while emerging markets contribute through rising middle-class incomes and health campaigns (Fortune Business Insights, 2025).

Table 2. *Growth forecast of the global functional food market (2021–2032)*

Source	Base Year	Market Value (USD B)	Projected Value (USD B)	CAGR (%)	Forecast Year
Grand View Research	2021	280.7	586.1	8.5	2030
Fortune Business Insights	2025	398.8	793.6	10.33	2032
Renub Research	2024	341.6	678.3	7.9	2033

A prominent trend in production is the integration of familiar ingredients into innovative formats to address contemporary health concerns. Protein remains a dominant force, with animal-sourced varieties rebounding in popularity, which is 80% of Americans identify as meat eaters in 2024, while plant-based options expand for sustainability reasons (Mellentin, 2024). Probiotics lead in gut health, with the global market expected to reach $74.7 billion by 2025 at a 7.3% CAGR, evolving into postbiotics for more stable applications (Bigliardi & Galati, 2013). Brands are reformulating traditional foods for convenience and taste, such as adding plant-based proteins to bread or enhancing yeast with minerals like zinc and chromium (Hossain et al., 2025). Functional hydration is another rising area, with beverages incorporating electrolytes, adaptogens, and nootropics for metabolic monitoring, sleep support, and mood enhancement. For instance, products like Mushroom Mocha blends use functional mushrooms and herbs like ashwagandha, while satiety-focused items leverage fiber and proteins to combat obesity, with one-third of global consumers seeking foods that promote fullness (Sloan, 2025).

Sustainability is increasingly embedded in production trends, responding to consumer demands for eco-friendly practices. The rise of upcycled ingredients from food processing by-products, such as fruit and vegetable peels, minimizes waste and adds nutritional value (Guldiken et al., 2021; Plessas, 2022). Carbon-to-protein conversion and precision fermentation are transforming production, enabling scalable alternatives like cultivated meat that reduce environmental impact. Hybrid products blend indulgence with health benefits, such as fortified snacks balancing global and local flavors, catering to dualities in consumer behavior, health versus pleasure, and international versus regional sourcing (Mintel, 2025). In 2024, only 62% of new food and beverage launches were truly innovative, emphasizing the need for AI-driven tools to accelerate ingredient discovery, formulation, and flavor creation (Geraghty, 2025; Innova Market Insights, 2025). This tech integration speeds up the research process, allowing for personalized nutrition tailored to individual needs, like women's health or metabolic issues.

Innovations in production technologies are revolutionizing the functional food sector, bridging scientific advancement with market demands for personalization, sustainability, and efficacy. Among the most transformative developments is additive manufacturing (3D food printing), which allows the layer-by-layer fabrication of customized products with enhanced textures and nutrient distribution—particularly beneficial for embedding heat-sensitive bio-actives (Putnik & Kovačević, 2021; Tavares et al., 2025). Similarly, lab-grown meat (LGM) is redefining protein production by offering sustainable, nutrient-enriched alternatives that reduce environmental impact. Microbial and precision fermentation enable the synthesis of next-generation probiotics (NGPs) and bioactive compounds targeting gut health, immunity, and even cognitive well-being, while non-dairy probiotic beverages derived from soy, fruit, and cereal matrices expand accessibility for lactose-intolerant consumers (Bigliardi & Galati, 2013). To address sensory limitations, flavor-modulation technologies utilize natural aroma compounds or encapsulation to mask bitterness in fortified foods, ensuring palatability without diminishing nutritional value (Foodbev Media, 2024). Concurrently, enzyme-based desugaring processes lower glycemic indices in functional drinks and confectionery, while biopolymer nanoparticles enhance nutrient delivery and bioavailability of compounds such as carotenoids and fibers, supporting eye and metabolic health (Sinuate Media, 2025). Table 3 provides an overview of these emerging innovations, ranging from microencapsulation and 3D food printing to AI-assisted formulation and upcycling, highlighting their mechanisms, applications, and benefits that collectively drive the modernization of functional food production.

