

# TRENDS SHAPING THE FUTURE OF FOOD

2024 - STATE OF FOODTECH TRENDS



**DigitalFoodLab**  
BE PART OF THE FUTURE





# Contents

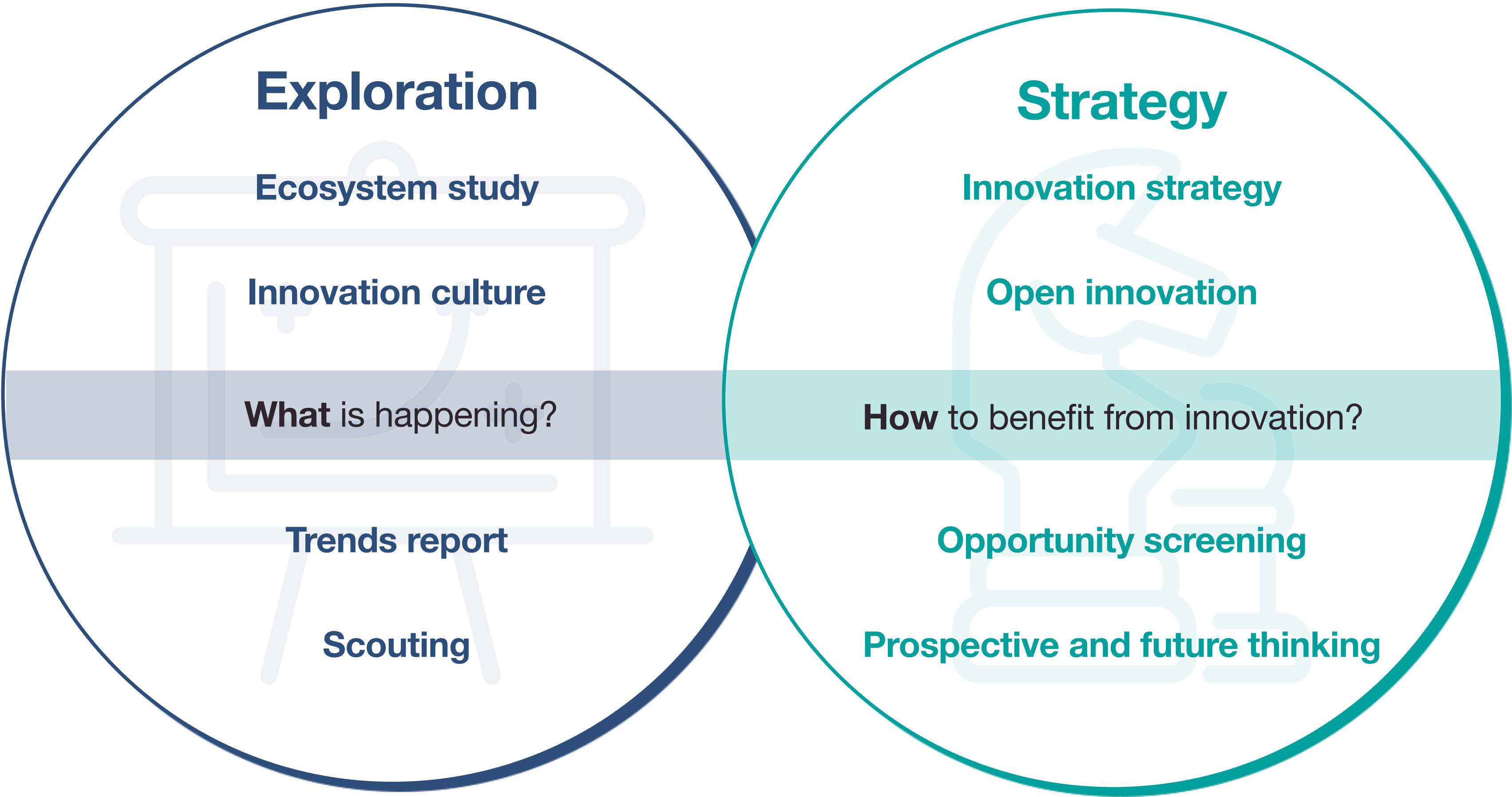
About DigitalFoodLab .....	3
Introduction .....	4
I - What is the future of food about?.....	9
II - The resilient farm.....	16
III - Alternative proteins.....	27
IV - Instant retail.....	36
V - Food as medicine.....	44
VI - Food automation.....	52
VII - The smart supply chain.....	59





# DigitalFoodLab

Our mission is to help our clients to be part of the future of food



50+ clients



A collection of logos for various clients, including Cargill, Nestlé, Danone, bel, Limagrain, MSCI, METRO, Coca-Cola, Crédit Mutuel Equity, Food & Bio Cluster Denmark, and Carrefour.

Some of our territories: alternative proteins, functional ingredients, agtech, decarbonisation, new brands, digital retail/restaurant, healthy ageing.



# Hello,

Welcome to the  
future of food!

First of all, we thank you for reading this report. This is the fourth edition of our report on trends shaping the future of food. Each year, we gather all our knowledge on innovation all along the food value chain, from seeds to food products to grocery stores to health.

Innovation is coming from researchers and large corporations and, above all, from startups. Indeed, the entrepreneurial mindset is more agile and enables more risky ventures. While food was long discarded as not disruptive enough for investments, things have changed, and now startups are getting heavily funded to reinvent the way we grow food, shop and cook it.

From our analysis, we have identified **28 FoodTech trends and grouped them into six megatrends** shaping the future of food: the resilient farm, sustainable proteins, food as medicine, the smart supply chain, instant retail, and food automation.

This year, in addition to reviewing the trends, we added a larger introduction to the factors driving this revolution towards a third stage of food (after a long period of scarcity and a more recent period of abundance), which we call **Digital Food**. If you have any questions on the contents or on how you and your company could move toward the future of food, please [contact us](#)!





## What is the future of food?



DigitalFoodLab

BE PART OF THE FUTURE



# Three drivers combined with new technologies are creating the conditions for a food revolution

## CLIMATE

The direct relationship between food and climate change requires radical behaviour modifications

# 26%

of global emissions linked to agriculture & food

## POPULATION

Declining in developed economies

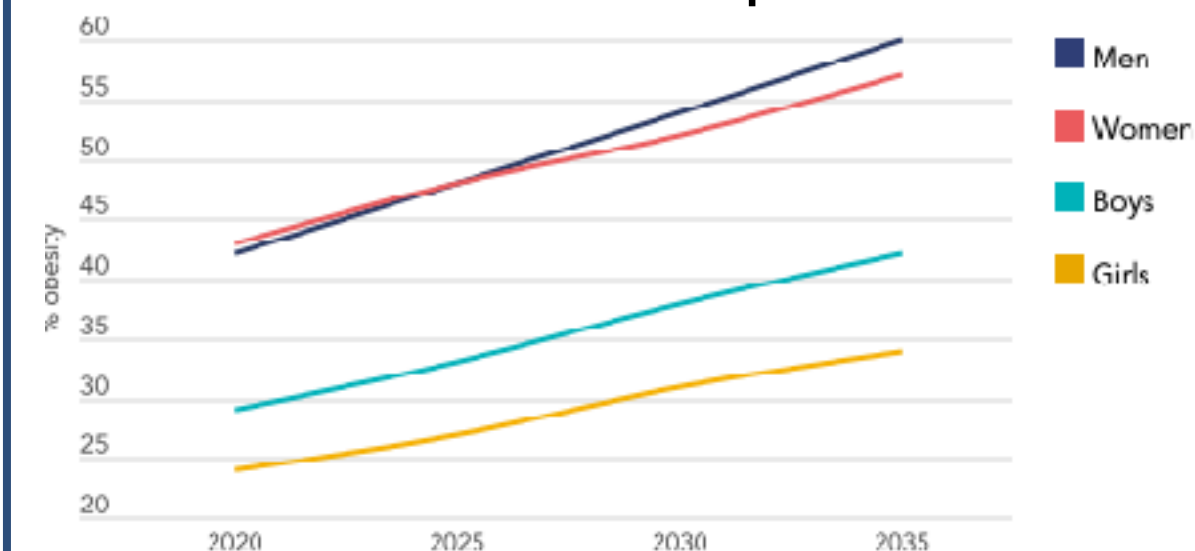
=> need for automation

Increasing in parts of the world

=> new opportunities

## HEALTH

Food products must become healthier and more personalised



Obesity and other food-related conditions are skyrocketing

## NEW TECHNOLOGIES

(synthetic biology, genetics, AI, robotics...)

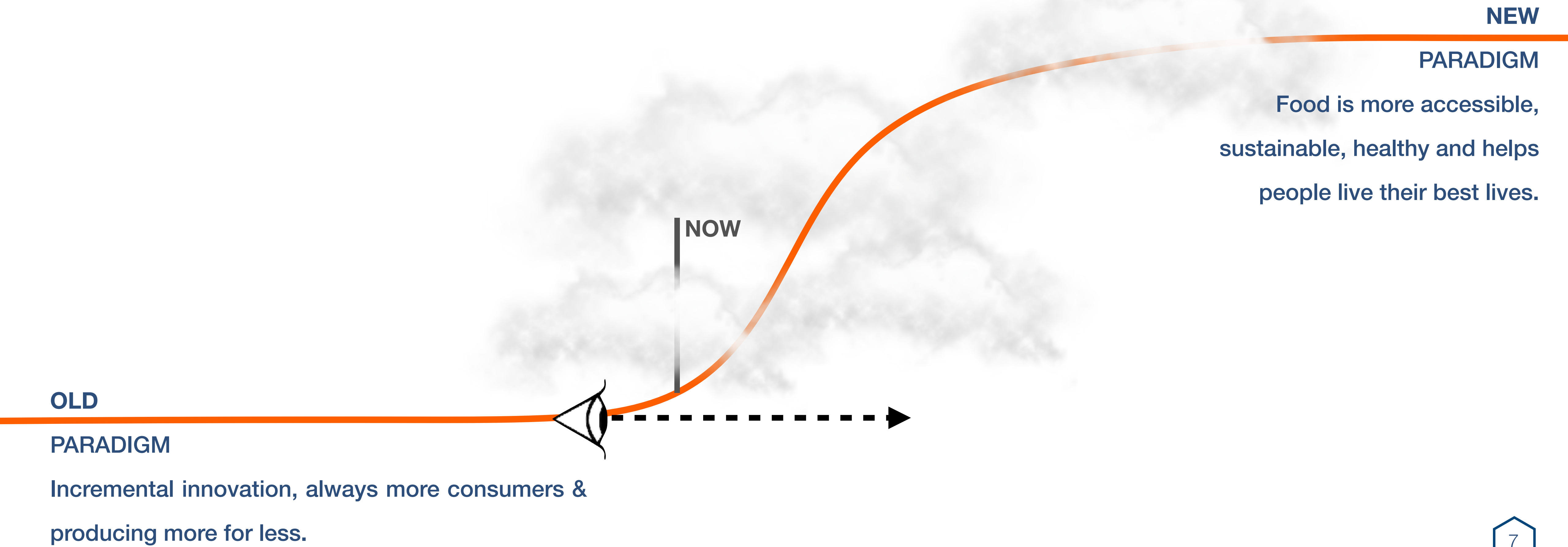
## NEW FOOD ERA: DIGITAL FOOD

Startups are driving this change; established food companies must consider what their place will be in the future of food.



# When will it happen?

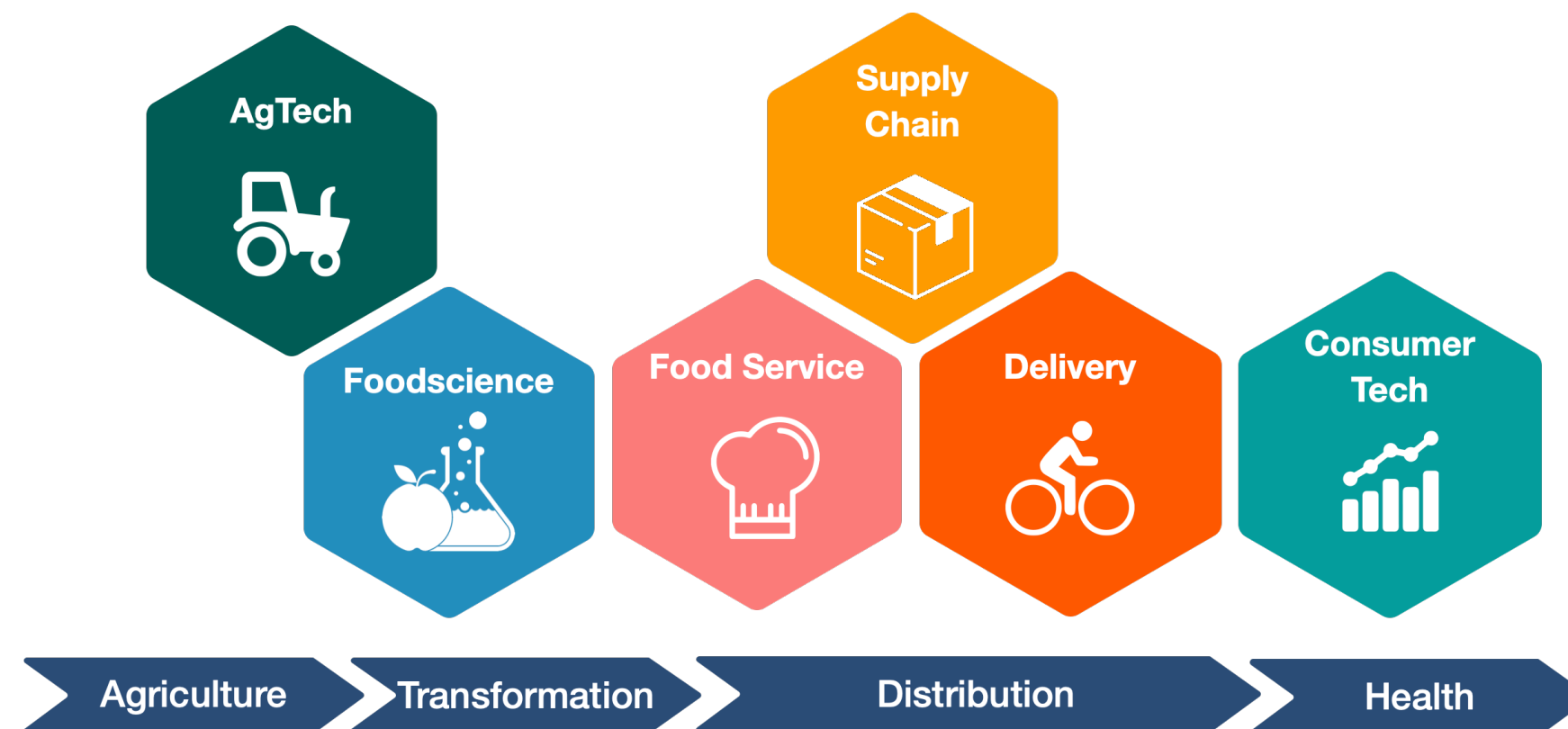
This revolution will see the transition from our current paradigm to a new one where food is more accessible, healthier, and sustainable. We are at the start of this radical shift. And, as often, most players see the future as an extension of the past. With this report, we aim to show you trends that will be key in shaping the future of food!





# FoodTech is the future of food

Like many other industries, agriculture, food and retail companies have externalised long-term innovation to research centres. These are good at delivering relevant research results but not transforming them into new products. Startups, however, using this research, are leading the food revolution. **That's why, in a word, foodtech is the future of food!**

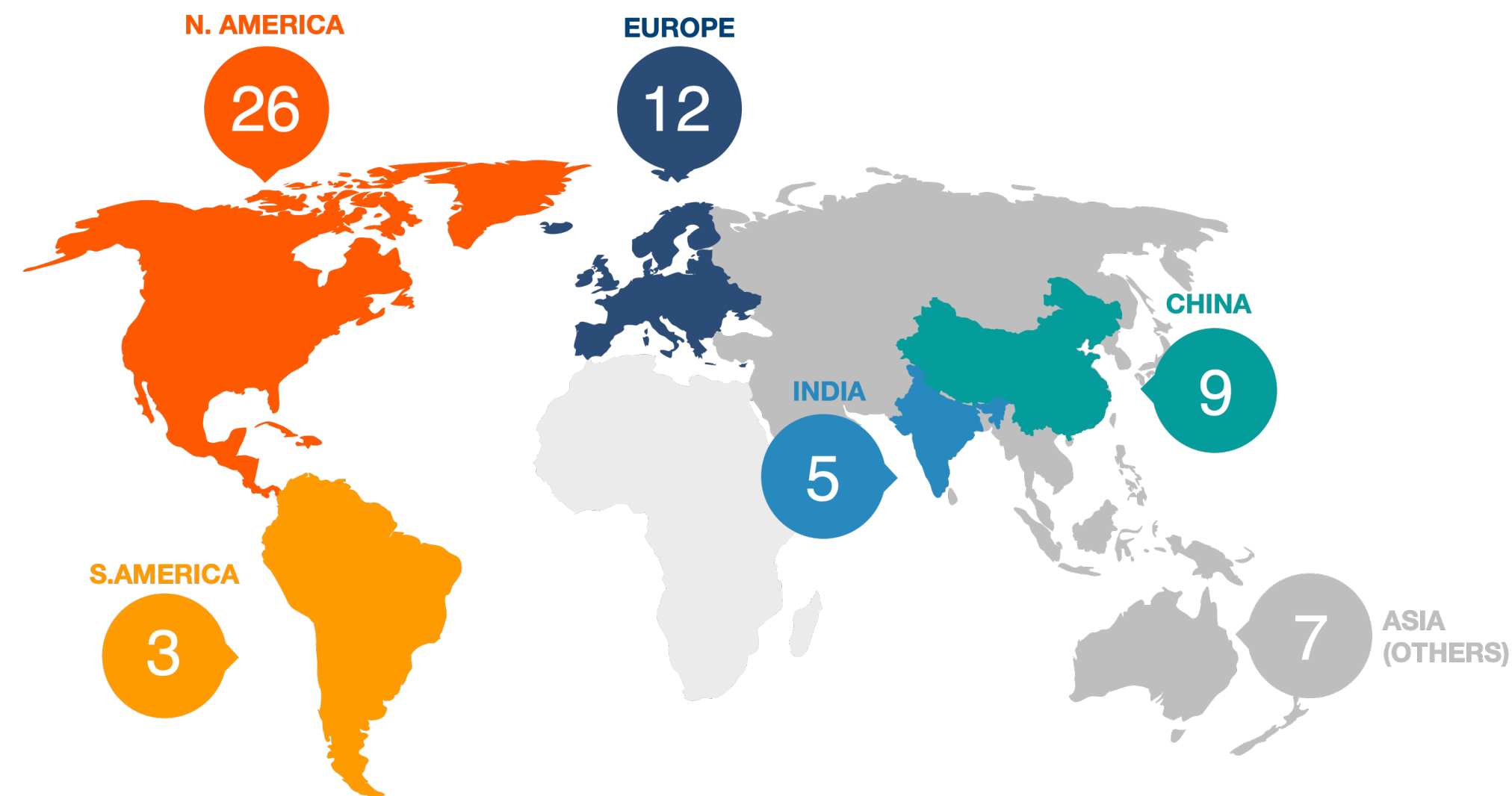


Startups alone won't have sufficient leverage (and capital) to change the whole food supply chain. While some of this revolution will be led by startups, **for the main part, it will be incumbent leaders, through partnerships, investments and acquisitions, that will manage this transition.** The food revolution is already underway; the clock is ticking for those with no plans for the long term.



