

The Big Read **Agricultural production**

Future of food: inside agritech's Silicon Valley

Investors are flocking to a Dutch university at the centre of a food production revolution

Emiko Terazono in Wageningen 6 HOURS AGO

By altering the colour of lights in his indoor grow-room, Leo Marcelis can change the smell, taste and even the vitamin content of his tomatoes.

For more efficient growth, switch on the red light; to develop shorter plants with higher levels of antioxidants, use more blue; and for a long-stemmed plant with fewer branches, turn on the dark red.

“It’s about the balance between the different colours,” says the professor of crop production at Wageningen university in the Netherlands, as he surveys a climate-controlled room with shelves laden with tomato seedlings.

“If that slice of tomato has double the amount of vitamin C, then it might help a large portion of the world population that doesn’t get enough.”



de Zedde, right, is on the role of AI and robotics in food production

Wageningen may not be a household name, but it is at the heart of a [new revolution](#) that is starting to have an impact on both the food industry and agricultural production. Alongside University of California, Davis, and Cornell University in the US, it is one of the world's leading research centres for food technology.

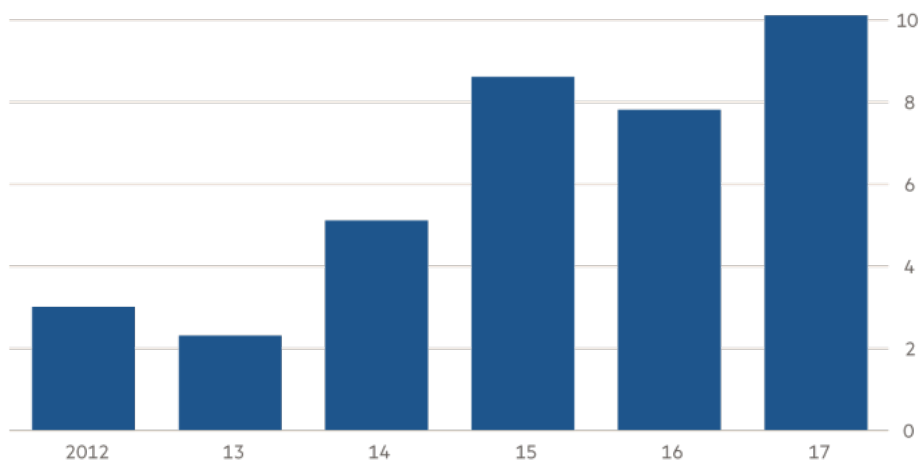
Although Wageningen is surrounded by the flat plains that stretch across this corner of northern Europe, it enjoys the nickname "Food Valley" — a nod to the Silicon Valley-style innovation and start-up frenzy that is beginning to take shape in the sector.

Some investors believe the food business is about to face disruption of the sort that Silicon Valley has already visited on hosts of other industries.

Tony Fadell, who worked on the first generation of the iPod before starting Nest, the smart thermostat business bought by [Google](#) in 2014, compares "big food", including both the [multinational food business](#) and the [large agricultural trading groups](#), to the technology companies of the 1970s. Agricultural production is ripe for the kind of innovation that changed finance in the 1980s, personal and business communications in the 2000s and social life this decade, he says.

Annual financings in agrifood technology

\$bn



Source: AgFunder © FT

"All the big agricultural companies are like the mainframe IT companies of the 70s — waiting to be disrupted," says the American engineer, who is now an investor in start-ups based in Paris.

The flurry of interest in agricultural and [food technology](#) is the result of several powerful trends. Growing demand for protein, especially from the developing world, is putting pressure on [food supply](#). At the same time, consumer tastes in the western world are shifting from mass-produced brands towards [healthier and more unique products](#).

Into that mix comes a burst of scientific innovation, ranging from gene editing, artificial intelligence and digital technology, that is now being applied to food production and crops.

As one of the hubs of agricultural research, Wageningen now finds itself trying to adapt to a different world where start-ups and venture capital are eager to make their mark.

"Until 10 years ago, agriculture was not sexy enough to talk about it," says Ernst van den Ende, one of Prof Marcelis's colleagues. "When I started studying at Wageningen, my classmates, said 'why you're going there? It's only for farmers'. But that's changed."



iPod developer Tony Fadell: 'All the big agricultural companies are waiting to be disrupted' © Bloomberg

Once an unfashionable backwater, agricultural technology has started to capture the imagination of investors.

Around the globe, money is rushing into new forms of [agriculture and food distribution](#), funding projects ranging from vertical farms and agricultural robots to alternatives to meat. In the five years to 2017, annual global investment in food tech, from farm management systems to robotics and mechanisation, more than tripled to \$10bn, according to AgFunder, a venture capital tracker.

