

Soil health is foundational to food security. Image: Agreena



Field To Future

How Biotech and Business Models Can Change the Food System

The global food system is under strain. The closure of the Strait of Hormuz in the spring has hit agriculture sectors hard, while the looming El Niño weather phenomenon promises a volatile time for harvests. As risks mount for human and planetary health, businesses are investing in new strategies and technologies to transform how we grow, source, formulate and replenish our food.

By Lena Hunter

The global food system is entering a critical decade. Resource constraints and consumer expectations are forcing production and supply chains to evolve as the global population inches toward 9 billion by 2050. Yet recent months have laid bare the fragility of our food systems. With this year's four-month blockade of the Strait of Hormuz, a handful of fertilizer trade routes have revealed themselves as chokepoints for global food security. As farmers are squeezed, staple crop prices are climbing—pushed higher by the frequent droughts and heat waves now hammering yields worldwide.

In tandem, public health systems are struggling to meet the needs of the aging and chronically ill. Diet and chemical exposure are major health outcome differentiators, yet in most countries, between one-third and one-half of what we eat is highly processed food. As studies mount connecting artificial

additives to health issues, so too do those linking fiber, sleep and gut hormones to longevity.

Meanwhile, recognition is growing of the role of people's diets in achieving international climate targets. With the farm-to-table journey under the microscope, governments hold powerful cards to instigate change from both ends, from healthy eating guidelines for consumers to subsidies for farmers. In the private sector, agricultural technology companies and ingredients companies alike are rolling out biotech-enabled products to support sustainable food production and biodiversity restoration for human and environmental health.

This report examines how the most critical businesses in the supply chain—in agriculture ingredients and packaging—are responding to this complex landscape, and shaping a healthier, more natural and more sustainable food system.

The ultra-processed food scare

Of the biggest pariahs in the 2026 public health narrative, ultra-processed food is a hot contender for top spot. Diets high in UPFs have been linked to [over 30 adverse health outcomes](#), including type 2 diabetes, several cancers, cardiometabolic diseases, asthma, anxiety and depression. Meanwhile, damning reviews have emerged of national eating habits: In the U.K., [65 percent of calories](#) in school children's diets come from white bread, biscuits, carbonated drinks and chips. In Australia, South Korea and Spain, UPFs [account respectively for](#) 42, 25 and 24 percent of average diets.

The U.S. is the highest per capita consumer of UPFs; almost [75 percent](#) of the total food supply is estimated to be ultra-processed, and diet-related chronic diseases are the [leading causes of death and disability](#). U.S. Health Secretary Robert F. Kennedy Jr. has [asserted](#) that they are “driving the obesity epidemic” and has made slashing them from American plates a pillar of the Make America Healthy Again campaign.



Worldwide, the same sentiment echoes, as governments move en masse to regulate UPFs in school canteens.

A tailwind for natural and functional foods

The aversion to UPFs is not just top-down. “Consumers are increasingly looking for simpler, more familiar ingredients, preferably nature derived, that support their health goals and align with their values,” says Nick Hampton, CEO of U.K.-based ingredient supplier Tate & Lyle. For example, he observes that sweeteners like stevia are increasingly winning out over their pure sugar or high-fructose corn syrup counterparts, and that emergent calorie-free alternatives like allulose – which occurs naturally in figs, raisins and maple syrup – have “high potential despite low awareness.”

“With the climate crisis necessitating a shift in consumption patterns, and the United Nations finding that plant-based foods generally use less energy, land and water, and have lower greenhouse gas intensities than animal-based foods, we believe plant-based eating will grow in importance,” says Hampton.

Antonio Delgado Romero, CEO and co-founder of Natac, a Spain-based biotechnology company that produces plant-based extracts and ingredients, also sees consumers becoming “more proactive about maintaining their health and... looking for natural, scientifically supported solutions.” More than 80 percent of the world’s population currently use some form of traditional medicine – such as herbal medicine, Ayurveda and indigenous therapies – [according to](#) the World Health Organization (WHO), and Romero believes botanical science will play an “increasingly important role” in preventive health and wellness.

Natac’s portfolio for digestive health, for example, includes ingredients with long traditions of use in herbal medicine such as extract of milk thistle, dandelion and sage. “There remains enormous potential to better understand the properties of natural ingredients and to identify new applications that can support human health. Many botanicals have been used traditionally for centuries, but modern science is still uncovering new mechanisms and benefits.”