# A global movement that can have a huge impact

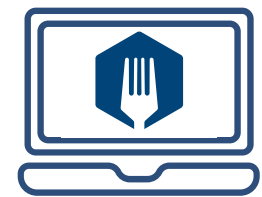
Investments in FoodTech are massive. Even if they declined in 2022, they are still higher than the sum of R&D investments by the leading food corporations. This money is getting increasingly well-distributed globally with strong ecosystems in the Americas, Europe, the Middle East and Asia. Finally, FoodTech is not only about food; it is about solving far-reaching challenges related to sustainability.



Distribution of the 62 FoodTech unicorns



9 of the 17 UN sustainability goals are directly related to the agrifood system



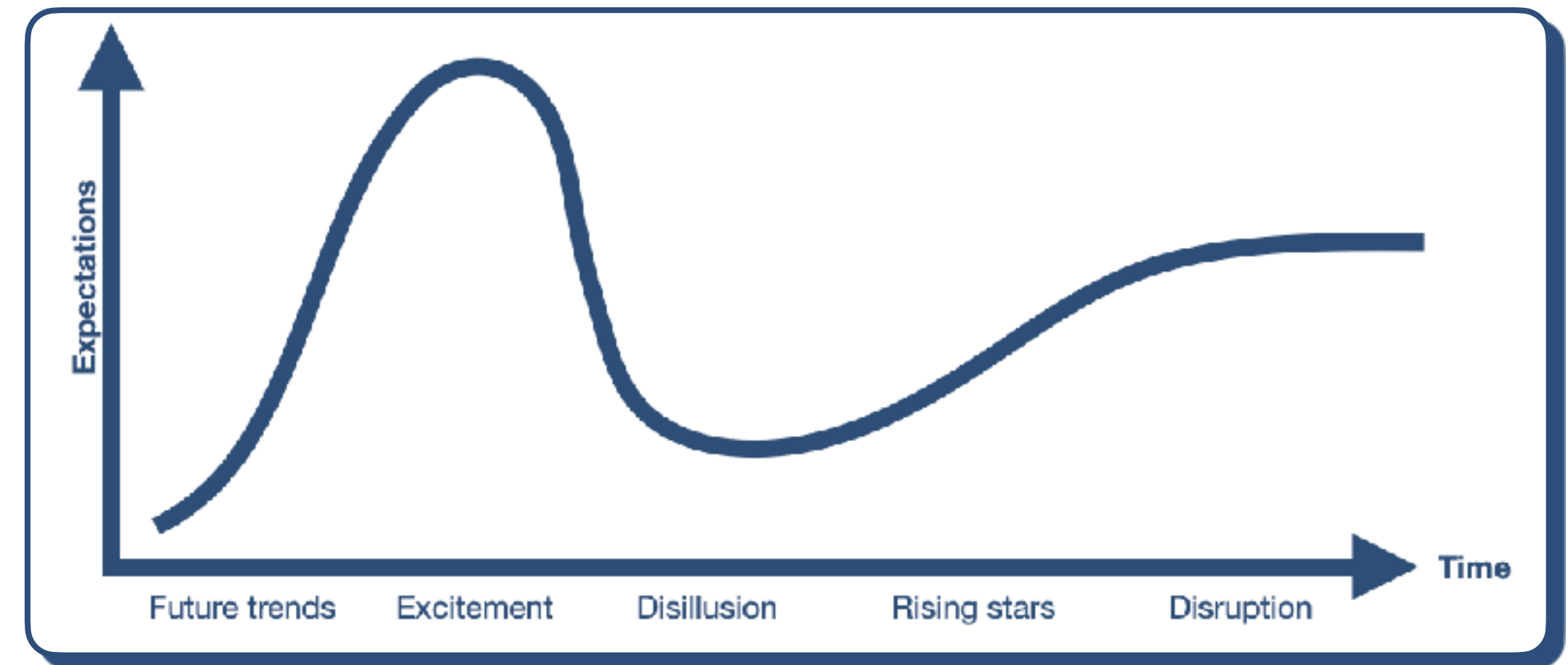
Download the latest report on FoodTech unicorns DigitalFoodLab’s website



# Measuring trends over time & expectations

We have updated our mapping of the most relevant FoodTech trends using the following innovation curve:

- 1 - A new technology appears, starts getting some attention, and eventually becomes a « trend » (a combination of an ecosystem of startups, a set of technologies or new business models, and B2B or B2C needs).
- 2 - At some point, the technology starts to work, and some initial results catch the attention of the public (investors, corporations, consumers...) and create a peak of excitement
- 3 - The initial excitement fades as either the technologies or business models appear to work at scale.
- 4 - Some trends re-emerge as legacy or new ventures find a way to address these challenges.
- 5 - We enter the final stage, where the trend is now becoming something obvious and seen by every observer.

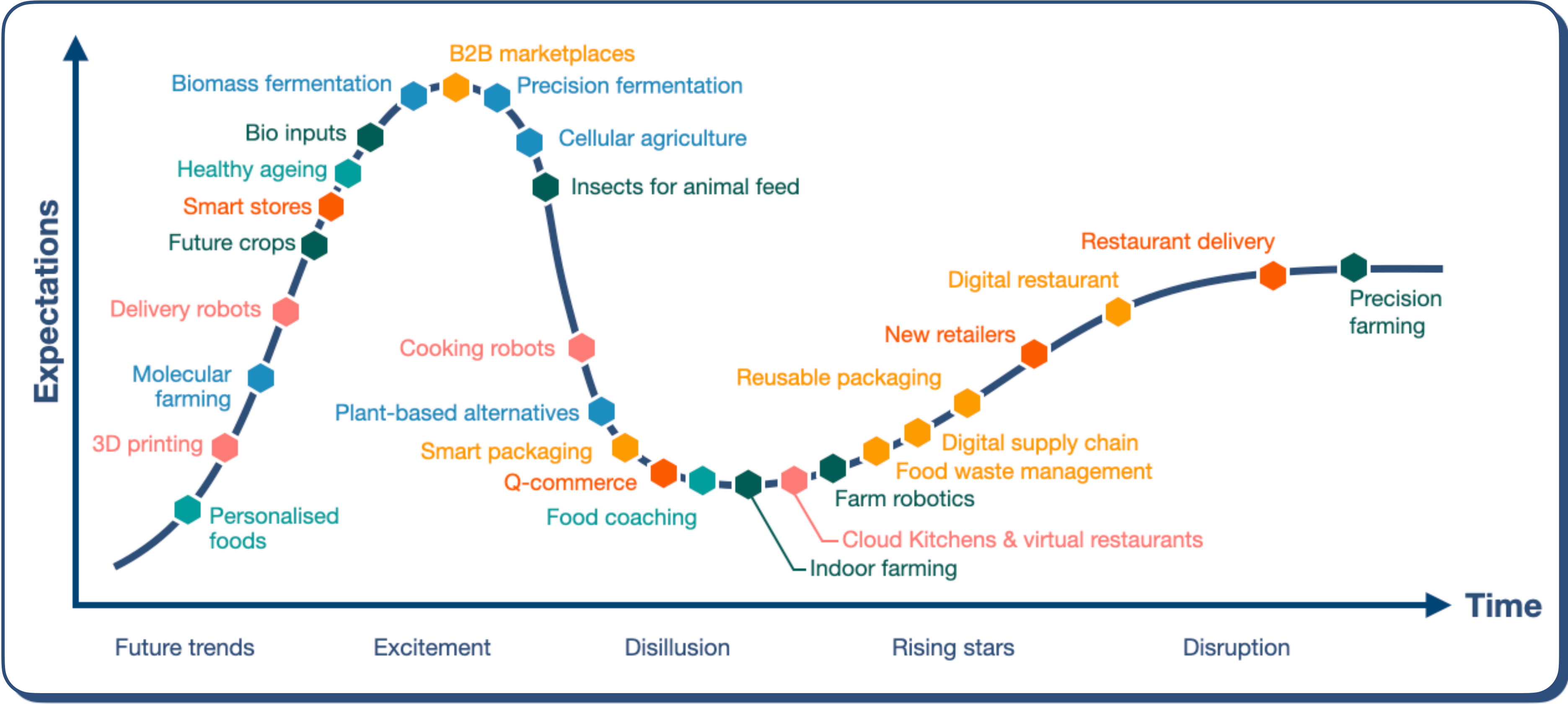


To position trends, we use our knowledge and discussions with entrepreneurs, investors, and large companies. We combine this « soft » information with « hard » data such as investments, the number of startups...

The speed at which a trend evolves through the curve can vary widely. Some may spend years blocked at the same spot as if waiting for something to happen, while others can jump from one spot to the other in a few months. It is then important to understand that the **position on the curve is not predictive of the speed of evolution.**



# Six megatrends shaping the future of food



- Resilient farm
- Instant retail
- Food Automation
- Sustainable proteins
- Food as medicine
- Smart supply chain

We have identified 28 trends, grouped in 6 megatrends, which collectively shape the future of food.



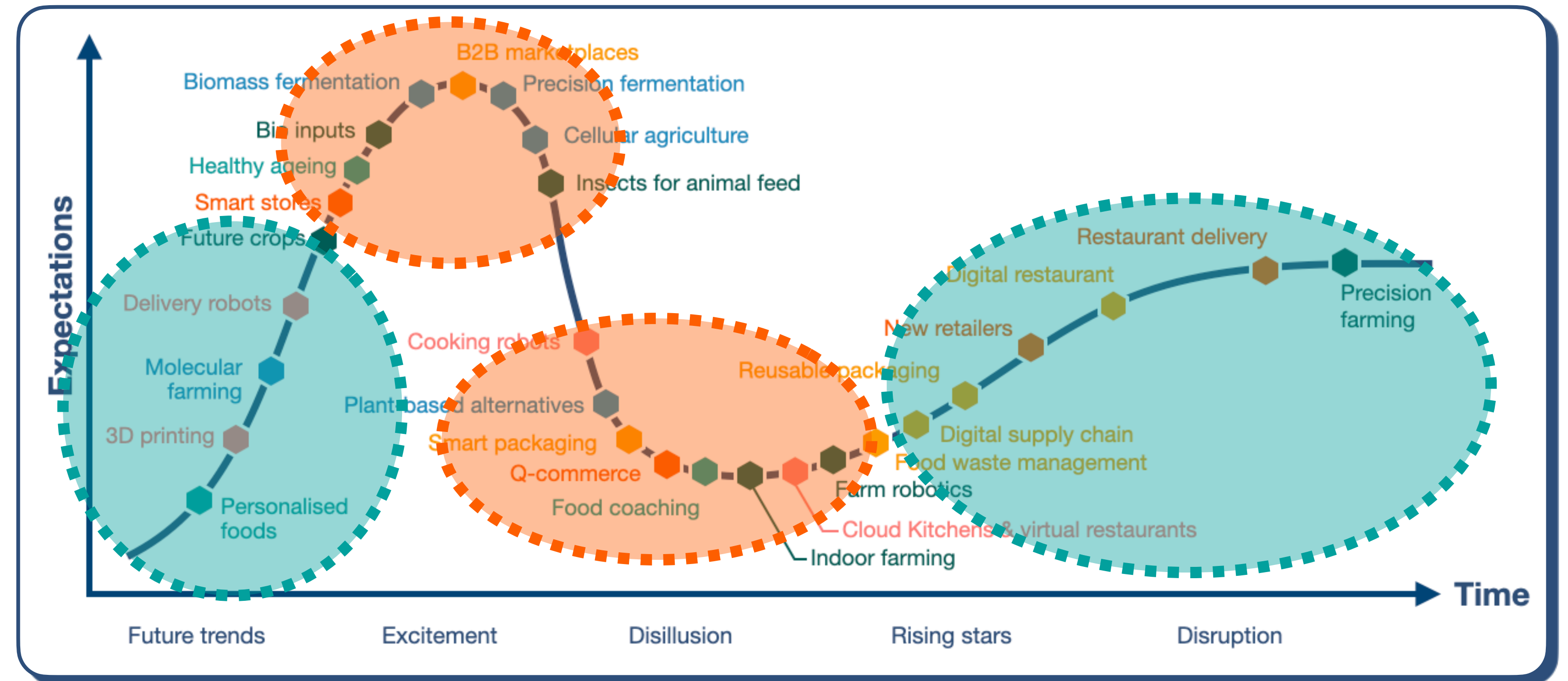
# Complicated and exciting times

## An uncommonly large number of trends in the disillusion stage

Interestingly, we now have many trends that are reaching the productivity/disruption stage. This means that we expect their adoption to progress further.

However, we have an unseemly combination of:

- Numerous trends in the disillusion phase, with some of these ecosystems in dire need of reinvention
- Many trends in the excitement phase pave the way for more disillusion.

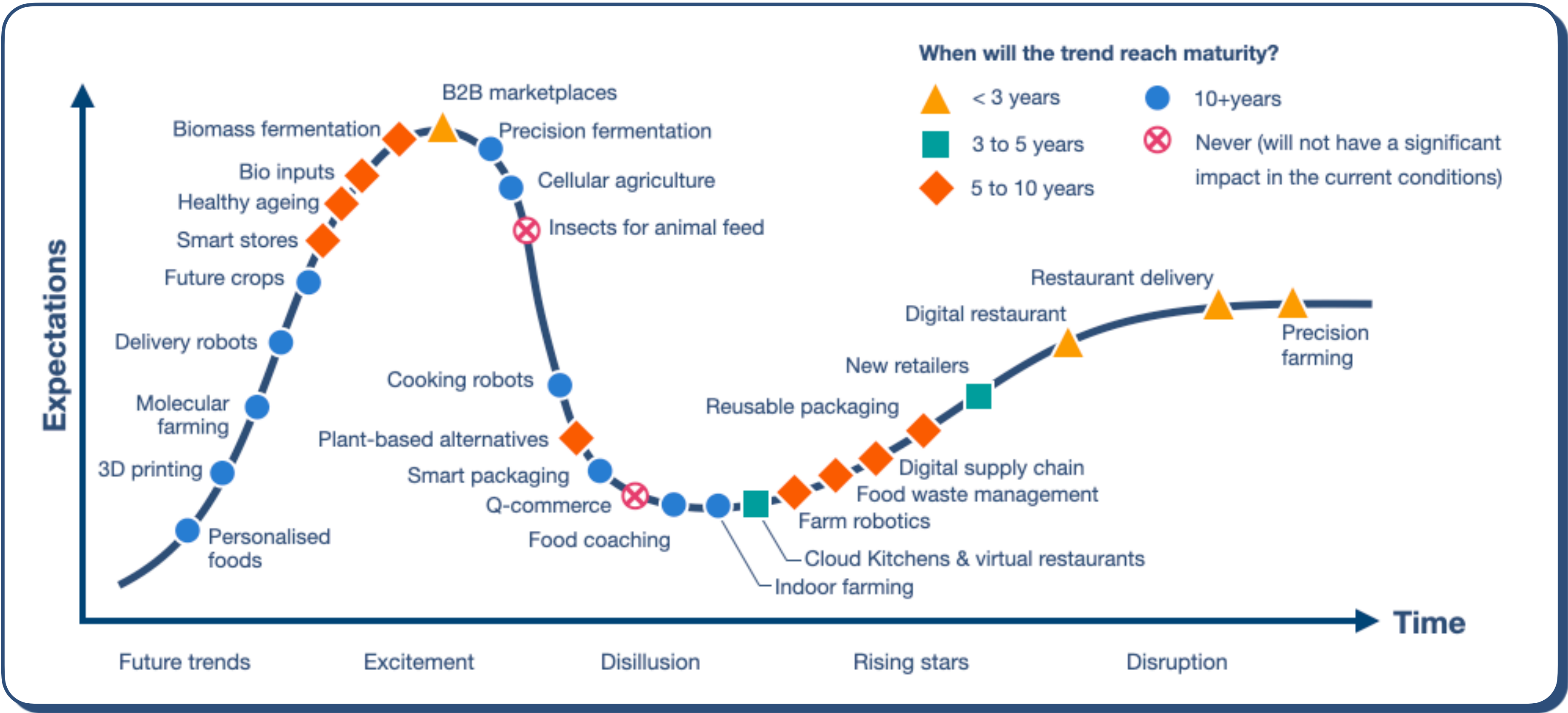


**Looking at this graph, we can only have the impression that the next year will be somewhat complicated for the overall FoodTech ecosystem,** except for a few topics that will either jump from excitement to productivity (unlikely) or see a fast adoption rate (primarily those in the disruption stage).



# And now, when do I see it on my table?

Based on the experience of past trends, notably in other areas, we have added an estimation of the time it will take for the trend to reach maturity.



These estimations should be understood as an **average** between the **minimum** and the **maximum** time for a trend to reach maturity.

By maturity, we mean that 20 to 30% of the market has adopted the trend.