Table 3. *Emerging Production Innovations in the Functional Food Sector*

Innovation / Technology	Description / Mechanism	Applications in Functional Foods	Key Benefits	References
Microencapsulation of Bioactives	Entrap sensitive ingredients within polymers (e.g., alginate, starch, or proteins) to protect from oxidation and heat degradation.	Encapsulation of probiotics, polyphenols, omega-3 fatty acids, vitamins.	Enhances stability, shelf life, and targeted release in the digestive tract.	D'Amico et al., 2025; Rezagholizade-shirvan et al., 2024
3D Food Printing (Additive Manufacturing)	Layer-by-layer fabrication of foods using edible inks to produce customized structures and nutrient profiles.	Personalized snacks, fortified bars, and texturized purees for elderly or clinical diets.	Allows precise nutrient dosing, novel textures, and personalization.	Putnik & Kovačević, 2021; Tavares et al., 2025
Microbial & Precision Fermentation	Engineered microorganisms convert substrates (e.g., sugars, CO_2) into functional proteins, vitamins, or bio-actives.	Production of probiotics, postbiotics, plant proteins, and dairy analogues.	Sustainable, scalable protein sources; improved digestibility and purity.	Guldiken et al., 2021; ICL Group, 2025
Upcycling of Food By-products	Valorization of processing residues such as fruit peels and cereal bran into fiber- or antioxidant-rich ingredients.	Functional bakery products, smoothies, and nutraceutical powders.	Reduces waste, adds nutritional value, aligns with circular economy.	Plessas, 2022; Guldiken et al., 2021
AI-Assisted Formulation and Flavor Design	Machine learning models predict optimal ingredient ratios and sensory profiles.	Development of clean-label, low-sugar products with improved taste and functionality.	Speeds R&D, reduces reformulation cost, enables personalized nutrition.	Geraghty, 2025; Innova Market Insights, 2025
Biopolymer Nanoparticles and Nano-Delivery Systems	Use of biopolymer matrices (e.g., chitosan, alginate) to encapsulate bioactives at nano-scale.	Fortified beverages and supplements are enriched with carotenoids, vitamins, or peptides.	Enhances bioavailability, solubility, and targeted release of nutrients.	Hossain et al., 2025
De-sugaring and Enzyme-Based Processing	Enzymatic or membrane processes remove simple sugars while retaining fiber and micronutrients.	Low-GI juices, diabetic-friendly confectionery, and fermented drinks.	Improves metabolic profile and consumer acceptance.	Sinuate Media, 2025

Innovation / Technology	Description / Mechanism	Applications in Functional Foods	Key Benefits	References
Flavor Modulation Technologies	Use of natural flavor maskers or encapsulated aroma compounds to offset bitterness from fortification.	Protein-enriched and botanical-infused foods.	Increases palatability and market acceptance.	FoodBev Media, 2024

Consumer demographics drive these trends, with millennials and families leading adoption, two-thirds purchasing functional foods, followed by Gen Z and X at half, and boomers at one-third. Nearly half of U.S. adults are proactive health seekers, planning healthier eating in 2024. Brain function enhancement appeals to over a quarter of consumers, while sleep and stress remedies grow in teas and dairy drinks. Dairy remains a prime delivery system, with yogurt and spreads advancing at a 7.9% CAGR, fortified with vitamins, minerals, and omega-3s. However, challenges persist, including reformulation costs, ingredient stability, and scalability, necessitating multidisciplinary collaboration (Eastlake, 2024; Rashidinejad, 2024).

Looking ahead, the functional food landscape promises continued innovation amid opportunities and hurdles. Advancements in biotechnology, such as AI for product design and sustainable sourcing, will enhance stability and bioavailability. With functional beverages alone expected to reach $208.13 billion by 2024 at a 7.5% CAGR, the industry is poised for transformation (Gupta et al., 2023). Emphasizing clean labels, personalization, and evidence-based claims will be crucial to meet regulatory demands and consumer trust, positioning functional foods as integral to global nutrition strategies.

3. Regulatory Frameworks and Quality Management in the Global Functional Food Industry

The global functional food industry, projected to exceed USD 300 billion by 2025, relies on robust regulatory frameworks to ensure safety, efficacy, and transparent labeling of products like probiotic-enriched yogurts and botanical-fortified beverages (FAO, 2025). These frameworks balance innovation with risk mitigation, addressing bioactive compounds' potential for health benefits and hazards. At the international level, the Codex Alimentarius Commission provides harmonized guidelines, such as the General Standard for Food Additives (GSFA), which regulates enhancers in functional foods without a dedicated category, treating them as conventional items with nutritive additions. Codex emphasizes evidence-based health claims and maximum additive levels to prevent contaminants, facilitating trade while protecting consumers.

