



# Future of Food

Tamás Landesz

## Abstract

The world is facing significant challenges in providing food and water security to a growing population without harming the environment. To address these challenges, the production of bioproducts and healthy, high-quality foods will become more critical, with protein coming from synthetic processes and insects. Agricultural production will move closer to where people live, using technologies such as horizontal agriculture, rooftops, synthetic biology, and genetically modified plants. Governments need to facilitate the dialogue surrounding the societal impacts of new technologies related to food, such as nanotechnology and biotechnology. The business-as-usual approach is no longer viable, and all countries must commit to sharing responsibility in implementing fundamental changes, including raising consumer awareness, proper regulations, and more equitable income distribution. The future of food requires innovation and entrepreneurship, supported by a community of researchers, entrepreneurs, and governments to achieve a sustainable, healthy, and equitable food supply chain. This includes reducing food waste through innovative technologies, sustainable agriculture, and significant dietary shifts. Microorganisms will be used to produce carbs, proteins, and fats, with lab-grown meat replacing animal farming. With smart cities impacting food consumption and waste reduction, personalized food products and better food packaging will be developed.

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**Interviewees**

Maurizio Bussi  
Lars Flottrøng  
Verena Kassar  
Robert Krotzer  
Tristan Lecomte  
Serj Tankian  
Freija Van Dujine

We need to start thinking about the future of food if we are going to feed 9 billion people in a way that does not destroy our environment.—Bill Gates

Food and water security are one of the biggest challenges facing our planet in the coming decades. Although these challenges are not new, relatively few people have considered how we would address the likely collapse of our food chains.

The world needs a revolution in food supply and energy, more than a revolution in computing technology.

According to Maurizio Bussi, a senior official at the International Labour Organization, current consumption patterns are not sustainable. Water, food, and air will be created artificially from available materials around us. Think of artificial hamburgers created in the laboratory. In the future, there may only be artificial meat, and people may not remember the taste of a real one. We will not have the same need for cows as today. Air and water pollution-related technology will win influence, as everything related to food is extremely important. We will need them in order to survive. In Western countries, we will experience a higher focus on the production of bioproducts and healthy, high-quality foods.

Some other interesting trends to consider, as expressed by our interviewees are as follows:

- Animals will continue to obtain legal rights that will limit the current processing methods.
- In 2050, only the superrich will be able to afford to eat animals, perhaps even on a clandestine basis.
- The protein we need, we will get from insects and synthetic processes.
- We will become a more vegetarian society, and our pharmacopeia will be delivered mostly in the form of smart foods.
- Agricultural production will move back where people live, e.g., horizontal agriculture, rooftops, synthetic biology, genetically modified plants, organic base materials, etc.
- Genetic understanding will bring us closer to understanding our food and energy needs.

Governments can play a role in facilitating the dialogue surrounding the societal impacts of new technologies, such as nanotechnology and biotechnology. As these technologies represent considerable change, citizens need to be consulted and have

their voices heard on how far such technologies should go when related to food. Governments can also play a role in supporting health awareness, for instance, by monitoring studies and generating information that we need in order to have a discussion on health and safety.

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## 1 The Future of Food and Agriculture

According to “The Future of food and agriculture—alternative pathways to 2050” (FAO, 2018) report the “world of freedom from fear and want” as envisioned by the founders of the United Nations has yet to be achieved. The same is true to the world free from hunger and malnutrition, despite the great socioeconomic progress and significant welfare improvements worldwide.

The Food and Agriculture Organization of the United Nations’ (FAO) estimates indicate that “821 million people, approximately one out of every nine people in the world were undernourished in 2017.” Concurrently, food insecurity is contributing to undernutrition, as well as overweight and obesity, and “high rates of these forms of malnutrition coexist in many countries.” The targets of the second Sustainable Development Goal (SDG) address the challenges of hunger, food insecurity, and malnutrition in all its forms. According to FAO, “current progress towards eliminating hunger and malnutrition is still insufficient to meet the goals of the 2030 Agenda for Sustainable Development. Much of humanity’s progress has come at a considerable cost to the environment. This has led to the degradation of natural resources and is contributing to climate change. Sustainable food and agriculture systems cannot be achieved without significant additional efforts and change of the ‘business as usual’ approach. Different pathways are possible to address current challenges, depending on the evolution of a variety of factors such as population growth, dietary choices, technological progress, income distribution, the state and use of natural resources, climate changes and efforts to prevent and resolve conflicts.”