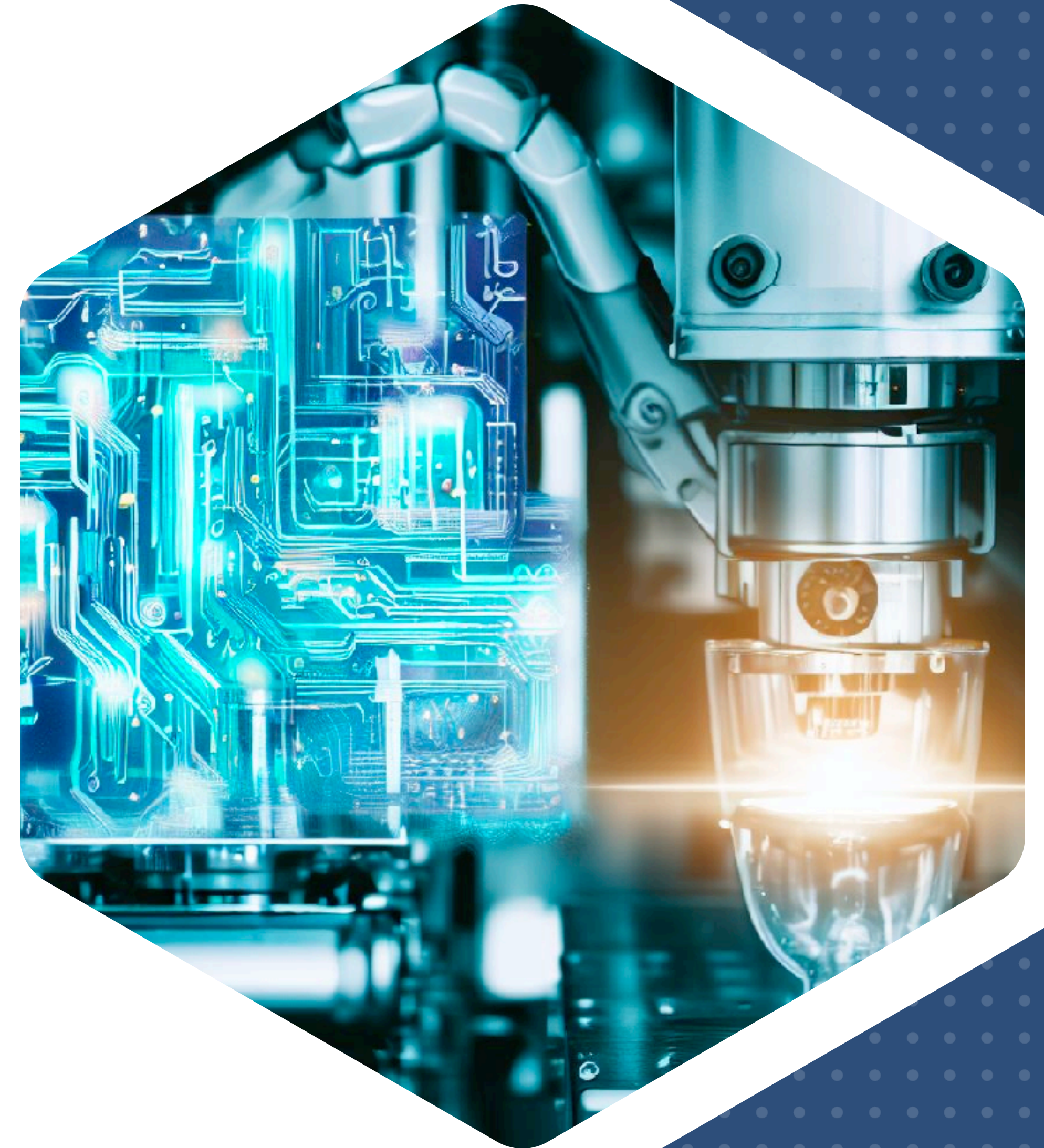
By « never », we mean that the trend will not be able to scale or will have to be reinvented as something different due to technical or market failures.



# Where is artificial intelligence?

Some highly commented topics, technologies, or categories are absent from the hype curve. Here are two examples:

- **Artificial Intelligence (AI):** while very commented, we see artificial intelligence and generative AI as tools to be used in different trends. They can be used in many instances, such as making smarter decisions along the supply chain to fight food waste or to make alternative protein processes progress faster. This may change if we see a trend where a group of companies use AI in a way that is distinctive from other identified trends.
- **Direct-to-consumer (DTC) brands:** consumer products created by startups are essential to the innovation ecosystem. However, the tools entrepreneurs use to reach the market are now very mature. In a word, while still very exciting, it is a « mature trend » that can now be analysed in terms of « consumer trends » (with the rise of new beverages, pet supplements...) that have not their place on the curve discussed in this document.





# Use case #1: Ecosystem study

**Mission for a global F&B company looking to understand the alternative protein ecosystem and how it could benefit from it.**

## **What we did:**

- Mapping of the different categories of the alternative protein ecosystem from the point of view of the client (its product categories).
- Recommendation (and workshop) to validate the core opportunities and threats
- Deep dives into those categories with a mapping of key startups, the state of research and other food companies' actions in this space.
- Recommendation of a path to action based on the identified trends.
- Set of workshops to spread the knowledge across the company.

## **Results:**

- Shared understanding of the opportunities and threats created by the ecosystem.
- Bespoke report, which has become the cornerstone of the client's understanding of the ecosystem.







## Megatrend #1: The resilient farm



DigitalFoodLab

BE PART OF THE FUTURE



# The resilient farm

## What are we talking about?

It has always been DigitalFoodLab's conviction that AgTech is a critical component of the FoodTech ecosystem, not a separate one. While upstream and downstream players are still very separated and often work in silos, disruptive innovation creates a growing convergence and integration in the farm-to-fork value chain.

Multiple trends drive us toward a more sustainable and resilient farm: the growing appetite for locally grown foods, fewer farmers and workers, energy costs, climate change concerns, notably regarding arable land, and the convergence of technology and farming.

### **This trend is going in two very different directions:**

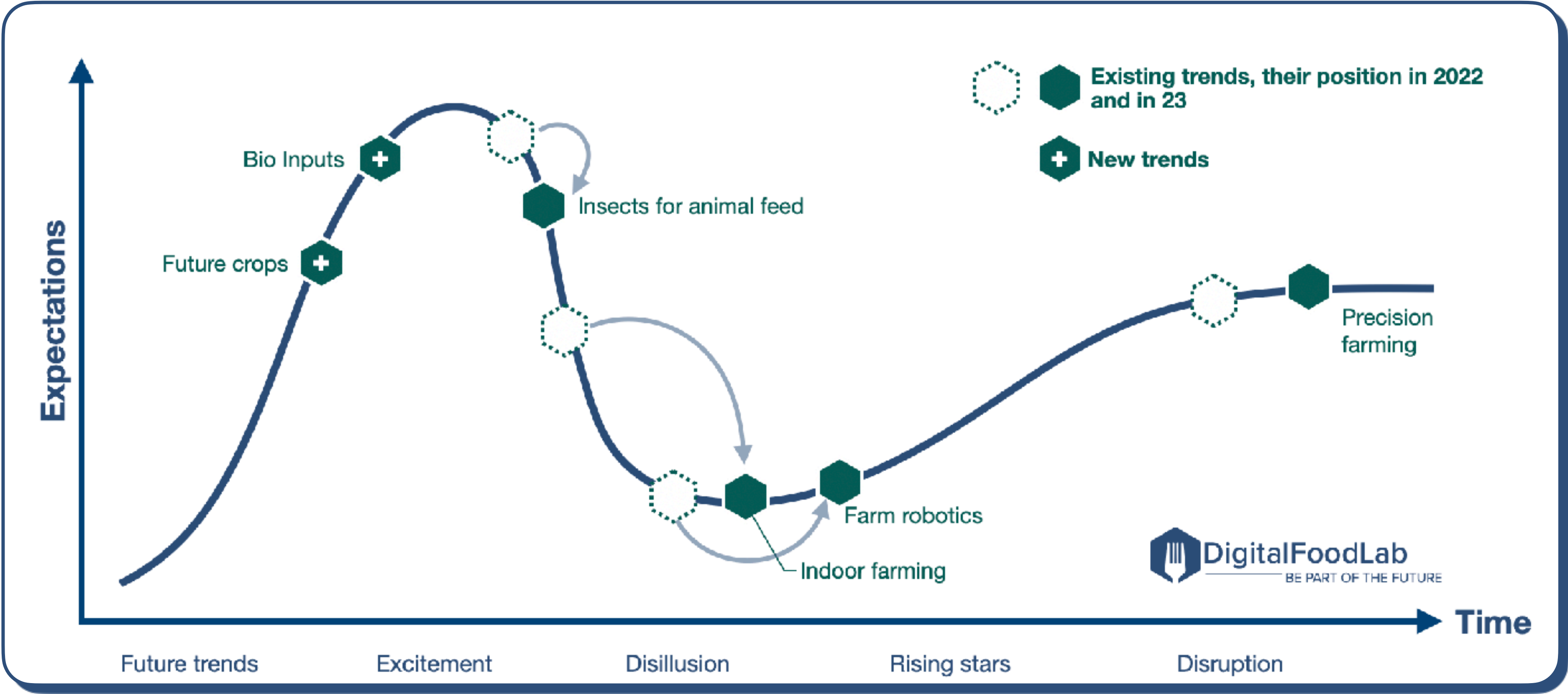
- ⦿ The first is augmenting and making the current farm more intelligent and automated.
- ⦿ The second is the space comprising urban, indoor, and next-generation farms. Let's say that after years of preference for the latter, the former is retaking the lead in terms of hype, investments and acquisitions.





# Six food trends shaping the future of farming

We have identified six trends on this curve that threaten the status quo of how farming is done today. Compared to last year, we have two new trends. The main « jump forward » is for indoor farming, which moved from excitement to disillusionment due to the current energy crisis.





# Precision farming

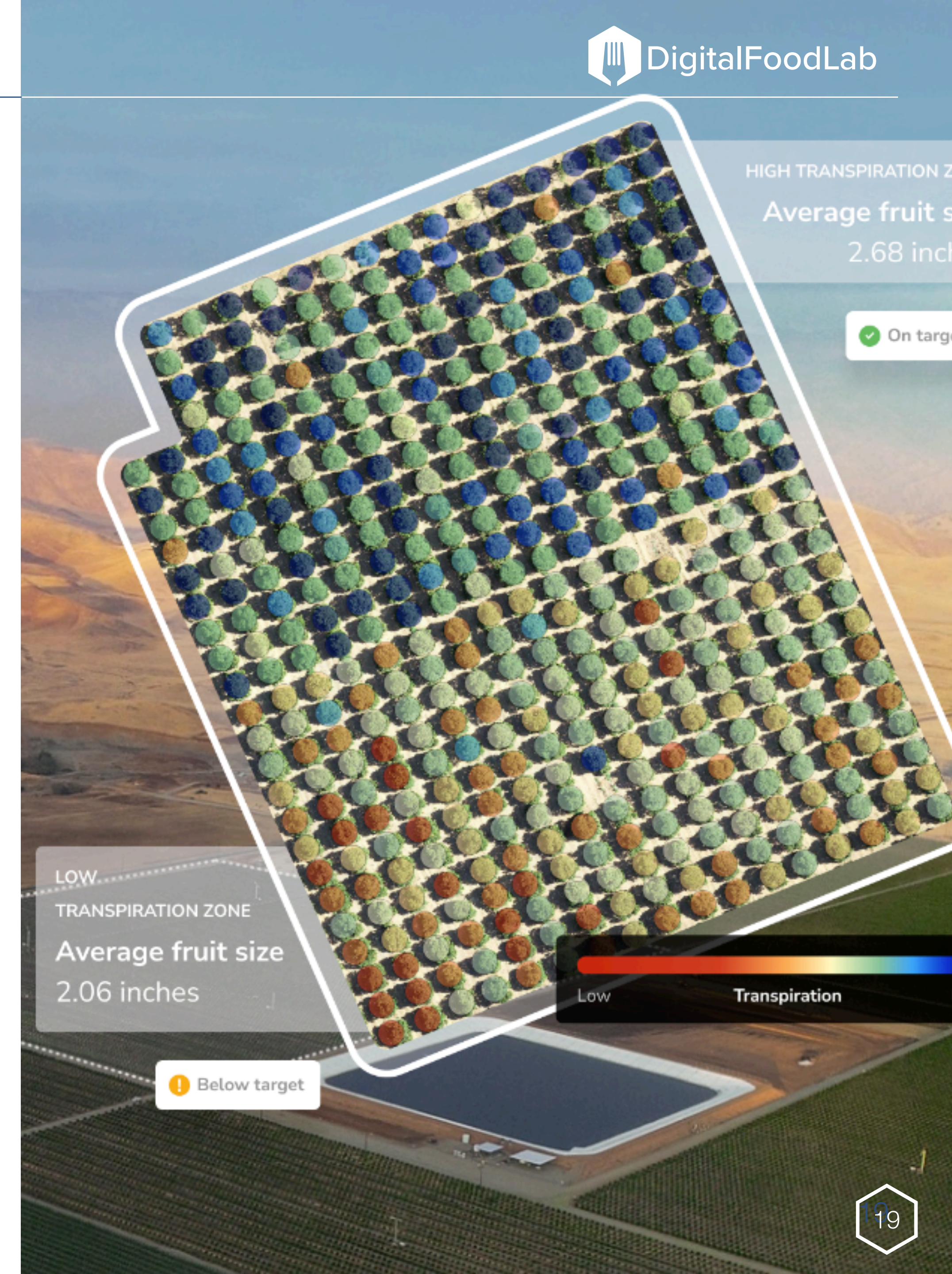
## An already well-established ecosystem

Precision farming is a farming management concept based on measuring and analysing data from the field. It aims to **increase food production by improving in-farm decision-making, product traceability and quality.**

### A MATURE AND LESS DISRUPTIVE SECTOR

This is one of the oldest and most mature Ag/FoodTech ecosystems, with many of the most well-established and profitable companies. Among them, we can mention Gro Intelligence (USA), Aerobotics (South Africa - *picture opposite*) or ENKO (USA).

The precision farming ecosystem has yet to reach maturity. One key challenge remains: making its software and tools more broadly available. For that, we can bet on both the adoption of artificial intelligence and large software giants (Google, SAP, and Microsoft), which are all launching their own ventures into this space.





# Farm robotics

## The first step toward the autonomous farm

Farm robotics is out of the disillusionment stage.

After some complicated years, many new companies are emerging in this category while investments are rising.

x2

The number of field robots in operation doubled between 2020 and 2021.

Robots developed by startups are full of artificial intelligence and machine learning vision systems, unlike the classic “automatic devices” used in farms to perform repetitive tasks.

The sector's growth is linked to the two drivers of this megatrend: the need for more autonomous farms (a reduced pool of skilled workers) and sustainability (reducing the amounts of inputs).



Vitibot (FR, a leader in the market of vineyard care robotics - see *opposite*) was acquired by the Italian manufacturer SAME Deutz-Fahr.



# Indoor farming

## Going back to a harsh reality

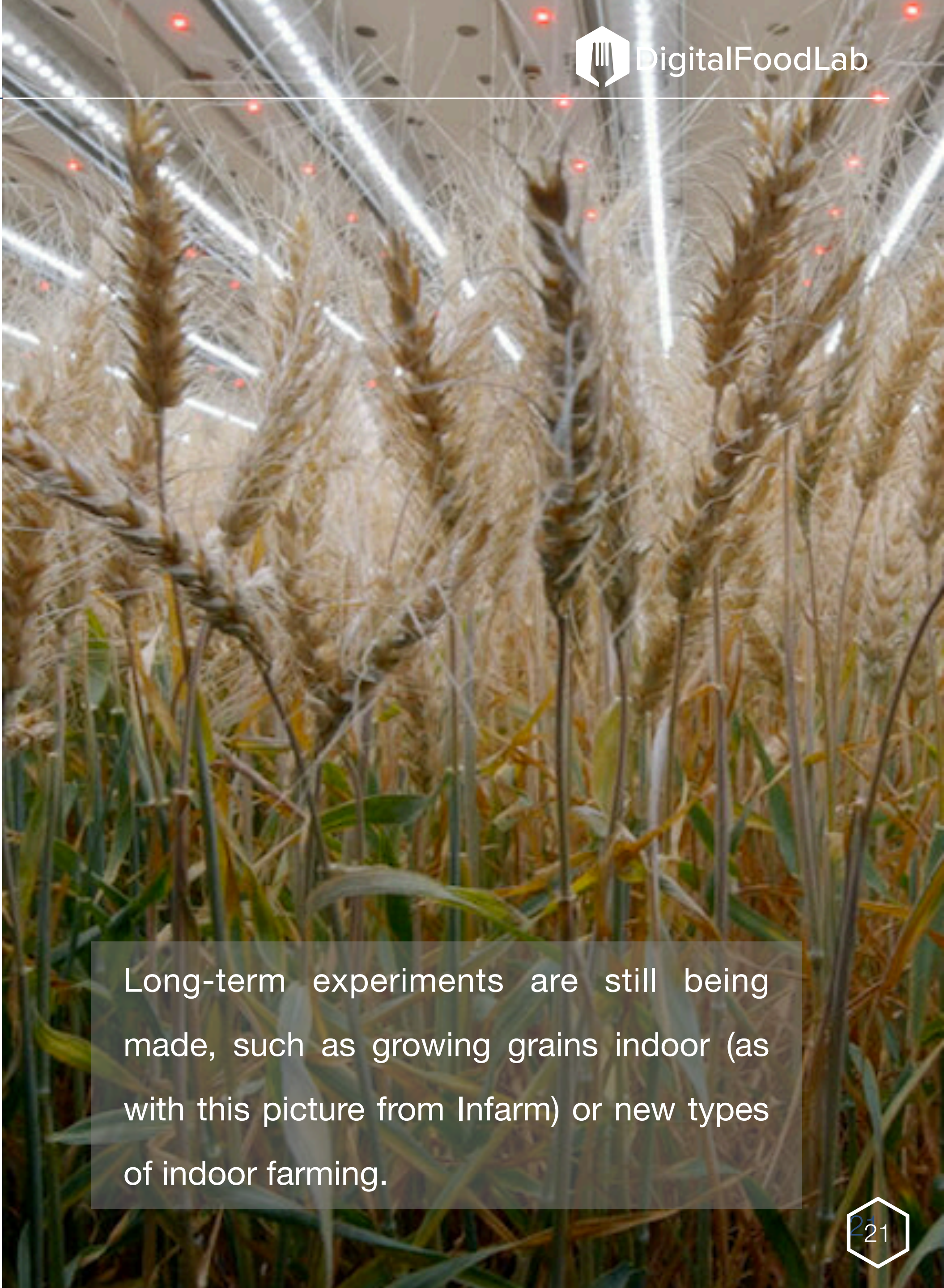
We are talking about **startups developing urban and indoor farms** (Plenty, Infarm, Intelligent Growth Solutions) to reduce the distance between production and consumption and increase yields, quality and sustainability.

### FACING DISILLUSION

**After a couple of years of impressive growth** (notably in terms of investments and new facilities being built), **this space is facing a reckoning**. The current **energy crisis** is making some projects' path to profitability very unlikely. Many startups are either scaling down or simply shutting down all their operations.

### SOLUTIONS FOR THE FUTURE

However, **this is not the end for indoor and urban farming**. Indoor farms are an answer to the challenges created by climate change. We expect a « rebirth » of the ecosystem around new business models or startups being more tech companies than farm operators.

A photograph showing rows of golden-brown grain stalks growing in an indoor facility. The plants are illuminated by bright, white, diagonal light strips, and small red lights are visible in the background.