Regionally, the United States' Food and Drug Administration (FDA) oversees functional foods under the Federal Food, Drug, and Cosmetic Act, categorizing them as conventional foods or dietary supplements without a distinct status. In 2025, the FDA's Human Foods Program Guidance Agenda prioritizes notifications for new dietary ingredients and closes GRAS loopholes via pre-market reviews, responding to botanical safety debates (Nutra Ingredients, 2025). This aims to curb unapproved additives, with increased scrutiny on claims amid legal challenges. In the European Union, the European Food Safety Authority (EFSA) enforces a precautionary model under Regulation (EC) No 1924/2006, mandating pre-market authorization for claims backed by scientific evidence, such as for cholesterol-lowering probiotics. The 2025 updates to nutrient source guidance detail toxicological dossiers, while novel food regulations require two-tier safety assessments for items like algae-derived omega-3s (ChemLinked, 2025). Japan's Foods for Specified Health Uses (FOSHU) system approves over 1,000 products with rigorous evidence, contrasting with China's May 2025 consultations on 28 food safety standards, including dairy and additives relevant to functional formats (Table 4) (Zmuni, 2025).

Table 4. *Comparison of major regulatory frameworks for functional foods*

Region	Regulatory Body	Framework Name	Key Features	Claim Approval Requirement
USA	FDA	FD&C Act	Treats as conventional foods/ supplements	Structure–function claims only
EU	EFSA	Reg. 1924/2006	Pre-market authorization	Scientific evidence mandatory
Japan	FOSHU	Specified Health Use	Government-approved list	Clinical data required

Quality management systems (QMS) are essential for operationalizing these regulations, providing structured processes for consistency and traceability. QMS, as defined by industry standards, documents procedures to meet quality objectives and compliance, integrating Hazard Analysis and Critical Control Points (HACCP) to identify risks like microbial contamination in probiotics (Food Ready, 2025). Total Quality Management (TQM) extends this through continuous improvement, audits, and employee training, reducing recalls by up to 20% and enhancing bioactive stability via encapsulation (PMC, 2024). In the food sector, ISO 22000 and Global Food Safety Initiative benchmarks like BRCGS ensure GMP adherence, with software tools revolutionizing monitoring for real-time data in supply chains (Food Logistics, 2024). These systems not only safeguard against hazards but also bolster brand reputation and customer satisfaction, as 70% of consumers prioritize safety in health claims (Aptean, 2022).

Challenges include regulatory inconsistencies complicating trade. For example, EU's 60% claim rejection rate versus US flexibility and botanical risks like hepatotoxicity from alkaloids, with 30% of adverse events linked to overconsumption (FAO, 2025). The FAO report notes enforcement gaps in developing regions, urging Codex updates and AI for claims validation (NutraIngredients, 2025). In summary, harmonized frameworks like FAO guidelines and robust QMS via HACCP and ISO 22000 will enable safe innovation, positioning the industry for sustainable growth amid 2025's scrutiny on botanicals and personalization (Table 5) (ChemLinked, 2025).

Table 5. *Common quality-management systems (QMS) applied to functional food manufacturing*

Standard	Focus Area	Applications in Industry	Key Benefits
ISO 22000	Food-safety management	Production and processing	Global recognition
HACCP	Hazard control plan	Probiotic and dairy plants	Prevents contamination
GMP	Manufacturing standards	Supplements & beverages	Ensures consistency

4. Business Dynamics and Market Growth of Functional Foods Worldwide

The global functional foods market, encompassing nutrient-enriched products like probiotic yogurts, fortified cereals, and omega-3 beverages designed to offer health benefits beyond basic nutrition, is a dynamic sector propelled by evolving consumer health priorities and technological advancements. Valued at hundreds of billions annually, this industry reflects broader shifts toward preventive wellness, with business strategies emphasizing innovation, sustainability, and digital expansion to capture rising demand. As of 2025, market growth is robust, influenced by post-pandemic health consciousness and economic factors, positioning functional foods as a key pillar in the broader nutraceutical landscape, with leading global companies shown in Table 6.

