



CHARAKA Exploring The Future Of Food





If the popular adage - you are what you eat - is correct, then the average modern consumer has something to be worried about. **Bad diets are killing more people globally than tobacco**, research shows, with major manufacturers choosing from thousands of laboratory-made additives to make our food more attractive and more addictive. Formulations today are confusing, with the vast majority containing ingredients that are synthetic, highly-processed and derived from animals.

But thanks to the possibility of using technology to probe ancestral wisdoms and the bounties of nature, this does not need to be the industry status quo. **The Live Green Co is developing its own Artificial Intelligence (AI) recommendation engine** that blends ancestral wisdoms of plant nutrition with biotech and machine learning to prescribe 100% natural plant alternatives to the additives in our food - at a fraction of the time & cost of traditional R&D. The resulting formulations promise to deliver cleaner, more nutritious & more sustainable food products at scale.

The recommendation engine, called Charaka, goes beyond imitating animal products to offer new and unique flavors, clean labels, functional ingredients and sustainable production and packaging, while adhering to the United Nations Sustainable Development Goals of Good Health & wellbeing, Decent Work & Economic Growth, and Sustainable Consumption & Production.

Charaka is currently built up of 15,000 plants & properties (approx. 500,000 data points) and provides alternatives to the more than 5000 food additives approved by the United States Food & Drug Administration and European Food Safety Authority. Using Charaka, The Live Green Co. has launched four lines of its own clean label products and completed a successful tech pilot with Sigma, a \$6B food manufacturing company with operations in 18 countries.

Charaka comes at an important moment as the adoption of cleaner and greener foods is being accelerated due to the pandemic. More than 80% of consumers report that their food habits have changed since the outbreak, with 57% eating fewer animal products. As a result, the plant-based food industry is set to **grow beyond \$25B by 2025** and the clean label opportunity is estimated to be worth **\$50B by then**.

Consumers today are viewing health & sustainability more holistically than ever before, as encompassing both, being a responsible consumer and a responsible citizen. It's time for the food industry to do the same.





The Food Industry Today

Transformation of the global food system is urgently needed as more than 3 billion people are malnourished (including those who are undernourished and over-nourished), and food production is overtaxing the planet's resources. These issues are exacerbated by a food industry that continues to use animal-based and synthetic substances in food production, which are neither healthy nor sustainable.

The food industry has already explored and created about 5000 chemicals that perform various functions in food processing, from anti-freezing agents in ice cream to emulsifiers in baked goods. While major food manufacturers largely use these 5000 or so chemical extracts, they are not necessarily good for the health of consumers nor the planet.

A recent study estimated that highly processed foods make up nearly 60% of today's urban diet. Consuming small amounts of additives may be safe, but the health risks add up if consumers rely heavily on processed foods. **A diet made up of processed foods is linked to chronic diseases** such as obesity, high blood pressure, heart disease and even cancer. Moreover, hypersensitive reactions to synthetic, highly-processed and animal food additives include digestive issues, nervous disorders (hyperactivity, insomnia & irritability), respiratory problems (asthma, rhinitis and sinusitis) and skin allergies (hives, itching, rashes and swelling).

Despite the growth of plant-based food companies and products, many such options are still use synthetic & highly-processed additives, high-pollution production methods and plastic packaging, thus offsetting the benefits of taking animals out of the equation. Without 360° Green sustainable practices, many food products from increasingly conscientious companies might be 'vegan' but not healthy or sustainable.

With **a new generation of consumers** who are more concerned about their health as well as climate change, the food industry is going through the paradigm shift of becoming healthier and more sustainable. This goes beyond vegan food products to clean labels, functional ingredients and sustainable production and packaging.





What Is Charaka?

Nature provides a rich repository of almost 500,000 plants and plant parts. Each of these plants can be treated as a complex and highly intricate data source of functionalities, phytochemical compounds, bioactive plant molecules, nutritional profiles, and physicochemical properties. Analyzing data at this scale and detail entails the processing of more than 1 billion data points, for which traditional food science methods and manual research have severe limitations.