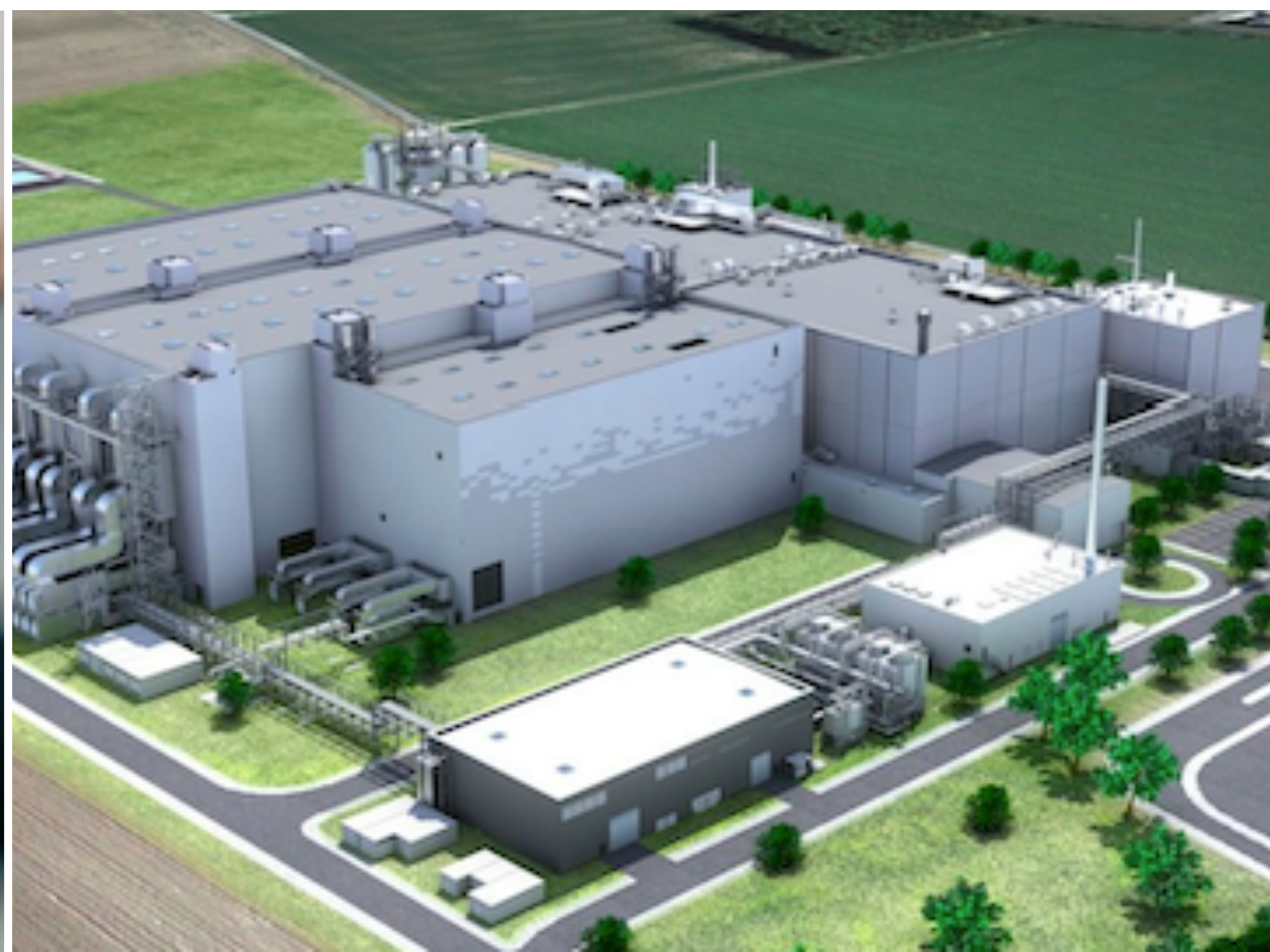
Long-term experiments are still being made, such as growing grains indoor (as with this picture from Infarm) or new types of indoor farming.



# Insects for animal feed

## Desilusion?

Almost a decade old, the ecosystem of startups growing insects has evolved from its initial focus on human nutrition to animal feed. It has also moved from experimentation to mass production, supported by very significant investments (more than 500M€ for Ynsect, FR) to develop industrial facilities. There is a growing disillusion as these factories appear to be more complicated to operate than anticipated. Additionally, costs are not decreasing as expected (due in part to the energy crisis). In a word, this ecosystem is less compelling for new investors. **We expect a consolidation**, where startups will be sorted on the type of insect they initially chose. **We have growing concerns about the ability of this ecosystem to deliver on its promise and to reach maturity** (beyond some exceptions).





# Bio inputs

## The rising ecosystem

**Companies in this field aim to develop a new generation of fertilisers that are organic and more efficient** (last longer and improve soil fertilisation over time...).

The subject of bio inputs is approached in two ways by startups. First, by working on fertilisers themselves, by offering biological alternatives to synthetic mineral fertilisers (Micropep). Others are looking for solutions to reduce the use of fertilisers, particularly by improving seeds to reduce their input dependency.

### MANAGING EXPECTATIONS: WHEN CAN IT MOVE FROM PROOFS-OF-CONCEPT TO MASS-MARKET?

The current energy crisis and the resulting rising costs of fertilisers are boosting the sector. But despite this current spotlight, these solutions represent only a tiny part of the global fertiliser market, and companies are still mainly in the R&D phase.





# Future crops

## Create the crops that will feed 10 billion humans

“Future crops” startups are seeking to improve the quality of seeds.

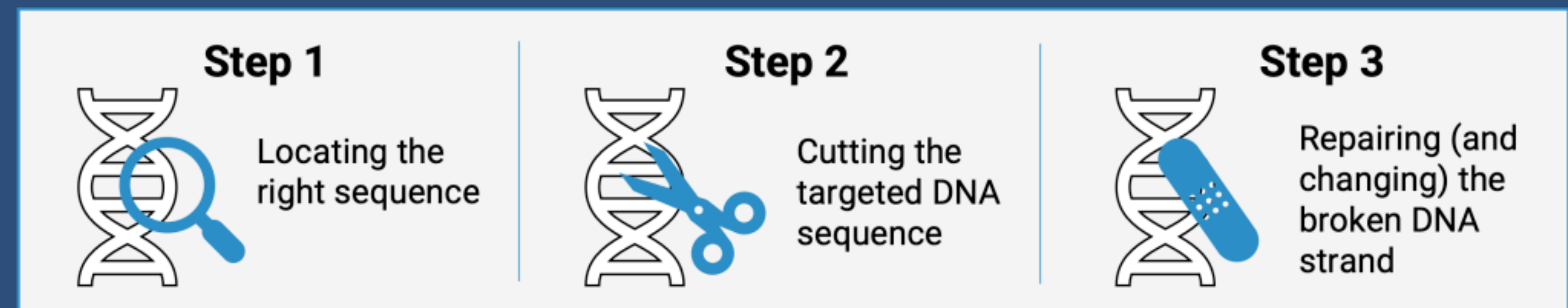
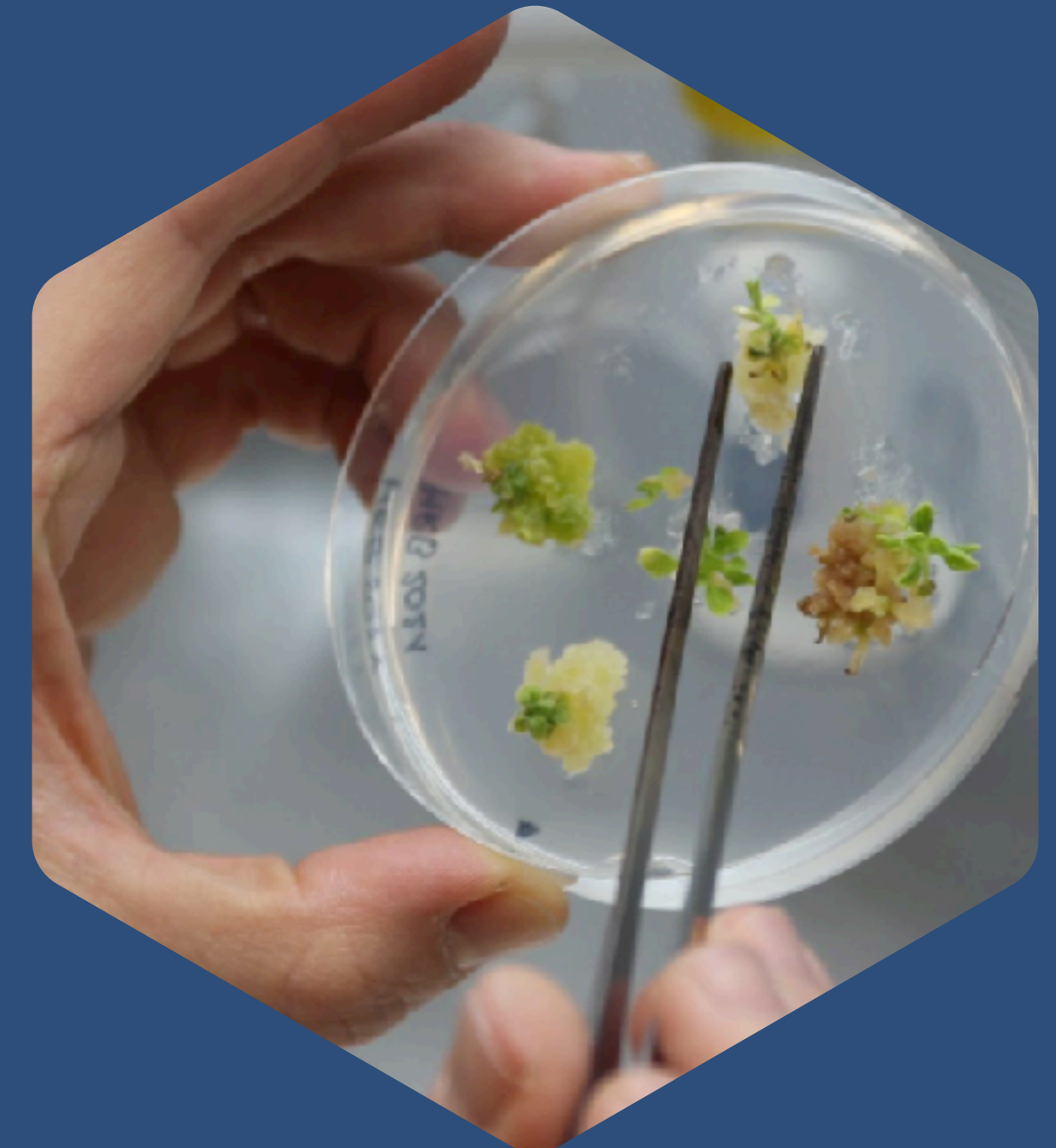
The goals are multiple: resistance to diseases, increase in yields, control of flowering, improvement of nutritional qualities, increase in life after harvest, etc.

# \$75M

Invested into Tropic Biosciences, a UK-based company using CRISPR to increase tropical crop resistance.

Startups use several technologies:

- **Genetic hybridisation** (genetic crossing)
- **Gene editing**, with CRISPR-Cas9 technology: this tool is increasingly used in the ecosystem (Better Seeds, Israel). It makes it possible to modify the genetic code of seeds to modify the desired characteristics (*see below*).



CRISPR-Cas9 process



# Use case #2: Innovation strategy

**Mission for a global CPG food company to set up a long-term strategy regarding innovation.**

## **What we did:**

- Education of the board through a couple of workshops to define the perimeter
- Identification of key opportunities and threats created by long-term evolutions (technologies, business models, behavioural changes).
- Deep dives on each of the priority categories.
- Co-construction of a vision on how the company should address these challenges.
- Identification of partners (startups, incubators, funds) to move forward.

## **Results:**

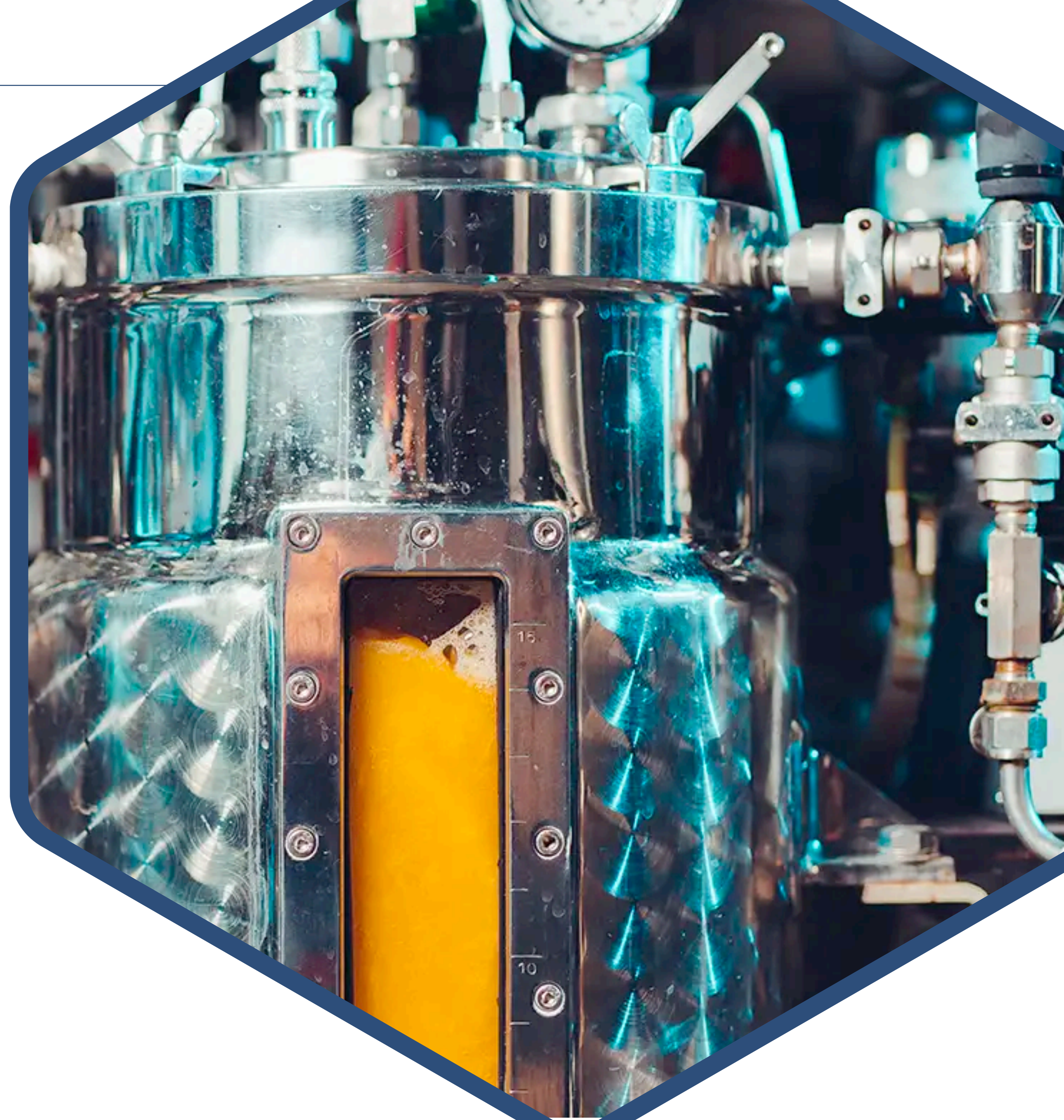
- Creation of a consensus across the client board and executives on innovation priorities and how to address them.
- Implementation of the recommended actions







## Megatrend #2: Sustainable proteins



DigitalFoodLab

BE PART OF THE FUTURE



# Sustainable proteins

## What are we talking about?

Alternative proteins attract thousands of entrepreneurs and billions of euros in investments while being a source of intense debate. As individuals, acting on what we eat is one of the most obvious ways to reduce our impact on climate. Indeed, animal proteins are directly linked to **up to 18% of global greenhouse emissions**.

We can identify at least five different technological approaches to alternative proteins. Companies using them have a few things in common, as they are:

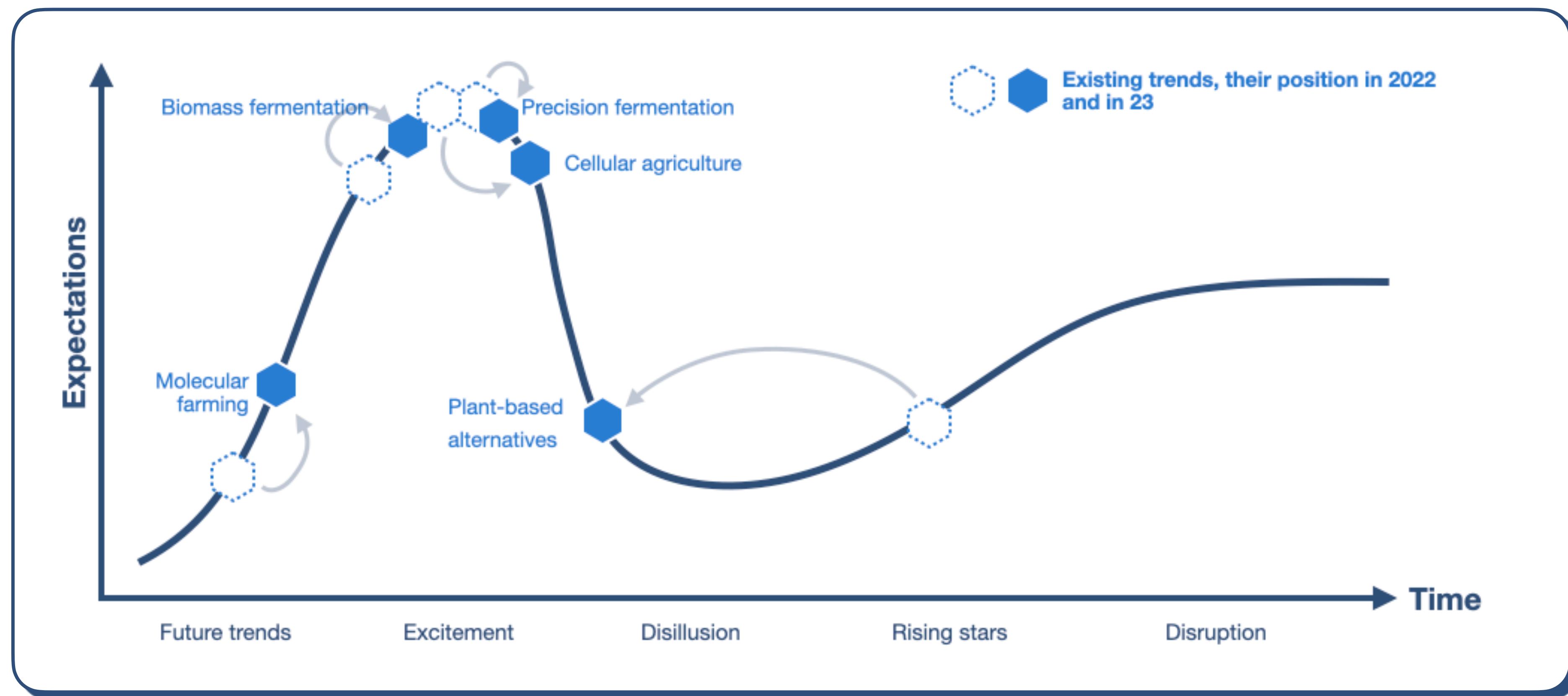
- Mostly trying to replicate animal products that we know and love, from meat to dairy. This is seen as the best way to help consumers « transition » from meat to alternatives and become real flexitarians.
- Marketing themselves as healthier, better for the planet and animal-friendly alternatives beyond simple « substitutes ».