Table 6. *Leading global companies and their strategic focus on functional foods*

Company	Flagship Products	Strategy Focus	Growth Segment
Nestlé S.A.	BOOST Glucose Control Shakes	Clinical nutrition and metabolic health	Aging population
Danone S.A.	Oikos Pro Line Yogurt	High-protein functional dairy	Sports nutrition
PepsiCo Inc.	CELSIUS Energy Drinks	Functional hydration and energy	Fitness segment

4.1 Market Size and Growth Projections

The functional foods market has demonstrated resilient expansion, with multiple forecasts underscoring its trajectory toward substantial valuation by the early 2030s. According to Grand View Research, the global market was estimated at USD 280.7 billion in 2021 and is projected to reach USD 586.1 billion by 2030, reflecting a CAGR of 8.5% from 2022 to 2030 (Grand View Research, 2025a). This growth is attributed to increasing consumer awareness of nutrient-rich foods amid hectic lifestyles and a burgeoning geriatric population seeking enhanced quality of life. Similarly, Renub Research anticipates the market will grow from USD 341.6 billion in 2024 to USD 678.32 billion by 2033, at a CAGR of 7.92%, driven by rising demand for immunity-boosting and digestive health products in emerging economies (Renub Research, 2025). Future Market Insights offers a more conservative outlook, projecting expansion from USD 246.5 billion in 2025 to USD 419.1 billion by 2035, with a CAGR of 5.5%, emphasizing the role of prebiotics and probiotics in sustained growth (Future Market Insights, 2025).

Regional dynamics further illuminate these projections, with Asia Pacific commanding the largest

share at 35.8% in 2021 due to population growth, rising disposable incomes, and heightened health awareness in countries like China and India. North America follows closely, holding over 24.7% of the market in 2021, fueled by fitness trends and applications in immunity, weight management, and cardio health across the U.S., Canada, and Mexico. Europe and other regions contribute through regulatory support for fortified products, though growth varies by segment. For instance, dairy products dominated with over 38% market share in 2021, expected to grow at a CAGR of 7.9%, while meat, fish, and eggs are forecasted at 9.4% CAGR due to protein fortification innovations (Grand View Research, 2025a).

Projections from other sources align with this upward trend but vary based on methodologies. Grand View Research's 2023 update estimates USD 329.7 billion in 2023, reaching USD 586.1 billion by 2030 at approximately 8.5% CAGR, highlighting vitamins' rapid growth at 9.7% CAGR. Straits Research values the market at USD 337.85 billion in 2024, projecting USD 595.49 billion by 2033, with bakery and cereals as key segments (Straits Research, 2025). The Business Research Company reports USD 279.79 billion in 2024, growing to USD 310.68 billion in 2025 at an 11% rate, accelerating to USD 452.5 billion by 2029 at 9.9% CAGR, segmented by bakery, dairy, and beverages (The Business Research Company, 2025). Fortune Business Insights forecasts USD 364.18 billion in 2024, expanding to 398.81 billion USD in 2025 and 793.60 billion USD by 2032 at 10.33% CAGR (Figure 1), with online retail as the fastest-growing channel while Future Bridge projects from USD 281 billion in 2021 to USD 500 billion by 2028 at 9.5% CAGR, underscoring pandemic-induced shifts toward wellness (Future Bridge, 2025).

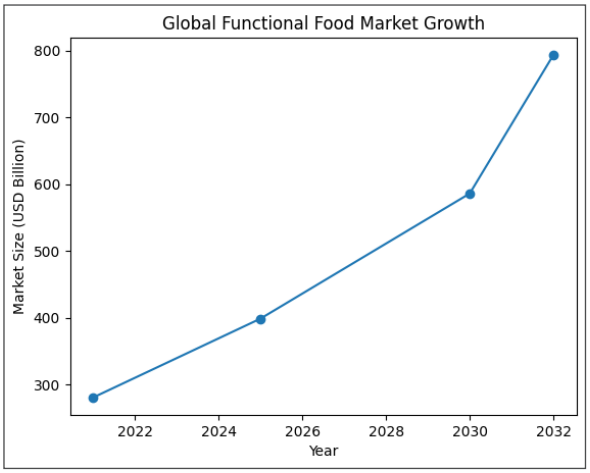

Figure 1. *Global growth trajectory of the functional food market (2021 – 2032).*

These variances stem from differing inclusions of beverages and ingredients, yet consensus points to double-digit growth potential through 2030, bolstered by e-commerce and government initiatives like India's Poshan Abhiyan for fortified foods (Fortune Business Insights, 2025).

