

## Food Reformulation with Alternative Proteins

Examining challenges for using alternative proteins to create more sustainable, nutritious food

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**Providing access to enough sustainable and nutritious food for the world's growing population is one of the major challenges facing the food industry. Reformulating food by replacing animal-derived proteins with alternative proteins — such as cultured meat and plant-based, insect, and algal proteins — may be the answer. Already a plethora of reformulated products offered in supermarkets, restaurants, and fast-food stores contain alternative proteins, particularly plant-based ones, that look, feel, smell, and taste like meat, fish, and dairy products.**

The main drivers for this reformulation are health- and environmentally conscious consumers in developed economies and those seeking more affordable protein in less developed economies. With growing demand on multiple fronts, [plant-based protein alternative foods could make up to 7.7% of global protein intake with a value of \\$162 billion by 2030](#). This could significantly reduce greenhouse gas emissions from the food industry, which are currently estimated to account for about 30% of emissions globally.

In considering how to deliver sustainable alternative protein foods through reformulation, there are significant scientific and technological hurdles to overcome. For instance, these types of proteins often require the use of additives and new processing technologies to produce affordable, palatable, and shelf-stable products at a time when consumers want “clean labels” with fewer ingredients. In addition, there may be increased manufacturing costs and disruptions because the use of allergenic alternative protein materials can result in additional requirements for cleaning and segregation.

### The Processing Paradox

A key challenge in reformulation that replaces animal-derived proteins is developing a nutritionally beneficial product that meets consumer expectations for taste and texture while maintaining the shelf stability the existing food supply chain demands. Consequently, plant-based alternative protein foods that replace meat and dairy products tend to be highly processed.

For instance, plant-based meat products, which commonly use soy protein, pea protein, and wheat gluten, can be dry and bland or have undesirable flavors. [To compensate](#), flavor enhancers such as yeast extracts, nucleotides, sugars, and spices may be added; sometimes, oils and fats are added to mimic the expected mouthfeel of animal meat, which can increase saturated fat and sodium levels. [Fiber from wheat, oat, apple, digestible starch, etc.](#) may be used as a binder to help stabilize fat and water content and enhance texture. To make up for any nutrient deficiencies compared with meat- and dairy-based foods, these products may also be fortified with vitamins

and minerals. Besides being used to improve taste, texture, and nutritional value, additives may also be used to enhance microbial stability and shelf life.

The need for additives and new processing procedures creates a paradox: Consumers want more natural, plant-based food; however, this can require more complex processing and recipes resulting in highly processed plant-based products that conflict with consumer preferences for clean-labeled products [“containing fewer ingredients or fewer or no ingredients that are seen as ‘non-natural.’”](#) This creates an opportunity for the food industry to [develop clean label solutions by incorporating natural ingredients](#).

### Allergenicity Complications

Another area of concern for alternative proteins is potential allergenicity risks and changes to allergen risk management needs. This is important so consumers don't think they are consuming traditional meat and dairy products when they are actually eating alternative proteins that may pose food allergy risks, such as soy and crustaceans from sustainably sourced seafood.

But what about the allergenicity of more recently discovered alternative proteins? How can food products containing these proteins be labeled clearly to protect consumers? For example, what's the allergenicity risk of insect proteins — many of which are similar to proteins in crustaceans such as crab or shrimp?

To prevent label confusion and improve allergen risk communication, the U.S. Food and Drug Administration Center for Food Safety and Applied Nutrition is drafting guidance documents related to “Labeling of Plant-based Milk Alternatives; Draft Guidance for Industry” and “Labeling of Plant-Based Alternatives to Animal-Derived Foods; Draft Guidance for Industry.” These guidelines — expected to be released late December 2022 — will add to the [FDA mandate that all labeling must be truthful and not misleading \(21 U.S.C. § 343\(a\)\)](#).

To prevent label confusion in Europe, [current EU law](#) only permits terms such as “milk” and “yoghurt” for dairy products.

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Plant-based alternatives cannot use these terms, even when accompanied with qualifiers such as “plant-based” or “vegan.” In 2020, the European Parliament voted against the same ban on the use of meat-related terms, such as “burger” and “steak,” for plant-based products to avoid cutting across efforts to make Europe carbon-neutral by 2050. However, national rules on meat-related labels are inconsistent across the EU, with some countries separately introducing their own bans. Producers of plant-based products will therefore need to carefully consider local laws on food labeling when exporting across the EU.

A further consideration is that many alternative proteins are new to our diets or only consumed infrequently in small amounts. Changes that significantly increase our exposure [might result in increased allergic reactions](#) due to either de novo sensitization or cross-reactivity in consumers already sensitized to proteins with structures similar to these new alternative proteins. The impact of new alternative proteins in our diet must be carefully characterized to confirm any risk of cross-reactivity and ensure that appropriate risk management controls and risk communication labeling measures are in place to advise and protect consumers.

## Hidden Hurdles of Reformulation

Reformulation can be costly, time consuming, and add complexity to sourcing and manufacturing operations. Although alternative protein sources can create opportunities for reduced costs upfront because plant-based proteins tend to cost less, there are “hidden” back-end costs such as new processing equipment, changes to allergen risk management practices, and potential supply chain quality inconsistencies. For instance, for every confirmed allergenic food of public health importance, all food manufacturers must apply hazard analysis and critical control points principles and good hygiene practices by implementing plans and procedures that focus on allergen management through cleaning and segregation to prevent cross contamination. Each of these food safety prerequisite plans and procedures may need to be changed or modified with the use of new alternative proteins.

Successfully navigating the alternative protein market and subsequent reformulation will require a considerable investment of time and effort establishing new sourcing and production controls, ensuring regulatory compliance, meeting consumer expectations, and providing relevant consumer risk communication — amid challenges such as climate change and the depletion of natural resources.

## How Exponent Can Help

Exponent's Chemical Regulation & Food Safety team has extensive experience designing risk management models for manufacturers and retailers to incorporate regulatory requirements and expected best practices into practical approaches to effectively support both consumer risk protection and business operations. We examine supply chain quality assurance models, processing impacts, toxicity, nutritional value, and intended use of novel proteins to provide advice on risk and status from a food safety and regulatory point of view with suggested targeted risk management measures. Leveraging a robust weight of evidence, we examine allergenicity potential through data-intensive literature reviews and bioinformatics to unearth any history of adverse hypersensitivity reactions and likelihood of cross-reactivity. We also help clients navigate complex food ingredient and labeling regulations, including FDA, EU, and UK regulations, as well as global food standards produced by Codex Alimentarius. Our expertise extends to all areas of maintaining food safety in the food system including sourcing and supply chain, specification management, innovative production and processing, mass production, storage and distribution, and retail, addressing allergens, pathogens, chemical contaminants, food contact materials, and physical hazards.



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