“We need to translate complex science into straightforward, meaningful information for brands and consumers. Clear documentation, visual data storytelling, and easy to-understand performance metrics help bridge the gap.”

Bernardo Medeiros, Vice President, Lubrizol Life Science

But food and wellness brands are not only swapping out ingredients; they are inserting new ones. This year, the hashtags #fibremaxxing and #fibermaxxing have been viewed more than 150 million times on TikTok, as the role of fiber in gut health and cognitive function comes into focus. With [over half](#) of consumers seeing gut health as important to their overall health, brands are scrambling to add fiber to their products and stirring ingredients manufacturers into a flurry of R&D.

Tate & Lyle conducts long-term research on soluble fiber. “17 research studies over 18 years in multiple populations show various health benefits, including its prebiotic effects in the gut that have a positive impact on calcium absorption and retention for bone health... a hot topic in populations with rapid weight loss,” says Hampton. These populations have become significant. Prescriptions of GLP-1 agonists like Ozempic and Wegovy have more than tripled since 2020. Today, the popular weight-loss drugs are used by around [12 percent](#) of Americans, creating a new consumer segment with higher-protein diets and a focus on metabolic health.

U.S.-based ingredients company IFF has also zeroed in on the GLP-1-user segment. “Increasingly, we are connecting food innovation directly to emerging health science and consumer insights,” says Leticia Gonçalves, president at IFF Health and Biosciences. “We support this shift with solutions that combine protein fortification, gut health support, and targeted probiotics.”

Often, bioengineered ingredients

are designed to alter the food-making process, rather than the product. In bakery, for example, enzymes can standardize production even when the quality of wheat fluctuates. In dairy, cultures can produce consistent textures and flavors despite changes in milk composition. These kinds of applications often resolve headaches in sourcing, with knock-on effects for food security. Fermentation-based processes, for example, can produce ingredients from alternative stocks with greater control and predictability. “It enables us to make products that are less dependent on variability in raw materials like milk

or grain, and more resilient to supply fluctuations,” says Gonçalves. “It also helps manufacturers stay resilient and competitive, even when under pressure from supply or cost volatility.”

However, the challenge in applying bioscience to food is not just improving nutrition without detracting from taste, texture or affordability—it’s also about justifying processed ingredients to health-conscious buyers. “Our data suggests that consumers are not opposed to processing itself, but increasingly expect it to deliver clear benefits, such as improved nutrition and great taste, provided ingredients and processes are transparently explained,” says Hampton.

“It’s important that the food industry [helps] consumers and policymakers to understand the essential role that processing must play in feeding a growing population more sustainably with better health outcomes,” says Hampton. “Ingredients that add nutrition, make nutritious foods more widely available via shelf-life extension, reducing spoilage [...] are essential to how we feed people more sustainably.”



Equipment at global ingredient company Tate & Lyle's Technical Applications Lab in Dubai. Image: Tate & Lyle PLC

Biotech has also produced sea changes in the personal care market, where consumers and regulators are becoming more stringent in demands for natural, clean-label products. Ozymoronically, simple products are becoming more sophisticated as manufacturers find novel ways to bioengineer “nature identical” and “nature inspired” molecules with high purity and lower environmental impact.

“There’s a lot of exciting innovation happening in the natural space right now... Advanced fermentation, for example, can enhance purity, optimize efficacy, and allows us to design ingredients with highly targeted functions,” says Bernardo Medeiros, vice president of Lubrizol Life Science, a U.S.-based provider of specialty chemicals for the personal care and pharmaceutical industries. Fermented

skin care has been buoyed by movements like K-beauty – a household concept today after exploding out of Seoul a decade ago. Centered on light-touch applications and natural aesthetics, it posits microbial ingredients like yeast extracts, lactobacillus and galactomyces as gateways to long-term skin barrier health.

Consumers in China, South Korea and Southeast Asia “are driving rapid adoption of science backed skin care [and] proage solutions” as the region “[tends] to embrace innovation quickly, which creates a strong environment for new ingredient technologies,” explains Medeiros. In Latin America and India, “younger populations, rising disposable income, and strong beauty cultures” are pushing up demand for high-performing but accessible products, while North America and Western Europe gravitate

toward “cleaner profiles, traceable sourcing, and high-quality natural or biotech enabled ingredients.”