Food and agricultural systems are affected by trends that may negatively impact their future sustainability. Shifting course is a must; we cannot continue doing “business as usual.” Attaining a more sustainable future will not be easy. All countries must commit to share responsibility in implementing fundamental changes.

According to FAO “raising consumer awareness will help contain the need to unnecessarily expand food production and reduce the ‘triple burden’ of malnutrition, but producing more will be unavoidable, and the way forward is doing so with less.” As we move toward sustainability, food prices may see a drastic increase, yet environmental sustainability and food security are not mutually exclusive. We must thrive to achieve a more equitable income distribution, which needs to include better access to assets for vulnerable groups. Food and agricultural sectors have an important role to play, but they cannot succeed ensuring equitable access to food on their own.

The combo of raising awareness and proper regulations can help contain the expansion of agricultural sectors. Managing demand through education is also critical to reduce the “triple burden” of malnutrition. Food prices should be “right.” Dietary patterns of high-income countries need balancing. International trade could help synchronize food production to reduce food deficits.

Sustainable agricultural intensification is key to saving land. Using water more efficiently is becoming a crucial factor. However, significant investments are needed in this sector.

Tristan Lecomte, founder of Pur Project, sees most innovations in agriculture in the past 50 years as a failure and just added up failure after failure. Science is divided between people working separately on pesticides, fungicides, and fertilizers, whereas nature is a totally interdependent system. Trees, virus, insects, and plants all interact together in a natural ecosystem. By having scientists working on each of them in a separate field, they have disbalanced our ecosystem the more they innovated, making it worse and worse. This is true in agriculture but also in food, medicines, and transport affecting our ways of life. Innovating to have more had drawbacks, and innovating to tackle that issue created new issues.

Lecomte argues that change is imminent by changing the way science serves us—not to be used to fight the environment and nature but to be used to observe and try to understand nature. We will never get there 100%, because it is so complex, but we should observe instead of trying to innovate and rationalize, creating problems.

A big shift by 2050, according to Lecomte, will be to use science to create a better understanding and find a better balance, a better way to live in harmony with nature. A total rethink how humans interact with nature, using technology and science to connect us with nature, instead of disconnecting us thinking that we can control it. For example, in agriculture—fields will not be cultivated anymore. We will return to “wild agriculture,” planting many trees to recreate an ecosystem like in a forest (much more resilient and diverse than the monoculture agricultural field, which is a failure, as we know it, because we lose much of the nutrients, forcing us to use a lot of fertilizers).

There will be sensors in the field checking the imbalances in nutrients, moistures, making up for this by using natural fertilizers for example by planting new trees. Science helping to get back to nature, wild nature, because it is much more powerful than any innovation we can think of. (Tristan Lecomte)

Thanks to genetic technologies, crops now produce more nutritious food, are more resistant to disease, drought and climate change, and require fewer environmental resources, such as water, fertilizer, and pesticides. We can even produce potatoes that produce less of a cancer-causing substance when fried, or medicinal foods that could be used as vaccines or other medicines (Ritchie, 2022). At the same time Lecomte argues that genetically modified organisms and pesticides kill an insect, another insect grows, and a new pesticide is needed, leading to an infernal circle. According Lecomte scarcity should not be an issue. A Japanese farmer called Fuku Oka for 50 years did wild agriculture and produced more rice than any other

farmer in Japan. He said don't do anything, just look at the forest soil, which is the richest, whereas agricultural soil is the poorest, explains Lecomte.

With what we produce today in food, we could feed 12 billion people, but half of the food we produce is wasted or does not reach people. And we eat so much meat—more than 50% of deforestation is linked to meat consumption. Why is it in India, cows are sacred? Because our ancestors understood that cows are a great source of fuel (burning faecalis) and fertilizer, but if you eat it, you eat up a lot of grass and forest, etc. So it is not wise to eat them. In other countries, our ancestors said that trees are sacred; people were living within their ecosystem and nature. But we lost all this and created an imbalance. Lecomte thinks that scarcity will be solved when we reconsider how we consume within the cycle of nature.