New technology led to a green revolution in the 1960s, when a focus on higher-yielding strains and new fertilisers drove sharp increases in production in the developing world. Now some observers are hoping that technology can help find ways to feed a global population predicted to hit almost 10bn by 2050 at a time when climate change and environmental pollution are causing land degradation and limiting access to water.

The [near-\\$1bn purchase by Monsanto](#), the seed and farm chemical company, of US-based Climate Corporation in 2013 highlighted the demand for new ways of producing food and helped catalyse interest in the sector.

Recommended

“Entrepreneurs have arrived, big investors have arrived and some big exits have occurred,” says Adam Anders, founder of Anterra Capital, a food and agriculture venture fund that set up in the Netherlands in 2009.

The Netherlands is one of the nations best placed to take advantage of this surge in interest. The country has made food science one of its strategic priorities and boasts one of the world’s most efficient agricultural systems. It is the largest exporter of vegetable seeds and its farmers use a fraction of the water of their counterparts elsewhere.

This proficiency in agriculture, combined with a leading trading port at Rotterdam and the fact that Rabobank is one of the biggest lenders to the food industry, has drawn agricultural traders, researchers and food companies to the small European nation.

“Massive changes will occur through the combination of technologies and new technological platforms, like combinations of genetics and sensors and AI to monitor the nutritional status of plants, animals and humans,” says Louise Fresco, president of Wageningen university and its research institutes.



Atze Jan van der Goot with a slab of meat-like fibres made from soy proteins © REX

One of the main challenges, she says, is the soaring demand for [protein products, especially meat](#), as the populations of developing nations become wealthier. The total amount of meat consumed globally is expected to increase by 76 per cent by 2050, according to a UN Food and Agricultural Organization review.

Shifting tastes away from the heavy emphasis on meat and dairy is key, she says, adding: “We obviously need a mix [of different forms of proteins].” This would include plants, fish and insect-based products. “I’m not saying everybody should be vegetarian, but we need a balance,” she adds.

In one lab, Atze Jan van der Goot, the university’s professor of sustainable protein technology, holds up what looks similar to a large slab of salt beef. His team was researching how to make long threads of protein from dairy products when it stumbled on a process to make soy protein into meat-like fibres.

76%

Forecast increase in consumption of meat by 2050, according to the FAO

“We believe this technology allows the formation of larger pieces of meat,” Mr van der Goot says, adding that a tender yet flavourful product with the mouthfeel of meat should be ready to come on to the market “a couple of years from now”.

His team has paired with a group of eight companies for the €6m project, from the Netherlands-based poultry processing machine manufacturer Meyn, which is backed by Warren Buffett, to [Givaudan](#), the Swiss flavour and fragrance specialist, and consumer goods giant [Unilever](#).

In another lab, Rick van de Zedde is working on a robot arm, equipped with an array of sensors to tell when a pepper is ripe and should be picked. “We are looking to see whether we can measure, non-destructively, the quality of fruit and vegetables without squeezing them,” he says.

Robotics is one area of technology that is expected to ease the labour shortage some parts of the agricultural sector is facing. Given that fruits and vegetables are not of uniform shape and ripeness, the technological challenges are extensive. On top of the mechanical dexterity and spatial cognition that the machines need to demonstrate, researchers hope that AI can help them learn to pick only the ripe fruit and vegetables.



Feedback

nt of Wageningen university, says advances in genetics and AI will transform food production

The university's reputation for innovation has drawn a cluster of nearly 200 companies to the 10km radius around Wageningen, from tiny start-ups to established food geneticists such as Keygene, which specialises in improving crops through molecular breeding, to giants such as Kraft Heinz.

To help foster those links with the private sector, the university set up a networking group in 2004 called [Food Valley NL](#), which offers help for start-ups and small companies, facilitating links to large corporations, potential advisers or partners as well as helping with legal services.

Roger van Hoesel, managing director of Food Valley, says the independent organisation has become an important international draw: groups from around the world, from India, to Lebanon and Japan, have come to see what makes the cluster network tick. "Everyone wants their own Food Valley," he says.

"For us being part of an ecosystem is very important," says Arjen van Tunen, chief executive of Keygene, founded in 1989. "There is a back-and-forth of information and building a competitive edge with our strategic allies."