Anatomy of a health crisis

Yet resource scarcity continues to set the play in the business of wellness and food. The inflation spikes of 2022 and 2023 may have abated, but the root causes have not: high energy prices, geopolitical uncertainty, protectionist policies and climate-change-driven disruption of crop harvests. The latter is placing critical and unpredictable pressure on supplies of grains, fruit and vegetables—the building blocks of healthy diets. In the EU, for example, climate change has heightened the variance of [water availability](#). [One-third](#) of the bloc now experiences water stress all year round. If [current emissions](#) continue, by 2050, yields of wheat and

The advertisement features a large aerial photograph of a modern industrial facility with a green roof and grey walls. The Natac logo is visible on the building. In the foreground, there are large storage tanks and a blue maintenance vehicle. A white graphic overlay on the left side contains the Natac logo and the text 'Plant extracts for greater wellbeing'. Below this text are three circular icons representing different plant extracts: Olive, Milk Thistle, and Pomegranate. The website address www.natacgroup.com is displayed at the bottom of the image.

Natac
Science to Market

Plant extracts for greater wellbeing

Olive Milk Thistle Pomegranate

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maize in drought-hammered Southern Europe are [expected to drop by 49 and 80 percent](#), respectively. These weather effects are compounded by a second issue: roughly [62 percent](#) of farmland soils in Europe and [25 percent](#) in China and Southern Asia are now degraded. The damage is largely caused by industrial monocultures, excessive use of chemical fertilizers and pesticides and intensive plowing. Together, these decimate the soil's microbial biodiversity and reduce the resilience of crops in the face of climatic extremes.

Geopolitics is compounding these challenges for farmers. The Iran war has dealt a severe blow to the global economy, with shipping through the Strait of Hormuz dwindling by more than 90 percent since February. Some [30 percent](#) of traded fertilizer passes through the Strait, and the Food and Agriculture Organization of the United Nations (FAO) has [warned](#) of the start of "a systemic agrifood shock that could trigger a severe global food price crisis within six to 12 months." Unfolding in stages, the first hit will be energy, then fertilizer, seeds, lower yields, commodity price increases and finally food inflation.

The effects are already visible: The [FAO Food Price Index](#), which tracks monthly changes in the international prices of a basket of globally traded food commodities, observed price rises in May across all major cereals for the fourth consecutive month. "[This is] supported by smaller expected harvests in major exporters, including the United States of America, where winter wheat crop conditions are among the least favourable in decades, while higher fuel and fertilizer costs added further upward pressure globally," reports the FAO.

The regenerative shift

To mitigate price shocks and human rights risks, the FAO has [recommended](#) "regenerative" techniques of intercropping of cereals and legumes to cut nitrogenous fertilizer use. The term "regenerative agriculture" has been circulating since the 1980s but has gained political traction in



Regenerative agriculture around the world: UK-based Regenagri is an international regenerative agriculture program that supports farms and organisations, like Lumbini Tea Valley in Sri Lanka (pictured), to transition to holistic farming. Image: Regenagri

the past decade as an alternative vision for industrial farming. In short, it is a practice of sustainable land management that aims to improve soil health, with knock-on effects for the quality of water, vegetation and land productivity. Importantly, healthy soils can store [significantly more CO₂](#). Farming produces some 15 percent of global greenhouse gas emissions, and the IPCC has therefore [hailed](#) carbon sequestration in agricultural soils as one of the most impactful approaches for net emission reductions.

In the U.S., [several municipal governments](#) have already pledged to promote regenerative agriculture to help achieve local sustainability goals. In the EU, residue regulations for pesticides are [set to tighten](#) in July 2026, hastening adoption of natural methods. In response, agricultural technology companies worldwide have produced a new wave of natural products that help growers use fewer chemical inputs.