The National Geographic Society published a five-step plan to feed the world: “By 2050 we will need to feed two billion more people. How can we do that without overwhelming the planet? The truth is that our need for food poses one of the biggest dangers to the planet. Agriculture is among the greatest contributors to global warming, emitting more greenhouse gases than all our cars, trucks, trains and airplanes combined—largely from methane released by cattle and rice farms, nitrous oxide from fertilized fields, and carbon dioxide from the cutting of rain forests to grown crops or raise livestock.” Farming is the principal consumer of water supplies and a major polluter. Fertilizers and manure disrupt the ecosystems of lakes, rivers, and coastal areas across all continents. Agriculture has also an increased negative impact on biodiversity. Transforming grassland and forests into farms, agriculture has been a major reason for wildlife extinction. Increasing global population is not the only reason for rising food needs. Improving economic status across populations worldwide, especially in China and India, is resulting in more demand for meat, eggs, and dairy, putting more pressure on the system to grow more corn and soybeans to feed more cattle, pigs, and chickens. If these trends continue, we will require about twice as much crops by 2050.

Together, the five steps suggested by the National Geographic Society could more than double the world's food output and drastically cut the environmental impact of agriculture worldwide:

- Step One: *Freeze agriculture's footprint; avoid further deforestation as a top priority.*
- Step Two: *Grow more on farms we've got; using high-tech, precision farming systems, as well as approaches borrowed from organic farming, we could boost yields in less productive farmlands—especially in Africa, Latin America, and eastern Europe—where there are “yield gaps.” We can be more efficient about where we grow, what we grow, and how we grow.*
- Step Three: *Use resources more efficiently; advances in both conventional and organic farming can give us more “crop per drop” from our water and nutrients.*
- Step Four: *Shift diets; today, only 55 percent of the world's crop calories feed people directly; the rest are fed to livestock (about 36 percent) or turned into biofuels and industrial products (roughly 9 percent). Finding more efficient ways to grow meat and shifting to less meat-intensive diets—at least in countries with*

*already a meat-rich diet—could free up substantial amounts of food across the world.*

- *Step Five: Reduce waste; an estimated 25 percent of the world’s food calories and up to 50 percent of total food weight are lost or wasted before they can be consumed. Of all the options for boosting food availability, tackling waste would be one of the most effective.*

But big shifts require big commitment. We are facing a pivotal moment, requiring finding a balance between food security and the preservation of our global environment. Our choices on what to purchase in the supermarket will help decide the future.

Concurrently, BBC Future series published a segment titled “Follow the Food” recommending five solutions to trigger this much needed transformation and rethink our food supply chains:

1. *Creating robot farmers and carrying out monotonous tasks conventionally done by humans with greater accuracy and less waste.*
2. *Preserving precious dirt, by using smaller, lighter robots to do the jobs currently performed by tractors.*
3. *Giving waste a second chance; as according to the United Nations, an estimated third of all food produced ends up rotting in the bins of consumers and retailers. One brilliant idea is using apps like “Too Good To Go,” which enables retailers to shift food destined for the bin—but still perfectly edible—to customers at a reduced cost.*
4. *Slowing the aging process, for instance, in bananas by modifying their DNA, so that they produce far less ethylene.*
5. *Making smarter choices and building a world fed by sustainable agriculture is a daunting task and will require all stakeholders to come together.*

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## **2 Future Environmental Changes on Food Consumption**

Climate change will gradually impact all sectors in agriculture. If left unattended, climate change will further increase poverty and inequalities. Its impacts go well beyond crop yields. Greenhouse gas emissions can only be reduced by additional investment in agriculture. But these are not sufficient—drastic economy-wide greenhouse gas reductions would be required.

Freija van Duijne, former President of the Dutch Future Society, adds that in the future, the focus on sustainability will grow, driven largely by societal pressure. As a result, food and ingredients impacting heavily on the environment will be replaced by more sustainable alternatives. In terms of reducing food waste, the inclusion of sensors and chips will help to give a more precise indication of when the quality and safety of a food product have expired. She adds that such digital components will also help to improve the logistics of supermarkets, with the aim of minimizing waste and ensuring the continued availability of products. Also, as people will increasingly

live in single households and eat on the go, the production of single portion sizes will help in tackling food waste.”