4.2 Key Players and Business Strategies

Leading companies in the functional foods arena dominate through strategic investments, mergers, and targeted launches, navigating a competitive landscape valued at over USD 300 billion. Nestlé S.A. stands out with its focus on research-driven innovations, such as BOOST Glucose Control shakes for blood sugar management, aligning with metabolic health demands. Danone S.A. emphasizes product diversification, launching Oikos Pro Line yogurts enriched with proteins and amino acids in 2020, now expanded globally to capture the dairy segment's 38% share. PepsiCo Inc. leverages its beverage portfolio for functional hydration, with innovations like CELSIUS energy drinks targeting fitness enthusiasts, contributing to a 36.7% projected growth in energy drinks through 2029 (Fortune Business Insights, 2025; Grand View Research, 2025a; Sloan, 2025).

Other majors include Abbott Laboratories, which prioritize clinical nutrition through shakes like PROTALITY for GLP-1 users, addressing weight management trends (Spherical Insights, 2025). General Mills Inc. employs mergers and acquisitions to bolster its bakery and cereals lineup, holding 26% market share in 2021, while Kellogg's focuses on high-protein snacks like MET-Rx bars with 28-32g protein per serving. Cargill Inc. and BASF SE supply key ingredients like probiotics and vitamins, supporting upstream dynamics with a focus on sustainability, while Coca-Cola Co. innovates in low-sugar functional drinks, such as sodas with prebiotics

and under 35 calories, tapping into digestive health sales up 34% as of 2024 (Grand View Research, 2025a).

Business strategies revolve around opportunity scanning, trend spotting, and go-to-market expansions, as outlined by Future Bridge, including partnerships like Fonterra's with 7-Eleven for ready-to-drink functional milks in Thailand. Companies invest in encapsulation and enzyme technologies to mask off tastes in botanicals, enhancing palatability and driving new launches in confectionery and bars. E-commerce acceleration post-pandemic enables direct-to-consumer models, with online channels projected as the fastest-growing distribution route (Fortune Business Insights, 2025). These tactics not only mitigate restraints like flavor challenges but also capitalize on drivers like rising incomes in Asia Pacific.

4.3 Consumer Trends and Market Challenges

Nowadays, consumer trends underscore a holistic approach to wellness, with functional foods increasingly sought for active living, metabolic support, and mental health. Four in 10 global consumers link gut health to weight, immunity, stress, mood, energy, and mental well-being, driving probiotic supplement sales to USD 2.1 billion, up 5.6% in 2024. Hydration emerges as the top purchase motivation, with functional beverages like wellness shots growing 13.6% and digestive drinks 34% year-over-year. Weight management ranks high, with 27% of consumers aiming to lose weight via high-fiber, low-sugar options; products with over 20g protein per serving hit USD 4.9 billion, up 9.3%. Mental health concerns affect 47%, boosting mood-support drinks by 62% and sleep teas by 6% (Sloan, 2025).

Sustainability and clean labels gain traction, with 64% preferring no artificial ingredients and 37% opting for organic; gluten-free claims lead growth through 2028. Blood sugar and hormone health, alongside mental management via food, are focal per Mintel, while Sloan highlights personalization for aging and GLP-1 users (Mintel, 2025; Sloan, 2025). Innovations like NEVE blends with beets for cognition or AWAKE caffeinated chocolate (50mg caffeine, ≤ 70 calories) exemplify these shifts.

Challenges temper this optimism, including off-tastes from functional ingredients like herbs, deterring purchases despite masking efforts. Regulatory complexities, such as varying global standards for claims, complicate compliance and innovation, as noted by Future Bridge (2025). Supply chain disruptions and high research costs for stability in bioactive add hurdles, though opportunities in e-commerce and emerging markets like Asia Pacific mitigate these. Overall, addressing these through evidence-based strategies will sustain the market's 8-10% CAGR momentum (Grand View Research, 2025a).

5. Production and Business Landscape of Functional Foods in Vietnam

Vietnam's functional foods sector, encompassing products like probiotic beverages, herbal supplements, and fortified dairy items designed for health benefits such as immunity boosting and digestive support, has emerged as a vibrant component of the country's burgeoning health and wellness industry. With a population around 100 million and rising health consciousness post-COVID-19, the market blends traditional herbal knowledge with modern production techniques, attracting both domestic manufacturers and international brands. As of now, the sector benefits from government initiatives promoting food safety and innovation, though it navigates a mix of rapid growth and regulatory hurdles.