Agricultural biosolutions work by

activating nutrient cycles and managing pests with natural deterrents. Botanical oils can disrupt pest mating and serve as contact insecticides. Adjuvants can help biopesticides cling to leaves for longer. Humic acids extracted from decomposed biomatter can improve soil structure, and wetting agents increase water-holding capacity. "These strategies can reduce irrigation volumes by up to 25 percent while maintaining or increasing yield," says Ignacio Domínguez, chairman and CEO at Spain-based Rovensa Group, a global provider of biosolutions. "We see the strongest uptake of biosolutions is in high-risk systems like fruit and vegetable crops, high value specialty crops, and broadacre farming [such as cereals and oilseeds] under drought or saline pressure."

Ingredients companies can also play a role in yield value. IFF, for example, provides enzymes and yeast for corn processing that improve conversion efficiency, enabling more value to be

extracted from the same raw material—whether for food or biofuel. “[It] is a clear illustration of how bio-innovation connects agriculture, food systems, and energy,” says Gonçalves.

Yet given the holdup in the Strait, biofertilizers may be the most persuasive regenerative tool. While the initial investment in biofertilizers may be higher than chemical fertilizers, a growing body of research finds that their long-term benefits outweigh the costs. Made from fungi or bacteria, biofertilizers break down phosphates in the soil, making them bioavailable to roots. This can lead to lower chemical fertilizer demand, improved soil carbon dynamics and a reduced environmental footprint per unit of yield.

Financing the farming revolution

However, biosolutions in farming are

not designed to work in isolation, nor to replace conventional chemicals one-for-one. They work best in tandem with other regenerative practices, like no-till farming (minimizing soil disturbance), cover cropping (planting non-cash crops to keep soil covered year-round) and agroforestry (planting trees and shrubs to shield crops from harsh conditions). For this reason, regenerative farming and biosolutions are yet to truly break into the mainstream. They are good for long-term resilience, but farmers can face a few years of lower yields while the soil is recovering. Upfront costs, not only of products, but of less intensive machinery, are another hurdle. In Europe, total transition costs can range from €2,000 to €5,000 per hectare and take up to nine years to repay. Incentives may reduce the timeline but leave a funding gap—especially for small and

“Sustainability is still often seen as complex, risky, or something that compromises yield and profitability. That perception slows adoption, particularly in high pressure production systems.”

**Ignacio Domínguez,
Chairman and CEO, Rovensa Group**



Regenagri is a regenerative agriculture initiative aimed at securing the health of the land and the wealth of those who live on it.

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- Access and use third-party verified data for sustainability reporting and better market access
- Access Regenagri's Carbon Insetting Programme



To find out more about how your farm, farming organisation, company or NGO can benefit from joining the Regenagri programme, **get in touch at regenagri.org/contact-us**



Wildflowers encourage insect biodiversity, including predator species that regulate crop pests.
Image: Agreena

medium-sized farms.

Margins are thin and capital is scarce. Venture capital, even more so. Agriculture presents several barriers for traditional VC: the industry is fragmented, slow to adopt new technologies, on the frontline of environmental risk and highly regulated. “It really comes down to one thing: access to financing,” agrees Frederik Aagaard, chief commercial officer at Denmark-based Agreena, which operates a carbon credit initiative for regenerative farming across some 5 million hectares of European farmland.

The Agreena CarbonProject is the first large-scale agricultural cropland project to be registered under Verra’s VM0042 methodology, a globally trusted carbon credit standard. By promoting interventions that restore soil and transform agricultural fields into verified carbon sinks, the project helps farmers adopt regenerative practices, while supporting companies’ sustainability goals. “If regenerative agriculture is going to attract serious capital to continue scaling beyond pilots, the underlying proof has to be trusted by the market,” says Aagaard. “Farmers need to know that if they change the way they’ve been doing their job for