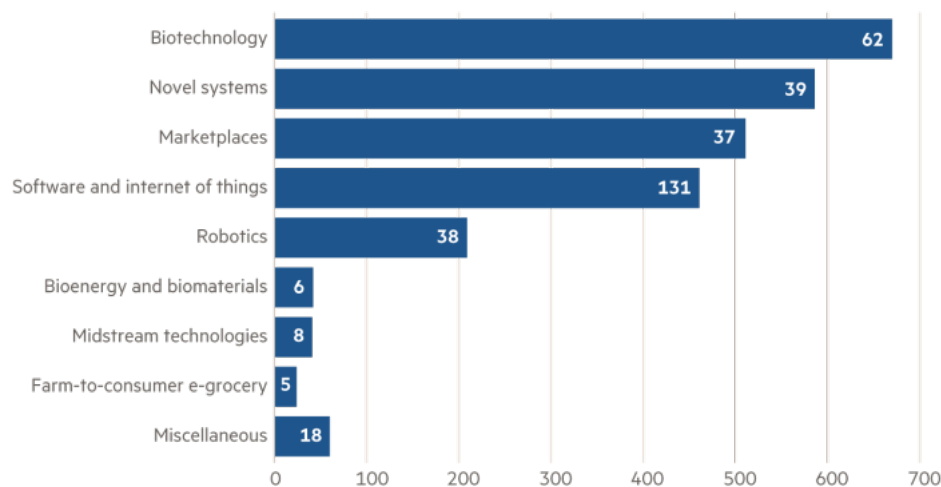
Unilever, the consumer goods company behind brands such as Ben & Jerry's and Marmite, is expected to launch a global food innovation centre on campus, which will bring together its network of food research in Europe. The company plans to open a large part of its labs and facilities to students, other companies and NGOs.

Rob Hamer, a Unilever executive who was until recently head of its R&D laboratory in the Netherlands, describes it as "a new way of working". He says: "If we want to make food production really sustainable, healthy, and safe, we can't do that alone. We need others to collaborate." Next to

Unilever is the research centre of Dutch dairy co-operative FrieslandCampina. Yili, China's largest dairy company, has recently expanded its own research centre on the campus.

Farming technology financing and deal volumes, 2017

\$m (figure in bars is number of deals)



Source: AgFunder © FT

The challenge facing the researchers at Wageningen, who have traditionally brought their innovations to market through collaboration with established companies, is how to engage with the new wave of entrepreneurs.

Wageningen is looking to back more small companies that spin off elements of its research. The university — which is in its centenary year and has a long history of working together with seed companies — now has 45 business development officers, liaising between labs and companies.

“Wageningen has a role to transfer scientific findings into innovation, fostering entrepreneurship,” says Ms Fresco.

Last year she launched a new unit called “value creation” to place a greater emphasis on bringing Wageningen’s research and innovation to market.



Wageningen University and inside one of the greenhouses

Sebastiaan Berendse, who joined the university early last year as the new division's director, says Wageningen will continue to work with large companies and consortiums, but believes early stage technologies may not sit well with the risk-averse nature of big organisations. Corporate cost-cutting drives generally eat into R&D budgets.

"Large corporates are not always the best, fastest route to impact and innovation. Radical innovations and novel technologies can also entail high risk in development time, money and success rate," he says.

Among the division's roles is to coach and mentor those who are looking to spin off their technologies, organising student incubators and working with the university's teaching staff to create an entrepreneurship education programme.

"The building blocks are there in the sense that the accelerators have arrived and the funds have arrived. The large corporates are present," says Mr Anders. "But we're not at the final finish line. The race has just started."

Photographs by Romy Arroyo Fernandez/FT

Alt-proteins Big food companies break 'business as usual' model

When [Tyson Foods](#), one of the world's [largest meat processing companies](#), took a 5 per cent stake in plant-based meat start-up Beyond Meat in 2016, everybody in the food industry took notice. It was the moment when alternative proteins went from being a niche sector to the mainstream.

Since then, the US company has gone further, investing in Memphis Meats, which is developing laboratory-grown meat from animal cells. Cargill, the agricultural trading house which is also a leading beef supplier in the US, has also invested in the cellular meat group, alongside Bill Gates and Richard Branson.

"We know we're going to need all forms of protein on the table — cultured, plant, animal and other new approaches. We invested in Memphis Meats because we know that it will be an important complement to our current, traditional protein options," Cargill says.

The agricultural trader has also invested in Puris, which makes pea protein extracted from yellow split peas, and Calysta, which is designing methane-based proteins.

The companies aim to cash in on a rise in the numbers of "flexitarians", who eat meat and fish only occasionally, which has spurred demand for alternative proteins.

In the US for example, plant-based food sales in 2017 grew by 17 per cent from a year before to \$3.7bn according to a survey from The Good Food Institute. Plant-based meat grew by 23 per cent, although it is still a small market, accounting for 1 per cent of overall retail meat sales.

Rosie Wardle helped launch Farm Animal Investment Risk and Return, an investor network which advocates sustainable animal farming. Since launching at the end of 2015, Fairr now has a backing of 180 institutional investors with assets of \$9tn.

"The current system as it is, is broken," she says. "Business as usual is not workable."

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