The functional foods market in Vietnam has shown consistent expansion, driven by increasing consumer demand for preventive health products amid urbanization and lifestyle changes. In 2015, the market was valued at USD 1,792 million, ranking third among ASEAN countries and exhibiting the highest regional growth rate from 2015 to 2020 (B&Company, 2020). By 2021, the closely related health supplements segment, often overlapping with functional foods, reached $562.9 million, with a 13% growth rate and projections for 20% annual growth over the subsequent decade (Vietnam Briefing, 2025). More recent data indicates the dietary supplements market, a key proxy for functional foods, was estimated at USD 889.4 million in 2024, poised to grow at a CAGR of 11.1% from 2025 to 2030, fueled by rising disposable incomes and an aging population (Grand View Research, 2025b). E-commerce sales of dietary supplements, including functional variants, hit VND 7.7 trillion (approximately $295.76 million) in 2024, marking a 36% increase from 2023, with 24 million units sold online, up 37% year-on-year (Lien & Lan, 2025). Projections for the broader functional foods market suggest it could reach USD 10 billion by 2025, reflecting heightened demand in categories like probiotics, herbal tonics, and collagen-infused

drinks (Gil, 2025). The market is segmented by ingredients (carotenoids, dietary fibers, probiotics), products (dairy, bakery, soy), and applications (sports nutrition, digestive health, cardio health), with forecasts indicating sustained revenue and volume growth through 2031 (6WResearch, 2024). Consumer adoption has surged, with surveys showing 67% of urban respondents aged 18-39 purchasing functional foods in the past year as of 2019, and usage rates climbing from 1.1% of the population in 2005 to 6.6% in 2010 (B&Company, 2020). This growth is supported by a shift toward organic and plant-based options, with over 60% of urban consumers prioritizing sustainability in purchases.

6. Management and Regulatory Challenges in Vietnam's Functional Food Sector

Vietnam's functional food sector, valued at over USD 889 million in dietary supplements as of 2024 and projected to grow at 11.1% CAGR through 2030, faces significant hurdles in management and regulation that impede its potential as a health innovation hub (Vietnam Briefing, 2025). Despite blending traditional herbal remedies with modern formulations, the industry grapples with fragmented oversight, counterfeit proliferation, and alignment gaps with global standards, exacerbated by rapid market expansion and e-commerce surges (Mind Connector, 2025). These challenges not only risk public health but also deter foreign investment and export competitiveness, as highlighted in recent government directives and draft decrees.

6.1 Overview of Regulatory Framework and Recent Developments

Vietnam's regulatory landscape for functional foods is governed primarily by Decree No. 15/2018/ND-CP, which mandates Good Manufacturing Practices (GMP) for all production establishments and classifies functional foods as "health protection foods" requiring pre-market registration with the Ministry of Health (MoH) (Vietnam National Trade Repository, 2022). This decree emphasizes food safety conditions, including technical regulations for producers and traders, but lacks specificity for emerging formats like online-sold supplements. The Food Safety Law, under amendment as of March 2025, aims to enact comprehensive updates by October 2025, incorporating industry feedback on compliance and international alignment (Vietnam Briefing, 2025). In July 2025, a draft decree was proposed to intensify control over product development, registration, and advertising, targeting health protection foods and supplements to curb misleading claims (Freyr, 2025). The Prime Minister's July 2024 directive instructed the MoH to revamp advertising rules, addressing violations in functional food promotions that often blur lines with pharmaceuticals (Nutra Ingredients, 2024). The establishment of the Vietnam Center for Food Safety Risk Assessment (VFSA) in November 2024 marks a step toward centralized risk evaluation, supporting management solutions for food safety threats (NIFC, 2024). These developments reflect a push toward decentralization and post-inspection enhancements, as directed by the Health Minister in March 2025, to improve quality control and usage monitoring (Stellapharm, 2025).