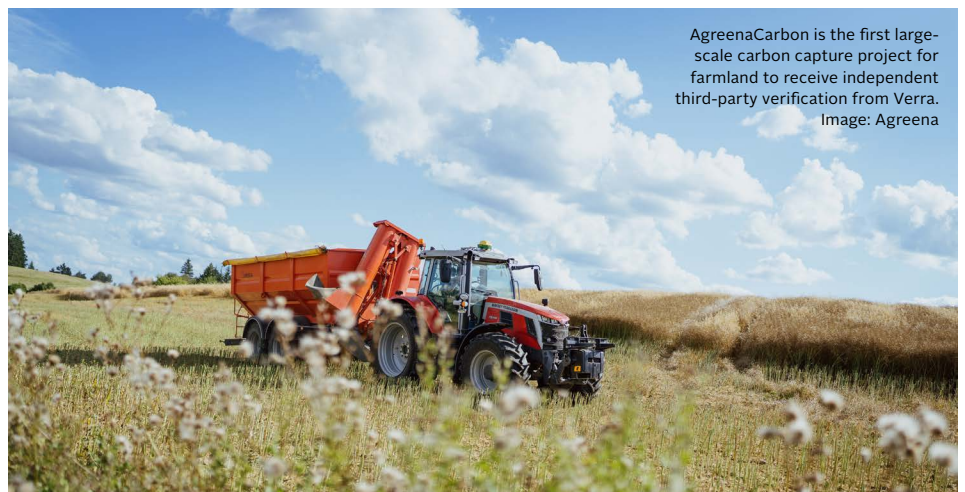
their whole life, it’s going to be worth it. They’re businesspeople too.”

Still, outcome buyers are often reticent to invest the sums needed to move pilot activities into commercially viable systems without the push of compliance or a crisis. For this reason, environmentally progressive politics is key. “Regulation timelines help shape the pace of adoption,” says Aagaard. “[It’s] as much a market and policy question as it is an agricultural one.” In 2024, for example, Denmark—a big dairy and pork producer—became

the first country to impose a tax on agricultural emissions, effective from 2030. The Netherlands has also rolled out progressive regulations to buy out thousands of high-emitting livestock farms. While promising for the climate, these moves are contentious among agricultural industry stakeholders: New Zealand, for example, aborted its carbon tax proposal in 2024 after conservative pushback.

Is ESG reporting hitting a wall?

As agriculture policies inch toward green targets and new technologies are folded into farming life, the reams of data generated would appear to be a boon for sustainability reporting. “On the other hand, we are seeing a dilution of obligated ESG reporting in Europe – for example, through restrictions on the scope of the Corporate Sustainability Reporting Directive – and a trend towards “green hushing,” where companies are choosing to be less public about their ESG commitments and performance because they are nervous about the legal and reputational risks,” says Katie Vickery, partner and international co-head of regulatory at the U.K.-based international legal practice Osborne Clarke. “The result is that overall volumes of ESG reporting, and therefore exposure to liability, may actually be decreasing, even though investors and consumers still want the information.”



AgreenaCarbon is the first large-scale carbon capture project for farmland to receive independent third-party verification from Verra.
Image: Agreena

Contrastingly, public claims about the sourcing and sustainability of food and wellness products are rife. But regulators are clamping down: In the U.K., the Competition and Markets Authority (CMA) is escalating its enforcement against greenwashing. Similarly, “the EU is introducing specific consumer legislation [...] effective from this year, [that] will standardise how wellness products are regulated under consumer law in terms of sustainability and sourcing claims,” says Vickery.

Beyond compliance: Ethical sourcing and social action

In best practice, ethical sourcing is fully transparent, strengthens local economies and respects local knowledge and labor practices. The Brazilian cosmetics company Natura operates an ethical sourcing model with

producers in the Amazon rainforest, from which it derives 46 bioactive ingredients for use in some 1,000 products. The region is one of the most biodiverse ecosystems on Earth, home to hundreds of Indigenous groups, the original stewards of the land. As individuals and companies continue to profit from exploiting its natural resources, companies that engage in ethical sourcing can help to push back. It’s sensitive work, however: “Sustaining trust and resilience in the face of increasing global supply chain pressures requires Natura to integrate advanced technology, strong governance, and close on-the-ground relationships,” says Ana Costa, vice president of sustainability, legal and corporate reputation.

The company’s field team in the Amazon works with more than 10,000

small-scale family farmers across 45 communities on projects like capacity building and technology transfer. Digital logs trace every production step: “Real-time GPS monitoring of sourcing activities [ensures] full traceability and transparency across 94 supply chains that harvest bio-ingredients in alignment with forest limits and seasonal cycles,” says Costa.