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### **3 Impact of Smart Cities on Food Consumption, Waste Reduction, and Synthetic Foods**

Van Duijne (2018) has researched the subject of future of food extensively. She envisions that in the decades to come, the focus on health will increase. Many products that are currently considered to be unhealthy will be redesigned to remove the unhealthy components and replace them with health-enhancing ingredients, without compromising the taste or attractiveness of the food itself. She also envisions that we will witness the emergence of personalized food products, which will be adapted based on an individual’s risk profile for certain diseases. In her view, the distinction between food and medicine will gradually disappear, which will be supported by the increased incorporation into the Western diet of special ingredients, such as exotic plant ingredients and spices, known for their health enhancing properties.

Furthermore, food packaging will improve in order to retain the quality of a product for longer while minimizing the quantity of materials and by using more environmentally sound materials. In order to achieve these future visions, Van Duijne adds that we need to create a stimulating environment for innovation and entrepreneurship, which can be facilitated by the entire community of researchers, entrepreneurs, and governments. To do this, it is her view that certain regulations also need to be examined closely. For example, food safety regulations are of course very important for the development of novel foods and novel food ingredients; however, we need to assess the difficulties and challenges such regulations pose for entrepreneurs wanting to bring innovative ingredients to the market. She adds that to further innovation on a business level, scientific research can also help to stimulate and identify new horizons and inspirational products beyond 2050.

#### **Avoiding Food Divides Between the Rich and Marginalized Communities**

Defeating undernourishment requires reducing poverty and inequalities in order to avoid food divides between the rich and marginalized communities. Environmental sustainability and food security do not need to be a zero-sum game. A more equitable income distribution allows for improved and healthier diets. Transitioning toward sustainability could improve the profitability of farms including agricultural employment. While the food and agricultural sectors remain important, they won’t be sufficient alone to guarantee equitable access to food.

#### **Future of Food Menu**

“Do you have any dietary restrictions?” they would ask you when booking a Michelin star restaurant in the South of France. Demand for vegan, flexitarian, pescatarian, and other type of meat-free diets has substantially increased in the past decade. But there is still a long way to go to reduce meat consumption.

The EAT-Lancet Commission on Food, Planet, and Health (2022) determined that substantial dietary shifts must take place by 2050. “Global consumption of

fruits, vegetables, nuts and legumes will have to double, and consumption of foods such as red meat and sugar will have to be reduced by more than 50%,” the panel of experts judged. Plant-based “meat; is already with us. The Beyond Burger and the Impossible Burger are widely available. The real challenge on the long run will be to persuade consumers to embrace cultivated or lab-grown meat. These will be developed from animal or fish cells in the nutrient bath of a ‘bioreactor.’” According to Bruce Friedrich from the Good Food Institute, which works to develop alternative meat, “people will look back at the idea of growing live animals for meat in the same way that we look back at horse-drawn carriages for getting from London to Brussels.” We may still have some heritage breed farms and slaughterhouses where the animals are treated well, but it will be a limited market.”

According to Chloe Rutzerveld, a food designer and futurist, we will switch to a whole new diet built with “microorganisms such as fungi, bacteria, yeast and microalgae to produce the carbs, proteins and fats we need. This food will again be produced in bioreactors, before filtered and dried into powders. She claims that 3D-printing technology will be able to replicate the texture and flavours of regular food.” Eating microorganisms grown in bioreactors will be transformative.

Of course, not everyone agrees that we would move to lab-grown food, but the number of proponents is continuously growing. Rutzerveld opines that “by 2050, climate change will dramatically affect what we can eat and drink. We will have to return to more seasonal patterns of eating – bananas, for example, will no longer be a cheap household staple.” Junk food consumption is predicted to rise in historically impoverished communities, especially in low- and middle-income countries (LMICs), driving the problem of obesity. It is projected that globally, 60% of men and 50% of women will be obese by 2050, projecting the current trends. We will need policies that reduce the abilities of companies to sell junk food at low prices.

We shall eat more fruit, vegetables, wholegrains, less junk food, and possibly less meat and dairy. According to the British “future of food report,” we may add jellyfish to our 2050 diet. Others predict that we will be eating insects for protein intake; drink alcosynth beverages without having to endure a hangover the day after; consume sonic-enhanced foods playing on our taste buds; eat edible plastic bottles to reduce waste; buy purple bread and farmed fish; and lab meat, miso super food, fungi, and algae among others. Given that we cannot take a cow or a chicken to space, our increased venturing to outer space will necessarily create the need for space farming. We may grow fungi, flies and microgreens in space to feed our astronauts.