This is where sophisticated deep learning and machine learning systems can play a significant role in discovering hidden and non-linear relationships. While such methods have been successfully implemented in drug discovery to predict the properties and activities of new compounds, they have not been used as much to drive innovation in the food manufacturing industry... until now.

The Live Green Co is developing a proprietary **machine learning software** called Charaka, which uses data about plants to recommend 100% natural plant alternatives to the animal, synthetic & highly-processed additives in our food products.

Charaka leverages data from three distinct sources:

One of the sources is the existing scientific research that has validated certain plants, plant parts and compounds. But of the more than 500,000 plants and plant parts that exist, it is estimated that only about 2-3% have been explored by modern science.

So, Charaka draws heavily from ancestral wisdoms. Around the world, various cultures have used plants as medicine for millennia. As many as 15% of the 500,000 plants and plant parts on the globe have been explored by ancestral wisdoms, but very little has been validated by modern science. There are, of course, great examples that have been validated by modern science. Chinese scientists, for instance, needed new anti-malarial drugs during the Vietnam War and decided to test a traditional herbology recommendation called artemisinin, and confirmed that it is effective to treat malaria.





Another example of ancestral wisdoms comes from the Indian wisdom called Ayurveda, which is at least 2500yrs old and based on the principle that 'food can be your first medicine'. This repository of plant knowledge leverages plants and plant parts for specific functions, be it the use of mung bean and chickpeas to make egg substitutes, or the use of raw jackfruit pulp as a soy-free chicken substitute. In fact, 'Charaka' - the inspiration behind the name of the recommendation engine - was a compiler and editor of Charaka Samhita, one of the oldest and the most important ancient authoritative writings on Ayurveda. More than 2000 patents filed in the United States and Europe belong to this wisdom.

Since many plant uses prescribed in ancestral wisdom have not been validated by modern science, Live Green does not use just any info from this source. The startup validates this data via existing 3rd party research, or its own R&D.

The third source is Live Green's own scientific R&D. The Chilean startup counts a small team of scientists that analyzes various ancestral plant wisdoms and validates them by examining their nutritional, organoleptic, physicochemical and molecular properties.

Thus far, Live Green has inputted ancestral and modern scientific data from around 15,000 plants into Charaka. While competitors like [Eat Just](#) and [Not Co](#) solely focus on molecular analysis to imitate animal products, Live Green goes beyond to focus on clean labels, functional ingredients, and sustainable production and packaging to disrupt the way the world consumes.



The Seven Steps TO CLEAN ICE CREAM



The Live Green Co. recently launched a **line of 100% plant-based ice-cream**, which they developed using Charaka in just 90 days and US\$ 15,000. Here's how:

- 1 The team used Charaka to analyze the ingredients of popular plant-based & traditional ice creams available on the market.
- 2 Charaka categorized the ingredients into natural, and animal, synthetic & highly-processed additives.
- 3 Charaka then analyzed the functionalities of each of the ingredients and additives, and scanned its databases to provide 100% natural plant alternatives like sunflower milk & cream, banana, avodado, flaxseed and sunflower oil.
- 4 Using these recommendations, the machinery of a local ice-cream parlour and the science of ice-cream manufacturing, Live Green's production team developed a line of proprietary ice-cream formulations.
- 5 Then, the team ran lab tests & focus groups to validate the sensory, shelf-life and nutritional qualities of the new ice creams – all without the help of chefs or any prior ice-cream manufacturing experience.
- 6 In total, the R&D process took less than 30 days, and the complete idea to commercialization - including packaging design and printing, raw materials purchase, forming manufacturing, logistics & distribution partnerships – took just 90 days and a cost of less than US\$ 15,000.
- 7 The Live Green Co.'s clean ice cream line will soon be available at one of Chile's largest supermarket chains, Jumbo.