Brazil is often presented as a case study for financing models that support local producers. The Amazônia Viva mechanism, for example, combines blended finance structures with technical assistance to provide credit and tailored financial solutions to farming cooperatives and associations. Since its establishment in 2022, it has raised over \$5 million, benefiting 15 cooperatives and associations and impacting more than 2,500 families in the region. Assigning

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monetary value to socio-environmental impacts can also help to locate social action in a business strategy. Natura's Integrated Profit and Loss system, for example, quantifies the co-benefits of its projects, and internal governance links executive compensation to climate and sustainability targets. "Once considered intangible by the market, it demonstrates that for every US\$ 1 invested, \$2.50 is returned in socio-environmental benefits to society," says Costa.

Many companies underestimate how deeply they now need to understand their supply chains. "[It's] quite literally from farm to final product. When that isn't in place, the legal exposure is significant across a range of current and forthcoming regulations," says Vickery. In Europe, new supply chain regulations include the EU deforestation rules, EUDR, CSDDD and Forced Labour Regulations. Other requirements, like the digital product passport, mean that detailed supply chain information will be shared not just with others in that supply chain but also with regulators and consumers. "You will not be able to access the EU market unless you can demonstrate a good understanding of your supply chain and the associated risks. Enforcement isn't just about fines; products will simply be stopped at the border," she adds.

In the face of trade disruptions, some companies are turning to new jurisdictions without fully assessing sanctions, export controls or human-rights risks. Yet this could become a flashpoint for ethical sourcing. "Turn the crisis into an opportunity," [urges](#) the FAO, "activate social protection programmes, drawing on lessons from Latin America" and "improve access to finance and support for informal farmers by integrating them into farmer associations and cooperatives."

The biomaterial boom

Sustainable sourcing is complemented by sustainable waste management. By 2050, the world is on track to generate annual volumes of plastic waste equivalent to the size of Manhattan,



Image: Agreena

and one and a half times the height of the Empire State Building, [according to](#) research by UC Berkeley. In recent years, apocalyptic images of Agbogbloshie e-waste dumpsite in Ghana, the Great Pacific Garbage Patch and plastic bags disgorged from the stomachs of dead marine creatures have provoked outrage and health fears about negligent waste management.

A powerful policy-design shift has emerged in response: Extended

Producer Responsibility (EPR). Underpinned by the polluter-pays principle, governments the world over are redrawing national waste management systems and launching regulations that hold food, beverage and retail companies to account for how their products are disposed of. "Namely if you place products and packaging on a market, you're responsible for its life cycle - financially and sometimes operationally. We already see a complex system of EPR schemes across Europe, the UK and a growing number of US states," says Vickery.

The regulatory push has created a slipstream for environmentally friendly design. Recyclable, reusable and biodegradable materials are in high demand: "Wellness brands are increasingly moving toward paperboard packaging made from renewable resources and recyclable materials — and in some cases, compostable," says Carlos Carrillo, vice president of global innovation at the U.S.-based sustainable packaging company Graphic Packaging International. "Even in demanding categories like fresh food, paperboard packaging can now deliver shelf life

“Sustainable sourcing is about protecting biodiversity, respecting local ecosystems and ensuring that resources remain available for future generations while continuing to meet market demand.”

**Antonio Delgado Romero,
CEO and Co-Founder, Natac**

comparable to traditional plastics," says Carrillo.

Biotechnology innovations have moved quickly into the consumer marketplace. The plastic films inside fresh food and drinks packets, having presented a recycling challenge for decades, can now be replaced with biodegradable water-based dispersion coatings. Plant-based packaging, often made from agricultural byproducts like sugarcane pulp, has become widely used in U.K. supermarkets and food delivery services. In retail, feather-light mycelium packaging, made from mushroom roots, has proved an effective swap for Styrofoam and has been adopted by companies like Dell and IKEA.

The business of change

Companies hold great power to

positively influence the sustainability of food systems and public health. Investing in local social-action projects, reducing hazardous chemicals and engaging in and developing green finance models are some of the ways businesses can use their power to create positive change.

The most impactful shift comes from measuring success not only by the bottom line and the promises of their products, but also by the lives and ecosystems improved by daily operations. Aagaard from Agreea cautions that not every environmental outcome needs to become its own standalone asset class: "The question is not simply how to financialize every outcome, but how to recognize and reward the full value created by healthier farming systems in a credible and measurable way."

"Increased integration of ag-tech, food science, and consumer brands across innovation pipelines is an industry-wide trend."

**Leticia Gonçalves, President,
IFF Health & Biosciences**



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