# Many technologies compete to replace meat, dairy, and more

At least five technologies compete to replace meat and dairy products as we know them. Compared to 2022, we removed insects for humans as it « vanished » after reaching the « disillusionment » stage (most startups disappeared).





# Scale & acceptability

## The two challenges for all protein alternatives

Beyond plant-based (see later), other technologies are moving forward, even if only slightly. All now share these two challenges:

- 1 - **scale** (producing larger quantities as cheaply as possible)
- 2 - **acceptance** (both by regulators and by consumers)

The years ahead will prove decisive on these two fronts, as most leaders are waiting for their pilot or commercial facilities to be completed and are also expecting new regulatory approvals in key regions.

Then, one question will remain: how to finance and structure the industrialisation of alternative proteins? Indeed, tens of billions will be needed in the next decade if we want alternative proteins to have any impact on the trajectory of climate change (only to build facilities and the bioreactors inside them). One answer could be distributed production (bioreactors in the cloud as an analogy to the cloud computing industry).





# Plant-based: collective illusion

## We are only at the beginning of the story

As you can see on the trends graph, we moved plant-based backwards. In the five years we have been updating this graph, this is our first time doing that.

**We wrongly and collectively believed that plant-based products and alternative proteins, as a whole, were ready for mass adoption.**

Many challenges remain, from taste to price. Then, consumers are not that ready to change their behaviours, notably as they are concerned that highly processed products could damage their health (the reason they bought them in the first place).

But answers are being developed, notably by startups to face all of these challenges:

- Many new facilities are currently being built to increase capabilities and lower costs
- In order to have cleaner labels, new formulations and ingredients are being developed, notably with artificial intelligence
- Established companies and startups are now grouping their efforts to communicate better to decision-makers and the public.

**We are confident in the future of this ecosystem, even the consolidation between brands without relevant value propositions well keep going on.**



## Italy Makes Moves To Crack Down On Plant

Attempts to stifle the plant-based meat sector have kicked

BY AMY BUXTON

9TH MARCH 2023

3 MINUTES READ





# Cellular agriculture

## A great leap forward, but still a big challenge ahead: industrialisation

*The principles behind cellular agriculture are simple to state, much harder to apply profitably at scale: animal cells are cultured to re-create proteins, fats and tissues. This can lead to many applications, such as meat, seafood, dairy products, and ingredients.*

The first products are still in their infancy (experiments in some restaurants, but mostly in labs) and are at least 3 to 5 years from market-ready but much farther from being massively accessible.

Indeed, even when excluding the legal and societal acceptance, four challenges remain today:

- **lowering the medium's cost** and making it animal-free
- **identifying** the best and most **stable stem cell lines**
- **improve the taste and texture** of final products.
- **scale the production**

Now, the first large-scale facilities are being planned. If things move well, they will be operational in 2025. The largest will eventually produce 13,000 tons of meat. Today, the world's consumption is around 350 million tons. To reduce global emissions by 1%, at least a thousand such facilities should be built. This is feasible, but it will require two decades, at the minimum.



In 2023, the US joined Singapore as the second country to authorise the commercialisation of cultivated meat.

When products reach consumers, we can expect the debate to become fierce between the companies and those looking to ban cultivated meat.



# Precision fermentation

## Dairy proteins without the cow

*Precision fermentation (PF) is about inserting the genetic code of the desired protein (dairy, egg, and beyond) in a micro-organism, which will then produce it through fermentation.*

**Most startups using PF are focused on dairy proteins**, but it can have many other applications, such as egg proteins flavouring, colourants, infant formula, honey, coffee...

Today, all players have B2B business models and develop partnerships with established brands to reach consumers. That's notably the case of Perfect Day, the most developed startup with multiple products on the US market using its protein. However, in Europe, **PF faces regulatory challenges** (a request for authorisation to market in Europe has been submitted and should give us information about the future of this technology on the old continent in 18 to 36 months). In the US, the regulatory barrier is relatively thin, and the challenge is the ability to scale the production efficiently, notably for casein (the key protein to make cheese products).

When this technology reaches price parity, the challenge will be to scale the production capabilities (i.e. factories) and how to help current farmers transition.





# Biomass fermentation

## Creating new sources of protein

*Biomass fermentation (BF) is about identifying in nature microorganisms that have the property to create an exceptional amount of protein through fermentation. This new source of protein can then be used to develop alternatives to meat, dairy, fish, etc...*

We can split this ecosystem into two categories:

- Startups that have identified a microorganism that can produce protein in an « uncontrolled » environment, ensuring fast production of proteins at a low cost or which can be fed with byproducts, reducing production costs.
- Startups using carbon dioxide to feed a microorganism and create a protein powder via fermentation (such as Solar Foods (FI)

Biomass fermentation faces the same challenges as the other technologies mentioned, notably regulation and the capability of creating tasty products for the consumer.





# Molecular farming

## Dairy proteins without the cow

*Molecular farming is about using genetically modified plants to produce desired proteins (or « using plants as bioreactors »).*

Today, companies work primarily on dairy proteins, using genetically modified seeds. But the potential is broader; there are opportunities with any type of protein used for food or cosmetics. Another potential area of interest concerns the ingredients needed for cellular agriculture (growth factors). The ecosystem is led by Moolec (UK) and Nobell Foods (USA, focused on cheese and meat alternatives).

The technology is highly promising, especially with the promise of being **more scalable** than precision fermentation or cellular agriculture. However, it is currently mostly experimental, and the amounts of proteins cultivated (proportionally to the size of the plants) are low. We expect to see the first open-field large-scale experiments in the next 2 to 3 years, which will then help us understand the real potential of this approach.







## Megatrend #3: Instant retail



DigitalFoodLab

BE PART OF THE FUTURE



# Instant retail

## What are we talking about?

Retail is changing fast and at many levels. A few years ago, the debate was centred on the existence of food e-commerce and consumers' appetite for grocery delivery. Now, the question is much more about the speed of its deployment, how stores can adapt, and the new paradigm for food retailing in the future.

Even in the current context of questioning around quick-commerce (grocery delivery in 30 minutes or less), we call this new paradigm *instant retail*.

Behind the name *instant retail*, we put all the innovations that enable consumers to access food quickly and efficiently from their screens. Instant gratification is not only about being delivered fast. It is also about accessing foods that match your values and needs in one click. This concept can then be stretched from ethnic marketplaces to anti-food waste platforms and from autonomous stores to restaurant delivery.





# Four trends, all of them out of hype

Instant retail unifies trends that spread over the innovation curve, from commonplace restaurant delivery to futuristic autonomous stores.

We have added « new food brands » as a separate trend to reflect the growing discussion around the future of DTC startups.





# Smart stores

## Very slow adoption

The smart stores topic (or “store automation”) covers several concepts:

- Upstream, with warehouse automation (notably for grocery delivery such as [Ocado's](#) warehouses).
- On the shelves, with technologies for identifying products ([Trigo](#)), transforming existing stores into checkout-free ones.
- The possibility of fully automating the store by offering “connected convenience stores” ([Boxy](#)).

### A VERY SMALL ECOSYSTEM

While exciting, this space is relatively small, with few emerging ventures.

Most checkout technology companies are large tech groups, notably Amazon, which licenses its solution to others.

Even if autonomous/smart stores can be used in a wide array of situations, such as petrol stations, industrial areas and offices, adoption could be faster in Europe and North America. The increasing need for more workers may speed up this.





# Quick-commerce Consolidation, and then, what's next?

*Quick-commerce is about delivering grocery items in less than 30 minutes from “dark” stores (small warehouses) located in dense urban centres.*

If things move fast in FoodTech, nothing came close to the speed at which quick-commerce startups went to the moon and are now crashing. **After one year of expansion assisted by limitless cash, things became more challenging in 2022. This led to a fast consolidation. Now, the number of players has shrunk enough to make this market healthier.**

## Is it the end of quick-commerce?

Unlike many doomsayers, we don't think it will end that quickly. However, the initial business model combining dark stores and salaried drivers may be ill-suited for developed economies with high labour costs and zoning limitations. It remains relevant for middle-income countries with booming cities and under-developed networks of convenience stores.

Grocery delivery operated by restaurant delivery platforms (such as DoorDash) could still develop, but it will remain marginal as the same problems (cost of picking/cost of delivery) will remain. In the long run, we still expect a disruption of the grocery market, notably with quick delivery. It may, however, come from new technologies such as delivery robots rather than from quick-commerce as we know it today.





# New retailers

## Focus on profitability rather than growth

The new retailers are the startups reinventing how grocery retail is done online, often by rebuilding the whole infrastructure (warehouses, stocks, software, relationships with suppliers) from the ground up. But, contrary to “old” retailers, they don’t consider their **online store** as another store but **as their only focus**. We can distinguish two categories:

1. The **heavyweights** such as Picnic, Rohlik or Oda. Their offering is often almost identical to incumbent retailers. They “just” attempt to do a better job by focusing only on online consumers. They are doing well, even if we observed some downrounds the last year.
2. The **innovators** who are trying to bring something disruptive to the market. It can be through subscriptions, reusable packaging (The Modern Milkman), ugly fruits and vegetables and damaged products, or a focus on ethnic products (such as Waysia in France or Yobaba in Germany).





# Restaurant delivery

## (Finally) reaching maturity

The main marketplaces connecting consumers to restaurants are now all mature and (directly or indirectly) publicly traded companies. They now have to communicate their data each quarter to investors (and so, to us) and showcase a path toward profitability. This path can appear straighter for some (DoorDash, USA) than others (Deliveroo). We can observe four evolutions:

- Regulation of driver status is not a priority anymore (beyond some regulations in Europe that could again reduce the number of players and indirectly the competition)
- Consolidation is still underway globally.
- All players ventured into grocery delivery, either in partnership with large retailers or through their stores. In the aftermath of Instacart's IPO, this is often seen as one of the areas where profitability can be reached.
- Services to clients (restaurants) and advertising are increasingly critical in their business model.

If most platforms are thinking about automating their deliveries, it still seems as far away as a decade ago.





# Use case #3: innovation culture & identification of potential partners

**Mission for a leading ingredient company which was looking to have a watch on disruptive innovation and a way to track opportunities.**

## **What we did:**

- Opportunity screening to define the categories of innovation that were the most relevant for the client and the perimeter (research, startups, and competitors)
- Set up a personalised watch with a monthly letter of what has happened in the innovation ecosystems. Each letter comes with an analysis of the potential opportunities to target.
- Organise annual workshops with the client's board to create an innovation culture and validate new categories to explore.

## **Results:**

- The client's board developed a long-term understanding of the innovation ecosystem to guide decision-making
- Reduction of the noise around innovation and more actions being taken.







## Megatrend #4: Food as medicine



DigitalFoodLab

BE PART OF THE FUTURE

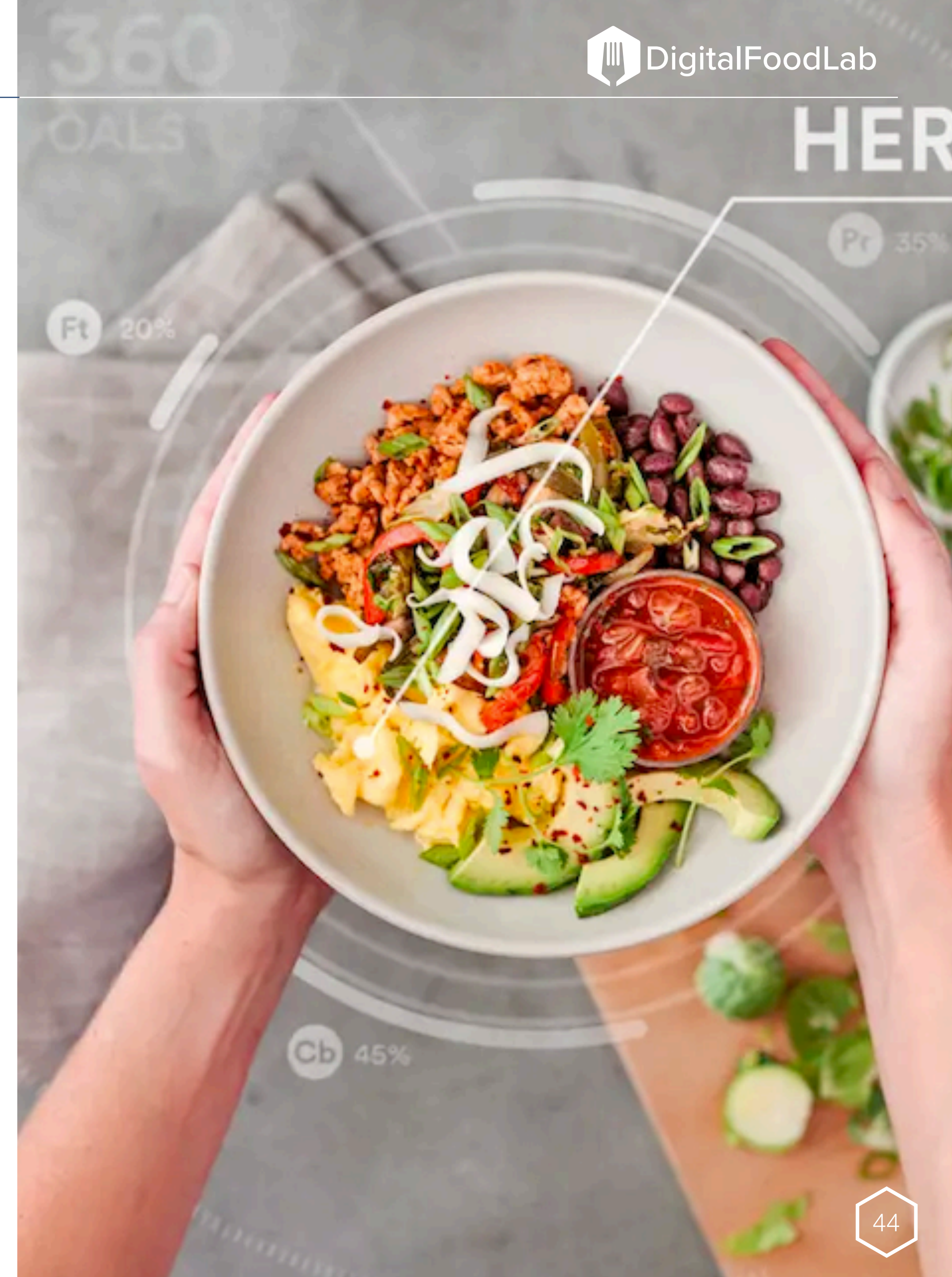




# Food as medicine

## What are we talking about?

We are renaming our megatrend « food personalisation » as « food as medicine ». Indeed, we are observing the convergence of two categories until now distinct: health and food. Novo Nordisk's Ozempic and Wegovy drugs are making waves. Both were created to manage diabetes. However, their increasing use as weight loss solutions (albeit expensive ones) is creating many opportunities and just showing the potential for healthier food products. However, today, we are still at the first stage of a potential revolution where we will all access a personalised diet.





# Why is food personalisation needed?



While we all know what we should do (with food), and we collectively often do the opposite. It is not unlike climate change and meat consumption: more people are aware of the link between the two, but they keep eating more meat.

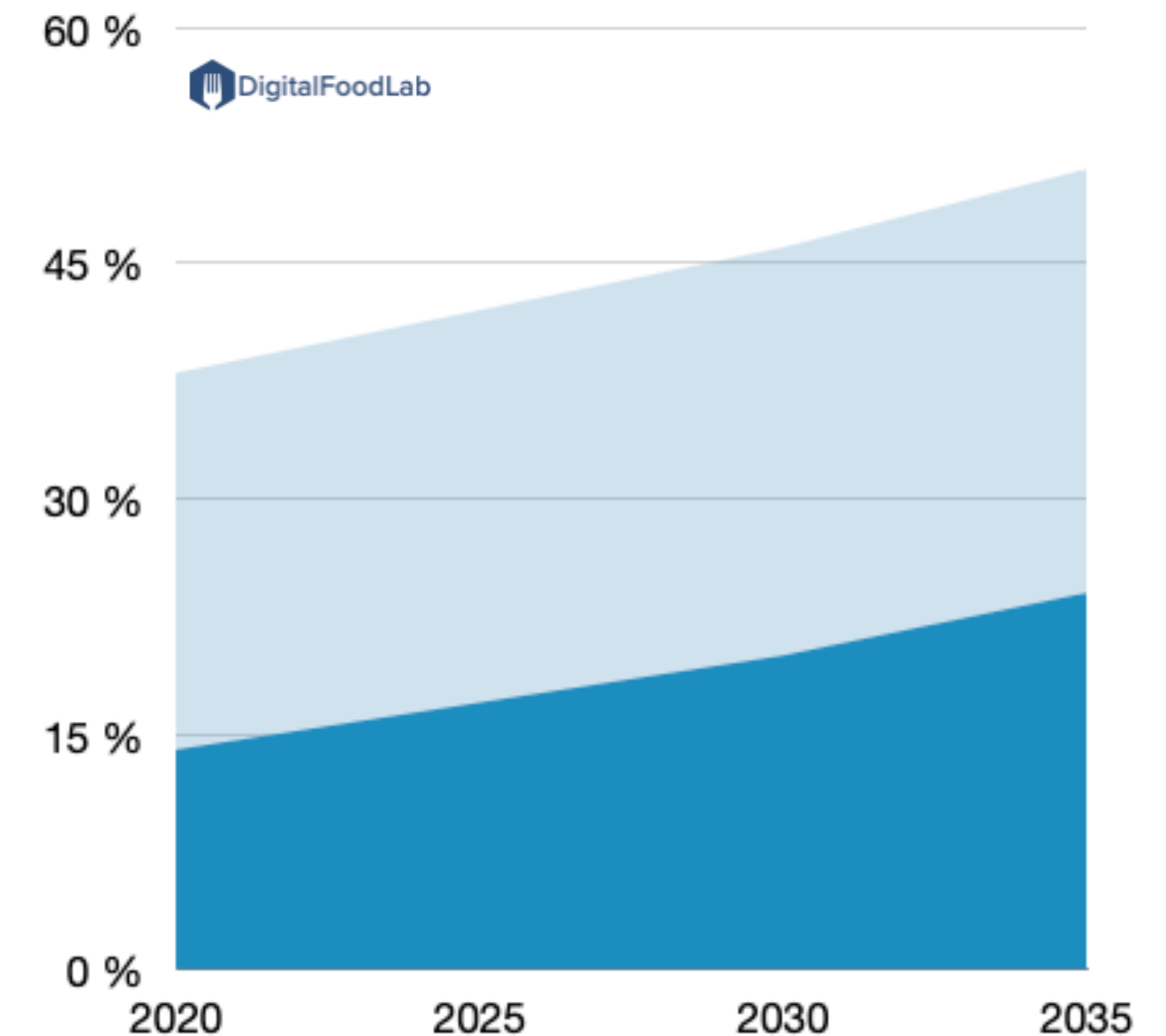
- 1 - there is now a wealth of research showing that simple changes in our diet could dramatically impact our health (such as this study).
- 2 - diseases, deaths and the rising costs of avoidable conditions can be directly related to food. It is anticipated that more than half of the world's population will be overweight by 2035. Beyond the human cost, this strains our economies and health systems.