#### 4. Input from Interviewees

##### **Maurizio Bussi**

##### **UN diplomat and director at the International Labour Organization**

Current consumption patterns are not sustainable. Water, food, and air will be created artificially from available materials around us. Think of artificial hamburgers created in the laboratory. In the future, there may only be artificial meat, and people may not remember the taste of a real one. We will not have the same need for cows as today. Air and water pollution-related technology will win influence, as everything



related to food is extremely important. We will need them in order to survive. In Western countries, we will experience a higher focus on the production of bioproducts and healthy, high-quality foods.

## **Lars Flottrøng**

### **Business Advisor, MoB**

#### **Strategy and risk management**

High-protein insects (already part of the menu in Asia), algae from the oceans, artificial food, multilevel greenhouses with organic growing based on renewal energy, super protein shakes, and dry powder cocktails will replace everything we eat today. Barbeque Saturday will be something that humankind knows from school books and stories that older generation tells the youth. A natural grown T-bone steak will cost as much as a suburban cottage and be available only to the richest people.

Is this fantasy or just one of these ongoing horror scenarios?

Not at all!

The world population clock reports a current population of 7,920,000, whereas the annual population increase reaches a 68,000,000.

In 2050, we expect to reach 10,000,000,000!

Already today, we take more from our earth than the latter offers and produces. We take more and more, consume too many resources, pollute too much water, catch too many fish, eat too much meat, cut too much wood, and produce too much carbon dioxide. We have been exhausting the earth's reserves.

Humans use as much ecological resources as if we lived on 1.7 earths.

The day on which natural resources are used up for the whole year is World Exhaustion Day—or Earth Overshoot Day. This is earlier every year!

And these are only the hard facts.

If we add to it the current trend to organic food, which is grown without pesticides and fertilizers but requires significantly more agricultural land, then we quickly realize that we face our earth's limits very, very soon. And this is not only because the available space to grow food is limited but also because of the fact that all other resources like the rainforest (which is already under heavy pressure as it occupies potential farming land) are as important for the future of our planet and the humankind as food is. The same relates to water.

If we still want to secure the future of our earth, we will have to fully reconsider the future food production and consumption picture. As there won't be enough farming land on one side, a growing population on the other one, new options have to be chosen.

The scenario described at the beginning seems to be more than realistic given all the facts and ecological problems we are creating every day.

Natural meat will be very expensive and very limited, as the cow head count will be reduced to a minimum to fight carbon emission and the land plots for cows will be rare. 3D food printing is one of the most challenging but at the same time promising tech directions to solve part of the future food problems. Whereas the first 3D burger was at around EUR 250,000, today's 3D burgers are at around EUR 15. The tech business promises to reach the McDonalds price already in 2022–2023. The meat

animal cells are grown in a laboratory and then “reprocessed” in a 3D printer into a burger. No cows and no farming land are required. Experts say that the taste is the same, and no difference can be found. Technology will be developing further, and very soon, we will see the first Wagyu steak from a 3D printer.

3D printing of French blue cheese, a fresh drafted, sorry, printed, ale from the 3D beer printer will be as normal as eating and drinking. Whether everybody has their own printer at home and just purchases the necessary basics and ingredients or whether the supermarket is just a food printing store is up to personal fantasy and/or income. But food will come out of a machine!

Insects are still an unknown part of the food menu, even if in Asia they are part of the food basket. What we know is that they seem to be everywhere, do not need care or a dedicated agro-policy, and present a potentially super source of protein. However, we do not know whether they present toxically, allergy, or other risks. Insects might become both stand-alone meals (what about a mealworm salad for a light lunch?) or ingredients and additions to rice or other courses.

Insect breeding seems to be less resource-consuming and less expensive than growing wheat, vegetables, and fruits, and they most probably present a never-ending source of “nice” food.

Algae are already worldwide well-known and an integrated part of vegetarian menus. With the increasing greenhouse effect and as a consequence the warming of the oceans, we see a growing algae “crop” every year.

Business would say—every problem is an opportunity, and exactly that is what humankind has to do as well. Once all our doing destroys the environment but at the same time leads to an increasing offer of algae, let’s farm it.

Gathering algae in the oceans would help reoxygenate the water (algae consume a lot of oxygen and lead to the disappearance of the hitherto known underwater world) and would also provide a high source of healthy food. This would work out, of course, only in the case it is done environmentally friendly with a strong focus on surviving fauna and flora.