6.2 Key Regulatory Challenges

Regulatory challenges in Vietnam's functional food sector stem from outdated provisions and enforcement gaps, particularly in addressing counterfeit and substandard products. A July 2025 proposal for stricter measures highlights legal loopholes in market management, with workshops revealing inadequate controls on fake supplements that undermine consumer trust (Vietnam Law & Legal Forum, 2025). Misleading advertisements, rampant on social media, often exaggerate health benefits, prompting the revamp directive amid rising violations. Online sales exacerbate issues, with a study of Doan et al. (2024) showing that 40-60% of rural and up to 76% of urban consumers self-medicate via e-commerce platforms, heightening risks from unverified functional foods (Doan et al., 2024). The draft decree on July 2025 sought to align with international standards like Codex Alimentarius, but it faced delays due to bureaucratic hurdles in registration processes. Food safety risks, including contaminants in herbal-based products, are amplified by limited risk assessment capacity. Highlights from ChemLinked (2025) point to Vietnam's overhaul of infant formula and colorant regulations, indirectly impacting functional foods through stricter additive controls. Management challenges compound regulatory issues, with supervision limitations allowing poor-quality products to flood the market despite legal frameworks, and result in frequent seizures, underscoring the need for real-time monitoring tools and for updating new policies, as shown in Tables 7 and 8.

Table 7. *Potential Regulatory Challenges in the Functional Food Sector.*

Challenge	Description
Counterfeit Products	Proliferation of fake supplements.
Misleading Advertising	Exaggerated claims on social media are blurring with drugs.
Online Sales Risks	High self-medication rates via e-commerce.
Registration Delays	Bureaucratic hurdles in pre-market approvals.
Risk Assessment Gaps	Limited capacity for contaminant evaluation.

Table 8. *Recent policy updates and institutional actions (2024–2025)*

Date	Policy and Directive	Purpose
Jul 2019	Mandatory GMP for health supplements	Ensure quality
Nov 2024	Establishment of VFSA	Centralized risk assessment
Mar 2025	Food Safety Law amendment draft	Align with global standards

7. Opportunities and Future Prospects for Functional Foods in Vietnam and Beyond

The functional foods sector, integrating health benefits like immunity enhancement and digestive support through products such as probiotic drinks and herbal supplements, holds immense promise for Vietnam amid its economic ascent and health-conscious population. Globally, the market is set for exponential growth, driven by sustainability, personalization, and technological innovations, offering cross-border synergies for Vietnam to leverage its herbal heritage. As of 2025, projections indicate robust expansion, with Vietnam's dietary supplements segment, a close proxy for functional foods, estimated at USD 889.4 million in 2024 and expected to grow at a CAGR of 11.1% through 2030, fueled by rising middle-class demand and e-commerce (Research and Markets, 2025). This section explores opportunities and prospects, emphasizing sustainable development and global integration.

7.1 Opportunities in Vietnam's Functional Food Market

Vietnam's functional food market is ripe with opportunities, propelled by demographic shifts, urbanization, and a growing emphasis on preventive health post-COVID-19. The sector benefits from abundant natural resources, including traditional herbs like turmeric and ginseng, enabling cost-effective production of affordable, culturally resonant products such as fortified teas and supplements targeting digestive and immune health (Innova Market Insights, 2025). Market entry for foreign investors is facilitated through partnerships with local firms, leveraging free trade agreements to import advanced technologies and export value-added items. Consumer trends show increasing preference for plant-based and organic options, with over 60% of urban buyers prioritizing sustainability, creating niches for eco-friendly functional beverages and snacks (B&Company, 2020). Government initiatives, such as the National Strategy on Nutrition to 2030, support R&D investments in fortified foods to address malnutrition, attracting grants and collaborations with international bodies as WHO. The market's rapid development is underscored by projections of the global functional food sector reaching USD 275.77 billion by 2025 at a 7.9% CAGR, with Southeast Asia, including Vietnam, contributing significantly through rising disposable incomes and health awareness. Opportunities also lie in addressing urban health concerns like stress and obesity, with functional foods tailored for millennials and Gen Z, who comprise 50% of the population and drive demand for convenient, innovative formats. Domestic manufacturers can capitalize on this by expanding product lines, such as collagen-enriched drinks for skin health, amid a market where 67% of urban youth have purchased functional foods recently.

7.2 Prospects and Trends in Vietnam

Looking ahead, Vietnam's functional food prospects are bright, with forecasts indicating the market could exceed USD 10 billion by 2025, driven by the integration of traditional medicine with modern biotechnology. Trends include a shift toward personalized nutrition, enabled by AI and data analytics for customized supplements addressing specific needs like metabolic health in an aging population projected to reach 20% over 65 by 2030. Sustainability will dominate, with consumers favoring low-sugar, plant-based products; for instance, hybrid innovations blending local flavors with global trends like probiotic-infused pho derivatives could capture export markets in ASEAN. Diet trends like organic