Food as medicine and personalisation are here to solve this problem by helping consumers by:

- 1 - creating healthier food products developed through newly discovered technologies
- 2 - offering personalised advice on what and how to improve their diets
- 3 - creating easy-to-use personalised food products and supplements.

## MORE THAN HALF OF THE WORLD'S POPULATION WILL BE OVERWEIGHT BY 2035

Share of the global population with:  obesity (BMI > 30)  overweight or obesity (BMI > 25)

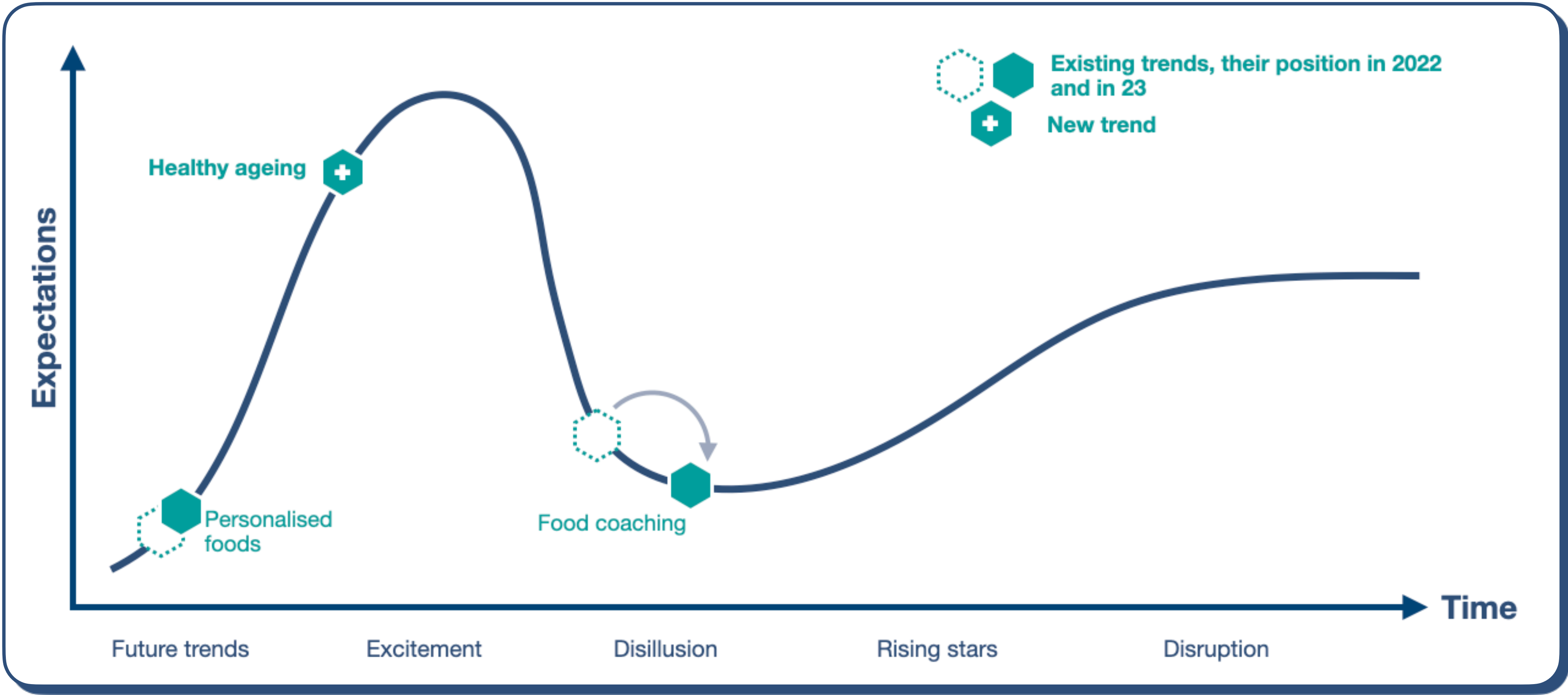


Source : world obesity report, DigitalFoodLab



# A potentially massive impact, but very few players

We are adding a new category to this ecosystem: healthy ageing. We are in the early stages, but it demonstrates large food companies' and consumers' appetite for innovation for healthier foods. This innovation is much needed. As population is shrinking in most developed economies, food companies will have to change their growth engine, often related to the increase in potential consumers.



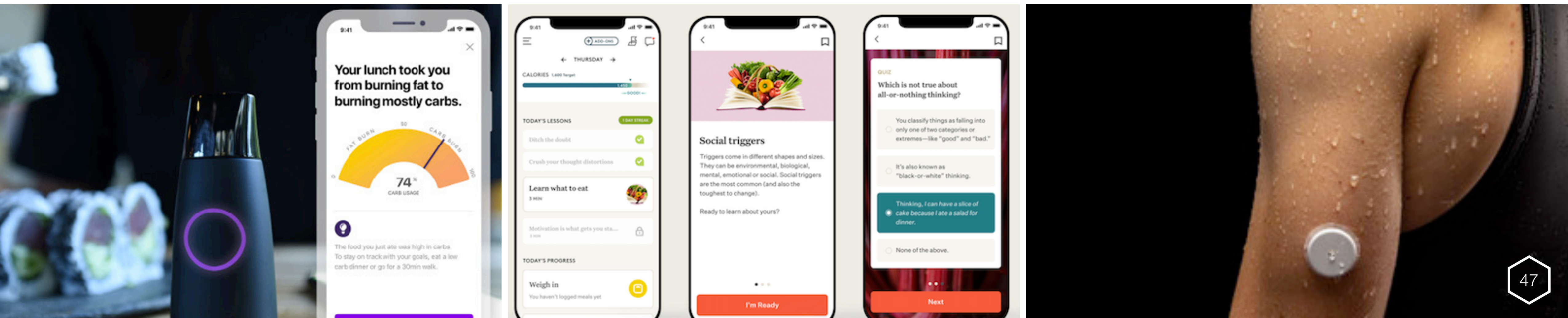


# Food coaching

## A move from services to devices, most of which are still too complex to use

Food coaching comprises many startups trying to help consumers manage their diets and follow nutrition plans. Some of them use **devices and testing kits** to get knowledge about the users and offer them diet recommendations: **DNA testing** ([Genopalate](#) - US), **Breath analysers** such as ([Lumen](#) - Israel), **microbiome testing** such as ([Zoe](#) - UK), **blood samples or glucose patches** ([Clear.bio](#) - NL), the most recent and maybe the most active space. However, most of the data these startups use is based on correlations, leading to interpretations that can be different, even opposite, from one startup to another. The more scientific rigour will be needed to reach a broader audience.

A second category of startups is **nutrition platforms, which are online nutrition tools used by the consumer and** provide personalised nutrition plans ([Noom](#) - US).





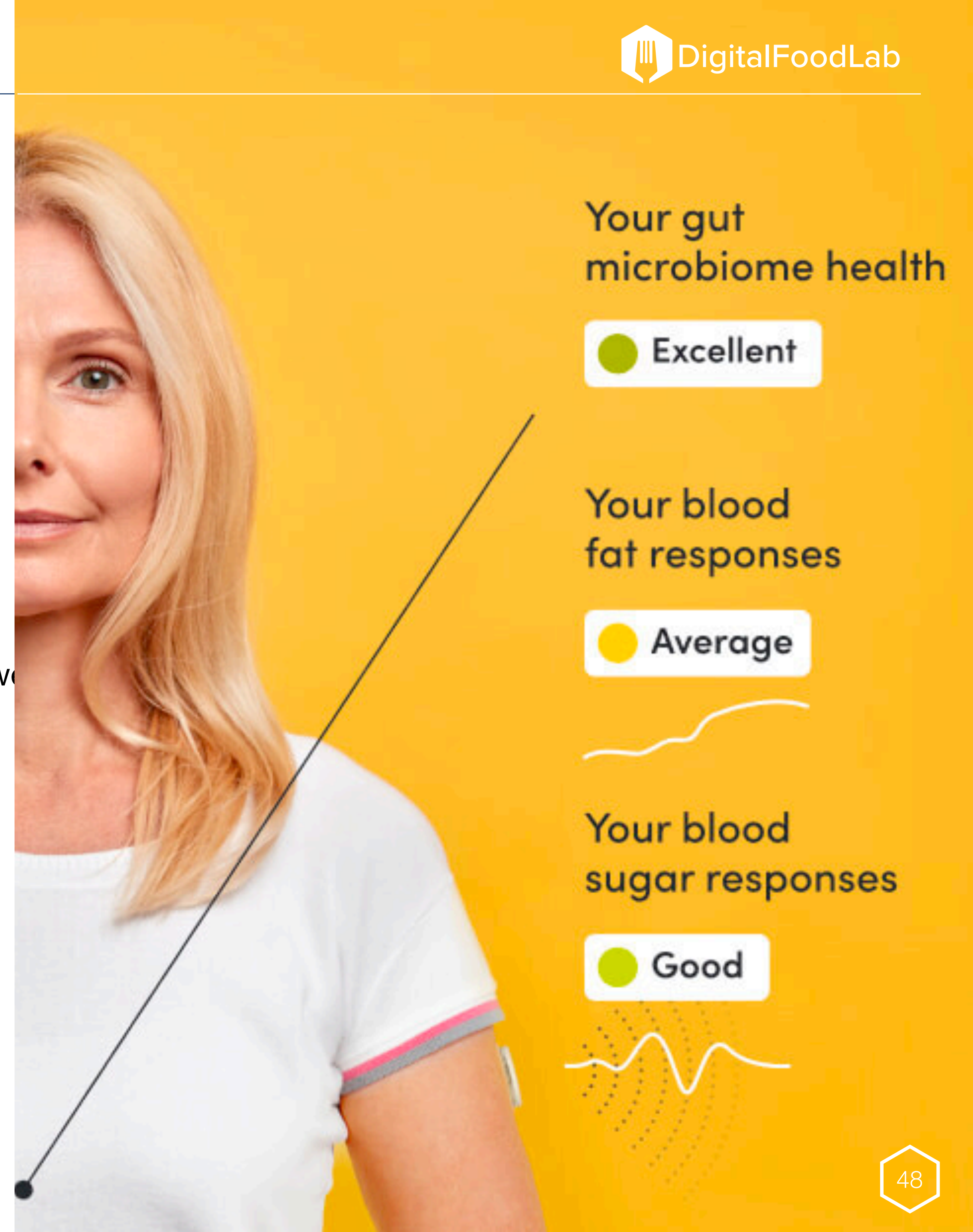
# Healthy ageing

## Ingredients for a diet that will make us live a longer life

In the broader sustainable protein ecosystem, a sub-category of innovators (startups, researchers, large companies) is now developing ingredients that positively impact our health. We can divide it into two categories:

1 - new ingredients to be added to existing food products will provide nutrients we metabolise less as we age. We observe two main fields of innovation here: genetically modified foods (notably vegetables) and ingredients derived from breastmilk (created through precision fermentation notably).

2 - ingredients that will lessen the long-term damage of processed foods on our health (notably healthier oil, fats, and sugars).





# Personalised food

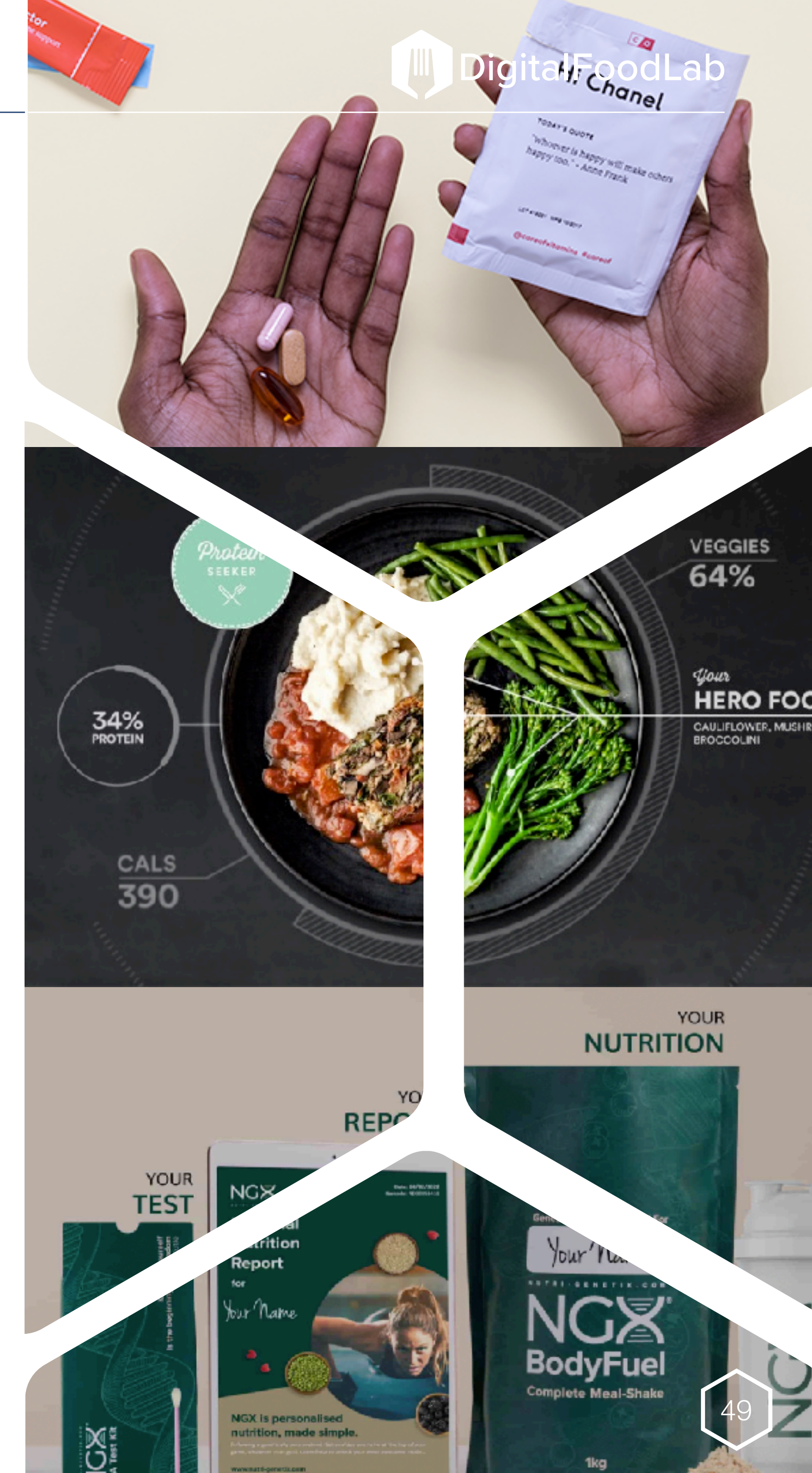
## Far far away...

**Personalised food refers to products or supplements that would be truly personalised to fit a consumer's specific needs.**

We can identify two paths toward this goal:

**1- personalised food supplements or “meals”.** Startups sell customised products based on test results (DNA, microbiome, devices, survey...). This is the most realistic path right now, even if this model has many limitations, one of which is its low adaptability. We can mention Care/of (US, acquired by Bayer) for supplements and NGX (UK) for drinking meals.

**2- personalised and evolutive micronutrition:** on the verge of research and commercialisation, a handful of startups have tried to launch « supplement » printers for the home or the office. Most stagnate or are failing (as Mixfit, which recently closed) as the costs are high, and the technology is not convincing enough for consumers.





# Use case #4: Creating a digital platform for a food company

**Mission for a food company looking to set up a digital and service platform around personalisation as a way to target new clients.**

## **What we did:**

- mapping of the market created by independent players and the initiatives of other FMCG companies.
- deep dives on all the components potentially available for a platform focused on food personalisation.
- Co-creation of a business case and action plan to boost the client's business
- Identification of partners

## **Results:**

- creation of a consensus inside the client's teams around the project and its priorities
- client currently following DigitalFoodLab's recommendations and is now starting to build the first blocks of the platform







## Megatrend #5: Food automation



DigitalFoodLab

BE PART OF THE FUTURE



# Food automation

## What are we talking about?

Compared to other industries, food is not automated. Unskilled labour is used in kitchens, warehouses, delivery and consumer service. This is weird when you think about it. When you watch a science fiction movie, the first thing that sets us in the future is often some food delivery robot or a 3D printing cooking robot. However, things couldn't be as far from reaching this goal, and today, many cooking and delivery robot startups are shutting down.

### A PARADIGM SHIFT

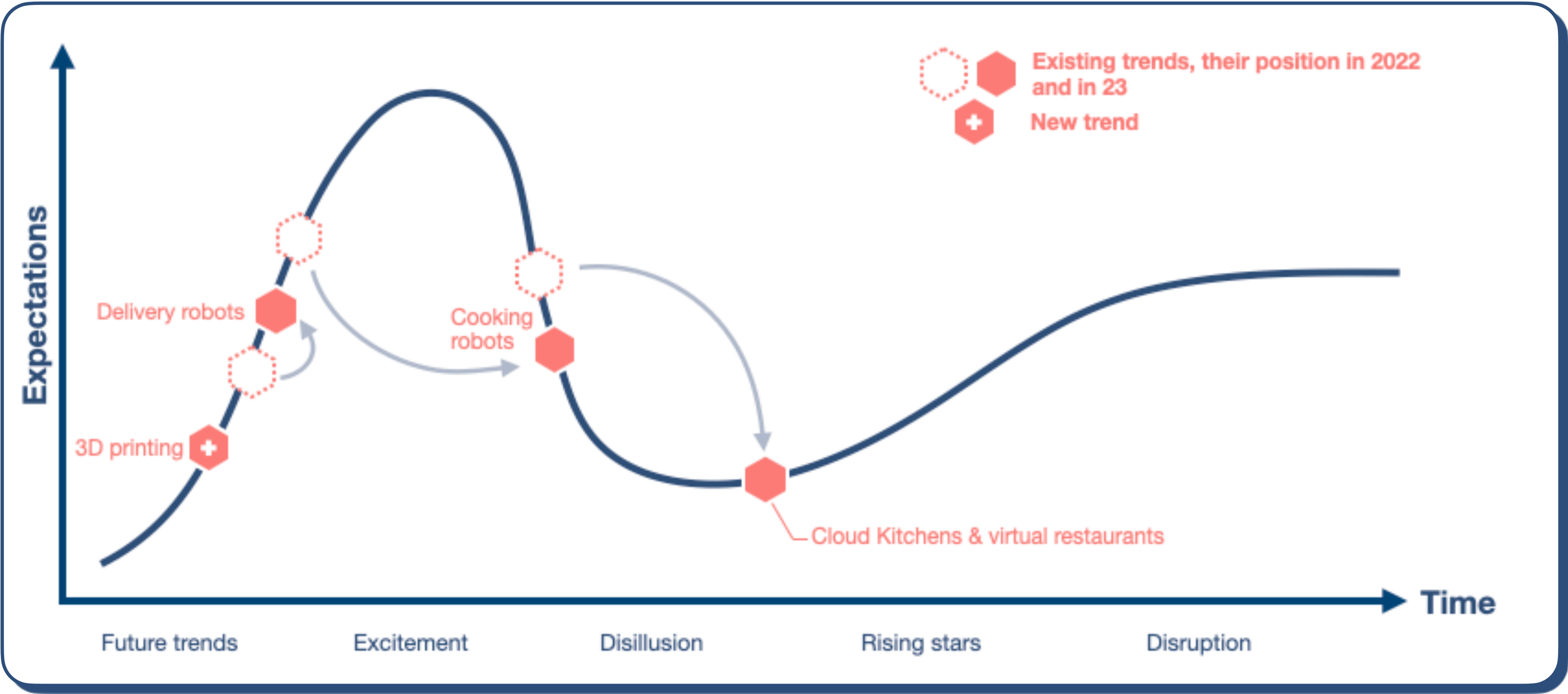
For many years, startups have used robotic arms and other complicated and costly technologies to replicate humans' actions, but it is not working. This didn't work. Now, new ventures are getting their inspiration from the food industry. The new goal is to scale down factories to the size of a restaurant rather than to emulate a chef with robotic arms. This paradigm shift doesn't yet translate into autonomous delivery, where experiments are still happening without any foreseeable massive deployment.