Multilevel greenhouses (please imagine a 12-level glass greenhouse, flooded with light) where ecological food will be grown based on the latest technologies and where only renewable energies would be used and effect on nature will be brought to an absolute minimum will cover a significant part of the world. Of course, only if these land parts are still available for these high-tech food farms. Four to five crops per year, grown with the use of genetic science, robots, and artificial intelligence, but not left without humans’ love and care, are possible. However, genetic science has to be developed with all the responsibility to health and safety and not only based on shareholders’ value.

Protein shakes, powder food, and energy batons will become as usual as bread is today. Already used by sportsmen to fasten muscle growth, they will perform an integrated part of our daily consumption like all the other mentioned options. Instead of a 5-course dinner, we will have a small—hopefully tasty—quick shake or power baton. What else do we need?

Water is a limited resource as well but even more important than food. A human can survive without food for a while, however, without water cannot. The available

freshwater resources are dramatically shrinking; large lakes like the Baikal are under risk or already disappeared like the Poopó lake in Bolivia; the glaciers are disappearing, and rivers are dirty and messed up. There won't be enough fresh water available to provide the daily norm of drinking water to the 10b humans, not talking about irrigation of farming land and the agriculture needs to grow enough food. Humankind will have to develop new technologies to desalinate salt water and to convert it into the most valuable part of our needs besides air and oxygen.

Based on all the points described above, a typical daily menu would look like the following:

Breakfast: Protein bar and desalinated water

Lunch: Warm mealworm salad, 3D escalope on algae mousse, fried locusts in sweet breading, and desalinated water

Dinner: Fresh fried cockroaches with 3D potato, sweet sand grass dessert, and artificial wine

Tasty?

We understand that humankind tastes will change and will have to change, as natural food will be a deficit and unreachable for 98% of the population. However, even the provided replacement still needs an existing earth with an environment allowing to breathe, grow, and live.

It is our responsibility to care about our planet, to take immediate measures to rescue what is still available, to rechannel all possible funds into science, to search for new feed technologies, and to stop waste production and carbon emission. Only if we really do everything depending on us today—and not tomorrow—humankind will get a chance to survive. It is up to us to decide what we are going to leave our children—a green planet or a gray one.

### **Verena Kassar**

#### **Founder of Zero Waste Academy**

I envision a positive food system of the future:

The food retail trade as we know it now will no longer be the central marketing system for food. With an increased focus on regional and local production, most of our food will come from the local area and will be delivered in a climate-neutral way by drones and electric delivery. Everyone can afford good quality food because the environmental impact is factored into the value of the food.

Industrial agriculture is therefore very low, and we can see a resurgence of biodiversity, all over the world.

### **Robert Krotzer**

#### **City councillor of Graz, Austria for Health and Care**

In the future, social inequality, poverty, and hunger will be a thing of the past.

### **Tristan Lecomte**

#### **Chief executive officer, Pur Projet**

2050 will see a big shift. We will use science to create a better understanding and find a better balance, a better way to live in harmony with nature. A total rethink how

humans interact with nature, using technology and science to connect us with nature, instead of thinking that we can control it. For example, in agriculture—fields will not be cultivated anymore. We will return to “wild agriculture,” planting many trees to recreate an ecosystem like in a forest (much more resilient and diverse than the monoculture agricultural field, which is a failure, as we know it, because we lose much of the nutrients, forcing us to use a lot of fertilizers. The chemicals in the agricultural sector today still come from world war rocket fuels.

### **Serj Tankian**

#### **Singer of System of a Down**

All food will have to be sourced locally to combat carbon waste. Farm-to-table industries will grow exponentially along with agricultural intelligence so that people can grow their own food anywhere in the world.

### **Freija Van Duijne**

#### **Futurist, public speaker, foresight expert, CEO, and founder of Future Motions**

In the future, the focus on sustainability will grow, driven largely by societal pressure. As a result, food and ingredients impacting heavily on the environment will be replaced by more sustainable alternatives. In terms of reducing food waste, the inclusion of sensors and chips will help to give a more precise indication of when the quality and safety of a food product have expired. She adds that such digital components will also help to improve the logistics of supermarkets, with the aim of minimizing waste and ensuring the continued availability of products. Also, as people will increasingly live in single households and eat on the go, the production of single portion sizes will also help in tackling food waste.

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