Sigma Case Study

Charaka, however, has not been active only within the four walls of The Live Green Co. The startup is a graduate of last year's **Tastech by Sigma** acceleration program, aimed at startups and scale-ups around the world. During the program, Sigma and Live Green successfully pilot-tested the Charaka recommendation engine, which uses AI to identify and replace animal, synthetic and highly-processed food additives with 100% natural plant alternatives.

Every year, the food industry spends between \$3-5B to develop and launch over 15,000 new products. Charaka can be used to create 100% plant, clean-label, functional and sustainable formulations at a fraction of the cost, compared to the industry average development period of about 2yrs.

In a move that echoes a vital trend towards **startup-corporate collaboration** within the food industry, Sigma Alimentos announced a minority investment into Live Green at the end of the pilot.

The investment serves as a win-win for both businesses: Mexico's Sigma Alimentos will benefit from the ability to clean labels with the AI-powered R&D technology of The Live Green Co., while the Chilean startup will benefit from Sigma's proven product formulation development IP, market intelligence and capacity to scale production across geographic and product lines. Further, the partnership provides Live Green with access to even more data to enhance its algorithms.

Currently, Charaka is in its early stages of development with a database that spans one-twenty-fifth of what's actually possible. Live Green estimates that an investment of \$12-15M and a timespan of 30-36 months is required to complete the development, with additional time & money needed to offer customization of Charaka's recommendations to suit different body types and health conditions. Nonetheless, **Charaka V2** is expected to be made available to 3rd party food companies **by 2022**.

Buy-in from reputed players like Sigma expedites the product development toward an exciting future.



If Food Manufacturers HAVE CHARAKA...



- ✓ They neither need an army of food, biochem and biotech scientists nor expensive R&D labs.
- ✓ They can innovate quickly and freely in response to market trends and competition.
- ✓ They can offer tastier, healthier & more sustainable products, and show their consumers that they genuinely care.
- ✓ They can attract new segments of consumers, like vegans, vegetarians and flexitarians.
- ✓ They can save time & money. Research shows that 15k food products are launched each year at an average time-spend of 2yrs and a failure rate of 90%.





Answering The Sustainability Call

Charaka offers a unique solution at a social and environmental tipping point. The pandemic brings our personal health and that of our planet into the spotlight, with the present moment offering a **unique chance** for humans to start prioritizing both, especially when it comes to food choices. In 2021, after CO2 atmospheric levels last year hit a record high and 1/3rd of consumers started considering themselves **flexitarians**, forward-thinking food companies must lead the movement through a commitment to both healthy and sustainable production. Live Green's Charaka can lead food companies and populations towards this future in a multitude of ways -

Firstly, **clean eating** delivers more nutrition. Foods in their natural state are more flavorful and fill the body with plentiful vitamins and minerals as well as high-quality protein and healthy fats. This improves heart and brain health, assists with weight management, builds a stronger immune system and increases energy levels.

Secondly, the smarter use of **natural plant ingredients** instead of synthetic, highly-processed & animal additives can help achieve mass clean eating, which becomes more & more critical as the world population reaches 10Bn by 2050. As we have seen with Live Green's ice-creams, Charaka makes it possible to swap out synthetic stabilizers, emulsifiers and anti-freezing & anti-caking agents with natural alternatives like banana, avocado, sunflower oil and flaxseeds at scale.

Lastly, the platform also makes possible the identification of more **sustainable** ingredients in terms of their production, processing & packaging.

The ultimate goal of food companies of today should be to offer **360° Green** solutions - product, production & packaging; without compromising on taste or shelf-life. Charaka helps achieve this to disrupt the way the world consumes, and make healthy & sustainable life-style available & affordable to everyone and not just a niche.

Because it is no longer about a few people living green perfectly, but about entire populations doing it even if imperfectly.



**the
LIVE
GREEN
CO.**

www.thelivegreenco.com