# Four trends for an automated food value chain

We have identified four food trends behind food automation. This is one more trend than in our previous edition, as we are adding 3D printing as a new trend (notably in relationship with the alternative protein ecosystem).





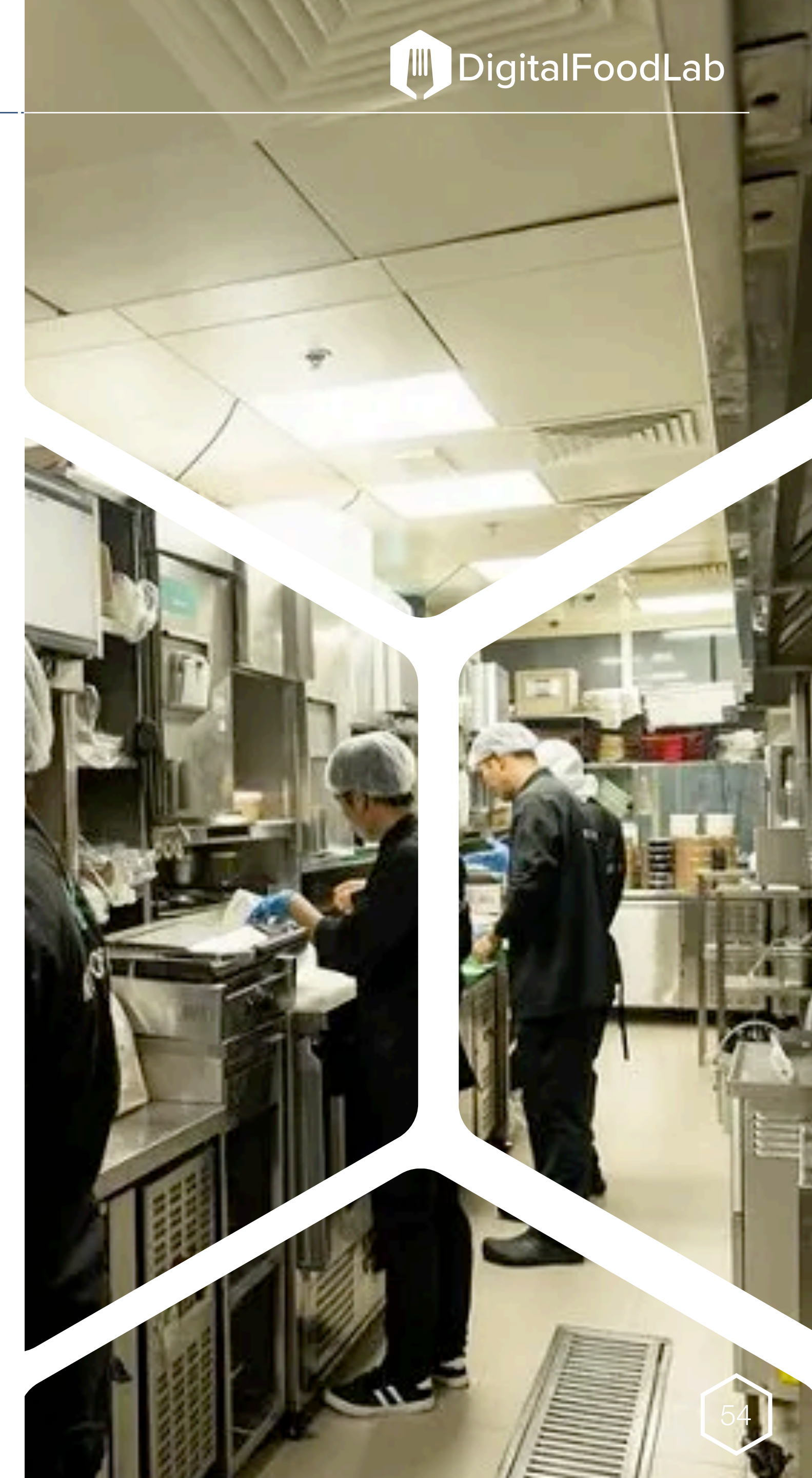
# Cloud kitchens and virtual restaurants

## Rising doubts

**A cloud, dark or ghost kitchen is primarily a space operator.** It manages modular kitchens that will then be rented to other companies. Thus, cloud kitchen operators can be seen as real estate managers: they raise a lot of money ([Karma Kitchen](#), [Cloud Kitchens](#)) to build and rent kitchens. These fundraisings must be interpreted as **real estate investments rather than investments in food startups**. And, as for other parts of real estate market, the current conditions are making their lives harder. After a boom in the number of locations, vacancies have reached an unsustainably high level. We expect many places to either shut down or rethink their model.

**A virtual restaurant** is primarily a marketing expert that **creates restaurant brands**, menus and marketing material. These restaurants are only operated online through delivery platforms.

From an integrated business model, virtual restaurants became more virtual as they franchised their brands. Most **offer their brands to restaurants as a tool to increase their sales**. This is compounded by the emergence of brands launched by influencers ([Mr Beast](#) in the USA). While the boom is not over for virtual brands, **we expect a phase of rationalisation with a concentration** inside the hands of a handful of players with the know-how to create, scale and market new brands.





# Cooking robots

## Recovery through a new generation of startups

This cooking robots ecosystem is made up of very different technologies :

1. **collaborative robots** which replace an employee for complex tasks.
2. **automated restaurants**, which can perform several recipes “like a chef”.
3. **automated kiosks and vending machines** that can serve a meal or salad according to the user’s choice of ingredients.

Cooking robots have had a bad time in recent months (and years). Since Zume's shutdown in 2020, we have seen numerous failures in the ecosystem.

Among many others: DoorDash, which had acquired Chowbotics, a salad robot maker, shut it down; and Pazzi, a pizza robot, shut down.

So, what was wrong with this ecosystem? Maybe they **don't solve a real-world problem and are far from becoming profitable**: what is the point of using a \$25,000 robotic arm to serve coffee?

### A NEW GENERATION IS EMERGING

Emerging startups are developing new robotics solutions, focusing on integrating less costly robots (actually often mechanical tools rather than robots) robot into a classic kitchen and how it could be adapted to humans (Hyphen, or the salad chain Sweetgreen, which acquired Spyce in 2021).





# Delivery robots

## One step forward, two step backs

The following characteristics define delivery robots:

- **Their ability to circulate** on the sidewalk, on the road or in the air.
- **Their level of autonomy:** some of these vehicles are fully autonomous, while others are teleoperated.

The pandemic and the labour shortage in its aftermath boosted robotic delivery experimentations. However, they were less successful than expected. In recent months, the number of down rounds (valuation of a deal being equal or below the last round) and startups shutting down or slashing in their workforce (Starship Technologies and Nuro - which had previously raised more than \$1.5B) has been impressive. As for autonomous cars, experiments are still getting more and more convincing; it's just that it will take longer before we see these robots and drones used in our daily lives at scale.





# 3D Printing

## A futuristic technology that may have finally found its use

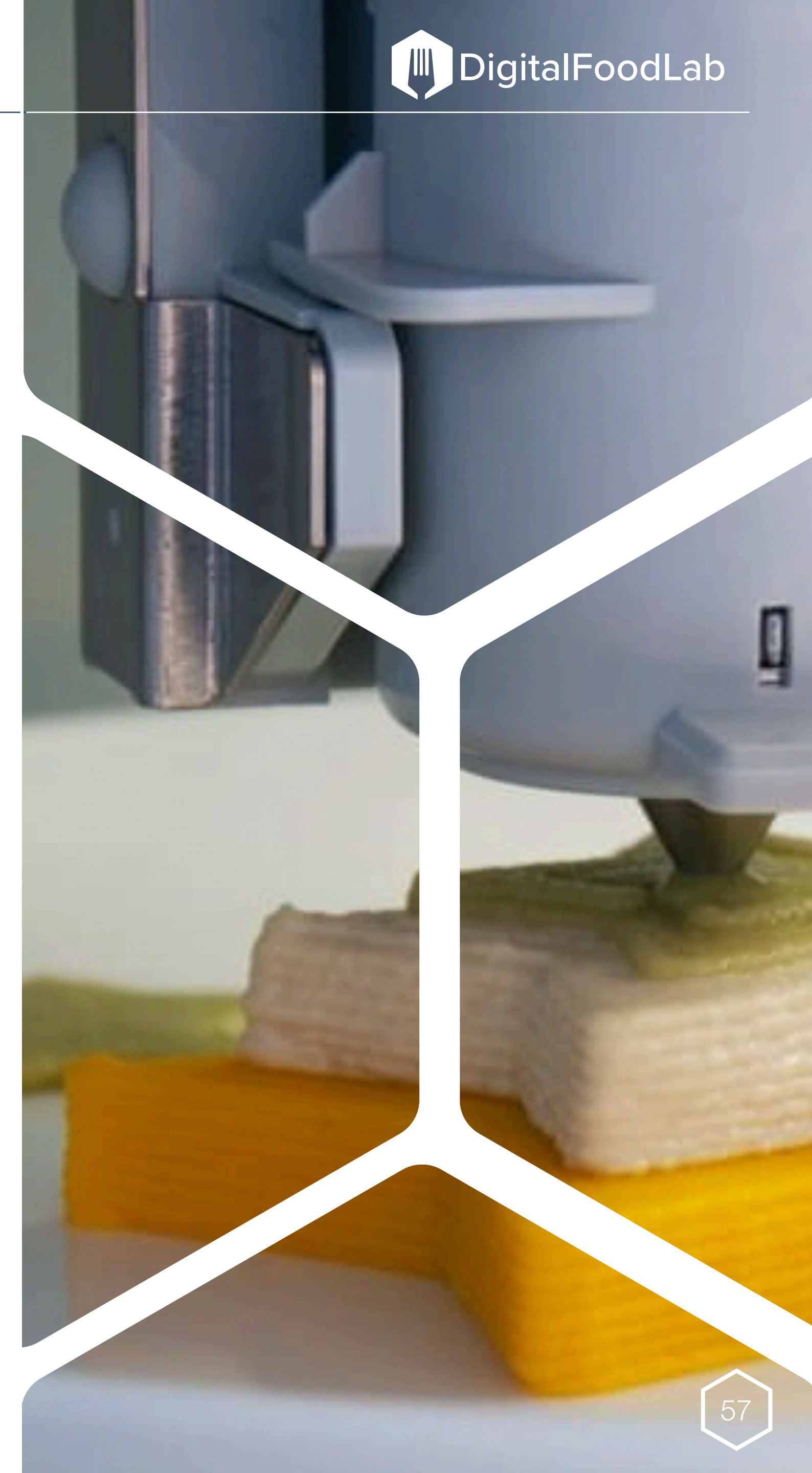
3D printing for food consists of creating new forms of food in precise portions and shapes. Two types of startups use this technology: creativity and alternative proteins.

### CREATIVITY

Some companies use 3D printing to have greater **creativity** in the food format, with various applications, from food-waste fighting to personalisation. For example, Nourished (UK) uses 3D printing to create customised batches of chewable supplements. Others use 3D printing to create original shapes with chocolate or sugar.

### 3D PRINTING FOR ALTERNATIVE PROTEINS

Some startups use 3D printing to define precisely the texture or the ingredients used in a product. This is used primarily by plant-based companies such as Redefine Meat (plant-based meat, Israel) or Revo Foods (plant-based fish, Austria), as well as cellular agriculture companies like Aleph Farms (Israel) to recreate the complex texture of meat and fish products.







## Megatrend #6: The smart supply chain



DigitalFoodLab

BE PART OF THE FUTURE





# The smart supply chain

## What are we talking about?

The supply chain is fascinating, even if often ignored. However, it's often quite old and in dire need of becoming smarter and more digital. Just consider this figure: 40% of all food is never eaten and never leaves the farm or the factory (15% never leave the farm in the UK, and 16% in the US).

Two underlying forces are driving this megatrend:

- **The fight against waste** (from packaging and food waste): this is directly related to climate change and the growing concern of consumers and companies about their impact.
- **Digitisation to reduce labour costs and promote standardisation:** the accessibility of new digital tools throughout the food supply chain is changing how people work and collaborate. We analyse the recent development as linked to the decreased availability of unskilled workers (notably in foodservice) and the desire for more standardisation from CPG companies and restaurant chains.

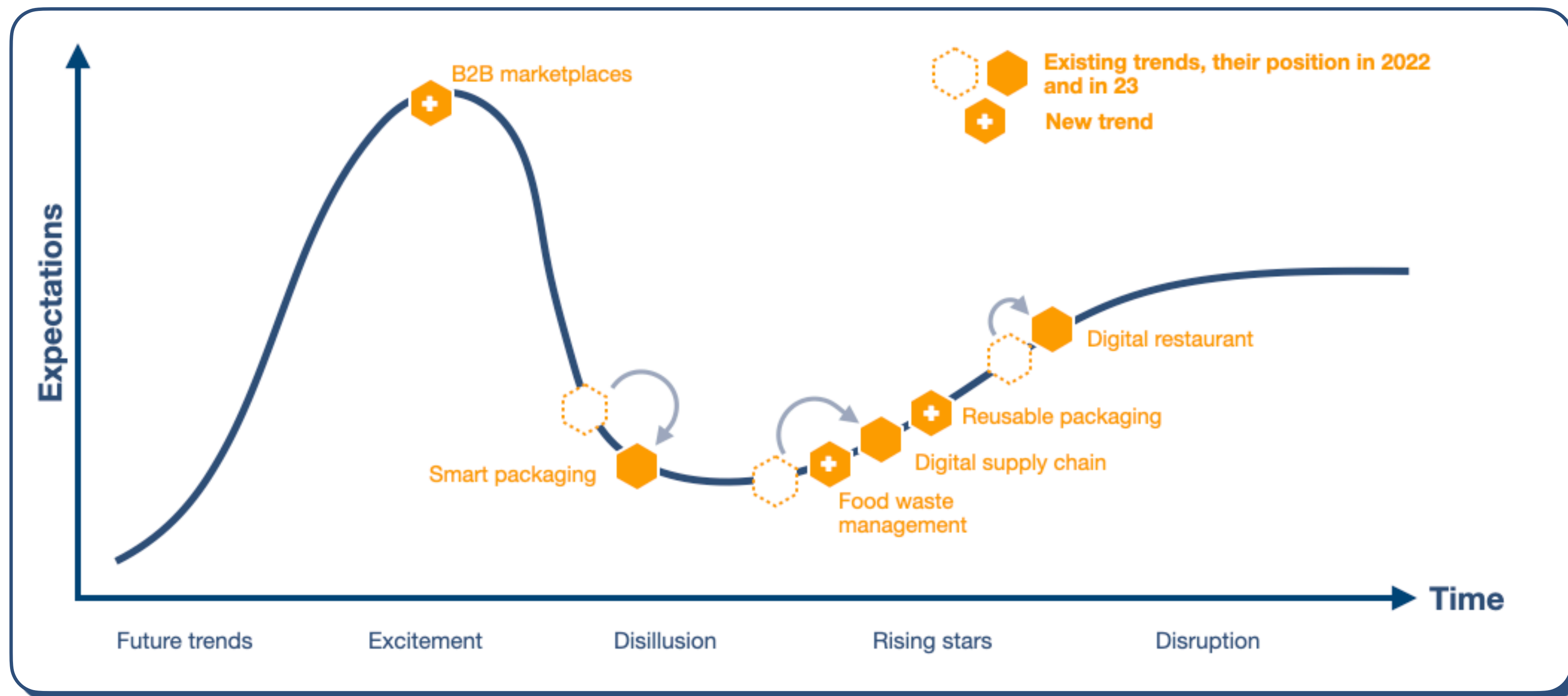
Indeed, with the use of B2B marketplaces and digital tools, consumers can have a much more similar experience from one store (or restaurant) to another.





# An unjustly undervalued ecosystem

We have identified six food trends behind the smart supply chain. We added two new trends, actually « splits » from existing ones. B2B marketplaces have been booming and deserve to be considered separately from services targeting the digitisation of the supply chain, and « reusable packaging » has been separated from « smart packaging » due to the emergence of many new players incentivised by new laws.