and vegan options present innovative potential, with herbal supplements dominating over 70% of the market in 2021 due to perceived safety and immune benefits (Vietnam Briefing, 2025). The rise of e-commerce and social media marketing is expected to accelerate growth, with online platforms facilitating 37% more-unit sales in 2024, paving the way for omnichannel strategies by 2030 (Quan et al., 2020). Regulatory enhancements, such as the amended Food Safety Law effective October 2025, will foster trust by standardizing claims and GMP, potentially boosting foreign direct investment to USD 1 billion annually in nutraceuticals. Prospects also involve public-private partnerships, as seen in collaborations with the Vietnam Association of Functional Foods, aiming to develop evidence-based products for chronic disease prevention. With a CAGR of 11.1% for dietary supplements through 2030, Vietnam is positioned to become a regional hub, exporting to markets like Japan and the U.S where demand for Asian herbal functionals is rising. Challenges like counterfeits will be mitigated through blockchain traceability, enhancing prospects for sustainable growth and job creation in agribusiness.

7.3 Global Opportunities and Prospects Beyond Vietnam

Globally, functional foods present expansive opportunities, with the market expected to grow from USD 398.81 billion in 2025 to USD 793.60 billion by 2032 at a 10.33% CAGR, emphasizing personalization and sustainability (Sloan, 2025). Key trends include mental wellness products, with 47% of consumers seeking mood-enhancing foods like adaptogen-infused beverages, opening doors for Vietnam's herbal exports (Lexone Stratent Group, 2025). to replace nanoparticles or chlorine treatments (Nguyen et al., 2025), several bioactive compounds commonly incorporated into functional foods exhibit notable antibacterial activity that can be harnessed to inhibit pathogenic bacteria on leafy surfaces (Pacheco-Cano et al., 2020). Sustainability drives hybrid products blending health and indulgence, such as low-calorie functional snacks, projected to reduce environmental footprints while addressing global food challenges (Quan et al., 2020). Beyond Vietnam, prospects involve AI-driven innovations for microbiome health and smart snacking, with the top 2025 trends featuring protein-packed, gut-friendly items amid rising exercise demands (Grand View Research, 2025b; Snaet, 2025). The global market is forecasted at USD 228.79 billion in 2025 with a 10% CAGR to 2030, supported by regulatory advancements in health claims across regions like the EU and the U.S (Riviera, 2025). Opportunities for Vietnam lie in cross-border collaborations, such as those at the ISNFF 2025 conference, to integrate local botanicals into global supply chains for nutraceuticals (ISNFF, 2025).

Prospects highlight value-for-money nutrition, with cost-effective, nutrient-dense foods tackling inequalities, and robot-assisted production enhancing efficiency by 2030. Mintel's 2025 trends underscore dualities of health-indulgence and global-local sourcing, enabling Vietnam to position itself as a supplier of authentic, sustainable ingredients amid a market growing to USD 310.68 billion in 2025 alone. Overall, harmonizing Vietnam's prospects with global trends through innovation and policy alignment could yield economic benefits exceeding USD 20 billion regionally by 2035 (Table 9).

Table 9. *Opportunities and projected growth of functional foods in Vietnam and globally*

Region	Market Size (USD Billion)	CAGR (%)	Key Growth Drivers	Sources
Vietnam	0.89 (2024) → >10 (2025 est.)	11.1	E-commerce, herbal integration	Research & Markets (2025)
Global	398.8 (2025) → 793.6 (2032)	10.3	Personalized nutrition, AI, sustainability	Fortune Business Insights (2025)

8. Conclusion

In conclusion, the global functional food industry has witnessed robust growth, driven by heightened consumer demand for health-enhancing products, innovative production techniques, and sophisticated business models that emphasize sustainability and personalization, while regulatory frameworks in regions like the European Union and the United States ensure stringent quality control, safety standards, and evidence-based claims to protect public health. In Vietnam, the sector is rapidly evolving, with increasing domestic production and business activities supported by a burgeoning middle class and traditional herbal knowledge, yet it grapples with challenges such as fragmented management practices, inconsistent enforcement of regulations, and limited research infrastructure compared to international benchmarks. Moving forward, harmonizing Vietnam's policies

with global standards, fostering public-private partnerships, and investing in scientific validation and consumer education will be pivotal to unlocking the full potential of functional foods, thereby promoting economic development, enhancing nutritional outcomes, and positioning Vietnam as a competitive player in the worldwide market.

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