# The digital restaurant

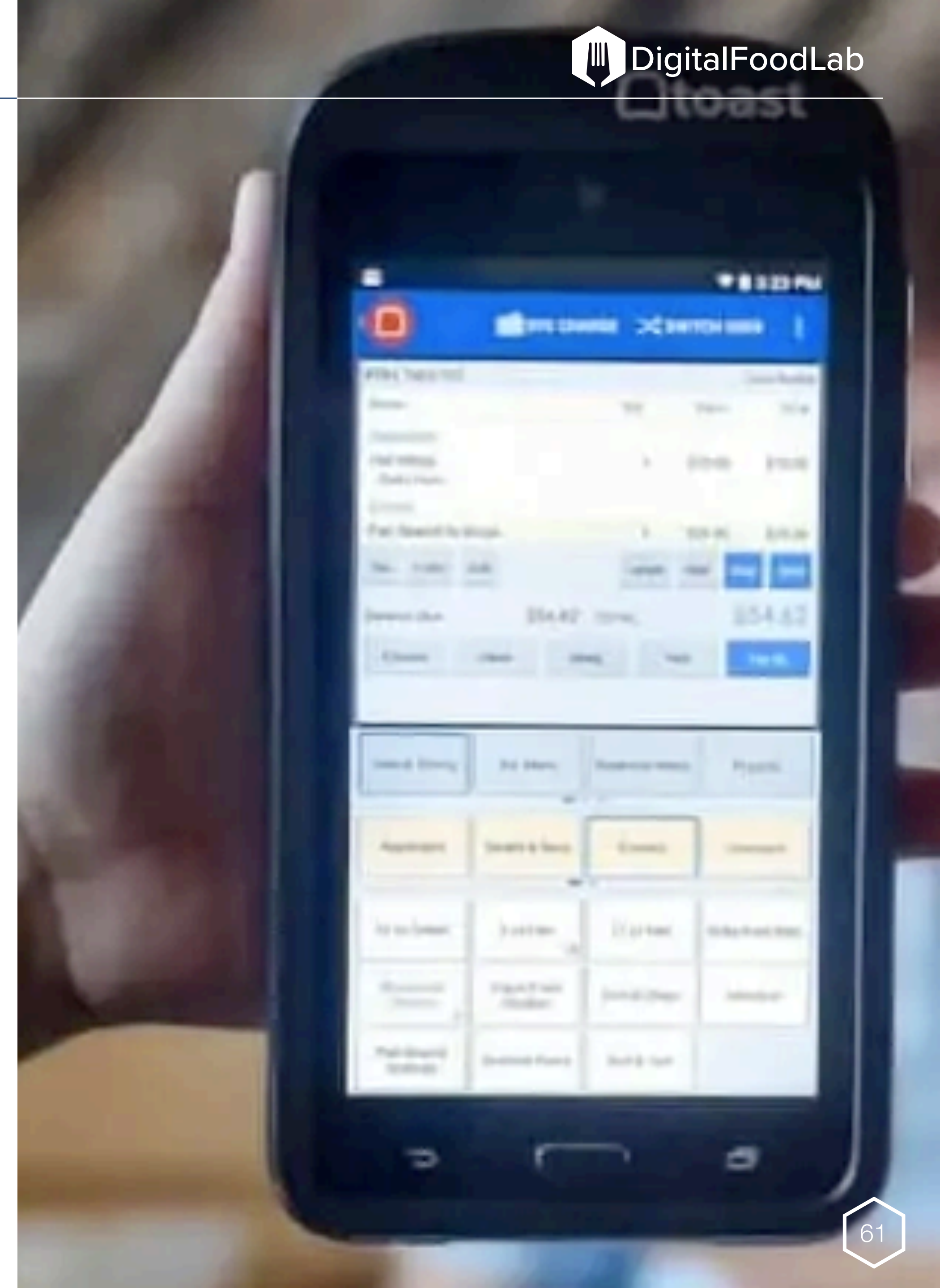
## A growing ecosystem of services

The ecosystem of startups working on digitising the restaurant (and more broadly, any point of sale) is growing year after year. The emergence of a generation of digital native restaurateurs boosts it. Players in this sector work on a variety of topics, notably (but not exclusively):

- **Booking**
- **Management** of online orders/delivery (Deliverect)
- **Payment**: ePOS or payment at the table via mobile
- **HR management**

### CONSOLIDATION & FUTURE

Some startups struggled to grow again after the pandemic and had difficulty raising money. This led to numerous acquisitions in this ecosystem, especially among ePOS and payment players. We expect this movement to continue as there is a growing expectation for more integrated services, notably full suites of services that a restaurateur can personalise to their needs.





# Smart Packaging

## Getting more exciting

Smart packaging refers to solutions enabling **food waste reduction while improving product shelf-life, protecting against disease, and promoting a clean way to create food packaging** with less plastic and more biodegradable or compostable elements.

### BIODEGRADABLE SOLUTIONS

**Biodegradable** applies to a products capable of decomposing in a favourable environment.

There is a growing number of startups in this sector, with players working on many technologies (Tipa, Israel). While underinvested for years, we expect this category to be a strong focus for new entrepreneurs.

### PROTECTIVE LAYERS

The real disruption in the packaging world may come from solutions without any packaging. With protective layers applied on fresh products (fruits, vegetables, meat or fish), some companies are reducing food waste, improving product shelf-life, and reducing food costs.



Among the most notable players to look at, we can mention Apeel (the only unicorn in this space) and Sufresca. Both add a layer on the surface of fruits and vegetables. This helps keep moisture in and oxygen out, meaning products last twice as long.



# Reusable packaging

## Boosted by regulations

Reducing waste in foodservice concerns food but also its packaging. To lower the environmental impact and act in response to the restrictions imposed by regulators, an ecosystem of startups focused on reusable packaging recently emerged. There are two categories of players:

1. Startups managing reusable packaging such as Vytal (Germany).
2. Startups developing a network of collectors combined with RFID-tagged reusable packages like Cuploop (Estonia).

### REGULATION IS KEY

Regulation is a critical driver in this space. One example is the 2021 European Union's Single-Use Plastics Directive. This directive bans certain single-use plastic items and promotes sustainable alternatives, including reusable packaging. This has led to increased interest in reusable packaging solutions in the continent and explains most of the growth in this ecosystem.





# Food waste management

## From discounted goods to procurement management

Solutions are being developed all along the food supply chain, from the farm to the restaurant and the grocery store, to limit the quantity of food waste to a minimum. It involves various solutions:

- **Foodservice:** tools make it possible to better monitor food waste (Winnow's scales) and optimise actions to reduce it.
- **Unsold food:** applications connecting customers to restaurants and stores with surplus unsold food (Too good to go).
- **On-shelf solutions:** dynamic shelf life labelling and pricing with sensors (Innoscentia) or AI (Smartway).
- **Customer appliances:** tools for domestic use, such as home composters (Lomi).

After years of focus on discounting goods (or giving them away), the focus shifted to software solutions to manage these decisions. **Now, we expect this ecosystem to evolve towards procurement management for retail stores, with foodwaste in mind** (and eventually to merge with the B2B marketplaces' ecosystem).

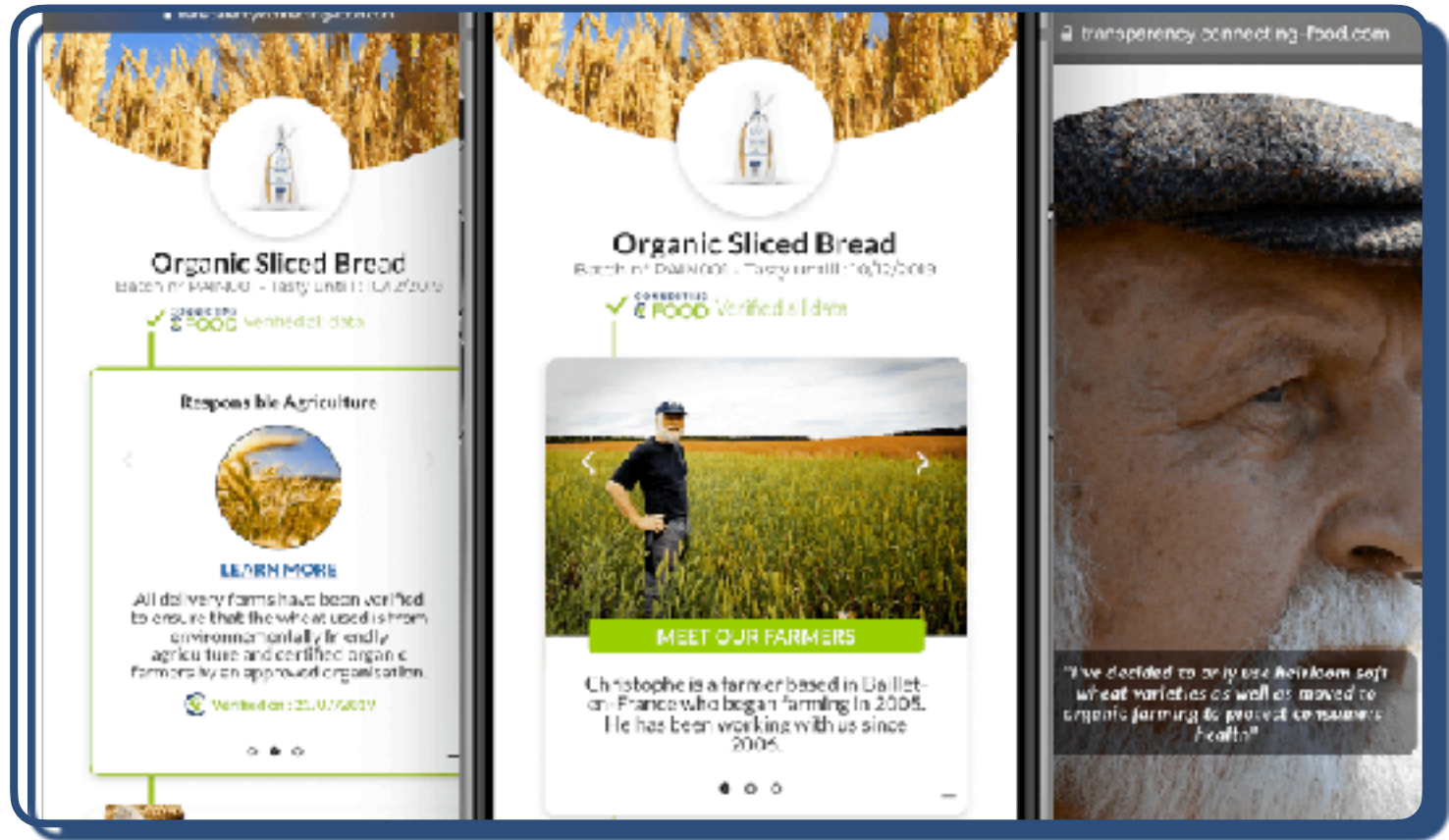




# Digital supply chain

## A focus on decarbonation

Years after the blockchain hype, the traceability ecosystem is still evolving. Initial promises of transparency turned out to be more complex than expected, and some actors have had to refocus on food safety or compliance missions.

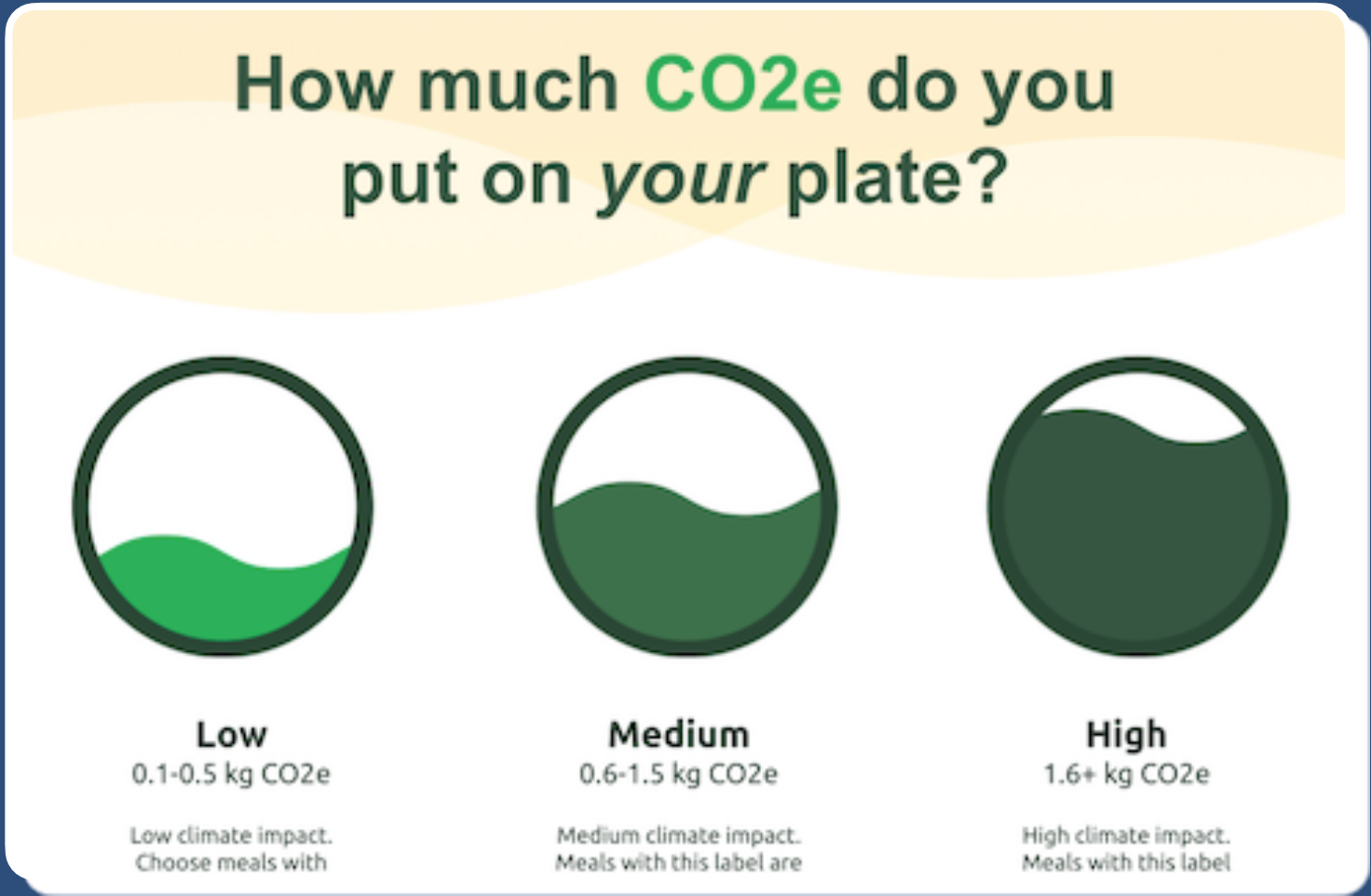


Today, the main focus of startups working on the digitalisation of the supply chain is **carbon counting**.

Some companies offer platforms that allow the industry players to calculate their products' life-cycle assessment and carbon footprint ([CarbonCloud](#), [CarbonMaps](#)). The main challenge lies in gathering data related to livestock and agricultural production. In addition to these services, startups develop **carbon credit trading platforms**. For example, [Agreena](#) helps farmers switch to regenerative agriculture by issuing carbon credits and assisting farmers in reselling them on the voluntary market.

### COMMUNICATE TO CONSUMERS

Some startups work on consumers' information about the CO2 they “consume”. It could be by showing a climate footprint label on the pack ([Oatly](#)) or by allowing restaurateurs to calculate the carbon impact of their dishes and display it on their menus ([Klimato](#)).





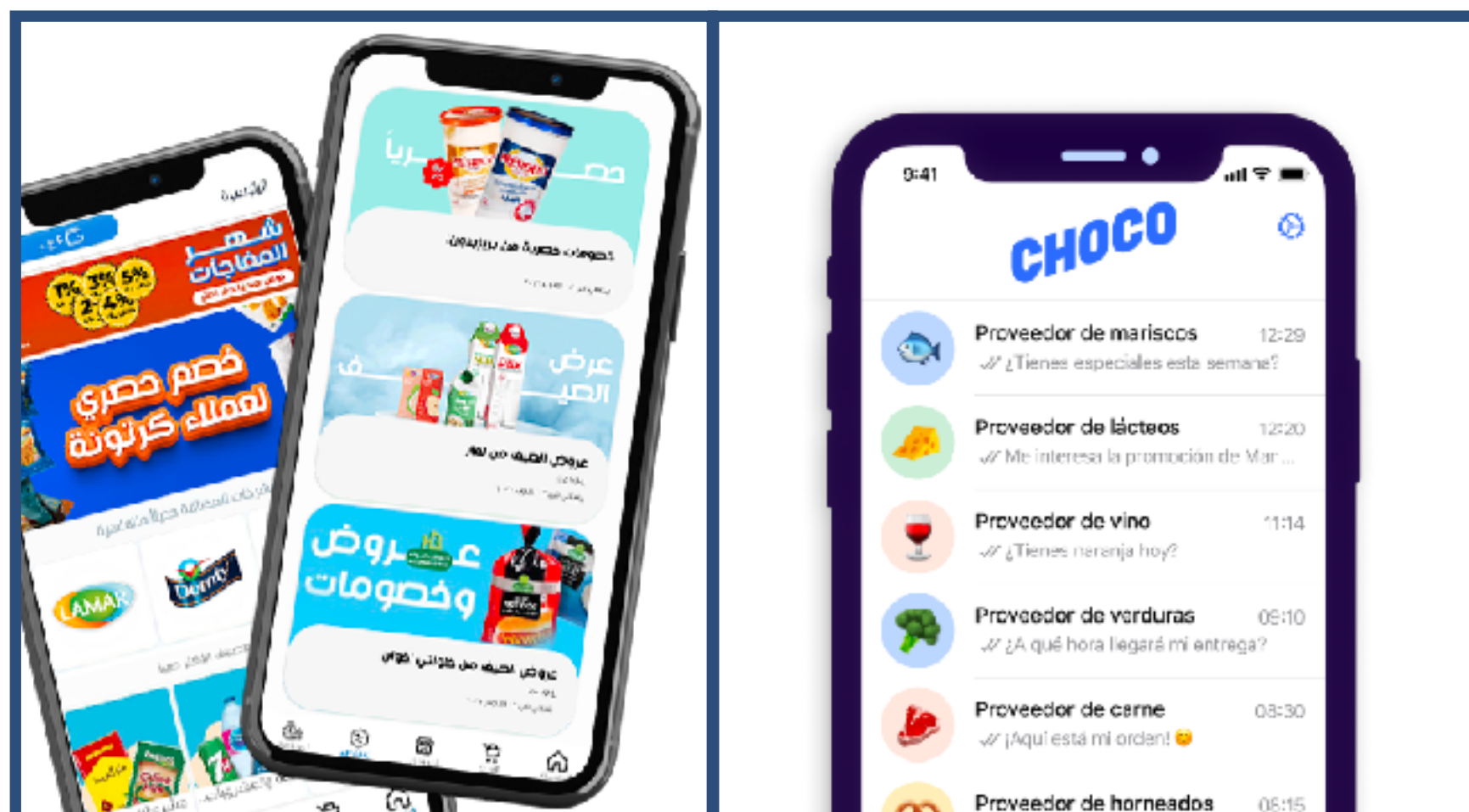
# B2B Marketplaces

## A booming ecosystem

From a previous focus on grocery delivery, many investors and entrepreneurs have now moved their interest upstream to the procurement of retailers (mostly restaurants in Europe and North America and corner stores in Asia and Africa). Startups in this field digitise the supplier-store relationship entirely: the interaction occurs directly via a mobile application and an integrated messaging system.

### STILL A YOUNG ECOSYSTEM

Today, this ecosystem is hard to read, as **we have multiple types of players**, some 100% digital, such as Choco (Germany), some acting as marketplaces (Deliveristo, Italy) and some integrating the logistics (Cheetah, US). The competition of prominent players, such as ABInBev Bee's, also adds a certain level of challenge.







Learn more on the future of food & discover how we can work together at [digitalfoodlab.com](https://digitalfoodlab.com)

Contact us at: [contact@digitalfoodlab.com](mailto:contact@digitalfoodlab.com)